Board of Building Standards

EDUCATION COMMITTEE MEETING
AGENDA

DATE: SEPTEMBER 21, 2023
TIME: 10:00 AM
LOCATION: BBS LIBRARY, 6606 TUSSING ROAD, REYNOLDSBURG, OHIO
Click here to join the meeting

Call to Order

Consent Agenda

Course Applications

ER-1 Advanced Legal Aspects of Code Administration for Building Officials and Inspectors (ICC)
All certifications (6 hours)
Staff Notes: This is the "advanced" version of a course approved for 2022. Because it is due to be presented on September 22, we administratively approved it. We request the Board to ratify this approval.
Committee Recommendation:

ER-2 Code Enforcement and the International Property Maintenance Code (ICC)
All certifications (1.5 hours)
Staff Notes: Focus is on international property maintenance code and how it can be integrated with the IBC and IRC. the IPMC is outside the scope of the OBC and RCO.
Committee Recommendation:

Old Business

New Business

Adjourn

EDUCATION COMMITTEE MEETING
CONSENT AGENDA

Course Applications

EC-1 Commercial Food Service Plumbing (Assn Plumbing & Hydronics Contractors)
All certifications (2 hours)

EC-2 Electric Vehicle Charger Installation and NEC Requirements (Ohio Certificate Renewal)
All certifications (4 hours)

EC-3 Law and Ethics in Code Enforcement (ICC)
All certifications (1.5 hours)

EC-4 Mass Timber and Type IV Construction in the IBC (ICC)
All certifications (1.5 hours)

EC-5 Medical Gas (ICC)
All certifications (1.5 hours)

EC-6 Ohio Plumbing Code Clarification (Assn Plumbing & Hydronics Contractors)
All certifications (2 hours)

EC-7 Preparing for the 2024-26 Code Cycle (ICC)
All certifications (1.5 hours)

EC-8 Quick Hits on Emerging Building Safety Topics (ICC)
All certifications (1.5 hours)

EC-9 Review of OPC 3-7 and 9 (Assn Plumbing & Hydronics Contractors)
All certifications (4 hours)

EC-10 Review of OPC Chapters 1-11 (Assn Plumbing & Hydronics Contractors)
4 hours all certifications.

EC-11 Single-Stack Vent Systems (Assn Plumbing & Hydronics Contractors)
All certifications (2 hours)

EC-12 Understanding the Ohio Plumbing Code (Assn Plumbing & Hydronics Contractors)
All certifications (8 hours)

EC-13 Using Isometric Drawings for Code Understanding (Assn Plumbing & Hydronics Contractors)
All certifications (2 hours)

EC-14 The Evolution of Structural Masonry Systems (International Masonry Institute)
All certifications (1 hour)

EC-15 Third Parties and Residential Energy Code Compliance (ICC)
All certifications (1.5 hours)

File Attachments for Item:

ER-2 Code Enforcement and the International Property Maintenance Code (ICC)

All certifications (1.5 hours)

Staff Notes: Focus is on international property maintenance code and how it can be integrated with the IBC and IRC. the IPMC is outside the scope of the OBC and RCO.

Committee Recommendation:

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

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

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

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

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

New Course Information

Course title: Code Enforcement and the IPMC

Course instructor: Cecilia Muela

Course description:

This class will have a direct focus on the benefits of working with the IPMC in successful execution of code enforcement programs. Code Enforcement departments have many tentacles that touch on many working departments, and it is essential to understand how to effectively walk cases to compliance with the assistance of the IPMC and minimum life safety requirements at every scope and trade. Discussion will also take place on how to look into adopting this code and the benefits thereof.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

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

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☐ No

☐ On Demand ☐ Webinar

Course Website:

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

Course applicable for the following certifications *

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

Application materials included *

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

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

File Name	Size
Outline_PPT_BIO -Code Enforcement and the IPMC 90 min.pdf	838.56 kB

Applicant Full Name *

Laura Morris

Date of Submission

09/01/2023

Instructions for new Continuing Education Approval form

Provider Information

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

Course Renewal

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

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

New Course Information

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

Special Content

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

Code Enforcement and the IPMC

This class will have a direct focus on the benefits of working with the IPMC in successful execution of code enforcement programs. Code Enforcement departments have many tentacles that touch on many working departments, and it is essential to understand how to effectively walk cases to compliance with the assistance of the IPMC and minimum life safety requirements at every scope and trade. Discussion will also take place on how to look into adopting this code and the benefits thereof.

Objectives

- Participants will receive an introductory overview of how the International Property Maintenance Code (IPMC) works cohesively with other model codes.
- This course will help enhance the inspection skill set of those conducting inspections for code compliance and enforcement.
- Participants will learn the effectiveness of using the IPMC as part of their Code Enforcement Program.
- Participants will learn how to navigate through this code as they prepare their noticing documentation.
- Participants will learn how to identify and discuss minimum requirements for basic fire safety, plumbing/mechanical/electrical systems in existing buildings.

Outline

Instructor Introduction (10 MIN)

Part 1: **Why the IPMC?**

I. History of codes and why the IPMC is the premium code for Code Enforcement Programs (10 MIN)
II. Who's who? (10 MIN)
III. Scope and Administration (15 MIN)

Part 2: **IPMC Overview and Adoption**

I. Unpacking the meat and potatoes of the IPMC (20MIN)
    a. Exterior and Interior Inspections
    b. Minimum Requirements for life safety
    c. Minimum Requirements for health safety
II. How to adopt the IPMC as your Code Enforcement Model Code (15 min)

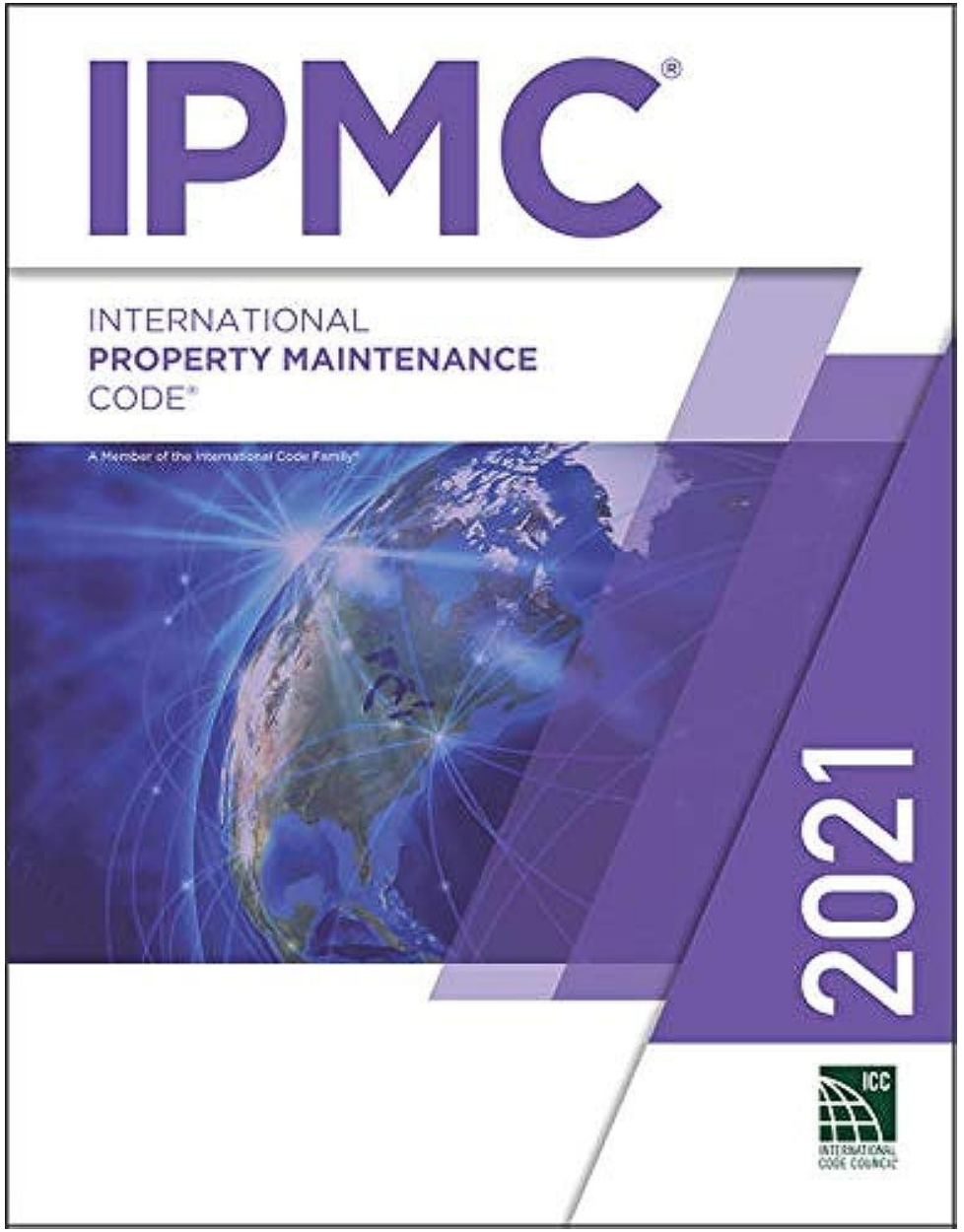
Questions (10 min)

Cecilia Muela is currently a Director of Code Enforcement Services and Building Official with 4LEAF, Inc. Previously, Ceci served as the Assistant Chief Building Official for the City of Santa Rosa. Ceci has been in the Building Industry for over 22 years with a focus in Code Enforcement for over 16 years and has shared her knowledge at the local, county, state, and federal levels.

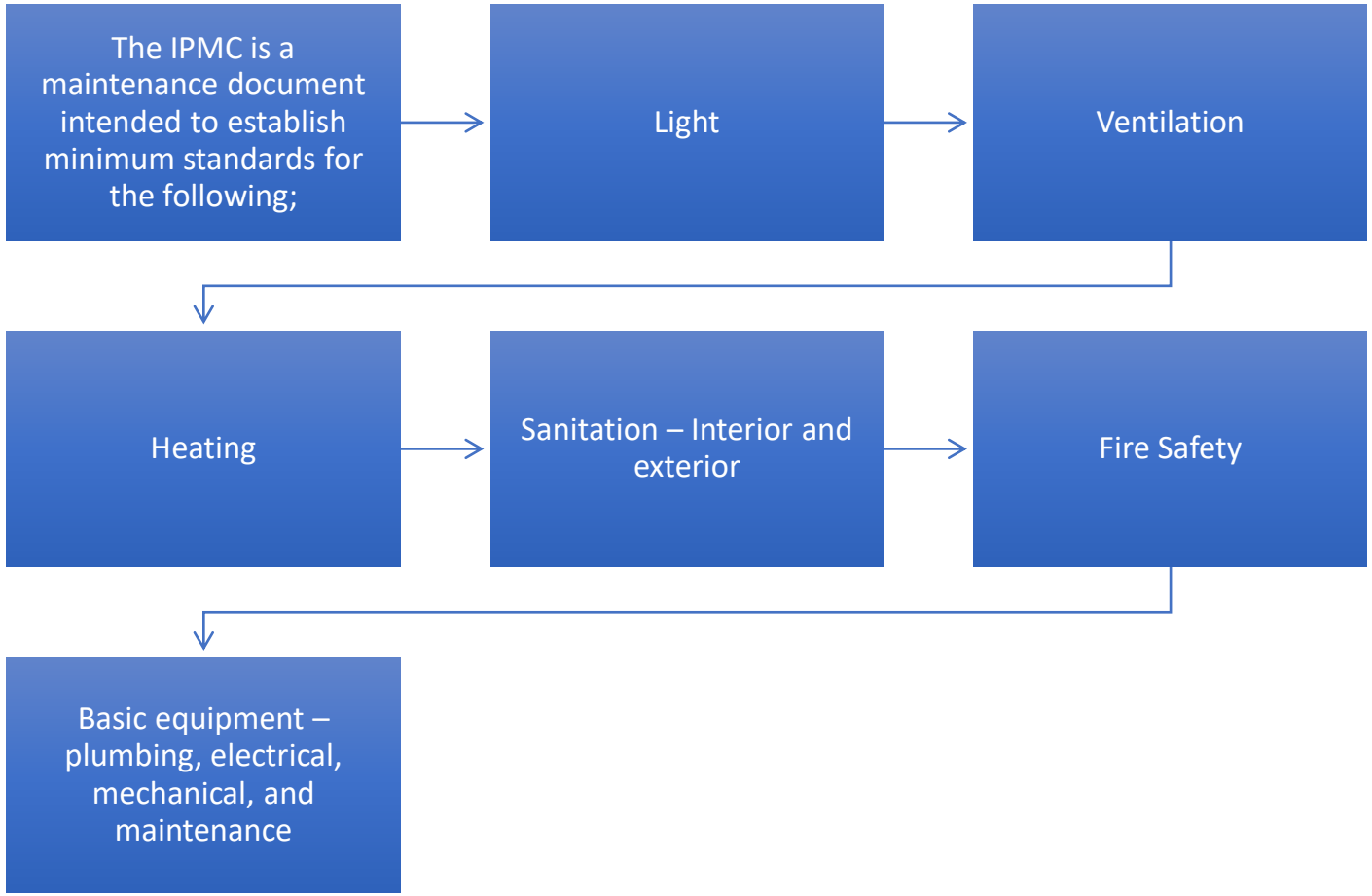
Ceci is an experienced educator, trainer, and professional presenter for the International Code Council (ICC), has an extensive history of educating professionals throughout the United States and is one of the most sought-after instructors today. Additionally, Ceci is the Chair of the Ad Hoc Committee on Diversity Equity and Inclusion for the International Code Council and serves as an expert witness in Code Enforcement matters.

As founder of the Women Leaders in Code Enforcement Group, Ceci drives innovation with a direct focus on building pathways for women in every facet of the building and safety industry through training and mentorship opportunities while highlighting the many contributions of women in our industry.

Code Enforcement & The IPMC



IPMC (International Property Maintenance Code)



Chapter 1—Administration

Chapter 2—Definitions

Chapter 3—General Requirements

Chapter 4—Light, Ventilation and Occupancy Limitations

Chapter 5—Plumbing Facilities and Fixture Requirements

Chapter 6—Mechanical and Electrical Requirements

Chapter 7—Fire Safety Requirements

Appendix A—Boarding Standard

For who and for what?

- ✓ It is the code intended for existing buildings
- ✓ Owners, Owner agents, occupants, operators
- ✓ To protect public health, safety, and welfare

Scope

- Parameters for due process
- Application to all existing residential and non-residential structures and all existing premises
- Sets minimum requirements and standards;
  - Maintenance of structures
  - Maintenance of equipment and facilities
  - Light and ventilation – space, heating
  - Sanitation - trash debris, rodent harborage, mold
  - Protection from the elements – protective treatment
  - Fire and other hazards
  - “Maintenance” being the key word

Part 1 Application **Section 101**

- Does not authorize removal of necessary equipment or services that are required, by owner agents
- Does not serve as substitute for meeting requirements of other codes
- Does not impair remedies of enforcement
- Does touch on the need for good workmanship
- Is compatible with all other I-Codes and interact harmoniously
- Historic Buildings do not apply if deemed safe by Building Official

Application of other codes

- Repairs
- Additions
- Alterations
- Or changes of occupancy

All must conform to applicable codes.

“..This code does not null, cancel, modify or set aside provisions of the IZC – International Zoning Code..”

Conflict between codes

"Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern. Where there are differences between this code and reference standards, the provisions of this code shall apply"

"… if different sections specify different requirements most restrictive shall apply"

Part 2 - Administration and Enforcement

Section 103

Establishes the department of property maintenance inspection

- Who does this include?
  - The code official
  - Deputies as appointed by the code official
  - You!

Just how exactly?

Appointments

The Code Official is appointed by the Chief appointing authority

The Code Official then deputizes employees with powers as delegated by the code official

Code Official: *The official who is charged with the administration and enforcement of this code, or any duly authorized representative*

Photo by City of Lafayette

Section 103.4 Liability

The Code Official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction, in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally, and is hereby relieved from all personal liability for any damage accruing to persons or property as a result of an act of by reason of an act of omission in the discharge of official duties.

103.4.1 – Any suit or criminal complaint instituted against any officer or employee…..shall be defended by the legal representative of the jurisdiction.

File Attachments for Item:

EC-1 Commercial Food Service Plumbing (Assn Plumbing & Hydronics Contractors)

All certifications (2 hours)

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Tracy Jefferies - Exec Director

Organization: APHC

Address: 3891 Seabell Ct Columbus OH 43230 (office)

E-mail: aphc.contractors@gmail.com Telephone: 614-315-6924

Website: aphcofcentralohio.com

Conference Sponsor (if applicable) — Conference Email: —

Check here if Course Renewal: ☐ Prior course number _____ *(i.e. BBS2018-429)*

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

New Course Information:

Course title: Commercial Food Service Plumbing

Course instructor: Guy Miller Jr & Darrin Dawson

Course description: See attached doc with description & outline

Instructional hours per session: 2 hrs Number of Sessions: TBD

Course Date(s) and Location: Pending Approval for dates
653 McCorkle Blvd suite H Westerville OH 43082

Special Content:

Code Administration: ☐
Existing Buildings: ☐
Electrical Instruction: ☐
Plumbing Instruction: ☒

Conference Course: _____
Conference Name: _____
Conference location: _____

Course to be offered online? ☐ **On Demand** ☐ **Webinar** ☐

Course Website: _____

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

Course applicable for the following certifications

Residential Certifications Only: ☐ Commercial Certifications: ☐
Administrative Course, All Certifications: ☒

Application materials included:

☒ Course Outline or Course Learning Objectives
☒ Presentation Materials/Slides (not required for roundtable courses)
☐ Assessment Materials (for online courses)
☒ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

APHC

OBJECTIVE: A review of sections of the state plumbing code, emphasizing proper code interpretation, and understanding plumbing code as it relates to Commercial Food service.

MATERIALS/BOOKS: State of Ohio plumbing code book, overheads for illustrations, worksheets that students will provide answers to.

LENGTH OF COURSE: 2 hours

COURSE TITLE: Commercial Food Service Plumbing.

COURSE OUTLINE:

Part I — Chapters 6 -10 (1.5 hours)
Review of all plumbing code requirements focused on commercial food service. Proper backflow application for kitchen equipment.

Part II — Chapter 10 (0.5 hours)
Detailed code requirement for sizing and installing grease interceptor

PHYSICAL FACILITIES DESCRIPTION

Classroom at 653 McCorkle Blvd. Suite H in Westerville:

The room is set up in a classroom style with seating for up to 24 individuals at conference tables. The room is well lit using overhead fluorescent lighting. The room is also provided with audio/visual equipment; overhead projector, screen and eraser board for illustrations as needed for presentation purposes. The room is equipped with its own controls to control heating and cooling for comfort. Of course, restroom facilities are available.

This site is also equipped with a lab area consisting of workstations for the backflow prevention certification and recertification classes held. These stations (8) are equipped with different manufacturers' devices to test and repair. All tools and equipment needed for the lab portion of the class are provided as part of the course.

QUALIFICATIONS:

Darrin Dawson has worked 39 years in the plumbing industry. In May of 1990, he received his Master Plumbing Certification.

He has been a State of Ohio Certified Plumbing Inspector since June of 2003. He became a National Certified Medical Gas Inspector in June of 2007.

In April of 2022 he received a State of Ohio Backflow Certification.

Mr. Dawson has been an instructor for The Association of Plumbers and Hydronics Contractors (APHC) apprenticeship program for 16 years.

He is currently employed at The Delaware Public Health District as a Plumbing and Medical Gas inspector.

Guy Miller Jr.
629 Fenchurch Way
Gahanna, OH 43230
Ph. (614) 940-5700
guymillerjr@gmail.com

Certification: Master Plumber, State of Ohio-Id Number #24380 (exp)
Certified Backflow Preventer - Certificate #1300 (State of Ohio – exp)
Certified plumbing inspector - Certificate #K02033 (State of Ohio), 5523 (BBS)
Certified plumbing plans examiner- Certificate #K02033 (State of Ohio), 5523 (BBS)

Teacher: APHC Apprenticeship Program, Fourth Year Instructor
8/08-present

APHC Association - Continuing Education Classes
2021- Present

Work Experience:

1/85 – 1/95 Guy Miller Plumbing

1/95-8/03 Eric Guy Plumbing

8/03 – 2/10 Foreman: Crawford Mechanical Services

2/10-04/17 Foreman/Project Manager: Gutridge Plumbing

4/17-current Plumbing Field Supervisor-City of Columbus

Commercial Kitchen Plumbing

1

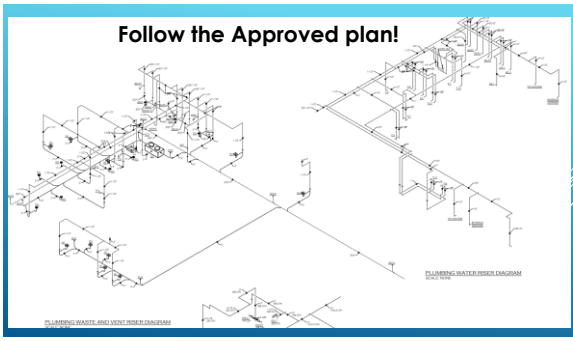
All Commercial Kitchen construction designs first must go through the approval process with the authority have jurisdiction.

Also the Kitchen design must go through Health Department food service approval.

Failure to get both may result in delays until you have met code compliance.

2

Follow the Approved plan!



3

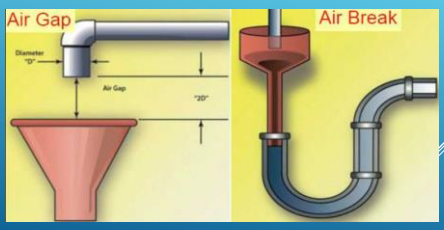
There are two approved ways to connect plumbing fixtures to the plumbing drainage system.

Direct or Indirect

Kitchen Fixtures are connected to the plumbing system based on their use.

4

Indirect connections



5

SECTION 802 INDIRECT WASTES 802.1

Where required. **Food-handling** equipment, in other than dwelling units, clear-water waste, dishwashing machines and utensils, pots, pans and dishwashing sinks shall discharge through an indirect waste pipe as specified in Sections 802.1.1 through 802.1.8. Health-care related fixtures, devices and equipment shall discharge to the drainage system through an indirect waste pipe by means of an air gap in accordance with this chapter and Section 713.3. Fixtures not required by this section to be indirectly connected shall be directly connected to the plumbing system in accordance with Chapter 7

6

Indirect with an air gap

7

What about this?

8

SECTION 1002 TRAP

REQUIREMENTS 1002.1 Fixture traps

Exceptions:

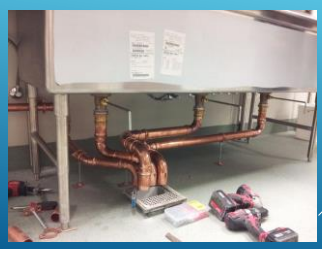
3. A grease interceptor intended to serve as a fixture trap in accordance with the manufacturer's installation instructions shall be permitted to serve as the trap for a single fixture or a combination sink of not more than three compartments where the vertical distance from the fixture outlet to the inlet of the interceptor does not exceed 30 inches (762 mm) and the developed length of the waste pipe from the most upstream fixture outlet to the inlet of the interceptor does not exceed 60 inches (1524 mm).

9

This "Exception" does not supersede food service code!

10

802.1.1 Food handling. Equipment and fixtures utilized for the storage, preparation and handling of food shall discharge through an indirect waste pipe by means of an air gap. Each well of a multiple-compartment sink shall discharge independently to a waste receptor.



11

Fixtures that need to remain sanitary for food preparation must connect indirectly by air gap.

12

802.2.1 Air gap. The air gap between the indirect waste pipe and the flood level rim of the waste receptor shall be not less than twice the effective opening of the indirect waste pipe.

13

802.1.7 Commercial dishwashing machines. The discharge from a commercial dishwashing machine shall be through an air gap or air break into a waste receptor in accordance with Section 802.2.

14

Ice storage and ice making equipment drainage pipes must always be indirectly connected with an air gap.

15

Steam Tables drainage pipes must always be indirectly connected with an air gap.

16

Fixtures or devices that are used for food prep must always be indirectly connected to the drainage system

17

Drains from beverage dispensers drainage pipes must always be indirectly connected with an air gap.

18

Bar Sinks

19

802.3 Waste receptors. For other than hub drains that receive only clear-water waste and standpipes, a removable strainer or basket shall be installed in waste receptors. Waste receptors shall not be installed in concealed spaces. Waste receptors shall not be installed in plenums, crawl spaces, attics, interstitial spaces above ceilings and below floors. Ready access shall be provided to waste receptors.

20

Floor sinks are waste receptors.

21

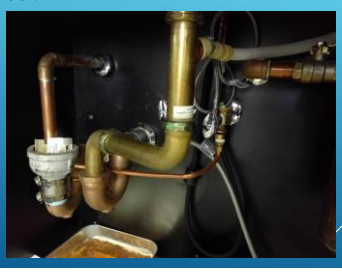
Mop Sinks are waste receptors.

22

802.3.1 Size of receptors. A waste receptor shall be sized for the maximum discharge of all indirect waste pipes served by the receptor. Receptors shall be installed to prevent splashing or flooding.

23

802.3.2 Hub drains. A hub drain shall be in the form of a hub or a pipe extending not less than 1 inch (25 mm) above a water-impervious floor.

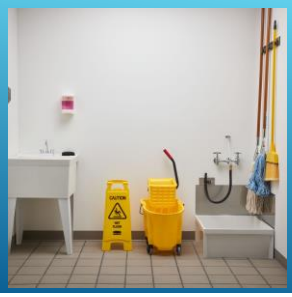


24

301.3 Connections to drainage system. Plumbing fixtures, drains, appurtenances and appliances used to receive or discharge liquid waste or sewage shall be directly connected to the sanitary drainage system of the building or premises, in accordance with the requirements of this code and the requirements of the department of the city engineer, in cities having such departments, the boards of health of health districts, or the sewer purveyor, as appropriate (see division (D) of section 3781.03 of the Revised Code). This section shall not be construed to prevent indirect waste systems required by Chapter 8.

25

Mop/service Sink should always be directly connected



26

608.2 Plumbing fixtures. The supply lines and fittings for plumbing fixtures shall be installed so as to prevent backflow. Plumbing fixture fittings shall provide backflow protection in accordance with ASME A112.18.1/CSA B125.1.

Air gap is the most effective form of backflow. If the fixture does not have a air gap, then a backflow device will be required.

27

There are many types backflow devices.
Applying correct backflow device depends on the circumstance.





28

Soda fountains

08.16.1 Beverage dispensers. The water supply connection to beverage dispensers shall be protected against backflow by a backflow preventer conforming to ASSE 1022 or by an air gap. The portion of the backflow preventer device downstream from the second check valve and the piping downstream therefrom shall not be affected by carbon dioxide gas.

29

608.16.10 Coffee machines and noncarbonated beverage dispensers. The water supply connection to coffee machines and noncarbonated beverage dispensers shall be protected against backflow by a backflow preventer conforming to ASSE 1022 or by an air gap.

All beverage dispensers!

30

Water connected to a steam oven will require a backflow device.

31

Required beverage backflow

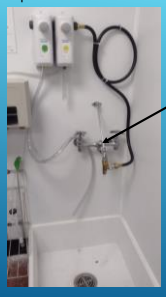
32

What about soap dispensers?

33

34

A prohibited installation



35

ASSE 1055 equipped soap dispensers can be directly connected to water distribution system

36

Install backflow devices for equipment that is not on site.

37

Grease laden waste

38

1003.3.1 Grease interceptors and automatic grease removal devices required. A grease interceptor or automatic grease removal device shall be required to receive the drainage from fixtures and equipment with grease laden waste located in food preparation areas, such as in restaurants, hotel kitchens, hospitals, school kitchens, bars, factory cafeterias and clubs. Fixtures and equipment shall include pot sinks, prerinse sinks; soup kettles or similar devices; wok stations; floor drains or sinks into which kettles are drained; automatic hood wash units and dishwashers without prerinse sinks. Grease interceptors and automatic grease removal devices **shall receive waste only from fixtures and equipment that allow fats, oils or grease to be discharged**. Where lack of space or other constraints prevent the installation or replacement of a grease interceptor, one or more grease interceptors shall be permitted to be installed on or above the floor and upstream of an existing grease interceptor.

39

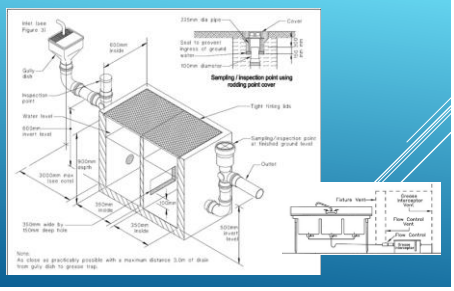
Dishwashers with prerinse sinks do **not** have go to grease interceptor.

40

1003.3.4 Hydromechanical grease interceptors, fats, oils and greases disposal systems and automatic grease removal devices. Hydromechanical grease interceptors; fats, oils, and greases disposal systems and automatic grease removal devices shall be sized in accordance with ASME A112.14.3, ASME 112.14.4, ASME A112.14.6, CSA B481.3 or PDI G101. Hydromechanical grease interceptors; fats, oils, and greases disposal systems and automatic grease removal devices shall be designed and tested in accordance with ASME A112.14.3, ASME 112.14.4, CSA B481.1, PDI G101 or PDI G102. Hydromechanical grease interceptors; fats, oils, and greases disposal systems and automatic grease removal devices shall be installed in accordance with the manufacturer's instructions. Where manufacturer's instructions are not provided, hydromechanical grease interceptors; fats, oils, and greases disposal systems and automatic grease removal devices shall be installed in compliance with ASME A

41

Install grease interceptor as per manufacture specifications.



42

Don't be this plumber!

43

1003.3.4.1 Grease interceptor capacity. Grease interceptors shall have the grease retention capacity indicated in Table 1003.3.4.1 for the flow-through rates indicated

TABLE 1003.3.4.1
CAPACITY OF GREASE INTERCEPTORS

TOTAL FLOW-THROUGH RATING (gpm)	GREASE RETENTION CAPACITY (pounds)
6	6
9	12
12	18
15	24
18	30
20	36
25	50
35	70
50	100
75	150
100	200

For SI: 1 gallon per minute = 2.765 cm, 1 pound = 0.454 kg.

a. For total flow-through ratings greater than 100 (gpm), double the flow-through rating to determine the grease retention capacity (pounds).

44

1003.3.2 Food waste disposers. Where food waste disposers connect to grease interceptors, a solids interceptor shall separate the discharge before connecting to the grease interceptor. Solids interceptors and grease interceptors shall be sized and rated for the discharge of the food waste disposers. Emulsifiers, chemicals, enzymes and bacteria shall not discharge into the food waste disposer.

45

1003.3.4.2 Rate of flow controls. Grease interceptors shall be equipped with devices to control the rate of water flow so that the water flow does not exceed the rated flow. The flow-control device shall be vented and terminate not less than 6 inches (152 mm) above the flood rim level or be installed in accordance with the manufacturer's instructions

46

Like This!

47

File Attachments for Item:

EC-2 Electric Vehicle Charger Installation and NEC Requirements (Ohio Certificate Renewal)

All certifications (4 hours)

Application for Continuing Education Course Approval

Provider Information:

Name: Harold L. Plant
Organization: Ohio Certificate Renewal
Address: P.O. Box 211102, Columbus, Ohio 43221
E-mail: mayda@ohiocertificate.com and Hal@ohiocertificate.com Telephone: 614-451-9003
Website: ohiocertificate.com
Conference Sponsor (if applicable) _____ Conference Email: _____

Check here if Course Renewal: _____ Prior course number _____ (*i.e. BBS2018-429*)
Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:

Course title: Electric Vehicle (EV) Charger Installation and NEC Requirements
Course instructor: J.D. White
Course description: Learners will gain an understanding of EVSE systems, the current technology in an evolving industry, terminology, levels/types, NEC compliance, permissible locations, and system commissioning. The class will also cover storage considerations and calculations.

Instructional hours per session: 4 Number of Sessions: TBD
Course Date(s) and Location: 09/22/2023 webinar, online and in-person TBD

Special Content:

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

Conference Course: _____
Conference Name: _____
Conference location: _____

Course to be offered online? ☑ **On Demand** ☑ **Webinar** ☑
Course Website: ohiocertificate.com
Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:
login and/or audio/visual confirmation, quizlets

Course applicable for the following certifications

Residential Certifications Only: ☑ Commercial Certifications: ☑
Administrative Course, All Certifications: ☐

Application materials included:

☑ Course Outline or Course Learning Objectives
☑ Presentation Materials/Slides (not required for roundtable courses)
☑ Assessment Materials (for online courses)
☑ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

Ohio Certificate Renewal
(614) 451-9003
OhioCertificate.com
P.O. Box 211102 Columbus, Ohio 43221-1102

EV Charger Installations

Course Outline

1. Why Discuss Electric Vehicles Supply Equipment - "EV Chargers"
2. EVSE is New & Changing - Every EV Model Year
3. Industry & NEC Definitions - Terminologies
4. Charging station fundamentals
5. Level 1: Single Phase 120 VAC 15-20 amps
6. Level 2: Single Phase 208/240 VAC 30-80 amps
7. Level 3: Three Phase 208/240/480 VAC 125 amps
8. Level 4: DC Ultra-Fast Chargers
9. Brand & Model specific installations
10. Load Calculations for adding EVSE
11. Installing Single EVSE Unit
12. Installing Multiple EVSE Units - Integration
13. NEC Mandatory Requirements
14. NEC Permissive Requirements
15. NEC EVSE Electrical Calculations
16. NEC EVSE Ventilation Calculations
17. Commissioning electric storage devices

Presentation Objectives

1. Learn the importance installing EVSE and Opportunities
2. Learn the necessity of staying current with EVSE Technologies
3. Learn the definitions used for EVSE Equipment
4. Learn the different levels and types of EVSE
5. Learn the NEC requirements regarding:
    a. Manufactures Installation Requirements
    b. Load Calculations
    c. Air Exchange Calculations
    d. OCPD for EVSE
    e. Grounding requirements for EVSE
6. Allowable Locations of EVSE Installations
7. Learn the methods and importance of EVSE System Commissioning

EVSE
Electric Vehicle Supply Equipment

1

Why Discuss EV Chargers?

- Electric Vehicles are gaining Popularity
- Customers Need Chargers Connected
- New Business Stream

2

Electric Vehicles are Old Technology

- Developed Late 1800's
- Same area of Steam and Single Piston Engines
- Used lead-acid batteries
- Had Very limited range

3

Gas Powered Vehicles Won Out

- Cars soon required roads.
- With roads came
  - Speed: Refueling and Driving
  - Oil excavation
  - Service stations
- Electric infrastructure lagged
  - EV suffered from poor Development

4

Gas Powered: EPA & Emissions

Gasoline use created unintended consequences.

Many cities developed air-quality issues.

The Environmental Protection Agency (EPA) was created in 1970.

The Clean Air Act was passed.

Onboard diagnostics 2 (OBD2) became law and standard on all vehicles in 1996.

Not all dirty air is from vehicles, but they produce a fair share

5

EVSE is New & Changing

- Every Model Year brings new levels and Methods of Connectivity
- Improved Battery Technology
- Drive Train Technology
- New Manufactures

6

Industry & NEC Definitions

- EVSE – Electric Vehicle Supply Equipment
- BEV – Battery Electric Vehicle
- Hybrid – Vehicle uses Gas to power Engine and Electric Motors
- PHEV – Plug-in Hybrid Electric Vehicle
  - Larger Batteries than standard Hybrid
  - Greater Battery only milage
- Fuel Cell Electric – Hydrogen converted to electric
  - Power generated is used to power motor, and charge Batteries

7

Charger Fundamentals

- Level 1 and Level 2 Capable EV convert Alternating Current, into Direct Current Onboard the Vehicle
- The Actual Charger is built into the EV
  - Converts AC to DC, Monitors Battery Charge Levels & Temp.
- The Wall Unit is only an Interface Controls Amps to EV to prevent Branch Circuit for overloads. Nonetheless is called a Charger
- Multiple Levels of Charging Rate by the External Wall unit

8

Battery Fundamentals

- 40KWH is Average EV Battery Size
  - 40,000 Watts in one hour
- Watt Hours are extended by Connected Load
  - 20KW for 2 Hours
  - 10KW for 4 Hours
  - 5KW for 8 Hours
- 75KWH and 100KWH is an Option for Some EV
  - Powering a Home is a possibility per above Loads

9

Level 1 Charging ~ On the Cheap

- Single Phase, Several EV include one these with the EV
- 120V
- 15-20 Amp Circuit and Outlet
- Circuits Draw 12 – 16 Amps
- Slowest Charging Rate
- Again, Vehicle converts the AC into DC within the Vehicle

10

Level 1 Charging

- Output charging power of 1.3 – 2.4 KW
- That output is 3.11 miles per charging hour
- An 8-hour charge will produce 30 - 40 Miles of Travel
- 40-50 Hours to charge a BEV (Battery Electric Vehicle)
- 5-6 Hours to charge a PHEV (Plug-in Hybrid Electric Vehicle)

11

Level 2 Charging ~ Real Minimum

- Single Phase 208Volt or 240Volt
  - Often Apartments and Condos are 1Ph derived from 3Ph Power
- 13-80Amp Connected Load
- Circuits are 20A – 100A Rated (80/125 OCPD Rule)
- Output Charging Rate is Adjustable, and Fixable by Installer
- The Vehicle converts the AC into DC within the Vehicle
- Except Golf Carts Level 2 Charging should be a Minimum

12

Level 2 Charging

- Output charging power of 3KW (12.5 Amp) – 19.2KW (80Amp)
- That output is 12-13 miles per charging hour
  - This is 6-9 times the miles per charging hour
- 40,000 Watt Hours
  - 3KW Charging — 13.3 Hours - Full Charge
  - 7KW Charging — 5.7 Hours – Full Charge
  - 11KW Charging — 3.6 Hours – Full Charge
  - 19.2KW Charging — 2.1 Hours – Full Charge

13

Level 2 Charging

- Output charging power of 3KW (12.5 Amp) – 19.2KW (80Amp)
- Not all EV can charge at 19.2 KW
- Most EV are 11KW charging or less
  - Battery Heat Dissipation is key to charging rate
- BEV Range of 10 – 75 Miles per Charging Hours
- A 6 Hour charge at 7KW will Full Charge
- Range of Full Charge is 150 Miles to 526 Miles

14

Level 3 Charging ~ DC Chargers

- Three Phase 208/240/480 VAC Input 167/144/72A for 60KW
- Charging Rate of 60KW, 180KW, or 360KW Units
- Most can Charge 2 Level 3 Charging Capable EV Simultaneously
- Output is 200 - 360A and Depending on 300-1000 VDC
- Units can weigh in as much as 500 Lbs
- Cost are 150-200 times the cost of Level 2 Chargers

15

Level 3 Charging

- Three Phase 208/240/480 VAC Input
- Charging Rate is 125A DC Output
- Most equipped to charge Level 2 capable or Level 3 capable EV
- Level 2 Capable EV Passes DC directly to Battery
- More Common to Commercial Business Locations
- Some Business Provide Charging as a Curtesy
- Commercial Charging Stations Typically Measured and Costed

16

Mythical ~ Arguably Level 4

- DC Ultra-Fast Chargers
- Some clump this into Higher Power Level 3,
  - Some call it Level 4, or even Level 3+, Can be Confusing
- Like Level 3 the External Charger converts AC into DC
- Exclusively Commercial and 3Ph Input Power
- Uses a Heavier Cable for Connection to Vehicle
- Charging times of 30 Minutes or Less

17

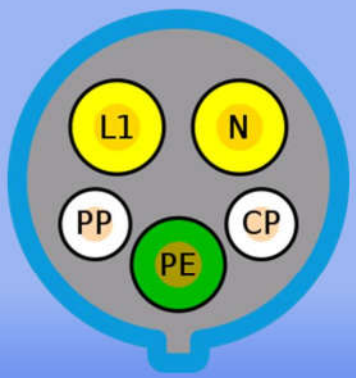
Charger Brand and Model Specific

- Manufactures instructions must be followed.
- Not all Charger Manufactures have the same requirements
- Nor the Same Installation Directions
- Multiple Different Brands

18

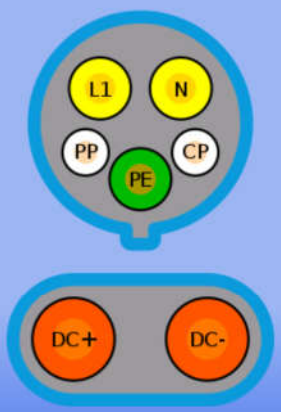
EV Connector Plug J1772
Most Common
10,000 Mating Cycles

Label	Function	Notes
L1	AC Line 1	
N	AC Neutral or Line 2	
PE	Equipment Ground	
PP	Plug Present	Prevent EV Movement
CP	Control Pilot	Signals Charging Level Charging Begin/End



EV Connector Plug CCS
Required for DC Charging
Added Row for DC

Label	Function	Notes
L1	AC Line 1	
N	AC Neutral or Line 2	
PE	Equipment Ground	
PP	Plug Present	Prevent EV Movement
CP	Control Pilot	Signals Charging Level Charging Begin/End
DC+	DC Positive Post	
DC-	DC Negative Post	



NEC 625 EVSE Definitions

Cable Management System.
An apparatus designed to control and organize the output cable to the electric vehicle or to the primary pad.

Charger Power Converter.
The device used to convert energy from the power grid to a high-frequency output for wireless power transfer.

Electric Vehicle Connector.
A device that, when electrically coupled (conductive or inductive) to an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of power transfer and information exchange.

Electric Vehicle Power Export Equipment (EVPE).
The equipment, including the outlet on the vehicle, that is used to provide electrical power at voltages greater than or equal to 30 Vac or 60 Vdc to loads external to the vehicle, using the vehicle as the source of supply.

Electric Vehicle Supply Equipment (EVSE).
The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the electric vehicle connectors, attachment plugs, personnel protection system, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

21

NEC 625 EVSE Definitions

Fastened in Place.
Mounting means of equipment in which the fastening means are specifically designed to permit periodic removal, without the use of a tool, for relocation, interchangeability, maintenance, or repair.

Fixed in Place.
Mounting means of an EVSE attached to a wall or surface with fasteners that require a tool to be removed.

Output Cable to the Electric Vehicle.
An assembly consisting of a length of flexible EV cable and an electric vehicle connector (supplying power to the electric vehicle).

Output Cable to the Primary Pad.
A multi-conductor, shielded cable assembly consisting of conductors to carry the high-frequency energy and any status signals between the charger power converter and the primary pad.

Personnel Protection System.
A system of personnel protection devices and constructional features that when used together provide protection against electric shock of personnel.

22

NEC 625 EVSE Definitions

Portable (as applied to EVSE).
A device intended for indoor or outdoor use that can be carried from charging location to charging location and is designed to be transported in the vehicle when not in use.

Power-Supply Cord.
An assembly consisting of an attachment plug and length of flexible cord that connects equipment to a receptacle.

Primary Pad.
A device external to the EV that transfers power via the contactless coupling as part of a wireless power transfer system.

Wireless Power Transfer (WPT).
The transfer of electrical energy from a power source to an electrical load via electric and magnetic fields or waves by a contactless inductive means between a primary and a secondary device.

Wireless Power Transfer Equipment (WPTE).
Equipment consisting of a charger power converter and a primary pad. The two devices are either separate units or contained within one enclosure.

23

NEC 625.17 Cords and Cables

(A) Power Supply Cord

1. Hard Service Type
2. Proper Ampacity for Load Being Served
3. Length to prevent cord from being draped on floor:
   I. 12” if Portable Equipment
   II. 6’ if Stationary Equipment

24

NEC 625.17 Cords and Cables

B. Output Cable for EV

1. Type of EV Cable, which has communications built in
2. An Integral Part of the Supply Equipment

C. Length of Supply Cable

25' by default, unless a cable management system used

25

NEC 625.22 Personal Protection

- Equipment required to have built in protection
- Prevents power greater than 60VDC available while unplugged
- This is part of the attachment cord CP Terminal

26

NEC 625 Part 3 Installation

625.40 Individual Circuit Require – Regardless size of charger

625.41 OCPD must be sized not less than 125% of Maximum Load

625.42 Load shall be considered as a Continuous Load for sizing of Branch Circuit, Feeder, and Service. Unless a Load Management system is used to prevent overloading a feeder or service

27

NEC 625.42 Adjustability

- Where Load is Adjustable, Access is required to be Restricted

1. Cover Door with Special Tool Required for Access
2. Physical Locking Device Accessible only to Qualified Persons
3. Software with a Password protection to limit adjustment to Qualified Persons.

28

NEC 625.43 Disconnecting Means

- More then 60A or More than 150V to ground
- Disconnecting means Required to be Readily Accessible
- Shall be Lockable in the Open (Off) Position

29

NEC 625.44 Equipment Connection

A. Portable Equipment

1. 125V 15 or 20A Grounding Non-Locking
2. 250V 15 or 20A Grounding Non-Locking
3. 250V 1Ph or 3Ph 30 or 50A Grounding Non-Locking
4. 60VDC 15 or 20A Grounding Non-Locking

30

NEC 625.44 Equipment Connection

B. Fastened in Place Equipment

1. 125 or 250V 15 up to 50A Grounding Non-Locking
2. 250V 3Ph up to 50A Grounding Non-Locking
3. 60VDC 15 or 20A Grounding Non-Locking

C. Fixed Equipment

All Other shall be Permanently Wired

31

NEC 625.46 Loss of Primary Power

- Means shall be provided to prevent back feeding from EV to Building with loss of utility power.
- 625.48 Provides an exception to this Default Rule.

32

NEC 625.47 Multiple Feeds

- If equipment is setup to accept more than one feed this is allowed.
  - The reason equipment must be setup to allow this is to ensure one feed does not back feed into another source.

33

NEC 625.48 Interactive Systems

- If the EVSE incorporates a power export function that is part of the interactive system, this can be used as a standby system.
- When used, article 702 shall apply

34

NEC 625.50 Location

- EV Connector shall be stored
  - Not less than 18" AFF for indoor location
  - Not less than 24" Above Grade Level for outdoor location

35

NEC 625.50 Ventilation

A. Ventilation Not Required

IF EV is listed for charging indoors without Ventilation Required Ventilation is allowed but not Required..

B. Ventilation Required

If EV is listed for charging indoors with Proper Ventilation Required Active Supply and Exhaust

Tables Must be consulted for proper Values

36

NEC 625.52(B)(1)(B) SAE Tables

- Minimum Ventilation in Cubic Feet per Minute for Each EV

Branch Circuit		Branch-Circuit Supply Voltage						
		Single Phase			3 Phase			
	DC				208 V or		480 V or	600 V or
	≥ 50V	120 V	208 V	240 V or 120/240 V	208Y/120 V	240 V	480Y/277 V	600Y/347 V
15	15.4	37	64	74	—	—	—	—
20	20.4	49	85	99	148	171	342	427
30	30.8	74	128	148	222	256	512	641
40	41.3	99	171	197	296	342	683	854
50	51.3	123	214	246	370	427	854	1066
60	61.7	148	256	296	444	512	1025	1281
100	102.5	246	427	493	740	854	1708	2135

37

NEC 625.52(3) Engineered System

- A person qualified in Building Ventilation Engineering is allowed to provided an engineered valuation based on using the established formulas found under the tables with preset values.

38

NEC 625.52(4) Circuit Interlock

- Mechanical Ventilation is required to be interlocked with the EVSE Equipment to ensure it is operation during the entire time of charging.
- I believe it is the intent of this requirement to ensure positive ventilation is operational if Chargers are used, and Chargers are interlocked to ensure the Ventilation is energized. I do not see a requirement for sail switched to prove Ventilation, but may not be a bad idea.

39

NEC 625.54 GFCI

- Note this is not a requirement for GFPE, but rather GFCI
- As if 210.8 is not clear enough
- This clarifies all Receptacles for EVSE shall have GFCI Protection of Personnel
- I believe EVSE Directly Wired would be exempt of this requirement.

40

NEC 625.60 EVPE

- This requirement is placed on the EV manufacture and not the installer of EVSE
- Note, all ICE BEV, HEV, PHEV have been including 120V limited wattage outlets in vehicles for the past couple years.

41

NEC 625 Part 4 Wireless Charging

- WPTE ~ Wireless Power Transfer Equipment
- 625.101 Grounding
- Primary pad base shall be grounded unless listed WPTE is double insulated.

42

NEC 625.102 WPTE Installation

A. Charger Power Converter if Built into Pad
Shall comply with 625.102(C)
Otherwise shall be listed as 3R enclosure

B. General if power converter not built into Pad shall be installed:
18" AFF if indoors, or 24" AFG if outdoors
Mounting can be Pedestal, Wall, Pole, Building, Structure, or a Raised Concrete Pad.

43

NEC 625.102(C) Primary Pad

- These pad are inductive like that of the primary of a transformer, with the secondary of the transformer mounted to the underside of the EV. (Also like a rechargeable toothbrush)
- Embedded to be flush as a way to prevent damage.

44

Assessment Materials

Quiz questions for EV (Electric Vehicle Supply Equipment) Chargers

Ohio Certificate Renewal

1. What is the average size of an EV battery in kilowatt-hours (kWh)?

    a. 10 kWh

    b. 20 kWh

    c. 40 kWh (Correct Answer)

    d. 60 kWh

2. Which level of charging provides the slowest charging rate?

    a. Level 1 (Correct Answer)

    b. Level 2

    c. Level 3

    d. Level 4

3. How long does it take to fully charge a Battery Electric Vehicle (BEV) using Level 1 charging?

    a. 5-6 hours

    b. 8 hours

    c. 30-40 minutes

    d. 40-50 hours (Correct Answer)

4. What is the primary advantage of Level 2 charging over Level 1 charging?

    a. Faster charging rate (Correct Answer)

    b. Lower cost

    c. Greater portability

    d. None of the above

5. What type of charging equipment is used for Level 3 charging?

a. Single-phase 240V

b. 120 V

c. Three Phase 208/240/480 VAC Input (Correct Answer)

d. Wireless chargers

6. What is the purpose of the Control Pilot (CP) in EV connectors?

a. To prevent EV movement

b. To signal the charging level (Correct Answer)

c. To activate the air conditioning

d. None of the above

7. What is the minimum height requirement for the storage of EV connectors in outdoor locations, according to NEC?

a. 6 inches above grade

b. 12 inches above grade

c. 18 inches above grade

d. 24 inches above grade (Correct Answer)

JD White

6048 Astor Avenue 614-546-7884
Columbus, OH 43232 jd.white2000@gmail.com

Objective:

To provide timely and informative teaching relative to Electrical Theory, Electrical Practices, and NEC Updates. All teaching is primarily geared for licensed contractors, architects, engineers, electrical inspectors, and electrician apprentices. Electrical Design and Drafting of small to moderate sized projects, using AutoCAD.

Work and Teaching Experience:

06/2007 - Present
Columbus State Community College
Title: Skilled Trades Apprenticeship Supervisor
Supervisor: Doug House, 614-287-2576

01/2006 – Present
Voltaire Electric Company, Inc. – Columbus, OH
Electrical System Design and Drafting
Title: Consultant 614-546-7884

06/2007 - Present
Columbus State Community College
Title: Adjunct Faculty Teaching:
Electrical Courses, National Electric Code, Employability, Construction Overview, Construction Estimating, Manual Drafting, and AutoCAD
Supervisor: Doug House, 614-287-2576

09/1999 – Present
Electrician Apprenticeship Instructor
Title: Year 1 – Year 4 Lead Instructor
OCILB Instructor, as needed
IEC Central Ohio 614-473-1050

10/2001 – Present
OCILB Instructor, 1-2 seminars per year
Ohio Contractor Training 614-203-1531

12/2008 – Present
OCILB Instructor, 4 seminars per year
Rebecca Warren Training 614-402-6551

JD White

6048 Astor Avenue 614-546-7884
Columbus, OH 43232 jd.white2000@gmail.com

11/2017 – Present
OCILB Instructor, 2-6 seminars per year
HalfMoon Education Services 715-835-5900

10/2005 - 08/2006
MG Abbott Electric Company – Columbus, OH
Title: Commercial Electrician, Estimator, and ITS Coordinator
Supervisor: Joe Abbott-President, 614-837-3614

07/1995 - 08/2005
Just Dandy Electric Systems, Inc. – Columbus, OH
Title: Owner, Electrician, Estimator, Project Designer...

08/1989 - 07/1995
Safeway Electric Company, Inc. – Columbus, OH
Title: Commercial Electrician, Commercial Division Manager
Supervisor: Andy Untch, 614-443-7672

10/1987 - 08/1989
Mansfield Wesleyan Church – Mansfield, OH
Title: Senior Pastor
Supervisor: Rev. Clyde Hanks-District Supervisor

09/1982 - 07/1987
Delphos Wesleyan Church – Delphos, OH
Title: Senior Pastor
Supervisor: Walter Jefferies-District Supervisor

07/1976 - 09/1982
MG Abbott Electric Company – Columbus, OH
Title: Electrician, Field Supervisor
Supervisor: Gene Abbott-Owner

07/1972 - 06/1974
US Navy – Quonset Point-RI
Title: ADJ (Aviation Machinist Mate Jet)
Supervisor: Various

JD White

6048 Astor Avenue
Columbus, OH 43232

614-546-7884
jd.white2000@gmail.com

Licensure:

Electrical
11/1990
Cities of: Columbus, Elyria, Springfield, Youngstown, Toledo, Dayton, and others
07/1992

Electrical State of Ohio
02/1996
State of Ohio #EL 14058

Fire Alarm Installer
02/2003
State of Ohio #54.25.3708

Education:

06/2005 – 05/2015
Columbus State Community College – Columbus, OH
ATS Electrical System Architecture Designer

09/1982 - 05/1987
Indiana Wesleyan University – Marion, IN
Christian Ministries & Biblical Literature

06/1981 - 05/1982
Columbus Technical Institute – Columbus, OH
General Education Studies

06/1973
GED Central High School, Columbus, OH

07/1972 - 08/1973
Naval Aviation Technical Training Center
Aviation A School Jet Engines – Memphis, TN
Naval Aviation Technical Training Center
Aviation B School Helicopters – Quonset Pt, RI
Rating: Aviation Machinist Mate Jet

References:

Joe Abbott - Previous Employer: 614-837-3614
Barb Tipton – Present Employer: 614-473-1050
Dr. Andy Rezin – Previous Supervisor: 614-551-8378
Doug House – Present Supervisor: 614-287-2576
Other References Available Upon Request

File Attachments for Item:

EC-3 Law and Ethics in Code Enforcement (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

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

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

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

☐ Check here if Course Renewal

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

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

New Course Information

Course title: Law and Ethics in Code Enforcement

Course instructor: Linda Piecynski

Course description

This presentation will address ethical concerns for government employees when dealing with the public, especially regarding First Amendment auditors. It will explain why these individuals invoke the First Amendment by recording government employees. Lastly, it will cover how to avoid being in a situation where a video goes viral on the Internet.

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

Special Content

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

Conference Course	Conference Name	Conference location

Course to be offered online?

- ☐ Yes
- ☑ No

☐ On Demand ☐ Webinar

Course Website

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

Course applicable for the following certifications *

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

Application materials included *

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

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

File Name	Size
Law & Ethics_Outline_BIO_PPT.pdf	166.96 kB

Applicant Full Name *

Laura Morris

Date of Submission

09/01/2023

Instructions for new Continuing Education Approval form

Provider Information

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

Course Renewal

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

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

New Course Information

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

Special Content

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

Law & Ethics in Code Enforcement
90 minutes

Description:

This presentation will address ethical concerns for government employees when dealing with the public, especially regarding First Amendment auditors. It will explain why these individuals invoke the First Amendment by recording government employees. Lastly, it will cover how to avoid being in a situation where a video goes viral on the Internet.

Goals:

1. Identify what a First Amendment Auditor is and what he or she is trying to do.

2. Understand what government may and may not do legally and ethically in First Amendment interactions with the public.

3. Learn strategies for decreasing the chances of government employees ending up on social media because of confrontations by First Amendment auditors.

Outline: 90 minutes

I. Ethics

A. ICC Code of Ethics 5 min.

B. Principles of an ethics code 5 min.

C. State ethics statutes for public employees 5 min.

D. Restricted activities 5 min.

1. Conflict of interest

2. Seeking improper influence

3. Accepting improper influence

4. Honorariums

5. Contracts with governmental bodies and self or family members

E. Most common unethical behaviors 5 min.

F. Examples of unethical behavior 5 min.

Law & Ethics in Code Enforcement
90 minutes

II. First Amendment auditors and public employees

A. Definition 10 min.

B. What the First Amendment covers 10 min.

C. Characteristics of auditors 10 min.

D. Provocation 10 min.

E. Consequences of interactions 10 min.

1. Social media

2. Civil rights lawsuits

F. Does the 1st Amendment apply? 10 min.

1. What can be regulated

2. Fora

3. Important terms

4. Meetings

5. Strategies

LINDA S. PIECZYNSKI

Linda S. Pieczynski is a former assistant state's attorney and municipal prosecutor in DuPage County, Illinois. She devotes her legal practice to teaching and writing about the legal aspects of code administration including building, property maintenance, fire and zoning codes. She has over 10 years of experience. She conducts trainings nationwide for the International Code Council (ICC). She is the author of numerous code related books including The Building Process Simplified, The Residential Inspector's Guide to Codes, Forms and Complaints, The Fire Inspector's Guide to Codes, Forms and Complaints, The Building Official's and Inspector's Guide to Codes, Forms and Complaints, and The Property Maintenance Inspector's Guide to Codes, Forms and Complaints, all published by Cengage. She also has served as editor of revisions to the Legal Aspects of Code Administration published by ICC.

Law and Ethics in Code Enforcement

Linda Pieczynski, J.D.

1

Code of Ethics - ICC

- The protection of the health, safety and welfare of the public by creating safe buildings and communities is a solemn responsibility of the International Code Council. Recognizing this, the ICC advocates commitment to a standard of professional behavior that exemplifies the highest ideals and principles of ethical conduct. The governing concepts embodied in this philosophy are characterized herein, for the benefit and guidance of those so engaged and for the enlightenment of the public so served.

2

Each individual participating in an ICC activity shall:

- Support the mission of the ICC to provide the highest quality codes, standards, products and services for all concerned with the safety and performance of the built environment.
- At all times, acting and ethical manner, complied with the ethical rules and regulations related to his or her profession, and avoid conflicts of interest
- Demonstrate integrity, honest and fairness while participating in ICC activities.
- For ICC certified individuals, maintain professional competence in all areas of employment responsibility and encourage the same for colleagues and associates.
- Act in accordance with the bylaws and policies of the International Code Council, including this Code of Ethics/

3

Principles

• Promote the public interest by putting "service to the public above service to oneself."

• "Strengthen social equity" by treating "all persons with fairness, justice, equality and respect" and reducing "unfairness, injustice and inequality."

• "Demonstrate personal integrity" by adhering to "the highest standards of conduct to inspire public confidence and trust in public service."

- *From "Who Are the Keepers of the Code? Articulating and Upholding Ethical Standards in the Field of Public Administration" by James Svara of Arizona State University*

4

State statutes on ethics

- Restricted activities
- Conflict of interest
- Seeking improper influence
- Accepting improper influence
- Honorariums
- Contracts with governmental bodies and self or family members

5

Most common unethical behaviors

- 1. Misusing time on the job
- 2. Abusive behavior (including sexual harassment)
- 3. Employee theft (pocketing funds and adjusting permit fees to hide it)
- 4. Lying to employees and supervisors
- 5. Violating internet policies

6

Scenarios

- Contractor brings boxes of candy to the office during the holidays for you and your coworkers
- Permit applicant offers a tip for expedited service
- Applicant's file is "buried" because you don't like her
- Permit fees get waived for certain companies and individuals but not in a uniform way
- Applicant is discouraged from applying for special use permit because you know the city council doesn't approve of plans due to the religion involved

7

First Amendment Auditors and Public Employees

- People who test local governments by going to public property such as parking lots and offices and filming any encounters with public employees
- Some seek to provoke a response which can be posted on social media
- Purported to be testing public employees to see if they comply with the First Amendment

8

First Amendment

- Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; for abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the Government for a redress of grievances

9

Characteristics for auditors

- Some refer to themselves as citizen journalists
- Can play an important role in documenting abuses e.g. George Floyd death
- Enter spaces open to the public such as city clerk offices, police stations, libraries
- Some refuse to identify themselves or explain what they are doing

10

Provocation

- Filming by these "auditors" lead some employees to call the police which can lead to what these individuals perceive to be harassment
- Auditor "fails" the public entity and employees for interfering with 1st Amendment rights
- Often video is posted on Facebook or YouTube
- Some people have their own channels
- Try to depict public employees in unfavorable light

11

Consequences

- Social media recordings that last forever
- May lead to civil rights lawsuits against the government under 42 U.S.C. Sec. 1983
  1. Under color of state law
  2. A deprivation of federal constitutional or statutory rights e.g. First Amendment

12

Does the 1st Amendment apply?

- Animal Legal Defense Fund v. Wasden, 878 F.3d 1184(2018)
- Animal rights organization challenged Idaho law making it a crime to enter a private agricultural production facility and make audio and video recordings (secret expose of animal abuse)
- Government tried to regulate speech by prohibiting filming
- Recording is speech!

13

What can be regulated

- Speech and other expressive activities – very difficult to regulate under the First Amendment including filming others in a public forum
- Conduct v. expressive activities
- Can define what areas are open to the general public v. areas open to employees

14

Public forum

- Traditional public forum
- Designated public forum
- Limited pubic forum

15

Important terms

- Content based restrictions
- Content-neutral restrictions
- Viewpoint based restrictions

16

Meetings

- "Public officials do not have to allow people to disrupt or derail their ability to conduct the people's business. It is perfectly acceptable for a governing body to establish rules that dictate when public comment can be made, how long the public comment can be given, and the topic that the public comment must surround. Governing bodies are also permitted the right to remove any person from a public meeting when that person actually disrupts the meeting. If a person's disruption of a meeting is so deleterious that it threatens the safety and security of the public, the governing body can request that the person in question be arrested for disorderly conduct.

17

Meetings

- And while public officials may wish to prospectively ban consistently disruptive people from future meetings, officials are warned that the only time such an action may even be legally permissible is if the officials can prove that the disruptive people proves to be an actual threat to the public safety—and even then, a limited suspension is perhaps most prudent. As a general rule, cities should utilize the least restrictive option to a disruptive citizen's rights when trying to regain and retain order of a public meeting."

18

Strategies

- Educate employees to know what the law is regarding the First Amendment e.g. filming is allowed of persons in a public forum
- Remain calm, cool and collected
- Know who to contact if there is an issue that arises
- Act as if everything you say and do will be on YouTube

19

File Attachments for Item:

EC-4 Mass Timber and Type IV Construction in the IBC (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Provider Information

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

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

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

☐ Check here if Course Renewal

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

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

New Course Information

Course title: Mass Timber and Type IV Construction in the IBC

Course instructor: Edward Lisinski

Course description

The 2021 International Building Code (IBC) allows for construction of tall mass timber buildings with larger heights and areas than previously permitted in Types III, IV, and V construction. This course will provide an overview of mass timber which includes any product currently permitted for use in Type IV (heavy timber) construction such as cross-laminated timber (CLT), structural composite lumber (SCL), glued laminated timber (glulam), mechanically laminated decking (aka nail-laminated timber, NLT), and large section sawn timbers. Learn about provisions first introduced in the 2015 and 2018 IBC for mass timber construction as well as an overview of tall mass timber construction per the 2021 IBC and 2021 International Fire Code.

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

Special Content

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

Conference Course	Conference Name	Conference location

☐ On Demand ☐ Webinar

Course to be offered online?

- [ ] Yes
- [x] No

Course Website

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

Course applicable for the following certifications *

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

Application materials included *

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

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

File Name	Size
Outline & PPT_New Mass Timber and Type IV Construction in the IBC.pdf	10.79 MB

Applicant Full Name *

Laura Morris

Date of Submission

09/01/2023

Instructions for new Continuing Education Approval form

Provider Information

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

Course Renewal

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

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

New Course Information

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

Special Content

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

Edward J. Lisinski

Phone: (414) 412-6096
Email: elisinski@awc.org

QUALIFICATIONS:

In my current position as Regional Manager for the American Wood Council, I monitor and participate in local, state and national building codes processes, as they relate to wood construction, in my region. I am responsible to provide training (both in-person and virtual) and resources for building and fire officials, inspectors and plan reviewers in my region. I am a State of Wisconsin licensed Professional Engineer, Master Plumber and have commercial and residential building and plumbing inspection certifications from the State of Wisconsin. I currently serve on the ICC Governing Committee for the Building Membership Council as Chair, the IBC-Structural Committee as Chair, and numerous other boards and committees. I am currently serving as the Immediate Past-President and Treasurer of the Wisconsin Code Officials Alliance.

EDUCATION:

Bachelor of Science in Architectural Engineering, Milwaukee School of Engineering

EMPLOYMENT:

12/2021-Present Regional Manager, American Wood Council.
My responsibilities include monitoring and participating in the local, state and national building codes processes, as they relate to wood construction; providing training (both in-person and virtual) for building and fire officials, inspectors and plan reviewers; and being a resource for the design, construction, review and inspection of wood construction in my region.

8/2005-11/2021 Plan Reviewer (8/05-6/11)/Assistant Director (6/11-12/14)/Director (12/14-11/21), City of West Allis Department of Building Inspection and Neighborhood Services

My responsibilities included directing a team of 16 building inspectors and staff; reviewing building plans for local, state and national building codes; writing building permits; meeting with contractors, architects and home owners to discuss projects; budgeting; hiring and disciplining my staff; being the primary contact for other departments in City Hall; writing municipal codes and ordinances; managing and updating department policies and procedures.

4/2019-5/2022 Co-Owner, E-Plan Exam
E-Plan Exam is a third party plan review company which provides municipal plan reviews for four municipalities in Wisconsin, and growing. We provide plan reviews for building, plumbing, mechanical, fire alarm and fire sprinkler systems. We also provide building code consulting services for architects, developers and contractors.

3/2000-8/2005 Architectural Designer, Anderson Ashton, Inc.
My responsibilities included drafting building plans, creating 3D models and renderings, designing structural systems for buildings, preparing all construction documents, drawings, and structural calculations, and performing code reviews.

9/2003-5/2006 Adjunct Instructor, ITT Technical Institute, Greenfield Campus
My responsibilities included teaching classes such as: Architectural Drafting I & II, Engineering Graphics I, Digital Information Management, Physical & Computer Aided 3D Modeling, and aid students in their design projects.

1994-2000 Laborer, Leppin Services, Inc.
My responsibilities included work in the construction field installing drywall, insulation, and steel and wood studs.

CERTIFICATIONS, LICENSES, AWARDS:

Professional Engineer, State of Wisconsin, No. 41154
Master Plumber, State of Wisconsin, No. 997556
Commercial and Residential Building and Plumbing Inspector, No. 997556
Gold Certificate in Supervision, Cities and Villages Mutual Insurance Company, August 2013
Silver Certificate in Management, Cities and Villages Mutual Insurance Company, December 2013
2014 West Allis/West Milwaukee Chamber of Commerce "Young Professional of the Year Award"
2020 NARI Milwaukee "Bill Bobrowitz Image Award"

PROFESSIONAL BOARDS AND COMMITTEES:

International Code Council (ICC), Building Membership Council
- Governing Committee Member, elected to first term, 2017-2021
  - Elected to second term 2022-2025
  - Elected as Vice Chairman for 2020-2021
  - Elected as Chairman for 2022 and 2023
- Chairman, Continuity and Outreach subcommittee, 2020-2021
- Raising the Profile subcommittee, Member 2016-Present, Chairman 2019
- Preparing for the Future Task Group Member, 2016-2018
- Higher Education Task Group Member, 2016-2018

ICC Structural Code Development Committee,
- Member 2015-Present
- Vice Chairman 2017-2019
- Chairman 2020-Present

ICC Building Code Interpretation Committee, Chairman 2017-2019
ICC Region III Code Development Committee Member, 2016-Present
Wisconsin Code Officials Alliance
- Member, 2013-Present
- Vice President, 2016
- President, 2017-2020
- Immediate Past-President 2020-Present
- Treasurer 2021-Present
- Board Liaison of Strategic Planning Committee, 2015-Present
- Member of Government Relations/Code Development Committee, 2015-Present

Building Inspectors Association of Southeastern Wisconsin;
- Member, 2005-Present
- Code Development Committee, Member 2015-Present, Chairman 2017-2021

COMMUNITY BOARDS AND COMMITTEES:

City of West Allis Plan Commission, 2002-2005
City of West Allis Historical Conservation Commission, 2004-2005; 2022-Present
West Allis Community Gala Planning Committee 2011-Present
West Allis Crime Stoppers Board of Directors, 2017-Present, Treasurer 2019-Present
West Allis Historical Society
- Board of Directors, 2009-Present
- Vice President, 2013-Present

West Allis Little League
- Volunteer Coach, 2010-2015
- Board of Directors, 2012-2015

West Allis Old Timers Baseball Association
- Board of Directors, 2010-Present
- Vice President 2014-2016
- President 2017-Present

Mass Timber and Type IV Construction in the IBC

Timed Outline: 90 min.

Description

The 2021 International Building Code (IBC) allows for construction of tall mass timber buildings with larger heights and areas than previously permitted in Types III, IV, and V construction. This course will provide an overview of mass timber which includes any product currently permitted for use in Type IV (heavy timber) construction such as cross-laminated timber (CLT), structural composite lumber (SCL), glued laminated timber (glulam), mechanically laminated decking (aka nail-laminated timber, NLT), and large section sawn timbers. Learn about provisions first introduced in the 2015 and 2018 IBC for mass timber construction as well as an overview of tall mass timber construction per the 2021 IBC and 2021 International Fire Code.

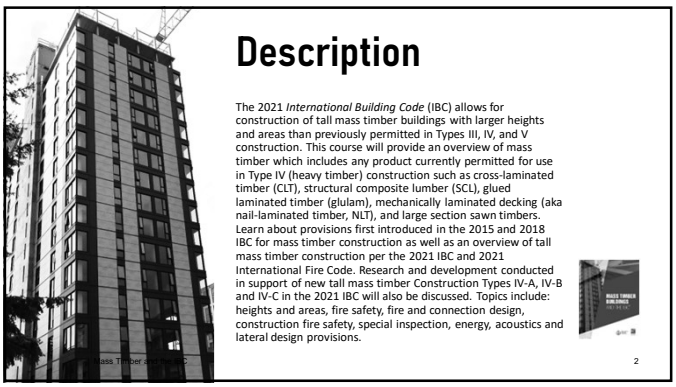
Learning Objectives

1. Recognize the unique fire resistive characteristics of mass timber as it influences the use of wood in building construction.
2. Summarize new provisions in the 2015, 2018 and 2021 IBC related to mass timber products and Type IV construction.
3. Recognize how new types of construction compare with existing types of construction in the IBC and specify the inherent differences and conservative approaches for the new construction types.
4. Evaluate the new provisions for heights and areas, construction fire safety, fire and connection design and special inspection in tall mass timber construction.

Outline: 90 minutes / 1.5 hrs.

Welcome & Introduction	5 min	
Introduction to Mass Timber Products	10 min	
2015/2018 IBC for Mass Timber Construction	10 min	
2021 IBC for Tall Mass Timber Construction	15 min	
Part 1: Background and Overview		5 min
Part 2: New Construction Types and Heights & Areas		5 min
Part 3: Fire Safety		10 min
Part 4: Fire & Connection Design and Special Inspection		5 min
Part 5: Acoustics, Energy, and Lateral Resistance		5 min
Part 6: Construction Fire Safety		10 min
Question & Answer	10 min	

1



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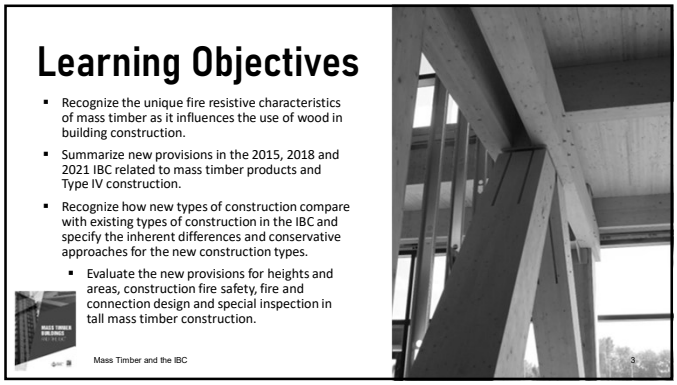

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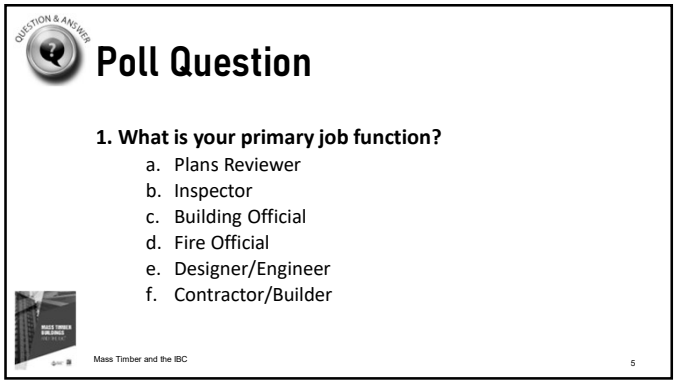

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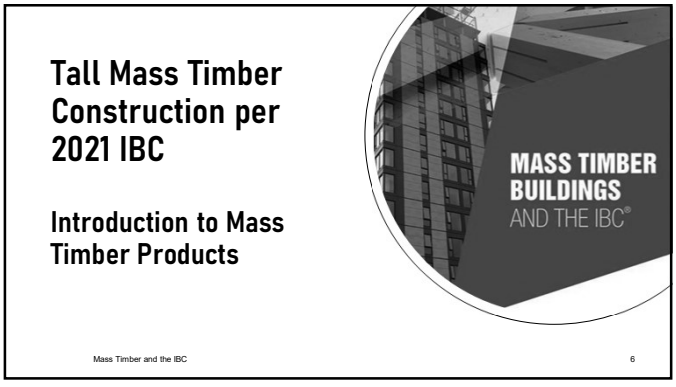

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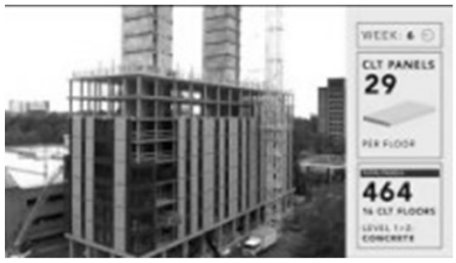
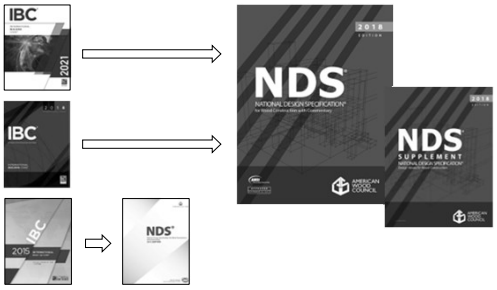
Why do we need mass timber buildings?



Mass Timber and the IBC 7

7

Standard for Engineered Wood Design



Mass Timber and the IBC 8

8

Sub-Outline

- Introduction to Mass Timber Products
- Types of Mass Timber Products
  - Code Acceptance
  - Technology
  - Application

Mass Timber and the IBC 9

9

Introduction to Mass Timber Products

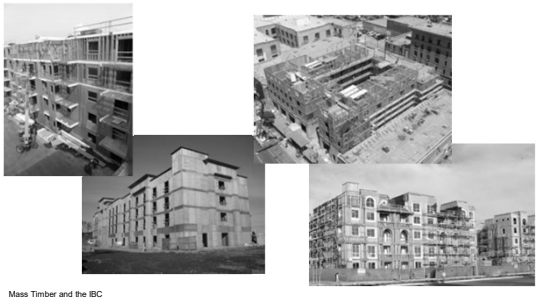
What are all these acronyms?

- Sawn Lumber
  - Heavy Timber – HT
- Glued Laminated Timber
  - Beam or column – Glulam
  - Floor or roof slab – GLT
- Mechanically Laminated Decking
  - Nail-Laminated Timber – NLT
  - Dowel-Laminated Timber – DLT
- Structural Composite Lumber – SCL
  - Laminated Veneer Lumber – LVL
  - Parallel Strand Lumber – PSL
  - Laminated Strand Lumber – LSL
  - Oriented Strand Lumber – OSL
- Cross-Laminated Timber – CLT
- Mass Plywood Panels – MPP

Mass Timber and the IBC 10

10

Traditional Stick Frame Construction



Mass Timber and the IBC 11

11

Mass Timber is NOT Light-Frame

… but Mass Timber elements can be used in all construction types

Mass Timber and the IBC 12

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Where is Mass Timber Allowed in the IBC?

- Types I & II – generally noncombustible inside and out
  - Heavy Timber allowed for limited roof applications in Type I-B & Type II
- Type III – noncombustible exterior walls, but interior any material
- Types IV & V – generally combustible
  - Type V includes any material permitted

LeMay – America's Auto Museum – Tacoma, WA
Courtesy of APA-The Engineered Wood Association

13

Mass timber elements are the ONLY combustible elements allowed for tall mass timber buildings

14

Minimum Sizes for Mass Timber

Spelled out in 602.4 and 2304.11

Table 2304.11 MINIMUM DIMENSIONS OF HEAVY TIMBER STRUCTURAL MEMBERS

Supporting	Min. Nom. Solid Sawn Size		Min. Glulam Net Size		Min. SCL Net Size	
	Width (in.)	Depth (in.)	Width (in.)	Depth (in.)	Width (in.)	Depth (in.)
Floor or Floor/Roof	8	8	6¾	8¾	7	7½
	6	10	5	10½	5¼	9½
Roof Only	6	8	5	8¾	5¼	7½
	6	6	5	6	5¼	5½
	4	6	3	$6^{7}/_{8}$	3½	5½

- CLT minimum thicknesses
  - Floors – 4″ actual
  - Roofs – 3″ nominal
  - Exterior Walls in Type IV – 6″ with limitations (see 602.4.2)

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Sub-Outline

- Introduction to Mass Timber Products
- Types of Mass Timber Products
  - Code Acceptance
  - Technology
  - Application

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Types of Mass Timber Products

- Sawn Lumber (Timbers)
- Glued Laminated Timber
- Mechanically Laminated
  - Nail-Laminated Timber (NLT)
  - Dowel-Laminated Timber (DLT)
- Structural Composite Lumber (SCL)
  - Laminated Veneer Lumber (LVL)
  - Parallel Strand Lumber (PSL)
  - Laminated Strand Lumber (LSL)
  - Oriented Strand Lumber (OSL)
- Cross-Laminated Timber (CLT)
  - Mass Plywood Panels (MPP)

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Sawn Lumber (Timbers)

- Beams and Stringers
- Posts and Timbers
- Mechanically Laminated Decking
- Glulam
- 500,000 SF, 300 lbs./SF Design Load
- 24″ x 24″ columns on ground floor
- 9″ x 9″ columns on the 9th floor
- https://www.butlersquare.com/history

Butler Building – Minneapolis
Courtesy of WoodWorks

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Code Acceptance

- Grading practices and identification shall comply with rules published by an agency approved in accordance with the procedures of DOC PS 20 or equivalent
  - IBC 2301.1.1
  - Adobe version pdf version on NIST

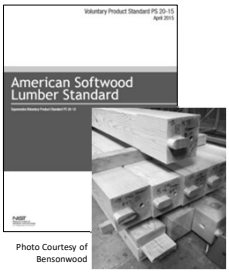

Photo Courtesy of Bensonwood

Mass Timber and the IBC 19

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Code-referenced Standard

- National Design Specification for Wood Construction
  - Design Values Supplement

Mass Timber and the IBC 20

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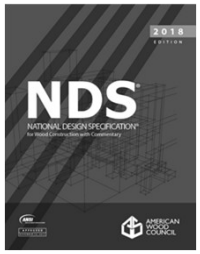
Sawn Lumber Design: 2018 NDS

1. General Requirements for Building Design
2. Design Values for Structural Members
3. Design Provisions and Equations
4. **Sawn Lumber**
5. Structural Glued Laminated Timber
6. Round Timber Poles and Piles
7. Prefabricated Wood I-Joists
8. Structural Composite Lumber
9. Wood Structural Panels
10. Cross-laminated Timber
11. Mechanical Connections
12. Dowel-Type Fasteners
13. Split Ring and Shear Plate Connectors
14. Timber Rivets
15. Special Loading Conditions
16. Fire Design of Wood Members



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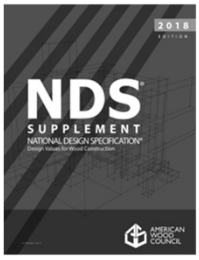
21

2018 NDS Supplement



1. **Sawn Lumber Grading Agencies**
2. **Species Combinations**
3. **Section Properties**
4. **Reference Design Values**
   - Sawn Lumber and Timber
   - MSR and MEL
   - Decking
   - Non-North American Sawn Lumber
   - Structural Glued Laminated Timber
   - Timber Poles and Piles

Mass Timber and the IBC 22

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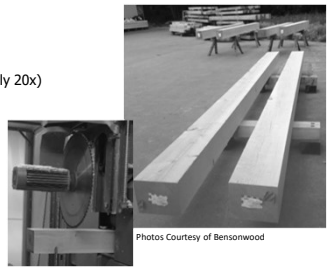
Sawn Lumber (Timbers)

Beams and Stringers

Posts and Timbers

- Readily available
- Western species 4x, 6x and 8x (possibly 20x)
- Southern Pine 2x (built-up)
- 8′ to 20′ lengths (2′ increments)

NOTE: always check for local availability



Photos Courtesy of Bensonwood

Mass Timber and the IBC 23

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Sawn Lumber (Timbers)

- Manufacturing sizes
  - Nominal vs. Actual
  - Dry vs. Green

Photos Courtesy of Fraserwood

Mass Timber and the IBC 24

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Types of Mass Timber Products

- Sawn Lumber (Timbers)
- Glued Laminated Timber
- Mechanically Laminated
  - Nail-Laminated Timber (NLT)
  - Dowel-Laminated Timber (DLT)
- Structural Composite Lumber (SCL)
  - Laminated Veneer Lumber (LVL)
  - Parallel Strand Lumber (PSL)
  - Laminated Strand Lumber (LSL)
  - Oriented Strand Lumber (OSL)
- Cross-Laminated Timber (CLT)
  - Mass Plywood Panels (MPP)

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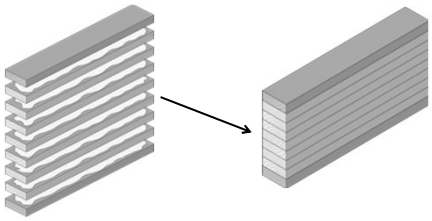
Glued Laminated Timber

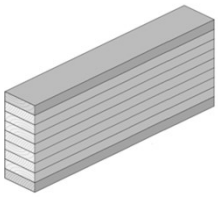
- STRUCTURAL GLUED LAMINATED TIMBER = Glued laminated timber = Glulam
  - composite of lumber laminations bonded with adhesives



26

Glulam – Characteristics

- Wood laminations bonded together
- Wood grain runs parallel to length



- Typical Widths
  - 3-1/8", 3-1/2", 5-1/8", 5-1/2" and 6-3/4" (possibly to 10-3/4")
  - Widths vary by species
- Laminations
  - 1-3/8" for Southern Pine
  - 1-1/2" for Douglas Fir

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Glued Laminated Timber - Glulam

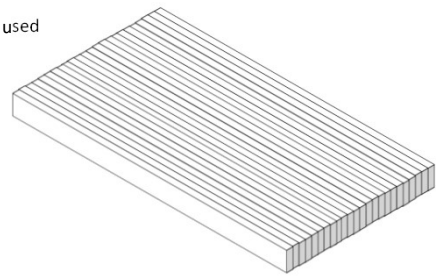
- Glulam – when used as a beam or column

Photo courtesy of naturallywood.com. Photo - Steven Errico

28

Glued Laminated Timber - GLT

- GLT – when used as a panel



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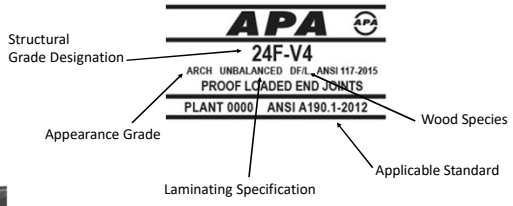
Code Acceptance

- IBC 2303.1.3 - Structural glued laminated timber manufactured and identified as required
  - Qualification and quality assurance
  - On-going third-party inspection
  - Grademark meeting ANSI A190.1
  - *D 3737: Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)*
  - Commonly uses sawn lumber - DOC PS 20

30

Marking per ANSI/APA A190.1



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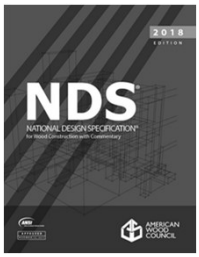
Glulam Design: 2018 NDS

1. General Requirements for Building Design
2. Design Values for Structural Members
3. Design Provisions and Equations
4. Sawn Lumber
5. **Structural Glued Laminated Timber**
6. Round Timber Poles and Piles
7. Prefabricated Wood I-Joists
8. Structural Composite Lumber
9. Wood Structural Panels
10. Cross-laminated Timber
11. Mechanical Connections
12. Dowel-Type Fasteners
13. Split Ring and Shear Plate Connectors
14. Timber Rivets
15. Special Loading Conditions
16. Fire Design of Wood Members



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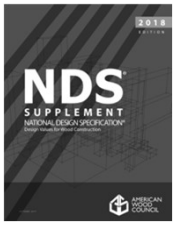
2018 NDS Supplement



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   - Sawn Lumber and Timber
   - MSR and MEL
   - Decking
   - Non-North American Sawn Lumber
   - Structural Glued Laminated Timber
   - Timber Poles and Piles

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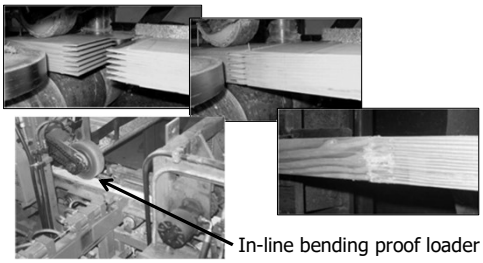
Finger Jointing Using RF Curing



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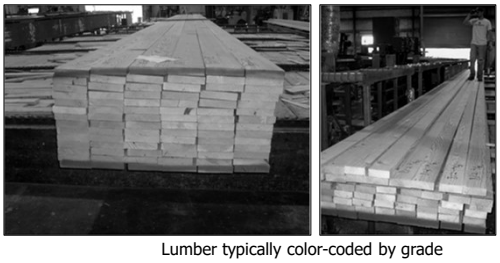
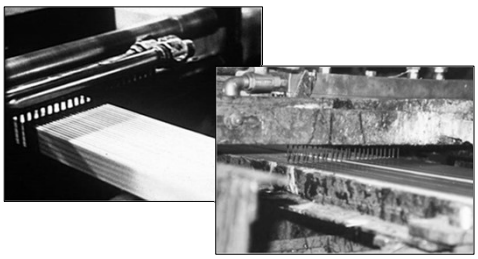
Pre-Adhesive Layup



Lumber typically color-coded by grade

35

Face Bonding



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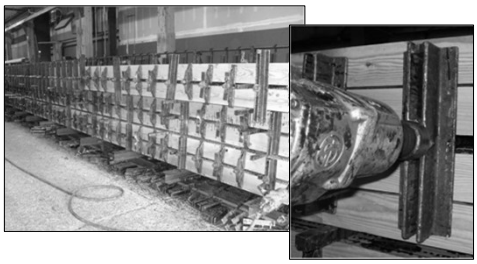
Clamping and Curing



Mass Timber and the IBC 37

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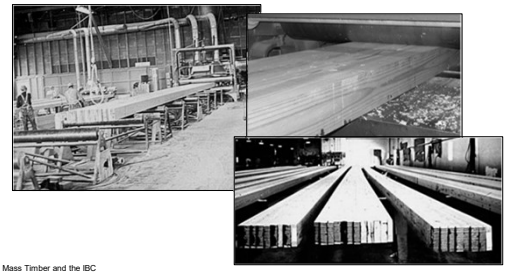
Fabrication & Finishing



Mass Timber and the IBC 38

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Church in Louisville, KY

12-1/4" x 84"
140' clear span

Mass Timber and the IBC 39

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Bullitt Center – Seattle, WA

250 YEAR STRUCTURE
HEAVY TIMBER, CONCRETE & STEEL

Architect: Miller Hull Partnership
Structural Engineer: DCI Engineers
Photo Credit: Miller Hull Partnership

Mass Timber and the IBC 40

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Bullitt Center – Seattle, WA

- Glulam beams and columns
- Nail-laminated timber floors

Architect: Miller Hull Partnership
Structural Engineer: DCI Engineers
Photo Credit: Miller Hull Partnership

Mass Timber and the IBC 41

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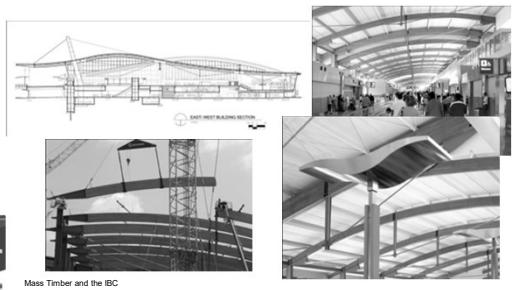
Raleigh Durham Airport



Mass Timber and the IBC 42

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Cathedral of Christ the Light - Oakland

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Cathedral of Christ the Light - Oakland

Design Team: Skidmore Owings & Merrill, Craig W. Harman
Webcore Builders
Glulam Manufacturer: Western Wood Structures
Photo Credit: Timothy Hursley, Cesar Rubio, and John Blaustein

44

Fire House - Multnomah County, OR

Owner: Multnomah County Rural Fire Protection District 10. Oregon
Architect: Hennebery Eddy Architects, Inc
Photo by Josh Partee

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Denver – Platte15

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Types of Mass Timber Products

- Sawn Lumber (Timbers)
- Glued Laminated Timber
- Mechanically Laminated
  - Nail-Laminated Timber (NLT)
  - Dowel-Laminated Timber (DLT)
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  - Laminated Veneer Lumber (LVL)
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- Cross-Laminated Timber (CLT)
  - Mass Plywood Panels (MPP)

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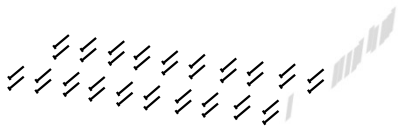
What is Nail-Laminated Timber?



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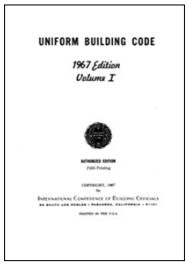
Code Acceptance


UNIFORM BUILDING CODE

1967 Edition
Volume I

(g) **Mechanically Laminated Floors and Decks.** A laminated lumber floor or deck built up of wood members set on edge, when meeting the following requirements, may be designed as a solid floor or roof deck of the same thickness, and continuous spans may be designed on the basis of the full cross section using the simple span moment coefficient.

Laminations shall be driven up and spiked closely together with a row of nails near each edge at spaced intervals and staggered vertically. Nail spacing in each row shall not exceed eighteen inches (18") for two-inch by eight-inch (2" x 8") nominal width and be proportional for other plank widths. Nail length shall be not less than two and one-half times the net thickness of each lamination.

A single span deck shall have all laminations full length.

A continuous deck of two spans shall have not more than every fourth lamination spliced within quarter points adjoining supports.

A continuous deck of more than two spans shall have not more than every third lamination spliced within quarter points adjoining supports.

Joints shall be closely butted over supports or staggered across the deck but within the adjoining quarter spans.

No lamination shall be spliced more than twice in any span.

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Code Acceptance

- 2304.9.3 Mechanically laminated decking. Mechanically laminated decking shall comply with Sections 2304.9.3.1 through 2304.9.3.3.
- 2304.9.3.1 General. Mechanically laminated decking consists of square-edged dimension lumber laminations set on edge and nailed to the adjacent pieces and to the supports.
- 2304.9.3.2 Nailing. The length of nails connecting laminations shall not be less than two and one-half times the net thickness of each lamination. Where decking supports are 48 inches (1219 mm) on center (o.c.) or less, side nails shall be installed not more than 30 inches (762 mm) o.c. alternating between top and bottom edges and staggered one-third of the spacing in adjacent laminations. Where supports are spaced more than 48 inches (1219 mm) o.c., side nails shall be installed not more than 18 inches (457 mm) o.c. alternating between top and bottom edges and staggered one-third of the spacing in adjacent laminations. Two side nails shall be installed at each end of butt-jointed pieces.

  Laminations shall be toenailed to supports with 20d or larger common nails. Where the supports are 48 inches (1219 mm) o.c. or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches (1219 mm) o.c., alternate laminations shall be toenailed to every support.
- 2304.9.3.3 Controlled random pattern. There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on at least two supports with end joints in these two courses occurring on alternate supports. A maximum of seven intervening courses shall be permitted before this pattern is repeated.

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Sawn Lumber Design: 2018 NDS

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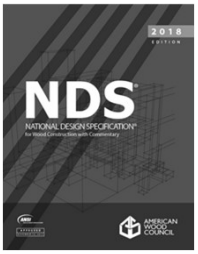

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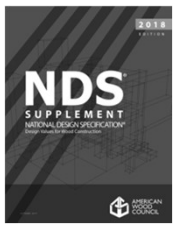
2018 NDS Supplement



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Nail-Laminated Timber

Courtesy: StructureCraft

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Nail-Laminated Timber

Courtesy : StructureCraft

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Nail-Laminated Timber

Courtesy : StructureCraft

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Nail-Laminated Timber

- Nail-Laminated Timber – 2x12 vertical
- Mechanically connected w/nails
- NDS principles of mechanics

Architect: Profeta Royalty Architecture
Structural Engineer: Structural Focus 2011

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Nail-Laminated Timber

- Samuel Brighouse Elementary School (Richmond, BC)

Design Team: Perkins + Will Canada, Fast + Epp
Photo Credit: Stephan Pasche

Courtesy : StructureCraft

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Nail-Laminated Timber

Architect: DLR Group
https://vimeo.com/162580838

- T3 – Minneapolis
  - Glued & Nail-laminated Timber – vertical 2x sawn lumber mechanically connected w/nails
  - Engineered with NDS principles of mechanics
  - **7 Stories total**
  - **6 Stories Type IV Construction**
  - **1 Story Type 1-A Podium**
  - **IBC Section 510**

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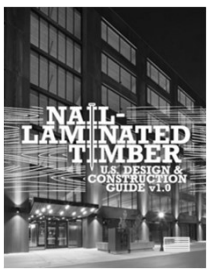
Nail-Laminated Timber Handbook

- Architecture
- Fire
- Structure
- Enclosures
- Supply & Fabrication
- Construction & Installation
- Erection Engineering

https://www.thinkwood.com/products-and-systems/mass-timber/nltguide



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Dowel-Laminated Timber

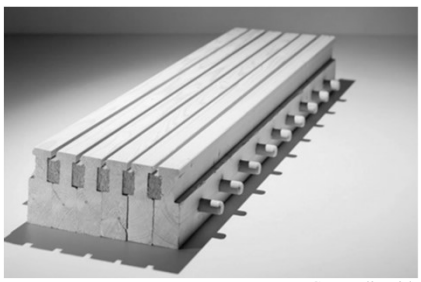

Photo courtesy of StructureCraft

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Dowel-Laminated Timber

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Dowel-Laminated Timber

Photo provided by B.Bishop

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Dowel-Laminated Timber

ICC-ES Evaluation Report

ESR-4069

Issued November 2019
Revised November 8, 2019
This report is subject to renewal November 2020.

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

DIVISION: 06 00 00 —WOOD, PLASTICS AND COMPOSITES
Section: 06 17 21—Dowel-Laminated Timber

REPORT HOLDER:

STRUCTURECRAFT BUILDERS INC.

EVALUATION SUBJECT:

DOWEL-LAMINATED TIMBER (DLT)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012 and 2009 *International Building Code®*

time of manufacture does not exceed 19 percent, and the dowels are dried to 5 to 9 percent moisture content prior to insertion. Once inserted, the dowels swell as they come into equilibrium with the higher moisture content of the surrounding lumber, providing additional friction for a tight fit of the dowel in the laminations.

The StructureCraft Dowel-Laminated Timber panels are available in thicknesses of 4 inches nominal (89 mm) to 12 inches nominal (286 mm), widths of 12 inches (305 mm) to 14 feet (4.3 m) and lengths up to 60.7 feet (18.5 m).

3.2 Material:

3.2.1 Wood Laminations: Wood laminations used in manufacturing StructureCraft Dowel-Laminated Timber are

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  - Laminated Strand Lumber (LSL)
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  - Mass Plywood Panels (MPP)

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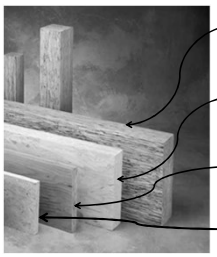
Structural Composite Lumber (SCL)



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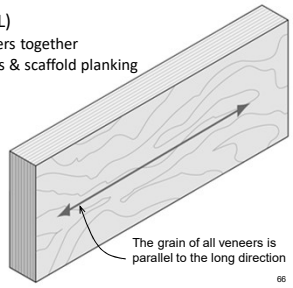
SCL – Features & Applications

- Laminated Veneer Lumber (LVL)
  - Produced by bonding thin veneers together
  - Used for beams, headers, rafters & scaffold planking
- Common Thicknesses
  - 1-3/4" to 7"
- Depths
  - 5-1/2" – 24"
- Lengths
  - Up to 60'



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Code Acceptance

- **2303.1.10 Structural composite lumber.** Structural capacities…in accordance with ASTM D 5456
- D 5456: *Specification for Evaluation of Structural Composite Lumber Products*


Designation: D5456 – 14b

Standard Specification for Evaluation of Structural Composite Lumber Products[1]

INTRODUCTION

Mass Timber and the IBC 67

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SCL Design: 2018 NDS

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4. Sawn Lumber
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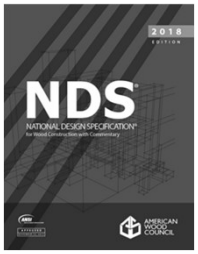

Mass Timber and the IBC 68

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SCL – Features & Applications

- Features
  - Wood veneers or strands primarily oriented in the same direction
  - Strong when face- or edge-loaded
  - Milled (sawn) to consistent sizes
- Strength Properties
  - APA publishes strength properties
  - See manufacturer criteria


Photo Courtesy of www.naturallywood.com

Mass Timber and the IBC 69

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Mass Timber and the IBC 70

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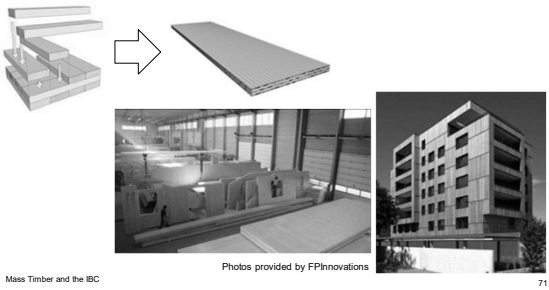
Cross-Laminated Timber


Photos provided by FPInnovations

Mass Timber and the IBC 71

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Code Acceptance

- 2303.1.4 Structural glued cross-laminated timber is to be manufactured and identified in accordance with ANSI/APA PRG 320

Mass Timber and the IBC 72

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CLT Design: 2018 NDS

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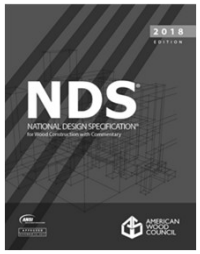

Mass Timber and the IBC 73

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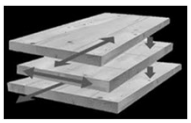
History of CLT

- 1985 1st CLT patent - France
- 1993 1st CLT projects - Switzerland and Germany
- 1995-1996 Improved press technology
- 1998 1st multi-story res building - Austria
- Early 2000's
  - CLT use (Europe) increased significantly
  - Green building movement driven
  - Better efficiencies, product approvals, improved marketing and distribution channels
  - Over 500 CLT buildings in England
- Recent - US and Canadian use of CLT



Mass Timber and the IBC 74

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CLT Press & Assembly Line

Photos Courtesy of Katerra

Mass Timber and the IBC 75

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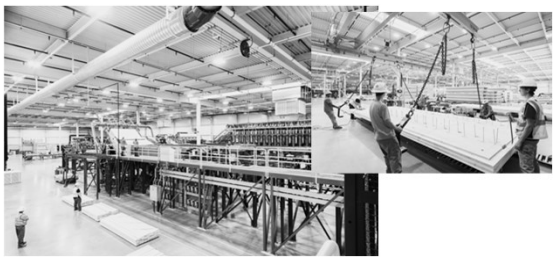
CLT Manufacturing Process



Photos Courtesy of Katerra

Mass Timber and the IBC 76

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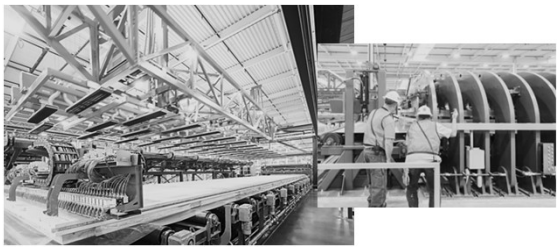
CLT Manufacturing Process



Photos Courtesy of Katerra

Mass Timber and the IBC 77

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Ready to Ship

Photo Courtesy of Katerra

Mass Timber and the IBC 78

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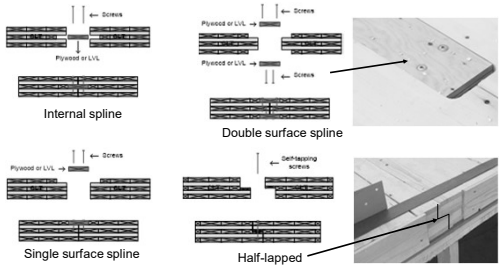
Typical Construction Details



Mass Timber and the IBC 79

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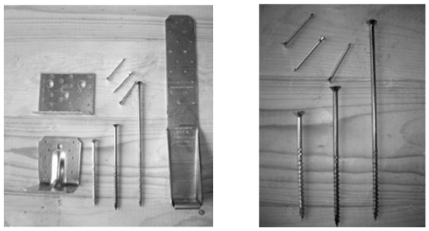
Typical Panel Connectors



Mass Timber and the IBC 80

80

Typical Panel Connectors

Mass Timber and the IBC 81

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CLT – Fitchburg, WI

- Factory
- Promega Feynman Center
- Fitchburg, WI

Owner: Promega Corporation
Architect: Uihlein-Wilson
Photos by J.B. Smith

Mass Timber and the IBC 82

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CLT – Huntsville, AL

- Private Army Hotel – Redstone Arsenal
- Four stories and 58,000 sq ft

Owner/GC: Lendlease (US) Public Partnerships LLC
Architect: Leidos (now Benham)
Structural Engineer: Schaefer Structural Engineers
Photo: Lendlease

Mass Timber and the IBC 83

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CLT – Huntsville, AL

Mass Timber and the IBC 84

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CLT – Huntsville, AL

85

CLT – Huntsville, AL

86

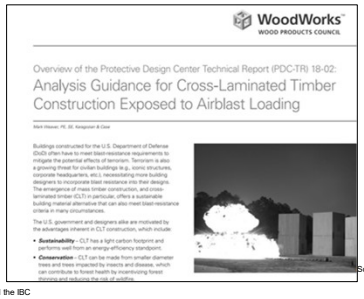
CLT – Huntsville, AL

87

CLT – Huntsville, AL

88

CLT – Blast Testing



WoodWorks
WOOD PRODUCTS COUNCIL

Overview of the Protective Design Center Technical Report (PDC-TR) 18-02:
Analysis Guidance for Cross-Laminated Timber Construction Exposed to Airblast Loading

Source: WoodWorks

89

CLT – WV Elementary School

- 46,200 sq. ft.
- 8-week assembly
- Architect: MSES Architects Fairmont, WV

Source: LignaTerra

90

CLT – WV Elementary School




Photos: LignaTerra

91

CLT – Clemson University


Courtesy of Clemson University

92

CLT – Boston

Courtesy of Generate Architecture and Technologies

93

CLT – Canadian Projects

- The Arbora
- Québec, Canada
  - 8 Stories
  - 434 Residential condos, townhouses and rentals

94

CLT and Glulam – Vancouver, BC

- Brock Commons
  - 18 Stories
  - Mixed use student housing
  - Glulam columns
  - CLT floors


95

Mass Timber Worldwide

www.Thinkwood.com/tallerwood

Source: ThinkWood

96

Mass Plywood Panel - MPP

- SCL-based "panel" or slab
- Alternative to CLT
- Like LVL – parallel laminations

Photo Courtesy
Freres Lumber

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Mass Plywood Panel

Photos Courtesy
of Freres Lumber

Photo courtesy of
Stephen A. Miller
and Skylab

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Q&A

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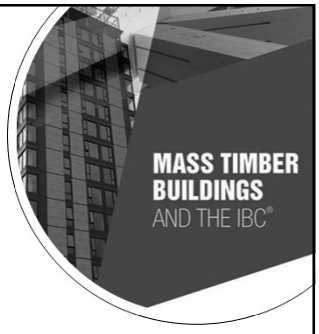
Outline

- Introduction to Mass Timber Products
- 2015/2018 IBC for Mass Timber Construction
- Break – 15 minutes
- 2021 IBC for Tall Mass Timber Construction
  - Part 1: Background and Overview
  - Lunch – 1 hour
  - Part 2: New Construction Types and Heights & Areas
  - Part 3: Fire Safety
  - Break – 15 minutes
  - Part 4: Fire & Connection Design and Special Inspection
  - Part 5: Acoustics, Energy, and Lateral Resistance
  - Part 6: Construction Fire Safety

100

2015/2018 IBC for Mass Timber Construction



101

Sub-Outline

- 2015 IBC Related to CLT and SCL
- 2018 IBC Related to Heavy Timber

102

2015 IBC: SCL in Type IV

- Structural Composite Lumber (SCL) defined as heavy timber

Minimum Nominal Solid Sawn Size		Minimum Glued Laminated Timber Net Size		Minimum Structural Composite Lumber Net Size	
Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
8	8	6¾	8¼	7	7½
6	10	5	10½	5¼	9½
6	8	5	8¼	5¼	7½
6	6	5	6	5¼	5½
4	6	3	6⅞	3½	5½

103

2015 IBC: CLT in Type IV

- Cross Laminated Timber (CLT) defined as heavy timber
  - Ext/Int Walls
  - Floors
  - Roofs

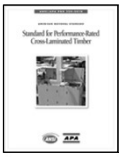
Photo provided by FPInnovations

104

2015 IBC: Definition and Standard

[BS] CROSS-LAMINATED TIMBER. A prefabricated engineered wood product consisting of not less than three layers of solid-sawn lumber or *structural composite lumber* where the adjacent layers are cross oriented and bonded with structural adhesive to form a solid wood element.

2303.1.4 Structural glued cross-laminated timber. Cross-laminated timbers shall be manufactured and identified in accordance with ANSI/APA PRG 320.



105

Supporting Data: CLT Fire Test

NGC Testing Services

Fire Testing Laboratory

IAS ACCREDITED Testing Laboratory TL-216

TEST REPORT Page 1 of 53

for

American Wood Council

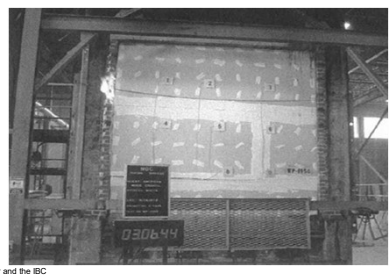
222 Catoctin Circle SE, Suite 201
Leesburg, VA 20175

Standard Methods of
Fire Tests of Building Construction and Materials
ASTM E 119 – 11a

Test Report No: WP-1950

106

Supporting Data: CLT Fire Test



107

2015 IBC: CLT Permitted Uses

- Types I and II – balcony and canopy or roof construction
- Type III – interior building elements
  - Roof-ceiling assemblies
  - Floor-ceiling assemblies
  - Interior walls
- Types IV or V – any

108

2015 IBC: CLT in Type IV

- Heavy Timber Family

602.4 Type IV. Type IV construction (Heavy Timber, HT) is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid or laminated wood without concealed spaces. The details of Type IV construction shall comply with the provisions of this section and Section 2304.11. Exterior walls complying with Section 602.4.1 or 602.4.2 shall be permitted. Minimum solid sawn nominal dimensions are required for structures built using Type IV construction (HT). For glued-laminated members and structural composite lumber (SCL) members, the equivalent net finished width and depths corresponding to the minimum nominal width and depths of solid sawn lumber are required as specified in Table 602.4. Cross-laminated timber (CLT) dimensions used in this section are actual dimensions.

Mass Timber and the IBC 109

109

2015 IBC: CLT in Type IV

- Exterior Walls (2 hours or less)

602.4.2 Cross-laminated timber in exterior walls. Cross-laminated timber complying with Section 2303.1.4 shall be permitted within exterior wall assemblies with a 2-hour rating or less, provided the exterior surface of the cross-laminated timber is protected by one the following:

1. Fire-retardant-treated wood sheathing complying with Section 2303.2 and not less than $^{15}/_{32}$ inch (12 mm) thick;
2. Gypsum board not less than $^{1}/_{2}$ inch (12.7 mm) thick; or
3. A noncombustible material.

Mass Timber and the IBC 110

110

2015 IBC: Plank Floors in Type IV

- Floors

602.4.6.1 Sawn or glued-laminated plank floors. Sawn or glued-laminated plank floors shall be one of the following:

1. Sawn or glued-laminated planks, splined or tongue-and-groove, of not less than 3 inches (76 mm) nominal in thickness covered with 1-inch (25 mm) nominal dimension tongue-and-groove flooring, laid crosswise or diagonally, $^{15}/_{32}$-inch (12 mm) wood structural panel or $^{1}/_{2}$-inch (12.7 mm) particleboard.

Mass Timber and the IBC 111

111

2015 IBC: CLT Floors in Type IV

- Floors

602.4.6.2 Cross-laminated timber floors. Cross-laminated timber shall be not less than 4 inches (102 mm) in thickness. Cross-laminated timber shall be continuous from support to support and mechanically fastened to one another. Cross-laminated timber shall be permitted to be connected to walls without a shrinkage gap providing swelling or shrinking is considered in the design. Corbelling of masonry walls under the floor shall be permitted to be used.

Mass Timber and the IBC 112

112

2015 IBC: CLT in Type IV

- Roofs

602.4.7 Roofs. Roofs shall be without concealed spaces and wood roof decks shall be sawn or glued laminated, splined or tongue-and-groove plank, not less than 2 inches (51 mm) nominal in thickness; $1^{1}/_{8}$-inch-thick (32 mm) wood structural panel (exterior glue); planks not less than 3 inches (76 mm) nominal in width, set on edge close together and laid as required for floors; or of cross-laminated timber. Other types of decking shall be permitted to be used if providing equivalent fire resistance and structural properties.

Cross-laminated timber roofs shall be not less than 3 inches (76 mm) nominal in thickness and shall be continuous from support to support and mechanically fastened to one another.

Mass Timber and the IBC 113

113

2015 IBC: CLT in Type IV

- Interior Walls

602.4.8 Partitions and walls. Partitions and walls shall comply with Section 602.4.8.1 or 602.4.8.2.

602.4.8.1 Interior walls and partitions. Interior walls and partitions shall be of solid wood construction formed by not less than two layers of 1-inch (25 mm) matched boards or laminated construction 4 inches (102 mm) thick, or of 1-hour fire-resistance-rated construction.

Mass Timber and the IBC 114

114

2015 IBC: CLT in Type IV

- Exterior walls – assembly must be 6" thick

602.4.8.2 Exterior walls. Exterior walls shall be of one of the following:

1. Noncombustible materials.
2. Not less than 6 inches (152 mm) in thickness and constructed of one of the following:
   - 2.1. Fire-retardant-treated wood in accordance with Section 2303.2 and complying with Section 602.4.1.
   - 2.2. Cross-laminated timber complying with Section 602.4.2.

Mass Timber and the IBC 115

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Sub-Outline

- 2015 IBC Related to CLT and SCL
- 2018 IBC Related to Heavy Timber

Mass Timber and the IBC 116

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2018 IBC: Heavy Timber Reorg

2018 IBC	2015 IBC	Provision
602.4	602.4	Type IV construction
602.4.1, 602.4.2	602.4.1	Wall assembly thickness
602.4.3	602.4.9	Exterior structural members
2304.11	2304.11	Heavy timber construction
Table 2304.11	Table 602.4	Minimum dimensions
2304.11.1	New	Details of heavy timber structural members
2304.11.1.1	602.4.3, 2304.11.1	Columns
2304.11.1.2	602.4.4, 2304.11.2	Floor framing
2304.11.1.3	602.4.5, 2304.11.3	Roof framing
2304.11.2.1	602.4.8.2	Exterior walls
2304.11.2.2	602.4.8.1	Partitions and interior walls
2304.11.3	602.4.6	Floors
2304.11.3.1	602.4.6.2	CLT floors
2304.11.3.2	602.4.6.1, 2304.11.4	Sawn or glued-laminated plank floors
2304.11.4	2304.11.5	Roof decks

Mass Timber and the IBC 117

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2018 IBC: Mech Laminated Decking

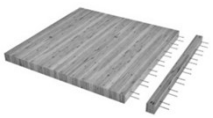
2304.11 Heavy timber construction. Where a structure, portion thereof or individual structural elements are required by provisions of this code to be of heavy timber, the building elements therein shall comply with the applicable provisions of Sections 2304.11.1 through 2304.11.4. Minimum dimensions of heavy timber shall comply with the applicable requirements in Table 2304.11 based on roofs or floors supported and the configuration of each structural element, or in Sections 2304.11.2 through 2304.11.4. Lumber decking shall be in accordance with Section 2304.9.

Mass Timber and the IBC 118

118

2018 IBC: Mech Laminated Decking

- Nail-laminated timber



2304.9.3.2 Nailing. The length of nails connecting laminations shall be not less than two and one-half times the net thickness of each lamination. Where decking supports are 48 inches (1219 mm) on center or less, side nails shall be installed not more than 30 inches (762 mm) on center alternating between top and bottom edges, and staggered one-third of the spacing in adjacent laminations. Where supports are spaced more than 48 inches (1219 mm) on center, side nails shall be installed not more than 18 inches (457 mm) on center alternating between top and bottom edges and staggered one-third of the spacing in adjacent laminations. For mechanically laminated decking constructed with laminations of 2-inch (51 mm) nominal thickness, nailing in accordance with Table 2304.9.3.2 shall be permitted. Two side nails shall be installed at each end of butt-jointed pieces.

Laminations shall be toenailed to supports with 20d or larger common nails. Where the supports are 48 inches (1219 mm) on center or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches (1219 mm) on center, alternate laminations shall be toenailed to every support. For mechanically laminated decking constructed with laminations of 2-inch (51 mm) nominal thickness, toenailing in accordance with Table 2304.9.3.2 shall be permitted.

Mass Timber and the IBC 119

119

2018 IBC: Mech Laminated Decking

TABLE 2304.9.3.2
FASTENING SCHEDULE FOR MECHANICALLY LAMINATED DECKING USING LAMINATIONS OF 2-INCH NOMINAL THICKNESS

MINIMUM NAIL SIZE (Length x Diameter) (inches)	MAXIMUM SPACING BETWEEN FACE NAILS [a,b] (inches)		NUMBER OF TOENAILS INTO SUPPORTS[c]
	Decking Supports ≤ 48 inches o.c.	Decking Supports > 48 inches o.c.	
4 × 0.192	30	18	1
4 × 0.162	24	14	2
4 × 0.148	22	13	2
3½ × 0.162	20	12	2
3½ × 0.148	19	11	2
3½ × 0.135	17	10	2
3 × 0.148	11	7	2
3 × 0.128	9	5	2
2½ × 0.148	10	6	2
2½ × 0.131	9	6	3
2½ × 0.120	8	5	3

Mass Timber and the IBC 120

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2018 IBC: CLT Exterior Walls – Type IV

602.4.2 Cross-laminated timber in exterior walls. *Cross-laminated timber* complying with Section 2303.1.4 shall be permitted within exterior wall assemblies not less than 6 inches (152 mm) in thickness with a 2-hour rating or less, provided the exterior surface of the cross-laminated timber is protected by one the following:

1. *Fire-retardant-treated wood* sheathing complying with Section 2303.2 and not less than $^{15}/_{32}$ inch (12 mm) thick;
2. *Gypsum board* not less than $^{1}/_{2}$ inch (12.7 mm) thick; or
3. A noncombustible material.

Mass Timber and the IBC 121

121

2018 IBC: Flame Spread

803.3 Heavy timber exemption. Exposed portions of building elements complying with the requirements for buildings of ~~Type IV~~ heavy timber construction in Section 602.4 or Section 2304.11 shall not be subject to interior finish requirements except in interior exit stairways, interior exit ramps, and exit passageways.

Mass Timber and the IBC 122

122

2018 IBC: SCL Dimensions

602.4 Type IV. Type IV construction ~~(Heavy Timber, HT)~~ is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid ~~or~~ wood, laminated wood, heavy timber (HT) or structural composite lumber (SCL) without concealed spaces. The minimum dimensions for permitted materials including solid timber, glued-laminated timber, structural composite lumber (SCL), and cross-laminated timber and details of Type IV construction shall comply with the provisions of this section and Section 2304.11. Exterior walls complying with Section 602.4.1 or 602.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire-resistance rating or heavy timber complying with Section 2304.11.2.2 shall be permitted.

Mass Timber and the IBC 123

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2018 IBC: Heights & Areas

- IBC Chapter 5 – Heights & Areas
- IBC Chapter 6 – Types of Construction
- Addressed in Sections 5 and 6 of CCWD

Free at awc.org

Mass Timber and the IBC 124

124

2018 IBC: Types of Construction

- IBC Chapter 6
  - Defines types of construction
  - Wood frame construction is typical in Types III, IV and V
  - Specific applications permitting use of wood in Types I and II

Mass Timber and the IBC 125

125

2018 IBC: Type V

- Permits use of wood or other approved materials for loadbearing and nonloadbearing structural elements
  - Including heavy timber

Mass Timber and the IBC 126

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2018 IBC: Type IV – Heavy Timber

- Exterior walls of noncombustible materials, FRTW or protected CLT
- Interior elements of solid or laminated wood without concealed spaces

Mass Timber and the IBC 127

127

2018 IBC: Type IV – Column/Beam

- Columns
  - Minimum 6″ × 8″ supporting roof/ceiling
  - Minimum 8″ × 8″ supporting floors
- Beams and Girders
  - Minimum 6″ × 10″ for floors
  - Minimum 4″ × 6″ for roofs

Old Faithful Inn, Yellowstone National Park

Mass Timber and the IBC 128

128

2018 IBC: Type IV – Floor/Roof

- Floors
  - Minimum 3-inch thickness covered with 1-inch nominal dimension T&G flooring or 4-inch thick CLT
- Roof decking
  - Minimum 2-inch thickness, 1-1/8-inch wood structural panels, or 3-inch thick CLT
- Partitions
  - 1-hour-fire-resistance-rated; or
  - Minimum 2 layers of 1-inch nominal board; or
  - Laminated construction 4-inches thick

Free at awc.org

Mass Timber and the IBC 129

129

2018 IBC: Type III

- Requires noncombustible or FRTW exterior bearing walls with minimum 2-hr FRR
  - Type IIIA – 1-hr FRR for building elements other than nonbearing walls
  - Type IIIB does not require any FRR other than exterior bearing walls

Mass Timber and the IBC 130

130

2018 IBC: Types I and II

- Requires most structural loadbearing elements to be noncombustible
  - Heavy timber permitted in roof
    - Table 601 footnote c (Type IB, IIA & IIB)
    - Alternate to 1-hr FRR noncombustible roof elements

Mass Timber and the IBC 131

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2018 IBC: Heights & Areas

- IBC Chapter 5
  - Size thresholds for wood frame structures often determined by structural rather than code limitations
  - CLT and developments in mass timber technology are changing structural limitations for wood

Mass Timber and the IBC 132

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2018 IBC: Heights & Areas

Table 504.3: Allowable Building Height (ft above grade)

TABLE 504.3: Allowable Building Height (ft above Grade)	Occupancy Classification		Type of Construction				
			Type III		Type IV	Type V	
			A	B	HT	A	B
	A, B, E, F, M, S, U	NS	65	55	65	50	40
		S	85	75	85	70	60
	I-1 Condition 1, I-3	NS	65	55	65	50	40
		S	85	75	85	70	60
	I-1 Condition 2, I-2	NS	65	55	65	50	40
		S					
	I-4	NS	65	55	65	50	40
		S	85	75	85	70	60
	R	NS	65	55	65	50	40
		S13R	60	60	60	60	60
		S	85	75	85	70	60

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2018 IBC: Heights & Areas

Table 504.4: Allowable Number of Stories above Grade

TABLE 504.4: Allowable Number of Stories above Grade	Occupancy Classification		Type of Construction				
			Type III		Type IV	Type V	
			A	B	HT	A	B
	A-1, A-2, A-3, A-4	NS	3	2	3	2	1
		S	4	3	4	3	2
	B	NS	5	3	5	3	2
		S	6	4	6	4	3
	E	NS	3	2	3	1	1
		S	4	3	4	2	2
	M	NS	4	2	4	3	1
		S	5	3	5	4	2
	S-2	NS	4	3	4	4	2
		S	5	4	5	5	3
	R-1	NS	4	4	4	3	2
		S13R				4	3
		S	5	5	5	4	3
	R-2	NS	4	4	4	3	2
		S13R				4	3
		S	5	5	5	4	3

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2018 IBC: Heights & Areas

Table 506.2: Allowable Area Factor

TABLE 506.2: Allowable Area Factor	Occupancy Classification		Type of Construction				
			Type III		Type IV	Type V	
			A	B	HT	A	B
	A-2, A-3	NS	14,000	9,500	15,000	11,500	6,000
		S1	56,000	38,000	60,000	46,000	24,000
		SM	42,000	28,500	45,000	34,500	18,000
	B	NS	28,500	19,000	36,000	18,000	9,000
		S1	114,000	76,000	144,000	72,000	36,000
		SM	85,500	57,000	108,000	54,000	27,000
	E	NS	23,500	14,500	25,500	18,500	9,500
		S1	94,000	58,000	102,000	74,000	38,000
		SM	70,500	43,500	76,500	55,500	28,500
	M	NS	18,500	12,500	20,500	14,000	9,000
		S1	74,000	50,000	82,000	56,000	36,000
		SM	55,500	37,500	61,500	42,000	27,000
	S-2	NS	39,000	26,000	38,500	21,000	13,500
		S1	156,000	104,000	154,000	84,000	54,000
		SM	117,000	78,000	115,500	63,000	40,500
	R-1, R-2	NS	24,000	16,000	20,500	12,000	7,000
		S13R					
		S1	96,000	64,000	82,000	48,000	28,000
		SM	72,000	48,000	61,500	36,000	21,000

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2018 IBC: Allowable Increases

- Automatic Sprinkler Systems
- Building equipped with NFPA 13 automatic sprinkler system, allowable floor area can be increased
  - Single-story building – 3x
  - Multi-story building – 2x

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2018 IBC: Single Occupancy

- IBC 506.2.3 – Buildings 3+ stories above grade have a total building area per story (A_a) calculated by Equation 5-2 with $S_a = 3$

$A_a = A_t + (NS \times I_f)$ Equation 5-1
$A_a = [A_t + (NS \times I_f)] \times S_a$ Equation 5-2

S_a = Actual number of building stories above grade plane, not to exceed three. For buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2, use the actual number of building stories above grade plane, not to exceed four

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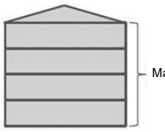
2018 IBC: Building Area

- **4 and 4+ Story Building**
  - Total Allowable Building Area
  - $A_a = 3 \times A_t$ (single story)
- **where**
  - A_a = allowable building area
  - A_t = allowable building area per story



- **Type IV (HT) Business**
  - Sprinklered
  - SM = 108,000 ft²
  - No frontage increase
- Stories of equal area
  - Each story may not exceed 324,000/4 = 81,000 ft²
- Stories of unequal area
  - No single story can exceed 108,000 ft²

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2018 IBC: Wood Interior Finish

- Exceptions
  - Traditional wood floor covering exempt from interior floor finish requirements (804.1)
  - Exposed portions of Type IV structural members also exempt, except in exit elements (803.3)

Butler Building – Minneapolis
Courtesy of WoodWorks

139

2018 IBC: Fire Walls

- Fire walls define separate buildings for allowable building size (706)
  - Not fire barriers (707)
  - Not fire partitions (708)
  - Not smoke barriers, smoke partitions or horizontal assemblies
  - Table 706.4 gives required ratings based on occupancies separated

TABLE 706.4
FIRE WALL FIRE-RESISTANCE RATINGS

GROUP	FIRE-RESISTANCE RATING (hours)
A, B, E, H-4, I, R-1, R-2, U	3[a]
F-1, H-3[b], H-5, M, S-1	3
H-1, H-2	4[b]
F-2, S-2, R-3, R-4	2

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2018 IBC: Fire Walls

- Type V construction
  - May be wood frame
- Types III and IV construction
  - Must be noncombustible in accordance with IBC 706.3

706.3 Materials. *Fire walls* shall be of any *approved* noncombustible materials.
Exception: Buildings of Type V construction.

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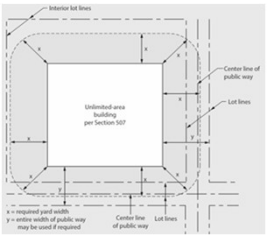
2018 IBC: Unlimited Area

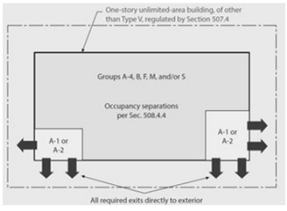
- One-Story – NFPA 13 Sprinklers
  - Public ways or yards not less than 60 feet wide – all sides
  - Group B, F, M and S
  - Limits in IBC 507.4



142

2018 IBC: Unlimited Area

- One-Story – NFPA 13 Sprinklers
- Group A-1 and A-2 allowed in unlimited area mixed occupancy containing Group B, F, M or S
  - Limits in IBC 507.4.1
  - Type III or IV construction
  - Occupancies separated per IBC 508.4.4
  - A-1 and A-2 portions shall not exceed max areas permitted by IBC 503.1
  - Group A-1 and A-2 exit doors must discharge directly to building exterior



143

2018 IBC: Unlimited Area

- One-Story – NFPA 13 Sprinkler System
- Group A-3
  - Limits in IBC 507.7
  - Types III or IV
  - Religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis
- Group A-4
  - Limits in IBC 507.4
  - Types IIIA, IIIB and IV
  - Tennis, swimming, skating and equestrian venues

144

2018 IBC: Unlimited Area

- One-Story – NFPA 13 Sprinkler System
- Group E
  - Limits in Section 507.11
  - Type IIIA or IV
  - Each classroom must have 2 means of egress, with one outside exit
  - Public ways or yards not less than 60 feet wide – all sides

Exit sign licensed under CC0 Public Domain

145

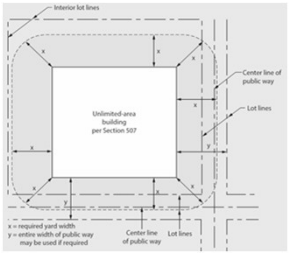
2018 IBC: Unlimited Area

- One-Story – Non-sprinklered Buildings
- Group F-2 or S-2
  - Limits in IBC 507.3
  - Public ways or yards not less than 60 feet wide – all sides

146

2018 IBC: Unlimited Area

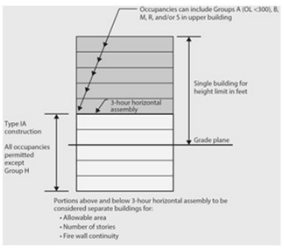
- Two-Story – NFPA 13 Sprinkler System
- Group B, F, M or S
  - Limits in Section 507.5
  - Public ways or yards not less than 60 feet wide – all sides



147

2018 IBC: Stacked Buildings – 510.2

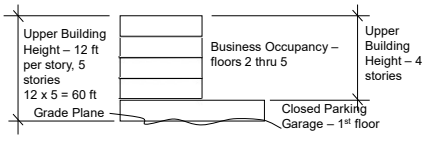
- 3-hour FRR Horizontal Assembly between upper & lower buildings
  - Upper Building
    - Group B, M and R
    - Group S-2 open & enclosed parking
    - Group A's (occupant load < 300)
  - Lower Building
    - Any occupancy except Group H



148

2018 IBC: Stacked Buildings – 510.2

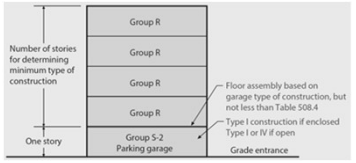
- Upper Building Height – in feet
  - Measured from grade plane
- Upper Building Height – in stories
  - Measured from top of lower building



149

2018 IBC: Stacked Buildings – 510.4

- Parking Beneath Group R
- Single-story Group S-2 parking garage
  - Grade entrance to parking
  - Type I if enclosed
  - Type I or IV if open



150

2018 IBC: Stacked Buildings – 510.7

- Open Parking Garage
- Beneath Groups A, B, I, M and R
- Height of upper building measured from grade plane and includes open parking garage level
- Open parking garage of Type IV construction permitted

Image courtesy of SRG Partnership

Mass Timber and the IBC 151

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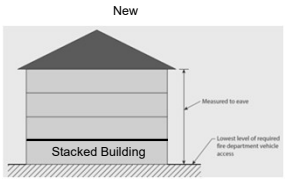
2018 IBC: Stacked Buildings

- Attic Protection per IBC 903.3.1.2.3 (NFPA 13R)
- Types III, IV, and V when using IBC 510.2 and 510.4
  - Alternatives are attic sprinklers, noncombustible construction, FRTW, or filling entire space with noncombustible insulation
  - Protection applies when roof assembly > 55 feet above lowest level of required fire department access
  - Additional requirements for living or storage use, when fuel-fire equipment is present, and in R-4 Condition 2



Mass Timber and the IBC 152

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Q&A

Mass Timber and the IBC 153

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Outline

- Introduction to Mass Timber Products
- 2015/2018 IBC for Mass Timber Construction
- Break – 15 minutes
- 2021 IBC for Tall Mass Timber Construction
  - Part 1: Background and Overview
  - Lunch – 1 hour
  - Part 2: New Construction Types and Heights & Areas
  - Part 3: Fire Safety
  - Break – 15 minutes
  - Part 4: Fire & Connection Design and Special Inspection
  - Part 5: Acoustics, Energy, and Lateral Resistance
  - Part 6: Construction Fire Safety

Mass Timber and the IBC 154

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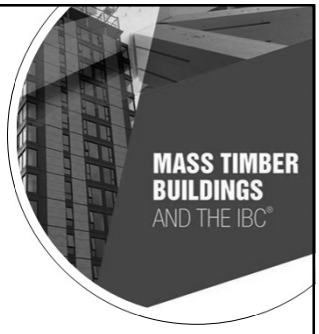
Tall Mass Timber Construction per 2021 IBC

Part 1: Background and Overview



Mass Timber and the IBC 155

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Mass Timber vs Traditional

Mass Timber		Conventional Light-Frame
	<-->	

Mass Timber and the IBC 156

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Mass Timber vs Traditional

Type IV-A, IV-B, IV-C <--> **Type IV-HT**

Mass Timber and the IBC 157

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Sub-Outline

- TWB Ad Hoc Committee
- Consensus Process

Mass Timber and the IBC 158

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ICC Tall Wood Ad Hoc Committee

- ICC Board Established ICC Ad Hoc Committee on Tall Wood Buildings - December 2015
  - Explore science of tall wood buildings
  - Investigate feasibility
  - Take action on developing code changes for tall wood buildings

Mass Timber and the IBC 159

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ICC Tall Wood Ad Hoc Committee

- Consensus committee with necessary balance of stakeholders
- Building and Fire Officials
- Architects and engineers
- Fire protection experts
- Representatives from building construction material industries
- Other construction-related professionals

Photo courtesy of Susan Jones, atelierjones

Mass Timber and the IBC 160

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ICC Tall Wood Ad Hoc Committee

- Four Work Groups appointed
  - Definitions and Standards
  - Fire
  - Structural
  - Codes
- 82 major issues investigated
- Hundreds of reports reviewed
- Performance Objectives discussed

Mass Timber and the IBC 161

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ICC Tall Wood Ad Hoc Objectives

- TWB identified performance objectives
  - No collapse under reasonable scenarios of complete burn-out of fuel without automatic sprinkler protection considered
  - No unusually high radiation exposure from the subject building to adjoining properties to present a risk of ignition under reasonably severe fire scenarios
  - No unusual response from typical radiation exposure from adjacent properties to present a risk of ignition of the subject building under reasonably severe fire scenarios

Mass Timber and the IBC 162

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ICC Tall Wood Ad Hoc Objectives

- TWB identified performance objectives (cont.)
  - No unusual fire department access issues
  - Egress systems designed to protect building occupants during design escape time, plus a safety factor
  - Highly reliable fire suppression systems to reduce risk of failure during reasonably expected fire scenarios – degree of reliability proportional to evacuation time (height) and collapse risk

163

ICC Tall Wood Ad Hoc Objectives

TWB determined that its comprehensive package of proposals met all performance objectives

164

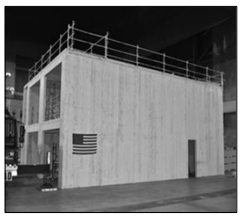
ICC Tall Wood Ad Hoc Committee

- Fire Work Group created fire test scenarios to study and validate TWB code change proposals
  - 2-story condo situation
  - 30 ft x 30 ft interior dimensions
  - Corridor and stair included in the structure
  - UL "modern furnishings" fuel load imposed → 570 MJ/m²
    - Fuel load was approximately 85th percentile of Group R fuel loads from survey of Group R's

165

Multi-Story Fire Tests

- Purpose: Perform tests of realistic fire scenarios applicable to tall wood construction in order to evaluate occupant and firefighter tenability for egress and suppression efforts, and provide data necessary to guide further development of relevant code and standard provisions
  - Conducted at U.S. government facilities (ATF)
  - Supervised by U.S. Forest Product Laboratory staff



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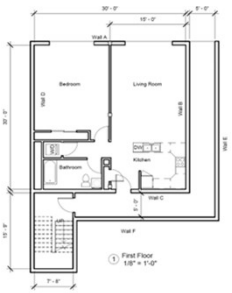
ATF Fire Test Plan

- **Tests 1 through 3:** unlikely scenario in which automatic sprinklers fail to activate and fire service unable to respond
- **Test 4:** normal sprinkler activation
- **Test 5:** automatic sprinklers fail to activate, but are later manually charged by fire service



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ATF Fire Test Scenarios

Test	Description	Date	Duration
1	All mass timber surfaces protected with 2-layers of 5/8" Type X GWB – establishes baseline	5/23/17	3 hours
2	30% of CLT ceiling area in living room and bedroom exposed – represents maximum exposure in Type IV-B	5/31/17	4 hours
3	Two opposing CLT walls exposed – one in bedroom and one in living room (there is a partition wall) – Type IV-B	6/20/17	4 hours
4	All mass timber surfaces fully exposed in bedroom and living room. Sprinklered – normal activation	6/27/17	6 minutes
5	All mass timber surfaces fully exposed in bedroom and living room (except bathroom). Sprinklered – 23 min delayed activation	6/29/17	30 minutes

Mass Timber and the IBC 169

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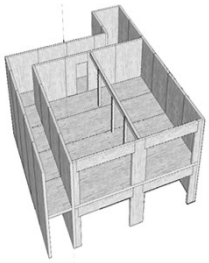
Two-Story Structure

- Two stories, one apartment per level
- Each apartment: 30 ft x 30 ft
- Ceiling height: 9 ft
- 5-ply CLT
  - Douglas Fir-Larch species group
  - Lamination Thickness: 1.375 inches
  - CLT Thickness: 6.875 inches
  - Polyurethane Adhesive
- Corridor around each apartment
- Stairwell



Mass Timber and the IBC 170

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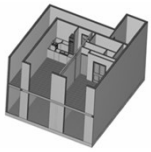
Apartment Layout

- Partitions used unrated ½" gypsum wallboard
- Kitchen & Living Room: 15 ft x 30 ft
- Bedroom & Bath: 15 ft x 30 ft
- 20-min rated door between compartment and corridor
- 90-min rated door between corridor and stairwell
- Fuel load ~570 MJ/m^2 (23 MW)



Mass Timber and the IBC 171

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Apartment Furnishings – Bedroom & Bath

Photos provided by U.S. Forest Products Laboratory, USDA

Mass Timber and the IBC 172

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Apartment Furnishings – Kitchen & Living Room

Photos provided by U.S. Forest Products Laboratory, USDA

Mass Timber and the IBC 173

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ATF Fire Tests

Fire Test #1

All mass timber surfaces protected with **2 layers of 5/8" Type X GWB**

awc.org/codes-and-standards
Link to Youtube videos available on this page

Mass Timber and the IBC 174

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ATF Fire Test #1 – All Mass Timber Protected

Video

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ATF Fire Tests

Fire Test #2

30% of CLT ceiling area in living room and bedroom **exposed**

awc.org/codes-and-standards
Link to Youtube videos available on this page

176

ATF Fire Test #2 – 30% CLT

Photos provided by U.S. Forest Products Laboratory, USDA

Video

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ATF Fire Test #2 – 30% CLT Ceilings Exposed

Results and Post-Fire Condition of Glulam and CLT After Gypsum Removal

- Fire intensity **decreased** subsequent to consumption of furnishings and contents (known as *decay phase*)
- Exposed mass timber surfaces **self-extinguished** in the decay phase
- Mass timber surfaces protected with 2 layers of 5/8" Type X GWB **remained mostly uncharred**

178

Section of Exposed CLT

179

ATF Fire Tests

Fire Test #3

Two **opposing CLT walls exposed** one in bedroom and one in living room

awc.org/codes-and-standards
Link to Youtube videos available on this page

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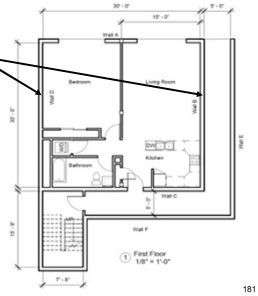
ATF Fire Test #3 – Exposed Walls

- Two opposing CLT walls exposed
  - Bedroom (D) and living room (B)
  - Results comparable to Test #2



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ATF Fire Test #3 – Exposed Walls

Mass Timber Contribution declining

Video

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ATF Fire Tests

Fire Test #4

All mass timber surfaces fully exposed in bedroom and living room

Sprinklered – normal activation

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Link to Youtube videos available on this page

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ATF Fire Test #4 – Sprinklers, Exposed

- All mass timber surfaces fully exposed in bedroom and living room
- Sprinkler – normal activation
- Fire extinguished in 6 minutes

Video

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ATF Fire Tests

Fire Test #5

All mass timber surfaces fully exposed in bedroom and living room

Sprinklered
- activation delayed for 20 minutes after first head activation in Test #4
- …approximately 23 minutes from ignition…

awc.org/codes-and-standards
Link to Youtube videos available on this page

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ATF Test #5 – Delayed Sprinklers, Exposed

- All mass timber surfaces fully exposed in bedroom and living room
- Sprinkler – water delayed 20 minutes after Test #4 sprinkler activation…approximately 23 minutes from ignition
- Flashover conditions reached in kitchen
- Bedroom nearly reached flashover
- Sprinkler system effectively suppressed fire

Video

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ATF Fire Test Results – Event Log

Test No.	Flashover (600°C) Living Room	Flashover (600°C) Bedroom	Time After Ignition (mm:ss) Flames in Hallway	Compartment door Fails	Sprinkler Activation
1 1st floor	13:27	17:20	26:51	57:46	N/A
2 2nd floor	11:42	17:20	30:38	63:59	N/A
3 2nd floor	12:37	17:00	13:06 (door frame installation error)	29:42 (door frame installation error)	N/A
4 1st floor	-	-	-	-	2:37
5 1st floor	-	-	-	-	23:00

Tests 2 and 3 terminated at 4 hours with no re-growth

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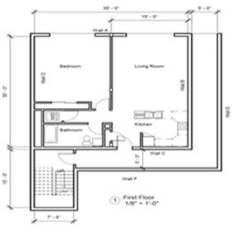
ATF Fire Test Results – Event Log

- Tests 2 and 3 terminated at 4 hours with no re-growth
- Flashover in living room consistent around 12-13 minutes
- Time to flashover in bedroom consistent at around 17 minutes
- Flames breach 20-minute hallway door about 27-30 minutes
- Test 3: 20-minute door failed early – improperly installed



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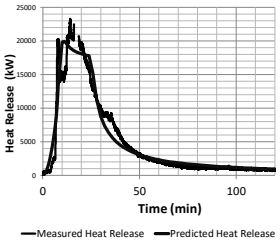
Comparison of Modeling & Measured Data

- Heat Release Data Comparison
  - Modeling conducted by Research Institutes of Sweden (RISE)
  - Measured data from ATF #2 with 30% Ceiling exposed



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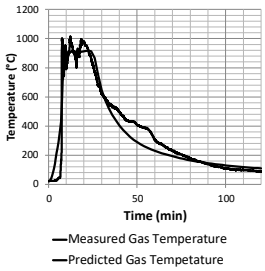
Comparison of Modeling & Measured Data

- Comparison of Ceiling Gas Temperature
  - Modeling conducted by Research Institutes of Sweden (RISE)
  - Measured data from ATF #2 with 30% Ceiling exposed



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Research Justification

- Each new Construction Type based on conditions in at least 1 of 5 ATF fire tests
- Fire Test Plan developed by TWB Fire Work Group
- Test Plan included testing various "generic" connections as recommended by Structural Work Group
- Both mass timber (CLT) panels and other mass timber (glulam beams and columns) tested

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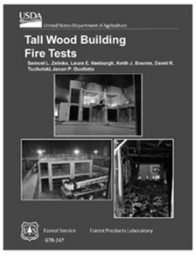
ATF Tall Mass Timber Fire Tests

Full Report on AWC Website

awc.org/codes-and-standards

Link to Youtube videos available on this page



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Sub-Outline

- TWB Ad Hoc Committee
- Consensus Process

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TWB Committee Proposals

- 17 code change proposals under Group A and Group B
- 3 new types of construction approved
- New entries in Height & Area
- Multiple new requirements for safety during construction
- Exterior wall test standard still required (NFPA 285)

ALL 17 PROPOSALS APPROVED AS RECOMMENDED

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TWB Group A Proposals

ALL APPROVED AS SUBMITTED OR APPROVED AS MODIFIED

- G108 New types of construction (602.4)
- G75 Height in feet (Table 504.3)
- G80 Height in stories (Table 504.4)
- G84 Allowable area per floor (Table 506.2)
- G89 Fire barriers (508.4 & 509.4)
- G146 MT Membrane/Special Const. (3102)
- G152 Appendix D-Fire Districts (G152)
- G28 Redundant water supply (403.3.2)
- FS5 Performance-based noncom protection (703.8)
- FS6 Sealing of Splices and intersections (703.9)
- FS73 Mass timber as fire blocking (718.2.1)
- FS81 Prescriptive noncom protection (722.7)
- IFC
  - F88 Owner responsibility (701.6)
  - F266 Fire safety during construction (3308.4)

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TWB Group B Proposals

ALL APPROVED AS SUBMITTED OR APPROVED AS MODIFIED

- S170 Fire resistance of connections (2304.10.1)
- S100 Special inspection provisions (1705.5.3)
- ADM35 Inspection of connection protection (110.3.5)

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Q&A

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Outline

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  - Part 5: Acoustics, Energy, and Lateral Resistance
  - Part 6: Construction Fire Safety

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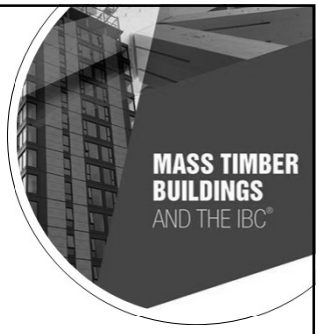
Tall Mass Timber Construction per 2021 IBC

Part 2: New Construction Types and Heights & Areas



Mass Timber and the IBC 199

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Sub-Outline

- Noncombustible Protection
- New Construction Types
- Heights and Areas

Mass Timber and the IBC 200

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Definitions

DEFINITIONS FOR NEW IBC TERMS

- Mass Timber: Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross section dimensions of Type IV construction.
- Noncombustible Protection (FOR MASS TIMBER): Noncombustible material, in accordance with Section 703.6, designed to increase the fire-resistance rating and delay the combustion of mass timber.

Mass Timber and the IBC 201

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Definitions

DEFINITIONS FOR NEW IBC TERMS

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Mass Timber and the IBC 202

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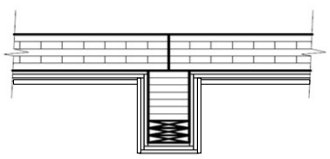
Noncombustible Time Contribution

722.7 Fire-resistance rating of mass timber. The required fire resistance of mass timber elements in Section 602.4 shall be determined in accordance with Section 703.2. The fire resistance rating of building elements shall be as required in Tables 601 and 705.5 and as specified elsewhere in this code. The fire-resistance rating of the mass timber elements shall consist of the fire resistance of the unprotected element added to the protection time of the noncombustible protection.



IV-A

IV-B

IV-C

Mass Timber and the IBC 203

203

Noncombustible Time Contribution

Protection Required

722.7.1 Minimum required protection. Where required by Section 602.4.1 through 602.4.3, *noncombustible protection* shall be provided for *mass timber* building elements in accordance with Table 722.7.1(1). The rating, in minutes, contributed by the *noncombustible protection* of *mass timber* building elements, components, or assemblies, shall be established in accordance with Section 703.6. The protection contributions indicated in Table 722.7.1(2) shall be deemed to comply with this requirement when installed and fastened in accordance with Section 722.7.2.

IV-A

IV-B

IV-C

Mass Timber and the IBC 204

204

Noncombustible Time Contribution

Protection Required

TABLE 722.7.1(1)
PROTECTION REQUIRED FROM NONCOMBUSTIBLE COVERING MATERIAL

Required Fire-Resistance Rating of Building Element per Tables 601 and 705.5 (hours	Minimum Protection Required from Noncombustible Protection (minutes)
1	40
2	80
3 or more	120

IV-A IV-B IV-C

Mass Timber and the IBC 205

205

Noncombustible Time Contribution

Protection Required

722.7.1 Minimum required protection. Where required by Section 602.4.1 through 602.4.3, *noncombustible protection* shall be provided for *mass timber* building elements in accordance with Table 722.7.1(1). The rating, in minutes, contributed by the *noncombustible protection* of *mass timber* building elements, components, or assemblies, shall be established in accordance with Section 703.6. The protection contributions indicated in Table 722.7.1(2) shall be deemed to comply with this requirement when installed and fastened in accordance with Section 722.7.2.

IV-A IV-B IV-C

Mass Timber and the IBC 206

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Noncombustible Time Contribution

Performance Method

703.6 Determination of noncombustible protection time contribution. The time, in minutes, contributed to the fire-resistance rating by the noncombustible protection of mass timber building elements, components, or assemblies, shall be established through a comparison of assemblies tested using procedures set forth in ASTM E119 or UL 263. The test assemblies shall be identical in construction, loading, and materials, other than the noncombustible protection. The two test assemblies shall be tested to the same criteria of structural failure.

1. Test Assembly 1 shall be without protection.
2. Test Assembly 2 shall include the representative noncombustible protection. The protection shall be fully defined in terms of configuration details, attachment details, joint sealing details, accessories and all other relevant details.

The noncombustible protection time contribution shall be determined by subtracting the fire-resistance time, in minutes, of Test Assembly 1 from the fire-resistance time, in minutes, of Test Assembly 2.

IV-A IV-B IV-C

Mass Timber and the IBC 207

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Noncombustible Time Contribution

Protection Required

722.7.1 Minimum required protection. Where required by Section 602.4.1 through 602.4.3, *noncombustible protection* shall be provided for *mass timber* building elements in accordance with Table 722.7.1(1). The rating, in minutes, contributed by the *noncombustible protection* of *mass timber* building elements, components, or assemblies, shall be established in accordance with Section 703.6. The protection contributions indicated in Table 722.7.1(2) shall be deemed to comply with this requirement when installed and fastened in accordance with Section 722.7.2.

IV-A IV-B IV-C

Mass Timber and the IBC 208

208

Noncombustible Time Contribution

Prescriptive Method

TABLE 722.7.1(2)
PROTECTION PROVIDED BY NONCOMBUSTIBLE COVERING MATERIAL

Noncombustible Protection	Protection Contribution (minutes)
1/2 inch Type X Gypsum Board	25
5/8 inch Type X Gypsum Board	40

IV-A IV-B IV-C

Mass Timber and the IBC 209

209

Noncombustible Protection –722.7.2

- Type X Gypsum Board Used as Noncombustible Protection
  - Screws shall penetrate ≥ 1" into mass timber
  - Screws shall be spaced no more than 12" o.c. in each direction
  - Screws at panel edges shall be between 1" and 2" from the edge
  - Panel edges shall be offset 18" from those of adjacent layers
  - Stair-step profile required at wall-to-wall & wall-to-ceiling intersections
  - Screw heads and panel joints shall be covered with joint compound

IV-A IV-B IV-C

Mass Timber and the IBC 210

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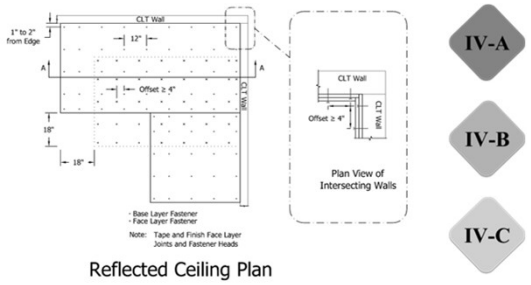
Noncombustible Protection –722.7.2



IV-A

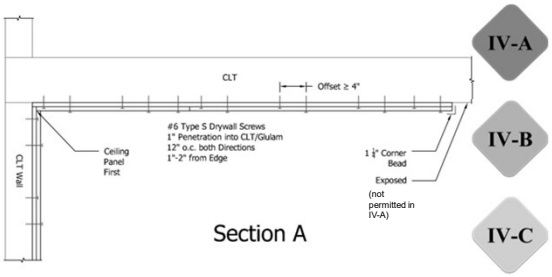
IV-B

IV-C

Mass Timber and the IBC 211

211

Noncombustible Protection –722.7.2



IV-A

IV-B

IV-C

Mass Timber and the IBC 212

212

Exterior Surfaces

722.7.2.2 Exterior surfaces. Layers of Type X gypsum board serving as noncombustible protection for the outside of the exterior heavy timber walls determined in accordance with Table 722.7.1(a) shall be fastened 12 inches on center each way and 6 inches on center at all joints or ends. All panel edges shall be attached with fasteners located at least 1 inch but not more than 2 inches from the panel edge. Fasteners shall comply with one of the following:

1. Galvanized nails of minimum 12 Gage with a 7/16-inch head of sufficient length to penetrate the mass timber a minimum of 1 inch.

2. Screws which comply with ASTM C 1002 (Type S, Type W, or Type G) of sufficient length to penetrate the mass timber a minimum of 1 inch.

IV-A

IV-B

IV-C

Mass Timber and the IBC 213

213

Sub-Outline

- Noncombustible Protection
- New Construction Types
- Heights and Areas

Mass Timber and the IBC 214

214

Building Element Fire-Resistance Ratings

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B
Primary structural frame[2] (see Section 202)	3[a, b]	2[a, b]	1[b, c]	0	1[b, c]	0	3[c]	2	2	HT	1[b, c]	0
Bearing walls												
Exterior[e, f]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT[g]	1	0
Nonbearing walls and partitions Exterior	See Table 705.5											
Nonbearing walls and partitions Interior[d]	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1½[b]	1½[b]	1[b, c]	0[c]	1[b, c]	0	1½[c]	1½	1½	HT	1[b, c]	0

Mass Timber and the IBC 215

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Building Element Fire-Resistance Ratings

TABLE 705.5 (formerly Table 602)
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, d, g]

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[e]	OCCUPANCY GROUP F-1, M, S-1[f]	OCCUPANCY GROUP A, B, E, F-2, I, R[c], S-2, U[b]
X < 5[b]	All	3	2	1
5 ≤ X < 10	IA, IVA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB, IVA, IVB	2	1	1[c]
	IIB, VB	1	0	0
	Others	1	1	1[c]
X ≥ 30	All	0	0	0

Mass Timber and the IBC 216

216

2021 IBC Construction Types

- Revise IBC 602.4 to reflect 3 new construction types

IV-A IV-B IV-C

- No changes to existing heavy timber provisions (formerly Type IV)
- Rename heavy timber to IV-HT (throughout code where referring to heavy timber as a construction type)
- Indicate heavy timber in sections where building elements are permitted to be "heavy timber" (e.g. Types I & II roofs)

IV-HT

Mass Timber and the IBC 217

217

2021 IBC Construction Types

Type of Construction -- Comparison			
Feature	**Type IV-A**	**Type IV-B**	**Type IV-C**
Description of New Construction Types	100% Noncombustible (NC) protection on all surfaces of Mass Timber (MT)	100% NC protection on all surfaces of mass timber (MT) except for limited exposed mass timber (MT) elements	100% exposed mass timber (MT) except: shafts, concealed spaces, and outside of exterior walls
Permitted Materials			
Structural Building Elements	MT or NC	MT or NC	MT or NC
Non-loadbearing Exterior Walls	MT or NC	MT or NC	MT or NC
Non-loadbearing Interior Walls	MT or NC	MT or NC	MT or NC
Shaft and Exit Enclosures			
Highrise* to 12 stories or 180 ft: *see IBC definition of highrise	NC or MT protected with 2 (or 3 when 3 hr FRR) layers of 5/8" type X	NC or MT protected with 2 layers of 5/8" type X gypsum or equiv each side of enclosure	NC or MT protected with one layer of 5/8" type X gypsum each side of shaft or enclosure
Above 12 stories or 180 feet:	NC	Not Permitted	Not Permitted

Mass Timber and the IBC 218

218

2021 IBC Construction Types

Type of Construction -- Comparison			
Feature	**Type IV-A**	**Type IV-B**	**Type IV-C**
Description of New Construction Types	100% Noncombustible (NC) protection on all surfaces of Mass Timber (MT)	100% NC protection on all surfaces of mass timber (MT) except for limited exposed mass timber (MT) elements	100% exposed mass timber (MT) except: shafts, concealed spaces, and outside of exterior walls
Permitted Materials			
Structural Building Elements	MT or NC	MT or NC	MT or NC
Non-loadbearing Exterior Walls	MT or NC	MT or NC	MT or NC
Non-loadbearing Interior Walls	MT or NC	MT or NC	MT or NC
Shaft and Exit Enclosures			
Highrise* to 12 stories or 180 ft: *see IBC definition of highrise	NC or MT protected with 2 (or 3 when 3 hr FRR) layers of 5/8" type X	NC or MT protected with 2 layers of 5/8" type X gypsum or equiv each side of enclosure	NC or MT protected with one layer of 5/8" type X gypsum each side of shaft or enclosure
Above 12 stories or 180 feet:	NC	Not Permitted	Not Permitted

Mass Timber and the IBC 219

219

2021 IBC Construction Types

Type of Construction -- Comparison			
Feature	**Type IV-A**	**Type IV-B**	**Type IV-C**
Description of New Construction Types	100% Noncombustible (NC) protection on all surfaces of Mass Timber (MT)	100% NC protection on all surfaces of mass timber (MT) except for limited exposed mass timber (MT) elements	100% exposed mass timber (MT) except: shafts, concealed spaces, and outside of exterior walls
Permitted Materials			
Structural Building Elements	MT or NC	MT or NC	MT or NC
Non-loadbearing Exterior Walls	MT or NC	MT or NC	MT or NC
Non-loadbearing Interior Walls	MT or NC	MT or NC	MT or NC
Shaft and Exit Enclosures			
Highrise* to 12 stories or 180 ft: *see IBC definition of highrise	NC or MT protected with 2 (or 3 when 3 hr FRR) layers of 5/8" type X	NC or MT protected with 2 layers of 5/8" type X gypsum or equiv each side of enclosure	NC or MT protected with one layer of 5/8" type X gypsum each side of shaft or enclosure
Above 12 stories or 180 feet:	NC	Not Permitted	Not Permitted

Mass Timber and the IBC 220

220

2021 IBC Construction Types

Type of Construction -- Comparison			
Feature	**Type IV-A**	**Type IV-B**	**Type IV-C**
Description of New Construction Types	100% Noncombustible (NC) protection on all surfaces of Mass Timber (MT)	100% NC protection on all surfaces of mass timber (MT) except for limited exposed mass timber (MT) elements	100% exposed mass timber (MT) except: shafts, concealed spaces, and outside of exterior walls
Permitted Materials			
Structural Building Elements	MT or NC	MT or NC	MT or NC
Non-loadbearing Exterior Walls	MT or NC	MT or NC	MT or NC
Non-loadbearing Interior Walls	MT or NC	MT or NC	MT or NC
Shaft and Exit Enclosures			
Highrise* to 12 stories or 180 ft: *see IBC definition of highrise	NC or MT protected with 2 (or 3 when 3 hr FRR) layers of 5/8" type X	NC or MT protected with 2 layers of 5/8" type X gypsum or equiv each side of enclosure	NC or MT protected with one layer of 5/8" type X gypsum each side of shaft or enclosure
Above 12 stories or 180 feet:	NC	Not Permitted	Not Permitted

Mass Timber and the IBC 221

221

2021 IBC Construction Types

- TYPE IV-A – Mass Timber with noncombustible protection
  - Noncombustible protection at least 2/3 FRR for Building Elements (Table 601, 705.5)
  - Taller buildings – no exposed mass timber
- TYPE IV-B – Mass Timber with limited exposed MT
  - Limits how much mass timber can be exposed
  - Limits how close exposed areas can be to one another
- TYPE IV-C – Mass Timber with no requirement for noncombustible protection, except certain features

IV-A IV-B IV-C

Mass Timber and the IBC 222

222

2021 IBC Construction Types

- TYPE IV-A – Mass Timber with noncombustible protection
  - Noncombustible protection at least 2/3 FRR for Building Elements (Table 601, 602)
  - Taller buildings – no exposed mass timber
- TYPE IV-B – Mass Timber with limited exposed MT
  - Limits how much mass timber can be exposed
  - Limits how close exposed areas can be to one another
- TYPE IV-C – Mass Timber with no requirement for noncombustible protection, except certain features

IV-A

Mass Timber and the IBC 223

223

2021 IBC Construction Types

- TYPE IV-A – Mass Timber with noncombustible protection
  - Noncombustible protection at least 2/3 FRR for Building Elements (Table 601, 602)
  - Taller buildings – no exposed mass timber
- TYPE IV-B – Mass Timber with limited exposed MT
  - Limits how much mass timber can be exposed
  - Limits how close exposed areas can be to one another
- TYPE IV-C – Mass Timber with no requirement for noncombustible protection, except certain features

IV-B

Mass Timber and the IBC 224

224

2021 IBC Construction Types

- TYPE IV-A – Mass Timber with noncombustible protection
  - Noncombustible protection at least 2/3 FRR for Building Elements (Table 601, 602)
  - Taller buildings – no exposed mass timber
- TYPE IV-B – Mass Timber with limited exposed MT
  - Limits how much mass timber can be exposed
  - Limits how close exposed areas can be to one another
- TYPE IV-C – Mass Timber with no requirement for noncombustible protection, except certain features

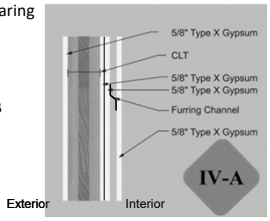
IV-C

Mass Timber and the IBC 225

225

2021 IBC Type IV-A Exterior Wall

- 3-hr FRR for exterior and interior bearing walls (Table 601)
- 2/3 FRR noncombustible protection
- 2-hr FRR noncombustible protection
- 2-hr FRR = 3 layers 5/8" Type X GWB
  - 40-min x 3 layers = 120-min
- Furring channel per AISI S220



Mass Timber and the IBC 226

226

2021 IBC Type IV-A

- Fire research
- Full-scale, multi-story
- Simulated new construction types
- ATF Fire Test Lab

IV-A

Mass Timber and the IBC 227

227

2021 IBC 602.4.1 Type IV-A

- All mass timber must have noncombustible protection – interior and exterior
- Floors must have minimum 1-inch noncombustible material above the mass timber

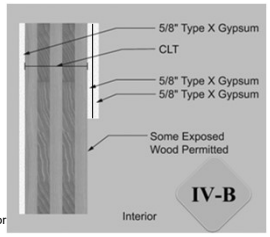
IV-A

Mass Timber and the IBC 228

228

2021 IBC Type IV-B Exterior Wall

- 2-hr FRR for exterior and interior bearing walls (Table 601)
- 2/3 FRR noncom protection = 2 layers 5/8" GB @ 40-min
- 2-hr x 2/3 = 80-min
- 40-min x 2 = 80-min



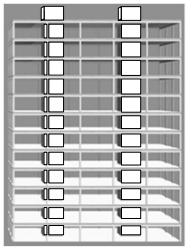
Mass Timber and the IBC 229

229

2021 IBC 602.4.2 Type IV-B

- Interior MT can be partially exposed
- Noncombustible protection certain areas
  - Exterior of exterior walls protected 40 min noncom
  - MT in concealed spaces protected
  - Shafts protected inside and room-side with 80 min noncom
  - Floors must have minimum 1-inch noncombustible material above the mass timber

IV-B



Mass Timber and the IBC 230

230

2021 IBC 602.4.2 Type IV-B

602.4.2.2.2 Protected Area. Interior faces of mass timber elements shall be protected in accordance with Section 602.4.2.2.1, including the inside faces of exterior mass timber walls and mass timber roofs.

Exceptions: Unprotected portions of mass timber ceilings and walls complying with Section 602.4.2.2.4 and the following:

1. Unprotected portions of mass timber ceilings and walls complying with one of the following:
   - 1.1 Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area equal to 20% of the floor area in any dwelling unit or fire area.
   - 1.2 Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area equal to 40% of the floor area in any dwelling unit or fire area.
   - 1.3 Unprotected portions of both walls and ceilings of mass timber, including attached columns and beams, in any dwelling unit or fire area shall be permitted in accordance with section 602.4.2.2.3.

IV-B

Mass Timber and the IBC 231

231

2021 IBC 602.4.2 Type IV-B

602.4.2.2.2 Protected Area

Exceptions (continued)

2. Mass timber columns and beams that are not an integral portion of walls or ceilings, respectively, shall be permitted to be unprotected without restriction of either aggregate area or separation from one another.

Exception 2 may be applied simultaneously with Exception 1.1, 1.2 or 1.3

IV-B

Mass Timber and the IBC 232

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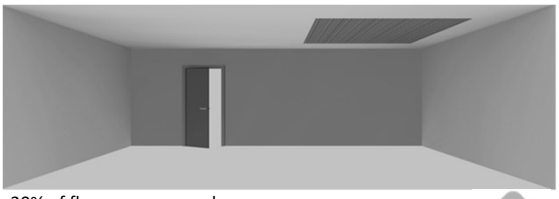
2021 IBC 602.4.2 Type IV-B

IV-B

Mass Timber and the IBC 233

233

2021 IBC 602.4.2 Type IV-B



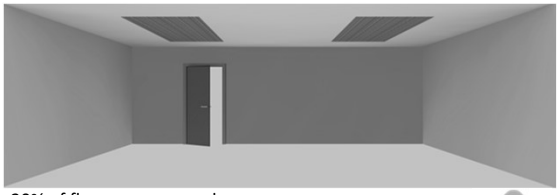
20% of floor area exposed

IV-B

Mass Timber and the IBC 234

234

2021 IBC 602.4.2 Type IV-B



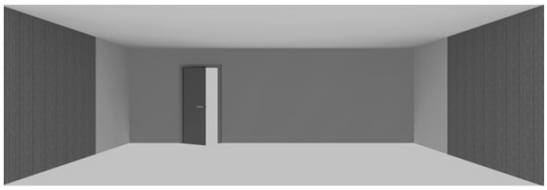
20% of floor area exposed

IV-B

Mass Timber and the IBC 235

235

2021 IBC 602.4.2 Type IV-B



40% of floor area exposed

IV-B

Mass Timber and the IBC 236

236

2021 IBC 602.4.2 Type IV-B

602.4.2.2.3 Mixed Unprotected Areas. In each dwelling unit or fire area, where both portions of ceilings and portions of walls are unprotected, the total allowable unprotected area shall be determined in accordance with Equation 6-1.

$$(U_{tc}/U_{ac}) + (U_{tw}/U_{aw}) \leq 1 \qquad \text{(Equation 6-1)}$$

IV-B

where:

U_{tc} = Total unprotected mass timber ceiling areas

U_{ac} = Allowable unprotected mass timber ceiling area conforming to Exception 1.1 of Section 602.4.2.2.2

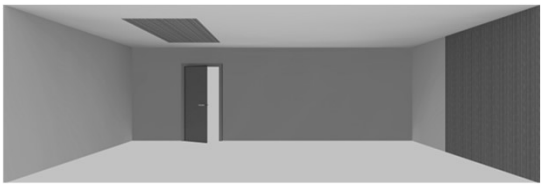
U_{tw} = Total unprotected mass timber wall areas

U_{aw} = Allowable unprotected mass timber wall area conforming to Exception 1.2 of Section 602.4.2.2.2

Mass Timber and the IBC 237

237

2021 IBC 602.4.2 Type IV-B

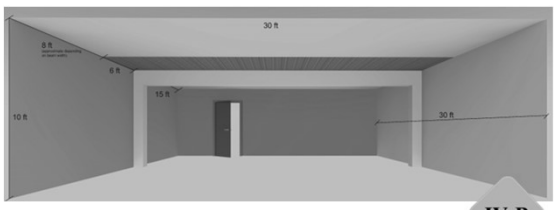


IV-B

Mass Timber and the IBC 238

238

2021 IBC 602.4.2 Type IV-B

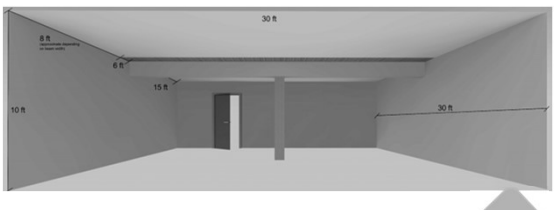


IV-B

Mass Timber and the IBC 239

239

2021 IBC 602.4.2 Type IV-B

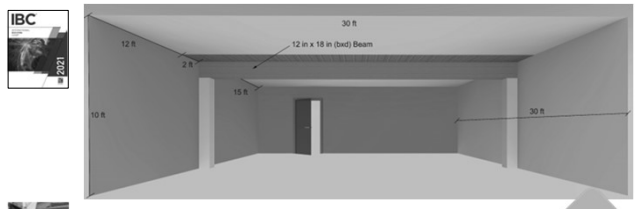


IV-B

Mass Timber and the IBC 240

240

2021 IBC 602.4.2 Type IV-B

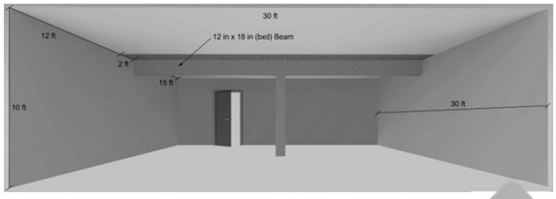


IV-B

Mass Timber and the IBC 241

241

2021 IBC 602.4.2 Type IV-B



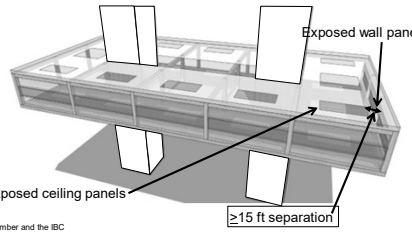
IV-B

Mass Timber and the IBC 242

242

Separation of Unprotected MT

602.4.2.2.4 Separation Distance Between Unprotected Mass Timber Elements. In each *dwelling unit* or *fire area*, unprotected portions of mass timber walls and ceilings shall be not less than 15 feet from unprotected portions of other walls and ceilings, measured horizontally along the ceiling and from other unprotected portions of walls measured horizontally along the floor.

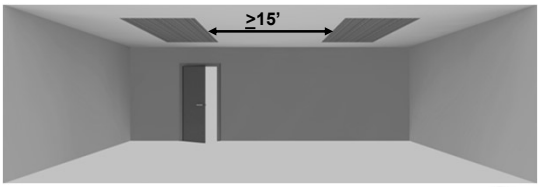


IV-B

Mass Timber and the IBC 243

243

2021 IBC 602.4.2 Type IV-B

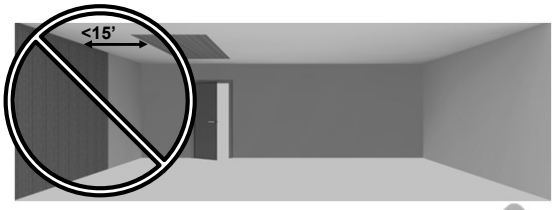


IV-B

Mass Timber and the IBC 244

244

2021 IBC 602.4.2 Type IV-B

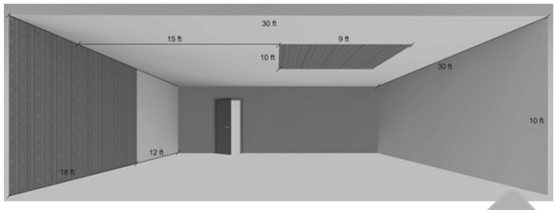


IV-B

Mass Timber and the IBC 245

245

2021 IBC 602.4.2 Type IV-B

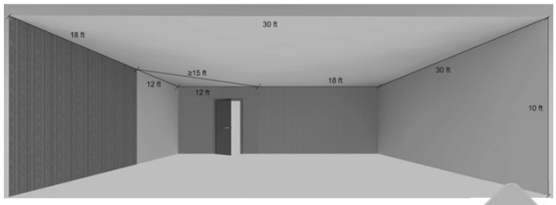


IV-B

Mass Timber and the IBC 246

246

2021 IBC 602.4.2 Type IV-B

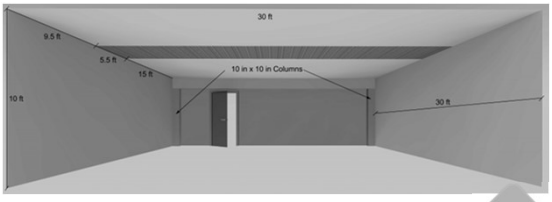


IV-B

Mass Timber and the IBC 247

247

2021 IBC 602.4.2 Type IV-B



IV-B

Mass Timber and the IBC 248

248

2021 IBC Type IV-C

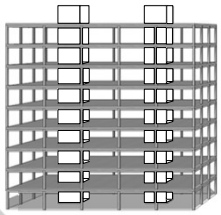
IV-C

Mass Timber and the IBC 249

249

2021 IBC 602.4.3 Type IV-C

- Interior MT can be exposed
- Noncombustible protection certain areas
  - Exterior of exterior walls protected 40 min noncom
  - Floors must meet IBC 804
  - MT in concealed spaces protected
    - No combustibles other than plenum
  - Shafts protected inside and room-side with 40 min noncom



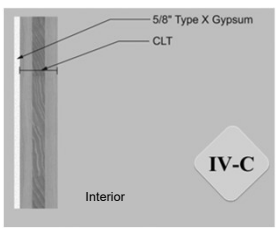
IV-C

Mass Timber and the IBC 250

250

2021 IBC Type IV-C Exterior Wall

- 2-hr FRR for exterior and interior bearing walls (Table 601)
- CLT must be designed for 2-hr FRR if exposed



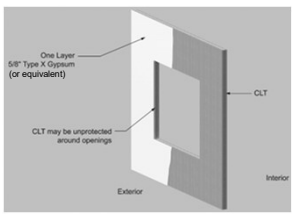
IV-C

Mass Timber and the IBC 251

251

Exterior Wall Section

All material outboard of Mass Timber MUST BE NONCOMBUSTIBLE
Except: water resistive barrier



IV-A
IV-B
IV-C

Mass Timber and the IBC 252

252

NFPA 285 Fire Tests

1402.5 ~~Vertical and lateral flame propagation~~ Water-resistive Barriers. *Exterior walls* on buildings of Type I, II, III or IV construction that are greater than 40 feet in height above grade plane and contain a combustible *water-resistive barrier* shall be tested in accordance with and comply with the acceptance criteria of NFPA 285…

Mass Timber and the IBC 253

253

Outline

- Noncombustible Protection
- New Construction Types
- Heights and Areas

Mass Timber and the IBC 254

254

Allowable Heights – Table 504.3

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION: TYPE I A	TYPE I B	TYPE II A	TYPE II B	TYPE III A	TYPE III B	TYPE IV A	TYPE IV B	TYPE IV C	TYPE IV HT	TYPE V A	TYPE V B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60
H-1, H-2, H-3, H-5	NS[c,d]	UL	160	65	55	65	55	120	90	65	65	50	40
	S												
H-4	NS[c,d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	140	100	85	85	70	60
I-1 Condition 1, I-3	NS[d,e]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	180	120	85	85	70	60
I-1 Condition 2, I-2	NS[d,e,f]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85									
I-4	NS[d,e]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	180	120	85	85	70	60
R[h]	NS[d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S13D	60	60	60	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	270	180	85	85	70	60

No changes to footnotes.

Sprinklered: IV-B = I-B & IV-A = 1.5 x IV-B with exceptions

IV-A IV-B IV-C

Mass Timber and the IBC 255

255

Allowable Stories – Table 504.4

ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a,b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION: TYPE I A	TYPE I B	TYPE II A	TYPE II B	TYPE III A	TYPE III B	TYPE IV A	TYPE IV B	TYPE IV C	TYPE IV HT	TYPE V A	TYPE V B
A-1	NS	UL	5	3	2	3	2	3	3	3	3	2	1
	S	UL	6	4	3	4	3	9	6	4	4	3	2
A-2	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	18	12	6	4	3	2
A-3	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	18	12	6	4	3	2
A-4	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	18	12	6	4	3	2
A-5	NS	UL	UL	UL	UL	UL	UL	1	1	1	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	11	5	3	5	3	5	5	5	5	3	2
	S	UL	12	6	4	6	4	18	12	9	6	4	3
E	NS	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	9	6	4	4	2	2
F-1	NS	UL	11	4	2	3	2	3	3	3	4	2	1
	S	UL	12	5	3	4	3	10	7	5	5	3	2
F-2	NS	UL	11	5	3	4	3	5	5	5	5	3	2
	S	UL	12	6	4	5	4	12	8	6	6	4	3

Sprinklered: IV-B = I-B & IV-A = 1.5 x IV-B with exceptions

IV-A IV-B IV-C

Mass Timber and the IBC 256

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Allowable Stories – Table 504.4 (cont'd)

ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a,b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION: TYPE I A	TYPE I B	TYPE II A	TYPE II B	TYPE III A	TYPE III B	TYPE IV A	TYPE IV B	TYPE IV C	TYPE IV HT	TYPE V A	TYPE V B
H-1	NS[c,d]	1	1	1	1	1	1	NP	NP	NP	1	1	NP
	S							1	1	1			
H-2	NS[c,d]	UL	3	2	1	2	1	1	1	1	2	1	1
	S							2	2	2			
H-3	NS[c,d]	UL	6	4	2	4	2	3	3	3	4	2	1
	S							4	4	4			
H-4	NS[c,d]	UL	7	5	3	5	3	5	5	5	5	3	2
	S	UL	8	6	4	6	4	8	7	6	6	4	3
H-5	NS[c,d]	4	4	3	3	3	3	2	2	2	3	3	2
	S							3	3	3			
I-1 Condition 1	NS[d,e]	UL	9	4	3	4	3	4	4	4	4	3	2
	S	UL	10	5	4	5	4	10	7	5	5	4	3
I-1 Condition 2	NS[d,e]	UL	9	4	3	4	3	3	3	3	4	3	2
	S	UL	10	5				10	6	4			
I-2	NS[d,f]	UL	4	2	1	1	NP	NP	NP	NP	1	1	NP
	S	UL	5	3				7	5	3			
I-3	NS[d,e]	UL	4	2	1	2	1	2	2	2	2	2	1
	S	UL	5	3	2	3	2	7	5	3	3	3	2
I-4	NS[d,g]	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	9	6	4	4	2	2

IV-C = IV-HT with exceptions

IV-A IV-B IV-C

Mass Timber and the IBC 257

257

Allowable Stories – Table 504.4 (cont'd)

ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a,b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION: TYPE I A	TYPE I B	TYPE II A	TYPE II B	TYPE III A	TYPE III B	TYPE IV A	TYPE IV B	TYPE IV C	TYPE IV HT	TYPE V A	TYPE V B
M	NS	UL	11	4	2	4	2	4	4	4	4	3	1
	S	UL	12	5	3	5	3	12	8	6	5	4	2
R-1	NS[i]	UL	11									3	2
	S13R	4	4	4	4	4	4	4	4	4	4	4	3
	S	UL	12	5	5	5	5	18	12	8	5	4	3
R-2	NS[i]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4	4				4	4	4		4	3
	S	UL	12	5	5	5	5	18	12	8	5	4	3
R-3[h]	NS[i]	UL	11									3	3
	S13D	4	4	4	4	4	4	4	4	4	4	3	3
	S13R	4	4					4	4	4		4	4
R-4[h]	S	UL	12	5	5	5	5	18	12	5	5	4	4
	NS[i]	UL	11									3	2
	S13D	4	4	4	4	4	4	4	4	4	4	3	2
	S13R	4	4					4	4	4		4	3
	S	UL	12	5	5	5	5	18	12	5	5	4	3
S-1	NS	UL	11	4	2	3	2	4	4	4	4	3	1
	S	UL	12	5	3~~4~~	4	3~~4~~	10	7	5	5	4	2
S-2	NS	UL	11	5	3	4	3	4	4	4	4~~5~~	4	2
	S	UL	12	6	4	5	4	12	8	5	5~~6~~	5	3
U	NS	UL	5	4	2	3	2	4	4	4	4	2	1
	S	UL	6	5	3	4	3	9	6	5	5	3	2

IV-A IV-B IV-C

Mass Timber and the IBC 258

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Allowable Areas – Table 506.2

ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D OR SM, as applicable) IN SQUARE FEET[a,h]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
		A	B	A	B	A	B	A 3xHT	B 2xHT	C 1.25xHT	HT	A	B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	45,000	30,000	18,750	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	180,000	120,000	75,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	135,000	90,000	56,250	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S1												
	SM												
B	NS	UL	UL	37,500	23,000	28,500	19,000	108,000	72,000	45,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	432,000	288,000	180,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	324,000	216,000	135,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	76,500	51,000	31,875	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	306,000	204,000	127,500	102,000	74,000	38,000
	SM	UL	UL	79,500	43,500	70,500	43,500	229,500	153,000	95,625	76,500	55,500	28,500

IV-A IV-B IV-C

Mass Timber and the IBC — General approach with exceptions. — 259

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Allowable Areas – Table 506.2 (cont'd)

ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D OR SM, as applicable) IN SQUARE FEET[a,h]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
		A	B	A	B	A	B	A 3xHT	B 2xHT	C 1.25xHT	HT	A	B
F-1	NS	UL	UL	25,000	15,500	19,000	12,000	100,500	67,000	41,875	33,500	14,000	8,500
	S1	UL	UL	100,000	62,000	76,000	48,000	402,000	268,000	167,500	134,000	56,000	34,000
	SM	UL	UL	75,000	46,500	57,000	36,000	301,500	201,000	125,625	100,500	42,000	25,500
F-2	NS	UL	UL	37,500	23,000	28,500	18,000	151,500	101,000	63,125	50,500	21,000	13,000
	S1	UL	UL	150,000	92,000	114,000	72,000	606,000	404,000	252,500	202,000	84,000	52,000
	SM	UL	UL	112,500	69,000	85,500	54,000	454,500	303,000	189,375	151,500	63,000	39,000
H-1	NS[f]	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	NP
	S1												
H-2	NS[f]	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	3,000
	S1												
	SM												
H-3	NS[f]	UL	60,000	26,500	14,000	17,500	13,000	25,500	25,500	25,500	25,500	10,000	5,000
	S1												
H-4	NS[f]	UL	UL	37,500	17,500	28,500	17,500	72,000	54,000	40,500	36,000	18,000	6,500
	S1	UL	UL	150,000	70,000	114,000	70,000	288,000	216,000	162,000	144,000	72,000	26,000
	SM	UL	UL	112,500	52,500	85,500	52,500	216,000	162,000	121,500	108,000	54,000	19,500
H-5	NS[f,g]	UL	UL	37,500	23,000	28,500	19,000	72,000	54,000	40,500	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	288,000	216,000	162,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	216,000	162,000	121,500	108,000	54,000	27,000

IV-A IV-B IV-C

Mass Timber and the IBC — General approach with exceptions. — 260

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Allowable Areas – Table 506.2 (cont'd)

ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D OR SM, as applicable) IN SQUARE FEET[a,h]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
		A	B	A	B	A	B	A 3xHT	B 2xHT	C 1.25xHT	HT	A	B
I-1	NS[d,e]	UL	55,000	19,000	10,000	16,500	10,000	54,000	36,000	18,000	18,000	10,500	4,500
	S1	UL	220,000	76,000	40,000	66,000	40,000	216,000	144,000	72,000	72,000	42,000	18,000
	SM	UL	165,000	57,000	30,000	49,500	30,000	162,000	108,000	54,000	54,000	31,500	13,500
I-2	NS[d,e]	UL	UL	15,000	11,000	12,000	NP	36,000	24,000	12,000	12,000	9,500	NP
	S1	UL	UL	60,000	44,000	48,000	NP	144,000	96,000	48,000	48,000	38,000	NP
	SM	UL	UL	45,000	33,000	36,000	NP	108,000	72,000	36,000	36,000	28,500	NP
I-3	NS[d,e]	UL	UL	15,000	10,000	10,500	7,500	36,000	24,000	12,000	12,000	7,500	5,000
	S1	UL	UL	60,000	40,000	42,000	30,000	144,000	96,000	48,000	48,000	30,000	20,000
	SM	UL	UL	45,000	30,000	31,500	22,500	108,000	72,000	36,000	36,000	22,500	15,000
I-4	NS[d,e]	UL	60,500	26,500	13,000	23,500	13,000	76,500	51,000	25,500	25,500	18,500	9,000
	S1	UL	121,000	106,000	52,000	94,000	52,000	306,000	204,000	102,000	102,000	74,000	36,000
	SM	UL	181,500	79,500	39,000	70,500	39,000	229,500	153,000	76,500	76,500	55,500	27,000
M	NS	UL	UL	21,500	12,500	18,500	12,500	61,500	41,000	25,625	20,500	14,000	9,000
	S1	UL	UL	86,000	50,000	74,000	50,000	246,000	164,000	102,500	82,000	56,000	36,000
	SM	UL	UL	64,500	37,500	55,500	37,500	184,500	123,000	76,875	61,500	42,000	27,000

IV-A IV-B IV-C

General approach with exceptions.

Mass Timber and the IBC — 261

261

Allowable Areas – Table 506.2 (cont'd)

ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D OR SM, as applicable) IN SQUARE FEET[a,h]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
		A	B	A	B	A	B	A 3xHT	B 2xHT	C 1.25xHT	HT	A	B
R-1[c]	NS[f]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-2[c]	NS[f]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-3[c]	NS[f]												
	S13D	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S13R												
	S1												
	SM												
R-4[c]	NS[f]												
	S13D	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000

IV-A IV-B IV-C

General approach with exceptions.

Mass Timber and the IBC — 262

262

Allowable Areas – Table 506.2 (cont'd)

ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D OR SM, as applicable) IN SQUARE FEET[a,h]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
		A	B	A	B	A	B	A 3xHT	B 2xHT	C 1.25xHT	HT	A	B
S-1	NS	UL	UL	48,000	26,000	17,500	26,000	17,500	76,500	51,000	31,875	25,500	14,000	9,000
	S1	UL	UL	192,000	104,000	70,000	104,000	70,000	306,000	204,000	127,500	102,000	56,000	36,000
	SM	UL	UL	144,000	78,000	52,500	78,000	52,500	229,500	153,000	95,625	76,500	42,000	27,000
S-2	NS	UL	UL	79,000	39,000	26,000	39,000	26,000	115,500	77,000	48,125	38,500	21,000	13,500
	S1	UL	UL	316,000	156,000	104,000	156,000	104,000	462,000	308,000	192,500	154,000	84,000	54,000
	SM	UL	UL	237,000	117,000	78,000	117,000	78,000	346,500	231,000	144,375	115,500	63,000	40,500
U	NS[i]	UL	UL	35,500	19,000	8,500	14,000	8,500	54,000	36,000	22,500	18,000	9,000	5,500
	S1	UL	UL	142,000	76,000	34,000	56,000	34,000	216,000	144,000	90,000	72,000	36,000	22,000
	SM	UL	UL	106,500	57,000	25,500	42,000	25,500	162,000	108,000	67,500	54,000	27,000	16,500

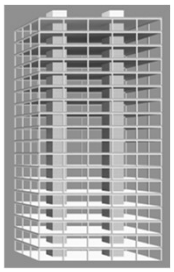
IV-A IV-B IV-C

General approach with exceptions.

Mass Timber and the IBC — 263

263

Type of Construction IV-A



IV-A

Building Elements	
Maximum Height	270'
Number of Stories (except H's)	9 - 18
Exposed Mass Timber	Fully Protected
Sprinklers	Yes
Primary Frame FRR	3 hours
Floor FRR	2 hours
FRR from Noncom Protection	120 minutes
Stairs Tower	Non-combustible
Concealed Spaces	OK if protected
Floor Topping	Noncombustible

Mass Timber and the IBC — 264

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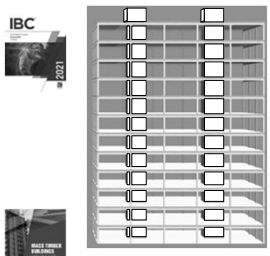
Type of Construction IV-B



IV-B

Building Elements	
Maximum Height	180′
Number of Stories (except H's)	6 - 12
Exposed Mass Timber	Partially
Sprinklers	Yes
Primary Frame FRR	2 hours
Floor FRR	2 hours
FRR from Noncom Protection	80 minutes
Stairs Tower	Protected mass timber
Concealed Spaces	OK if protected
Floor Topping	Noncombustible

Mass Timber and the IBC 265

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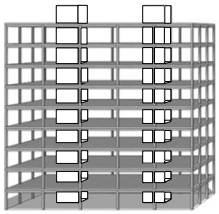
Type of Construction IV-C



IV-C

Building Element	
Maximum Height	85′
Number of Stories	4 - 9
Exposed Mass Timber	Fully Exposed
Sprinklers	Yes
Primary Frame FRR	2 hours
Floor FRR	2 hours
Stairs Tower	Protected mass timber
FRR from Non-com Protection	0 hours
Concealed Spaces	OK if Protected
Floor Topping	No requirement

Mass Timber and the IBC 266

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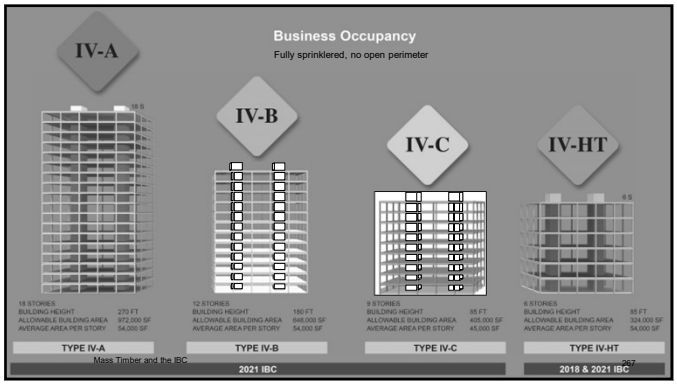

Mass Timber and the IBC 267

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Q&A

Mass Timber and the IBC 268

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Outline

- Introduction to Mass Timber Products
- 2015/2018 IBC for Mass Timber Construction
- Break – 15 minutes
- 2021 IBC for Tall Mass Timber Construction
  - Part 1: Background and Overview
  - Lunch – 1 hour
  - Part 2: New Construction Types and Heights & Areas
  - Part 3: Fire Safety
  - Break – 15 minutes
  - Part 4: Fire & Connection Design and Special Inspection
  - Part 5: Acoustics, Energy, and Lateral Resistance
  - Part 6: Construction Fire Safety

Mass Timber and the IBC 269

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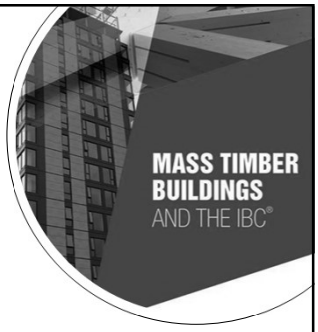
Tall Mass Timber Construction per 2021 IBC

Part 3: Fire Safety



Mass Timber and the IBC 270

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Sub-Outline

- Fire Barriers
- Shaft Walls
- Sealing Abutting Edges/Intersections and Fire Blocking Material
- New Redundant Sprinkler Water Supply Systems
- Concealed Spaces and Heavy Timber
- Owner's Responsibilities

271

Occupancy Separation

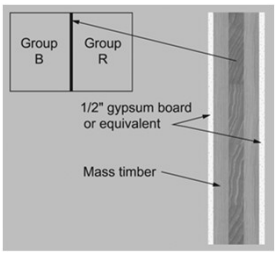
508.4.4.1 Construction. Required separations shall be *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies. Mass timber elements serving as fire barriers or horizontal assemblies to separate occupancies in Type IV-B or IV-C construction shall be separated from the interior of the building with an approved thermal barrier consisting of a minimum of ½ gypsum board or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

IV-B

IV-C

272

Separated Mixed Use



IV-B

IV-C

273

Incidental Use Separation

509.4.1.1 Type IV-B and IV-C construction. Where Table 509 specifies a fire-resistance-rated separation, mass timber elements serving as fire barriers or a horizontal assembly in Type IV-B or IV-C construction shall be separated from the interior of the incidental use with an approved thermal barrier consisting of a minimum of ½ inch gypsum board or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

IV-B

IV-C

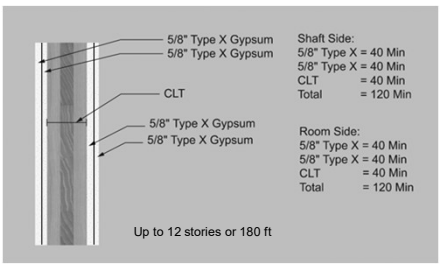
274

Sub-Outline

- Fire Barriers
- Shaft Walls
- Sealing Abutting Edges/Intersections and Fire Blocking Material
- New Redundant Sprinkler Water Supply Systems
- Concealed Spaces and Heavy Timber
- Owner's Responsibilities

275

Shaft Walls



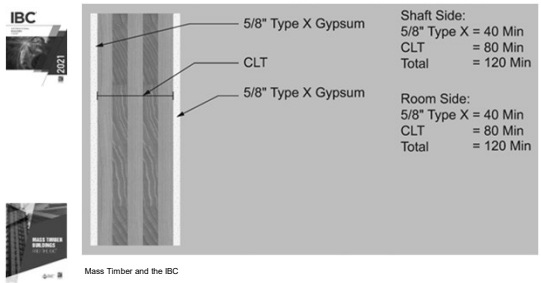
IV-A

Height restricted

IV-B

276

Shaft Walls



IV-C

Mass Timber and the IBC 277

277

Sub-Outline

- Fire Barriers
- Shaft Walls
- Sealing Abutting Edges/Intersections and Fire Blocking Material
- New Redundant Sprinkler Water Supply Systems
- Concealed Spaces and Heavy Timber
- Owner's Responsibilities

Mass Timber and the IBC 278

278

Sealing Intersections

- Mandatory sealing of adjacent mass timber elements in Section 703.7
  - Mass timber to mass timber
  - Mass timber to other materials

IV-A IV-B IV-C

Mass Timber and the IBC 279

279

Sealing Intersections (cont'd)

703.7 Sealing of adjacent mass timber elements. In buildings of Type IV-A, IV-B, and IV-C construction, sealant or adhesive shall be provided to resist the passage of air in the following locations:

1. At abutting edges and intersections of *mass timber* building elements required to be fire resistance-rated.

2. At abutting intersections of *mass timber* building elements and building elements of other materials where both are required to be fire resistance-rated.

Sealants shall meet the requirements of ASTM C920. Adhesives shall meet the requirements of ASTM D3498.

Exception: Sealants or adhesives need not be provided where they are not a required component of a tested fire resistance-rated assembly.

IV-A IV-B IV-C

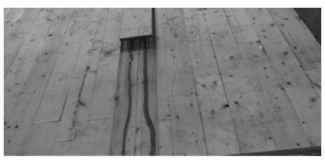
Mass Timber and the IBC 280

280

Sealing Intersections (cont'd)

1705.20 Sealing of mass timber
Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.7 is applied to *mass timber* building elements as designated in the *approved* construction documents.

IV-A IV-B IV-C



Mass Timber and the IBC 281

281

Fireblocking

718.2.1 Fireblocking materials. *Fireblocking* shall consist of the following materials:

1. Two-inch nominal lumber.

…laundry list continues with existing unchanged Items 2 through 8…

9. *Mass timber* complying with Section 2304.11.

Mass Timber and the IBC 282

282

Penetrations

Through penetrations

- Tested in ATF research

Not Specific to Tall Mass Timber

Mass Timber and the IBC 283

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Sub-Outline

- Fire Barriers
- Shaft Walls
- Sealing Abutting Edges/Intersections and Fire Blocking Material
- New Redundant Sprinkler Water Supply Systems
- Concealed Spaces and Heavy Timber
- Owner's Responsibilities

Mass Timber and the IBC 284

284

Water Supply to Required Fire Pumps

403.3.2 Water supply to required fire pumps. In all buildings that are more than 420 feet in building *height,* and buildings of Type IV-A and IV-B that are more than 120' in building height, required fire pumps shall be supplied by connections to not fewer than two water mains located in different streets. Separate supply piping shall be provided between each connection to the water main and the pumps. Each connection and the supply piping between the connection and the pumps shall be sized to supply the flow and pressure required for the pumps to operate.

IV-A

IV-B

Mass Timber and the IBC 285

285

Sub-Outline

- Fire Barriers
- Shaft Walls
- Sealing Abutting Edges/Intersections and Fire Blocking Material
- New Redundant Sprinkler Water Supply Systems
- Concealed Spaces and Heavy Timber
- Owner's Responsibilities

Mass Timber and the IBC 286

286

Concealed Spaces

Type IV-A & IV-B…at least 80 minutes of protection

602.4.1.5 & 602.4.2.5 Concealed spaces…Combustible construction forming concealed spaces shall be protected in accordance with Section 602.4.1.2.

602.4.1.2 Interior protection. Interior faces of all *mass timber* elements, including the inside faces of exterior *mass timber* walls and *mass timber* roofs, shall be protected…

602.4.1.2.1 Protection time. *Noncombustible protection* shall contribute a time equal to or greater than times assigned in Table 722.7.1(1), but not less than 80 minutes. The use of materials and their respective protection contributions listed in Table 722.7.1(2) shall be permitted to be used for compliance with Section 722.7.1.

TABLE 722.7.1(2)
PROTECTION PROVIDED BY NONCOMBUSTIBLE COVERING MATERIAL

Noncombustible Protection	Protection Contribution (minutes)
1/2 inch Type X Gypsum Board	25
5/8 inch Type X Gypsum Board	40

IV-A IV-B

Mass Timber and the IBC 287

287

Concealed Spaces

Type IV-C…40 minutes of protection

602.4.3.5 Concealed spaces…Combustible construction forming concealed spaces shall be protected with *noncombustible protection* with a minimum assigned time of 40 minutes as determined in Section 722.7.1.

TABLE 722.7.1(2)
PROTECTION PROVIDED BY NONCOMBUSTIBLE COVERING MATERIAL

Noncombustible Protection	Protection Contribution (minutes)
1/2 inch Type X Gypsum Board	25
5/8 inch Type X Gypsum Board	40

IV-C

Mass Timber and the IBC 288

288

Concealed Spaces

Type IV-HT (only)

602.4.4.3 Concealed spaces…Concealed spaces shall be protected in accordance with one or more of the following:

1. The building shall be sprinklered throughout in accordance with Section 903.3.1.1 and automatic sprinklers shall also be provided in the concealed space.
2. The concealed space shall be completely filled with noncombustible insulation.
3. Surfaces within the concealed space shall be fully sheathed with not less than 5/8-inch Type X gypsum board.

Exception: Concealed spaces within interior walls and partitions with a one-hour or greater fire resistance rating complying Section 2304.11.2.2 shall not require additional protection.

IV-HT

Mass Timber and the IBC 289

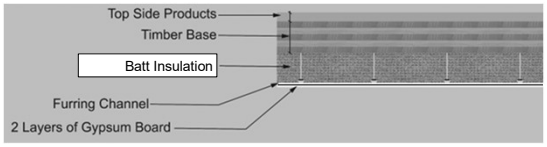
289

Concealed Spaces

2304.11.3 Floors. Floors shall be without concealed spaces or with concealed spaces complying with Section 602.4.4.3…

2304.11.4 Roof decks. Roofs shall be without concealed spaces ~~and roof~~ or with concealed spaces complying with Section 602.4.4.3…

IV-HT



Mass Timber and the IBC 290

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Concealed Spaces

IV-A, IV-B } Assigned NC Protection (at least 80-min)

IV-C 40-min protection

IV-HT 3 options (NFPA 13)

Mass Timber and the IBC 291

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Concealed Spaces

Photos provided by ATF Fire Research Laboratory

Mass Timber and the IBC 292

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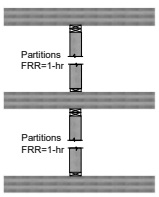
Concealed Space Exception

602.4 Type IV…

Combustible concealed spaces are not permitted except as otherwise indicated in Sections 602.4.1 through 602.4.4. Combustible stud spaces within light-frame walls of Type IV-HT construction shall not be considered concealed spaces but shall comply with Section 718.

IV-HT



Mass Timber and the IBC 293

293

CLT Wall Thickness

- Clarify min CLT thickness in Type IV-HT exterior walls
  - Requires min actual 4-inch CLT thickness rather than overall 6-inch wall thickness

IV-HT

602.4.4.2 Cross-laminated timber in exterior walls. *Cross-laminated timber* (CLT) not less than 4 inches in thickness complying with Section 2303.1.4 shall be permitted within exterior wall assemblies ~~not less than 6 inches in thickness~~ with a 2-hour rating or less. ~~provided the~~ Heavy timber structural members appurtenant to the CLT exterior wall shall meet the requirements of Table 2304.11 and be fire-resistance rated as required for the exterior wall. The exterior surface of the *cross-laminated timber* and heavy timber elements shall be ~~is~~ protected by one of the following:

Mass Timber and the IBC 294

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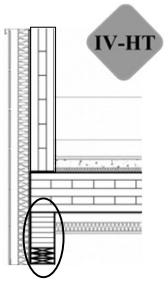
HT in Exterior Walls

- Provides for glulam and SCL in CLT exterior walls of Type IV-HT construction

602.4.4.2 Cross-laminated timber in exterior walls. *Cross-laminated timber* (CLT) not less than 4 inches in thickness complying with Section 2303.1.4 shall be permitted within exterior wall assemblies ~~not less than 6 inches in thickness~~ with a 2-hour rating or less. ~~provided the~~ Heavy timber structural members appurtenant to the CLT exterior wall shall meet the requirements of Table 2304.11 and be fire-resistance rated as required for the exterior wall. The exterior surface of the *cross-laminated timber* and heavy timber elements shall be ~~is~~ protected by one of the following:



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HT Roof Beams/Frames

TABLE 601

FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B
Primary structural frame[f] (see Section 202)	3[a,b]	2[a,b,c]	1[b,c]	0[c]	1[b,c]	0	3[a]	2[a]	2[a]	HT	1[b,c]	0
Bearing walls												
Exterior[e,f]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT[g]	1	0

c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed for roof construction, including primary structural frame members, where a 1-hour or less fire-resistance rating is required.
g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire resistance rating of not less than 1 hour.

IV-HT

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HT Interior Bearing Walls

TABLE 601

FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B
Primary structural frame[f] (see Section 202)	3[a,b]	2[a,b,c]	1[b,c]	0[c]	1[b,c]	0	3[a]	2[a]	2[a]	HT	1[b,c]	0
Bearing walls												
Exterior[e,f]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT[g]	1	0

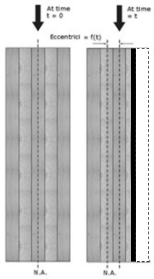
c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed for roof construction, including primary structural frame members, where a 1-hour or less fire-resistance rating is required.
g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire resistance rating of not less than 1 hour.

IV-HT

297

HT Interior Bearing Walls

- Table 601 Type IV-HT
  - Footnote g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire resistance rating of not less than 1 hour.
  - Calculated or protected



IV-HT

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Primary vs. Secondary Frame

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B
Primary structural frame [f] (see Section 202)	3[a,b]	2[a,b,c]	1[b,c]	0[c]	1[b,c]	0	3[a]	2[a]	2[a]	HT	1[b,c]	0
Bearing walls												
Exterior [e, f]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT[g]	1	0
Nonbearing walls and partitions – Exterior	See Table 705.5											
Nonbearing walls and partitions – Interior [d]	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1 ½[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	1 ½	1	1	HT	1[b,c]	0

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Primary vs. Secondary Frame

Primary Structural Frame. The primary structural frame shall include all of the following structural members:

- The columns.
- Structural members having direct connections to the columns, including girders, beams, trusses and spandrels.
- Members of the floor construction and roof construction having direct connections to the columns.
- Bracing Members that are essential to the vertical stability of the primary structural frame under gravity loading. ~~shall be considered part of the primary structural frame whether or not the bracing member carries gravity *loads.*~~

Secondary Structural Members. The following structural members shall be considered secondary members and not part of the primary structural frame:

- Structural members not having direct connections to the columns.
- Members of the floor construction and roof construction not having direct connections to the columns.
- Bracing members ~~other than those that are part of the *primary structural frame*~~ that are not designated as part of a primary structural frame or bearing wall.

300

Primary vs. Secondary Frame

Primary
- Columns and Beams

Secondary
- Floor Panels

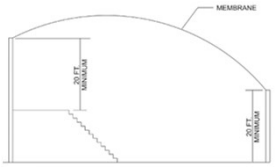
301

Membrane Structures

3102.3 Type of construction…
Heavy timber frame-supported structures covered by an *approved* membrane in accordance with Section 3102.3.1 shall be classified as Type IV-HT construction.

Note: The Exception to 3102.3 remains unchanged.

IV-HT



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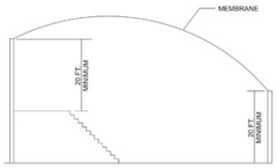
Membrane Structures

3102.6.1.1 Membrane.
A membrane meeting the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 710 shall be permitted to be used as the roof or as a skylight on buildings of Type II B, III, IV-HT and V construction, provided that the membrane is not less than 20 feet above and floor, balcony or gallery.

IV-HT



303

Sub-Outline

- Fire Barriers
- Shaft Walls
- Sealing Abutting Edges/Intersections and Fire Blocking Material
- New Redundant Sprinkler Water Supply Systems
- Concealed Spaces and Heavy Timber
- Owner's Responsibilities

304

Owner's Responsibility

IFC 701.6 Owner's responsibility. The owner shall maintain an inventory of all required fire-resistance-rated construction, construction installed to resist the passage of smoke and the construction included in Sections 703 through 707 and Sections 602.4.1 and 602.4.2 of the *International Building Code*. Such construction shall be visually inspected by the owner annually and properly repaired, restored or replaced where damaged, altered, breached or penetrated. Records of inspections and repairs shall be maintained…

IV-A

IV-B

305

Q&A

306

Outline

- Introduction to Mass Timber Products
- 2015/2018 IBC for Mass Timber Construction
- Break – 15 minutes
- 2021 IBC for Tall Mass Timber Construction
  - Part 1: Background and Overview
  - Lunch – 1 hour
  - Part 2: New Construction Types and Heights & Areas
  - Part 3: Fire Safety
  - Break – 15 minutes
  - Part 4: Fire & Connection Design and Special Inspection
  - Part 5: Acoustics, Energy, and Lateral Resistance
  - Part 6: Construction Fire Safety

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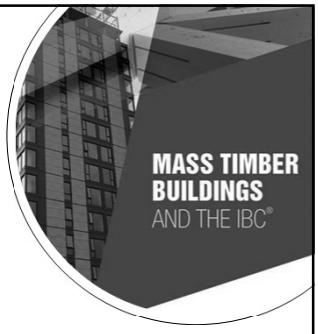
Tall Mass Timber Construction per 2021 IBC

Part 4: Principles of Fire Resistance Design, Protection of Connections and Special Inspections



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Sub-Outline

- Principles of Fire-resistance Design for New Construction Types IV-A, IV-B, and IV-C
- Design of Fire-resistance Protection for Mass Timber Connections
- Special Inspection of Tall Mass Timber Structures

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Mass Timber Fire-Resistance Design

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV			HT	TYPE V	
	A	B	A	B	A	B	A	B	C		A	B
Primary structural frame [f] (see Section 202)	3[a,b]	2[a,b,c]	1[b,c]	0[c]	1[b,c]	0	3[a]	2[a]	2[a]	HT	1[a]	0
Bearing walls												
Exterior [e, f]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT[a]	1	0
Nonbearing walls and partitions – Exterior	See Table 705.5											
Nonbearing walls and partitions – Interior [d]	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1 ½[a]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	1 ½	1	1	HT	1[b,c]	0

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Mass Timber Fire-Resistance Design

Noncombustible

(703.3)

≠

Fire-resistant

(703.2)

Mass Timber Fire-Resistance Design

Heavy timber inherent fire resistance

⇕

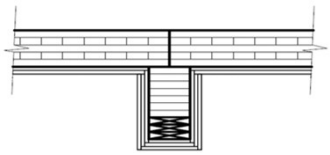
minimum prescriptive dimensions

311

312

Noncombustible Time Contribution

722.7 Fire-resistance rating of mass timber. The required fire resistance of mass timber elements in Section 602.4 shall be determined in accordance with Section 703.2. The fire resistance rating of building elements shall be as required in Tables 601 and 705.5 and as specified elsewhere in this code. The fire-resistance rating of the mass timber elements shall consist of the fire resistance of the unprotected element added to the protection time of the noncombustible protection.



IV-A

IV-B

IV-C

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Noncombustible Time Contribution

Protection Required

TABLE 722.7.1(1)
PROTECTION REQUIRED FROM NONCOMBUSTIBLE COVERING MATERIAL

Required Fire-Resistance Rating of Building Element per Tables 601 and 705.5 (hours)	Minimum Protection Required from Noncombustible Protection (minutes)
1	40
2	80
3 or more	120

IV-A

IV-B

IV-C

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Noncombustible Time Contribution

Prescriptive Method

TABLE 722.7.1(2)
PROTECTION PROVIDED BY NONCOMBUSTIBLE COVERING MATERIAL

Noncombustible Protection	Protection Contribution (minutes)
1/2 inch Type X Gypsum Board	25
5/8 inch Type X Gypsum Board	40

IV-A

IV-B

IV-C

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Mass Timber Fire-Resistance Design

Methods for establishing fire resistance (703.2.2)

1. Tested fire assembly (ASTM E119 or UL 263)
2. Fire-resistance designs documented in approved sources
3. Prescriptive assemblies using fire-resistance rated designs in Section 721
4. **Calculation of fire-resistance per Section 722**
5. Engineering analysis based on a comparison of building element, component or assembly designs that have been tested
6. Fire-resistance designs certified by an approved agency

703.2.3 Alternative protection methods per Section 104.11

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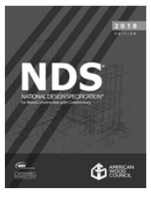
Mass Timber Fire-Resistance Design



IBC 722.1 | **NDS Chapter 16** | **TR-10**

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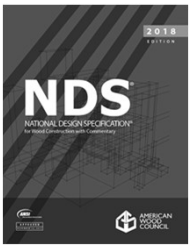
Mass Timber Fire-Resistance Design

SECTION 722
CALCULATED FIRE RESISTANCE

722.1 General. The provisions of this section contain procedures by which the *fire resistance* of specific materials or combinations of materials is established by calculations. These procedures apply only to the information contained in this section and shall not be otherwise used…The calculated *fire resistance* of exposed wood members and wood decking shall be permitted in accordance with Chapter 16 of ANSI/AWC *National Design Specification for Wood Construction (NDS)*.



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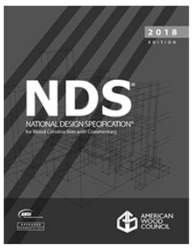
Mass Timber Fire-Resistance Design

NDS Section 16.2

- Fire design up to 2 hours
- Beams, columns, walls, floors/roofs
- Products
  - Sawn lumber
  - Glulam (softwood)
  - LVL
  - PSL
  - LSL
  - CLT



Mass Timber and the IBC 319

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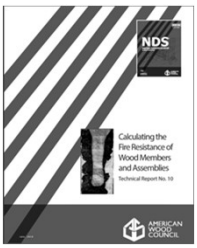
Mass Timber Fire-Resistance Design

AWC Technical Report 10

- NDS Chapter 16 basis
  - Background
  - Commentary
  - Examples



Mass Timber and the IBC 320

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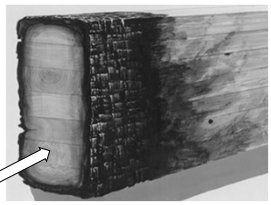
Mass Timber Fire-Resistance Design

Wood at high temperature

- **Low thermal conductivity**
- Dimensionally stable
- Predictable char rate
- **Inner portion remains cool**
  - Does not lose strength



Mass Timber and the IBC 321

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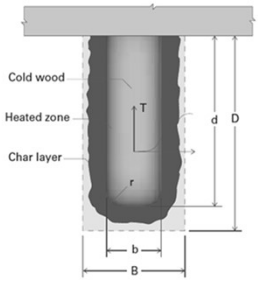
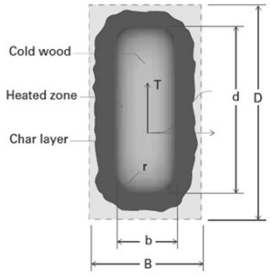
Mass Timber Fire-Resistance Design



Mass Timber and the IBC 322

322

Mass Timber Fire-Resistance Design



Mass Timber and the IBC 323

323

Mass Timber Fire-Resistance Design

Table 16.2.1A Char Depth and Effective Char Depth (for β_n = 1.5 in./hr.)

Required Fire Resistance (hr.)	Char Depth, a_{char} (in.)	Effective Char Depth, a_{eff} (in.)
1-Hour	1.5	1.8
1½-Hour	2.1	2.5
2-Hour	2.6	3.2

Mass Timber and the IBC 324

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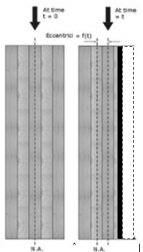
Mass Timber Fire-Resistance Design



CLT: modified char depth model

Mass Timber and the IBC 325

325

Mass Timber Fire-Resistance Design

Table 16.2.1B Effective Char Depths (for CLT with β_n = 1.5in./hr.)

Required Fire Resistance (hr.)	Effective Char Depths, a_{eff} (in.) lamination thicknesses, h_{lam} (in.)								
	5/8	3/4	7/8	1	1-1/4	1-3/8	1-1/2	1-3/4	2
1-Hour	2.2	2.2	2.1	2.0	2.0	1.9	1.8	1.8	1.8
1½-Hour	3.4	3.2	3.1	3.0	2.9	2.8	2.8	2.8	2.6
2-Hour	4.4	4.3	4.1	4.0	3.9	3.8	3.6	3.6	3.6

Mass Timber and the IBC 326

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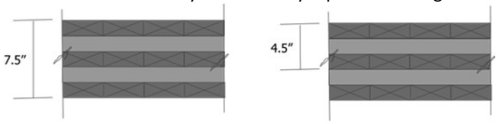
Mass Timber Fire-Resistance Design

Determination of effective CLT floor cross-section

- Assume 5-layers @ 1.5" (total = 7.5")
- Determine thickness for 1-hr FRR
- a_{char} = 1.8" (NDS Table 16.2.1B)
- d = 7.5" – 1.8" = 5.7"
- Could conservatively assume 3-layer panel for design

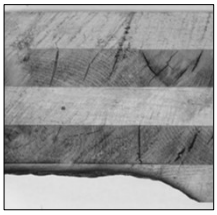


Mass Timber and the IBC 327

327

Mass Timber Fire-Resistance Design

- Fire-resistance of exposed mass timber
  - Cross-sectional dimensions
  - Load ratio



Mass Timber and the IBC 328

328

Mass Timber Fire-Resistance Design

- Fire-resistance of protected mass timber
  - Cross-sectional dimensions
  - Load ratio

- plus -

- Noncombustible protection

Mass Timber and the IBC 329

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Mass Timber Fire-Resistance Design

Waugh Thistleton Architects (Stradthaus – Murry Grove)

Mass Timber and the IBC 330

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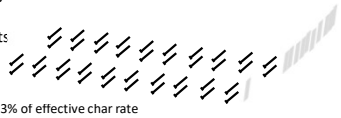
Mass Timber Fire-Resistance Design

Nail-Laminated Timber (NLT)

- NDS 16.2.5. Timber Decks
  - ≥ 2" thick (actual)
  - Clear-span between supports
  - Assembly of wood beams
    - Exposed partially on sides
    - Exposed fully on one face
    - Char rate on sides reduced to 33% of effective char rate
    - Does not address thermal separation
    - Typically requires one layer of Type X gypsum



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Mass Timber Fire-Resistance Design

16.2.4 Special Provisions for Structural Glued Laminated Timber Beams

For structural glued laminated timber bending members given in Table 5A and rated for 1-hour fire endurance, an outer tension lamination shall be substituted for a core lamination on the tension side for unbalanced beams and on both sides for balanced beams. For structural glued laminated timber bending members given in Table 5A and rated for 1½- or 2-hour fire endurance, 2 outer tension laminations shall be substituted for 2 core laminations on the tension side for unbalanced beams and on both sides for balanced beams.

Glulam column caps at the Bullitt Center

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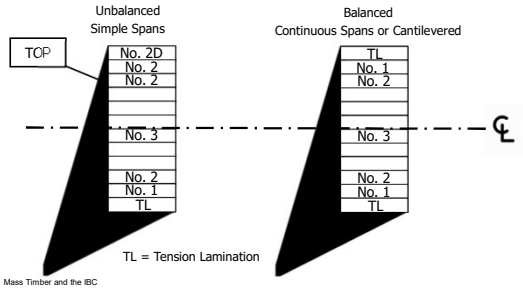
Glulam - Engineered Layups



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Tension Lams - Unbalanced

3-sided exposure only (protected compression side)

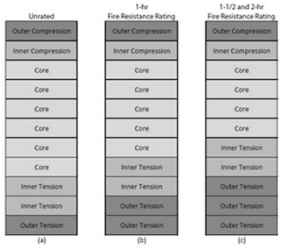

Figure 3-1 Typical glulam unbalanced beam layups

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Tension Lams - Balanced

3- or 4-sided beam (or column) exposure

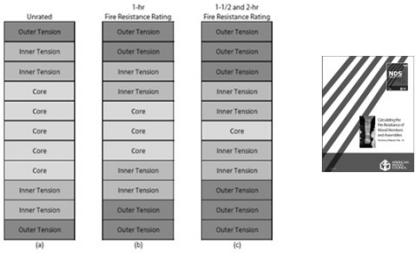

Figure 3-2 Typical glulam balanced beam layups

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Sub-Outline

- Principles of Fire-resistance Design for New Construction Types IV-A, IV-B, and IV-C
- Design of Fire-resistance Protection for Mass Timber Connections
- Special Inspection of Tall Mass Timber Structures

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Fire-Resistive Connection Protection

IV-A IV-B IV-C

704.2 Column protection. Where columns are required to have protection to achieve a *fire-resistance rating*, the entire column shall be provided individual encasement protection by protecting it on all sides for the full column height, including connections to other structural members, with materials having the required *fire-resistance rating*. Where the column extends through a ceiling, the encasement protection shall be continuous from the top of the foundation or floor/ceiling assembly below through the ceiling space to the top of the column.

704.3 Protection of the primary structural frame other than columns. Members of the primary structural frame other than columns that are required to have protection to achieve a *fire-resistance rating* and support more than two floors or one floor and roof, or support a load-bearing wall or a nonload-bearing wall more than two stories high, shall be provided individual encasement protection by protecting them on all sides for the full length, including connections to other structural members, with materials having the required *fire-resistance rating*.

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Fire-Resistive Connection Protection

IV-A IV-B IV-C

2304.10.1 Connection fire-resistance rating. Fire-resistance ratings for connections in Type IV-A, IV-B or IV-C shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is a part of the fire-resistance test.
2. Engineering analysis that demonstrates that the temperature rise at any portion of the connection is limited to an average temperature rise of 250°F, and a maximum temperature rise of 325°F, for a time corresponding to the required fire-resistance rating of the structural element being connected. For the purposes of this analysis, the connection includes connectors, fasteners, and portions of wood members included in the structural design of the connection.

Beam-to-column connection tested at ATF Fire Research Lab.

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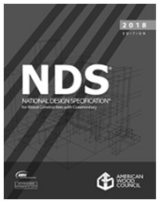
Fire-Resistive Connection Protection

But we can't test every connection!

2304.10.1 Connection fire resistance rating. Fire-resistance ratings for connections in Type IV-A, IV-B or IV-C shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is a part of the fire resistance test.
2. Engineering analysis that demonstrates . . .



IV-A IV-B IV-C

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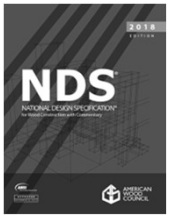
Fire-Resistive Connection Protection

NDS 16.3 Wood Connections

Where fire resistance is required, connectors and fasteners shall be protected from fire exposure

- Additional wood cover
- Fire-rated gypsum board
- Other approved materials like coatings or insulation (approved for required endurance time)
- OR a combination thereof



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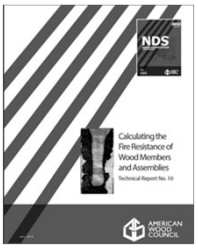
Fire-Resistive Connection Protection

AWC *Technical Report 10*

- NDS Chapter 16 basis
  - Protecting connections
    - Background
    - Commentary
    - Examples



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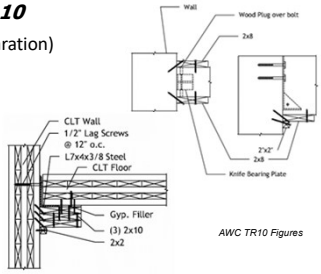
Fire-Resistive Connection Protection

AWC *Technical Report 10*

- Thermal protection (separation)
- Example details
- Common fasteners and connectors



AWC TR10 Figures

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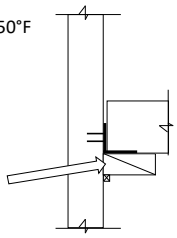
Fire-Resistive Connection Protection

- Thermal Separation – limit avg temp rise ≤ 250°F
- 2-hr Example
  - 3 inches of wood protection
  - $t_p = 60\left(\frac{3.0}{1.5}\right)^{1.23} = 141\ minutes$
  - Wood protecting a connection
  - 0.85 x (calculated protection time)
  - $0.85\ t_p = (0.85)\ 141\ minutes = 120\ minutes$



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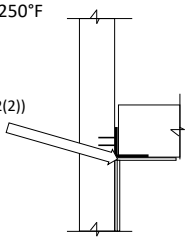
Fire-Resistive Connection Protection

- Thermal Separation – limit avg temp rise ≤ 250°F
- 1-hr Example
  - Gypsum Board
  - 0.5 x (NC Protection Time)
  - 5/8" Type X GB = 40 minutes (IBC Table 722.7.2(2))
  - $0.5\ t_p = (0.5)\ 40\ minutes = 20\ minutes$ NG



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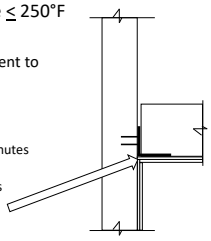
Fire-Resistive Connection Protection

- Thermal Separation – limit avg temp rise ≤ 250°F
- Multiple layers of protection
  - Reduction factor only applies to layer adjacent to connection
- 1-hr Example
  - 2 layers of 5/8" Type X GB
    - Layer adjacent to connection = 40 (0.5) = 20 minutes
    - Second layer = 40 minutes
    - Total thermal separation = 40 + 20 = 60 minutes



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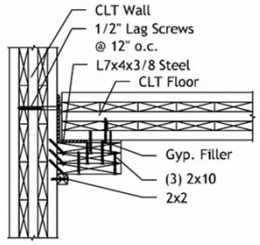
Fire-Resistive Connection Protection

- Char contraction
  - Abutting edges
  - Char layer < char depth
  - Wedge-shaped gap
  - Additional wood cover protects abutting edges
  - Fasteners attaching cover do not require protection



AWC TR10 Figure 8-4. Example connection protection

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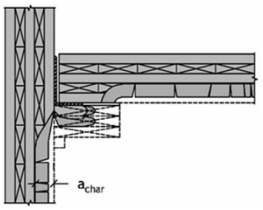
Fire-Resistive Connection Protection

- Char contraction
  - Abutting edges
  - Char layer < char depth
  - Wedge-shaped gap
  - Additional wood cover or blocking to protect abutting edges
  - Fasteners attaching cover do not require protection



AWC TR10 Figure 8-3. Char pattern with wood strip added

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Fire-Resistive Connection Protection

Code Official Inspection

110.3.5 Type IV-A, IV-B and IV-C connection protection inspection. In buildings of Type IV-A, IV-B and IV-C Construction, where connection fire-resistance ratings are provided by wood cover calculated to meet the requirements of Section 2304.10.1, inspection of the wood cover shall be made after the cover is installed, but before any other coverings or finishes are installed.

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Sub-Outline

- Principles of Fire-resistance Design for New Construction Types IV-A, IV-B, and IV-C
- Design of Fire-resistance Protection for Mass Timber Connections
- Special Inspection of Tall Mass Timber Structures

Mass Timber and the IBC 349

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Special Inspection

- New Section 1705.5.3 on Tall Mass Timber Construction
- New Table 1705.5.3
  - Required special inspections for new mass timber types
    - IV-A, IV-B & IV-C
- NOT Type IV-HT

IV-A IV-B IV-C

Mass Timber and the IBC 350

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Special Inspection

Table 1705.5.3. Required Special Inspections of Mass Timber Construction

	Type		Continuous Special Inspection	Periodic Special Inspection
1.	Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.			X
2.	Inspect erection of mass timber construction.			X
3.	Inspection of connections where installation methods are required to meet design loads.			
	Threaded fasteners	Verify use of proper installation equipment.		
		Verify use of pre-drilled holes where required.		X
		Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.		X
	Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.		X	
	Adhesive anchors not defined in preceding cell.			X
	Bolted connections.			X
	Concealed connections.			X

IV-A IV-B IV-C

Mass Timber and the IBC 351

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Special Inspection

- Connections for TMT can be designed with common connectors
  - Screws, bolts, etc.
  - Thus, periodic
- Continuous inspection
  - Adhesive anchors under sustained tension
  - Similar to precast

IV-A IV-B IV-C

Mass Timber and the IBC 352

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Special Inspection

1705.20 Sealing of mass timber
Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.7 is applied to *mass timber* building elements as designated in the *approved* construction documents.

IV-A IV-B IV-C

Mass Timber and the IBC 353

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Special Inspection

703.7 Sealing of adjacent mass timber elements…

- Sealants per ASTM C920

or

- Adhesives per ASTM D3498

Exception: Sealants or adhesives need not be provided where they are not a required component of a tested fire-resistance-rated assembly.

IV-A IV-B IV-C

Mass Timber and the IBC 354

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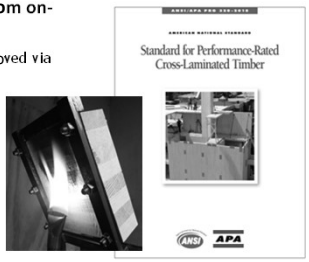
Special Inspection

Fabricated items exempt from on-site special inspection

- IBC 1704.2.5 – fabricator approved via QC/QA and third-party audit
  - CLT
  - SCL
  - Glulam
  - Sawn Timber



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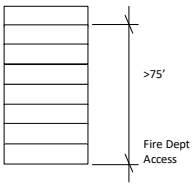
Structural Observation

1704.6.1 Structural observations for structures. Structural observations shall be provided for those structures where one or more of the following conditions exist:

1. The structure is classified as Risk Category III or IV.
2. The structure is a high-rise building.
3. The structure is assigned to Seismic Design Category E and is greater than two stories above the grade plane.
4. Such observation is required by the registered design professional responsible for the structural design.
5. Such observation is specifically required by the building official.

Not Specific to Tall Mass Timber



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Q&A

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Outline

- Introduction to Mass Timber Products
- 2015/2018 IBC for Mass Timber Construction
- Break – 15 minutes
- 2021 IBC for Tall Mass Timber Construction
  - Part 1: Background and Overview
  - Lunch – 1 hour
  - Part 2: New Construction Types and Heights & Areas
  - Part 3: Fire Safety
  - Break – 15 minutes
  - Part 4: Fire & Connection Design and Special Inspection
  - Part 5: Acoustics, Energy, and Lateral Resistance
  - Part 6: Construction Fire Safety

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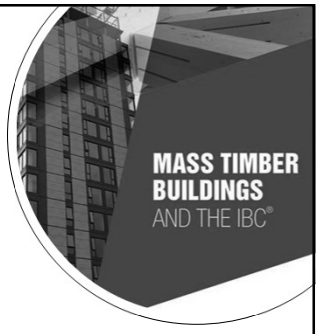
Tall Mass Timber Construction per 2021 IBC

Part 5: Acoustics, Energy and Lateral Load Performance



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Sub-Outline

- Acoustics
- Energy
- Lateral Resistance

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Acoustics

- IBC 1206
  - Airborne sound – STC
  - Structure-borne sound – IIC

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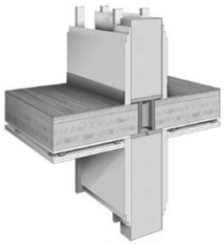
Acoustics

- Multi-family
  - STC minimum = 50
  - IIC minimum = 50
  - Field-test = 45



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Acoustics

Sound Transmission Ratings of Selected Mass Timber Panels

Mass Timber Panel	Thickness	STC Rating	IIC Rating
3-ply CLT wall	3"	33	N/A
5-ply CLT wall	$6^{7}/_{8}$"	38	N/A
5-ply CLT floor	$5^{1}/_{16}$"	39	22
5-ply CLT floor	$6^{7}/_{8}$"	41	25
7-ply CLT floor	$9^{5}/_{8}$"	44	30
2x4 NLT wall	3-1/2" bare NLT 3-1/2" with 3/4" plywood	24 bare NLT 29 with 3/4" plywood	N/A
2x6 NLT wall	5-1/2" bare NLT 5-1/2" with 3/4" plywood	22 bare NLT 31 with 3/4" plywood	N/A
2x6 NLT floor + 1/2" plywood	5-1/2" with 1/2" plywood	34	33

Source: Inventory of Acoustically-Tested Mass Timber Assemblies, WoodWorks

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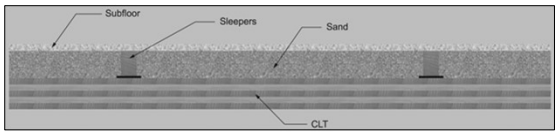
Acoustics

- Example – floor with exposed mass timber



IV-HT

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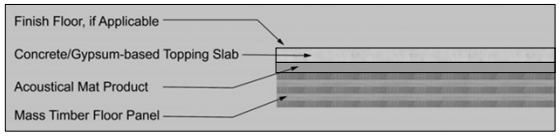
Acoustics

- Example – floor with exposed mass timber



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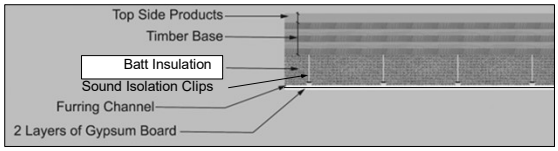
Acoustics

- Examples – floors with ceiling concealed



IV-HT

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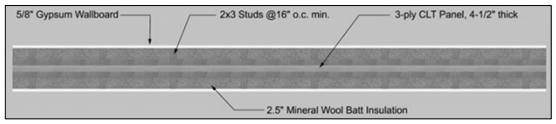
Acoustics

- Example – walls



IV-HT

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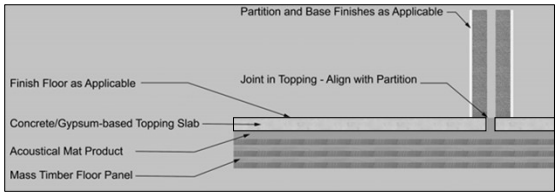
Acoustics

- Example – flanking control



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Sub-Outline

- Acoustics
- Energy
- Lateral Resistance

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Energy Performance

- Exterior walls
  - Mass timber panels (e.g. CLT)
  - Curtain walls
- IBC Chapter 13
  - IECC compliance paths
    - ANSI/ASHRAE/IES Standard 90.1
    - Prescriptive design per IECC C402 through C405
    - Performance design per IECC C407

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Energy Performance

IECC TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD

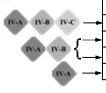
CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.037	U-0.037
Wood framed and other	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.032	U-0.032
Floors																
Mass	U-0.322	U-0.322	U-0.107	U-0.087	U-0.074	U-0.074	U-0.057	U-0.051	U-0.057	U-0.051	U-0.051	U-0.051	U-0.042	U-0.042	U-0.038	U-0.038

R-value method does not account for the mass effect

371

Energy Performance

- Does a CLT wall qualify as a "mass" wall?
  - Assume 1-3/8" lamination thickness
    - 3 layers = 4.125"
    - 5 layers = 6.875"
    - 7 layers = 9.625"
- Exterior fire protection required
  - All new construction types



Required Mass Timber Thickness for Minimum Heat Capacity of 5 Btu/ft²•°F	
Layers of 5/8" Type X Gypsum	Minimum Thickness of Mass Timber (in.)
0[1]	6.36 (5 layers)
1	5.53 (5 layers)
2	4.71 (5 layers)
3	3.88 (3 layers)
4	3.05 (3 layers)

372

Energy Performance

Required Minimum Thickness of Mass Wall to Meet IECC U-Factors

CZ	Req. U-Factor	All Except Residential			
		Layers of 5/8" Gypsum			
		0[1]	1	2	3
1	0.151	4.62	4.23	3.85	3.47
2	0.151	4.62	4.23	3.85	3.47
3	0.123	5.82	5.44	5.06	4.67
4	0.104	7.01	6.63	6.24	5.86
5	0.090	8.21	7.82	7.44	7.06
6	0.080	9.32	8.94	8.55	8.17
7	0.071	10.59	10.20	9.82	9.44
8	0.037	20.94	20.56	20.17	19.79

IV-A IV-B IV-C IV-A IV-B

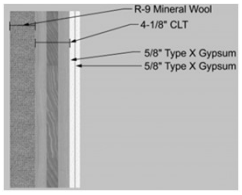
CLT
3 layers = 4.125"
5 layers = 6.875"
7 layers = 9.625"

373

Energy Performance

Additional Minimum R-value for a Non-mass 4-1/8-inch-thick Wall under IECC

CZ	Req. U-Factor	All Except Residential			
		Layers of 5/8" Gypsum			
		0[1]	1	2	3
		Additional required R-value			
1	0.064	9.62	9.14	8.66	8.18
2	0.064	9.62	9.14	8.66	8.18
3	0.064	9.62	9.14	8.66	8.18
4[2]	0.064	9.62	9.14	8.66	8.18
5[3]	0.051	13.60	13.12	12.64	12.16
6	0.051	13.60	13.12	12.64	12.16
7	0.051	13.60	13.12	12.64	12.16
8	0.032	25.24	24.76	24.28	23.80



R-9 mineral wool works

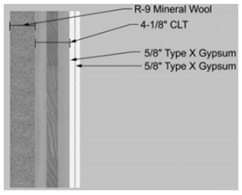
IV-A IV-B IV-C IV-A IV-B

374

Energy Performance

Additional Minimum R-value for a Mass 4-1/8-inch-thick Wall under IECC

CZ	Req. U-Factor	All Except Residential			
		Layers of 5/8" Gypsum			
		0[1]	1	2	3
		Additional required R-value			
1	0.151	0.62	0.14	0.00	0.00
2	0.151	0.62	0.14	0.00	0.00
3	0.123	2.12	1.64	1.16	0.68
4[2]	0.104	3.61	3.13	2.65	2.17
5[3]	0.090	5.10	4.62	4.14	3.66
6	0.080	6.49	6.01	5.53	5.05
7	0.071	8.08	7.60	7.12	6.64
8	0.037	21.02	20.54	20.06	19.58



R-9 mineral wool works

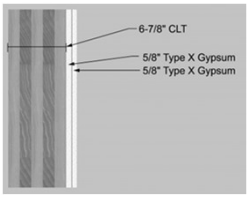
IV-A IV-B IV-C IV-A IV-B

375

Energy Performance

Additional Minimum R-value for a Mass 6-7/8-inch-thick Wall under IECC

CZ	Req. U-Factor	All Except Residential			
		Layers of 5/8" Gypsum			
		0[1]	1	2	3
		Additional required R-value			
1	0.151	0.00	0.00	0.00	0.00
2	0.151	0.00	0.00	0.00	0.00
3	0.123	0.00	0.00	0.00	0.00
4	0.104	0.17	0.00	0.00	0.00
5	0.090	1.67	1.19	0.71	0.23
6	0.080	3.06	2.58	2.10	1.62
7	0.071	4.64	4.16	3.68	3.20
8	0.037	17.58	17.10	16.62	16.14



IV-A IV-B IV-C IV-A IV-B

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Sub-Outline

- Acoustics
- Energy
- Lateral Resistance

377

Seismic Design Options

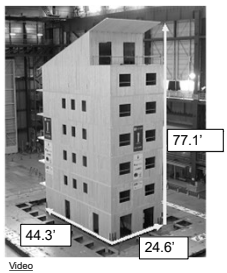
- *ASCE 7 Minimum Design Loads for Buildings and Other Structures*
- Response Modification Coefficient (R)
  - CLT not recognized vertical SFRS in ASCE 7-16
  - Options
    - Performance-based design procedure per ASCE 7
    - Demonstrating equivalence to an existing ASCE 7 system
    - ASCE 7, FEMA P695, and FEMA P795 Quantification of Building Seismic Performance Factors; Component Equivalency Methodology
- R-factor anticipated in ASCE 7-22

378

Shake Table Test

7-story CLT Building – 2007

- Conducted at E-Defense
- Building weight 270t
  - Self-weight 120t
  - Added weight 150t
- Panel thickness
  - 5.5" floors 1 and 2
  - 4.9" floors 3 and 4
  - 3.3" top 3 floors
- Wall panels length 7.5'



Video

379

Lateral Design Options

- Horizontal diaphragm example
  - Wood structural panels over CLT
  - Acceptable under current codes

Photo courtesy of StructureCraft

www.structurlam.com

380

Current Research

- Colorado State University
  - CLT shear wall testing (P695) to determine seismic R factor
- Colorado School of Mines
  - NEES project on rocking CLT shear wall
- Arup
  - Heavy timber buckling-restrained braced frame system
- Oregon State University
  - CLT diaphragm testing

photo courtesy of Robert Beckley

photo courtesy of Shiling Pei

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Current Standards

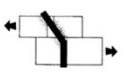
- *2021 Special Design Provisions for Wind and Seismic*
  - CLT Diaphragms
  - CLT shear walls
  - Ductility via nailed metal connectors
  - Referenced in 2021 IBC

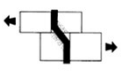
382

CLT Diaphragms

- Cross-laminated Timber (CLT) Diaphragm Design
  - Deflection per engineering
  - Unit shear capacity
    - Nominal dowel fastener shear capacities
      - 4.5 x Z*
      - Z* = Z x NDS adjustments except C_D, K_θ, ϕ, and λ
      - Mode III_s or IV
    - Wood, steel, and chord splices
      - 2 x diaphragm forces – seismic
      - 1.5 x diaphragm forces – wind
    - Chord splice fasteners – Mode III_s and IV
      - 1.5 x diaphragm forces – seismic
      - 1.0 x diaphragm forces – wind

§ 4.5





Ductile connections

383

CLT Shear Walls

- CLT Shear Wall Design
  - Deflection per engineering
  - Shear capacity
    - Nominal capacities per SDPWS Appendix B or
    - Approved alternative (by AHJ) CLT shear wall
  - NOT permitted
    - FTAO
    - PSW
    - ASCE 7 light-frame seismic

§ 4.6 & App. B

384

CLT Shear Walls

- Aspect Ratio Limit
  - $2 \leq h/b_s \leq 4$
- Hold-downs
  - 2 x v_s – seismic
  - 1.5 x v_s – wind
  - NDS App. E net section
- Dowel-type fasteners
  - Mode III_s or IV (ductile)
  - NDS App. E net section
- Deflection – 5-part equation

§ 4.6 & App. B

385

CLT Shear Walls

$$v_s = n\left(\frac{2605}{b_s}\right)C_G$$

where:

n = number of angle connectors along bottom of panel face

2605 = NDS connector nominal shear capacity (lbs)

b_s = individual CLT panel length (ft)

C_G = CLT panel specific gravity adjustment factor.

- C_G = 1.0 for G ≥ 0.42
- C_G = 0.86 for G = 0.35
- Linear interpolation permitted for G of 0.35 to 0.42

CLT Shear Wall Capacities* (ASD)

		Seismic		Wind	
Panel b_s x h (ft)	No. of Angles (n)	Shear (plf)	Hold-down (lbs)	Shear (plf)	Hold-down (lbs)
4 x 8	2	465	7443	651	7815
4 x 8	3	698	11,164	977	11,723
4 x 8	4	930	14,886	1303	15,630
4 x 8	5	1163	18,607	1628	19,538

*Capacity based on angles on one face

§ 4.6 & App. B

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Q&A

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Outline

- Introduction to Mass Timber Products
- 2015/2018 IBC for Mass Timber Construction
- Break – 15 minutes
- 2021 IBC for Tall Mass Timber Construction
  - Part 1: Background and Overview
  - Lunch – 1 hour
  - Part 2: New Construction Types and Heights & Areas
  - Part 3: Fire Safety
  - Break – 15 minutes
  - Part 4: Fire & Connection Design and Special Inspection
  - Part 5: Acoustics, Energy, and Lateral Resistance
  - Part 6: Construction Fire Safety

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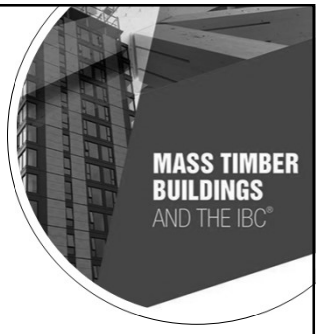
Tall Mass Timber Construction per 2021 IBC

Part 6: Construction Fire Safety



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Construction Fire Safety

- Standpipes
- Water Supply
- Noncombustible Protection
- Exterior Wall Coverings
- Owner's Responsibility

390

Construction Fire Safety

IFC 3308.4 Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction. Buildings of Types IV-A, IV-B, and IV-C construction designed to be greater than six stories above grade plane shall meet the following requirements during construction unless otherwise approved by the *fire code official.*

1. Standpipes shall be provided during construction in accordance with Section 3313.
2. A water supply . . .

391

Standpipes

3313.1 Where required. In buildings required to have standpipes by Section 905.3.1, not less than one standpipe shall be provided for use during construction. Such standpipes shall be . . .

- Installed prior to construction exceeding 40 feet in height above lowest level of FD apparatus access.
- Have FD hose connection at locations adjacent to stairways complying with Section 3311.1
- Keep extending to stay within one floor of the highest construction having secured decking or flooring

Not 2021 IBC change

392

Water Supply

3312.1 When required. An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building materials arrive on the site, upon commencement of vertical combustible construction, and upon installation of a standpipe system in buildings under construction, in accordance with Sections 3312.2 through 3312.5.

Exception: The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

Not Specific to Tall Mass Timber

393

Water Supply

3312.2 Combustible building materials. When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gpm shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet of the combustible building materials, as measured along an approved fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

Not Specific to Tall Mass Timber

394

Water Supply

3312.3 Vertical construction of Types III, IV, and V construction. Prior to commencement of vertical construction of Type III, IV, or V buildings that utilize any combustible building materials, the fire flow required by Sections 3312.3.1 through 3312.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

- 3312.3.1 Fire separation up to 30 ft
- 3312.3.2 Fire separation 30-60 ft
- 3312.3.3 Fire separation over 60 ft

Not Specific to Tall Mass Timber

395

Water Supply

3312.5 Standpipe supply. Regardless of the presence of combustible building materials, the construction type or the fire separation distance, where a standpipe is required in accordance with Section 3313, a water supply providing a minimum flow of 500 gpm shall be provided. The fire hydrant used for this water supply shall be located within 100 feet of the Fire Department Connection supplying the standpipe.

Not Specific to Tall Mass Timber

396

Fire Safety Reqmt's - Water Supply

IV-A IV-B IV-C

IFC 3308.4 Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction…(cont'd)

1. Standpipes . . .

2. A water supply for fire department operations, as approved by the fire code official and the fire chief.

Mass Timber and the IBC 397

397

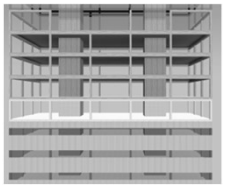
Noncombustible Protection

IFC 3308.4 Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction…(cont'd)

IV-A IV-B

3. Where building construction exceeds six stories above grade plane, at least one layer of noncombustible protection where required by Section 602.4 of the International Building Code shall be installed on all building elements more than 4 floor levels, including mezzanines, below active mass timber construction before erecting additional floor levels.

Exception: Shafts and vertical exit enclosures…



Mass Timber and the IBC 398

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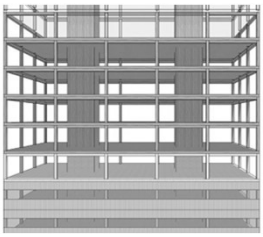
Noncombustible Protection

Protection (gray) applied to mass timber on all levels more than 4 stories below active construction floor



IV-A

IV-B

Mass Timber and the IBC 399

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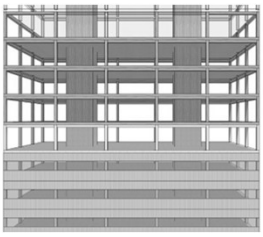
Noncombustible Protection

Work can only proceed on 9th floor after mass timber protection is applied as required on 4th floor



IV-A

IV-B

Mass Timber and the IBC 400

400

Noncombustible Protection

18-story Brock Commons Example

IV-A IV-B

Mass Timber and the IBC 401

401

Exterior Wall Coverings

IV-A IV-B IV-C

IFC 3308.4 Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction…(cont'd)

4. Where building construction exceeds six stories above grade plane required exterior wall coverings shall be installed on all floor levels more than 4 floor levels, including mezzanines, below active mass timber construction before erecting additional floor level.

Exception: Shafts and vertical exit enclosures…

Mass Timber and the IBC 402

402

Owner's Responsibility

3303.3 Daily fire safety inspection. The site safety director shall be responsible for completion of a daily fire safety inspection at the project site. Each day, all building and outdoor areas shall be inspected to ensure compliance with the inspection list in this section. The results of each inspection shall be documented and maintained on site until a certificate of occupancy has been issued. Documentation shall be immediately available on site for presentation to the fire code official upon request…

3rd offense → stop work

Not Specific to Tall Mass

403

Owner's Responsibility

3303.3 Daily fire safety inspection…(cont'd)

- Inspect hot work areas
- Inspect all temporary heating equipment
- Ensure trash/debris removed
- No exposed conductors on temporary wiring
- Flammable/hazardous materials stored properly
- Hydrants unobstructed and "clearly visible"
- Fire access roads obstruction-free
- Standpipes/sprinklers identifiable from access road
- Standpipes within 1 floor of highest construction
- Portable fire extinguishers in-service and properly spaced

Not Specific to Tall Mass Timber

404

Q&A

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Conclusion

This concludes *Mass Timber Buildings & the IBC*. You should now be able to:

- Recognize unique fire-resistive characteristics of mass timber
- Summarize new provisions in 2015, 2018 and 2021 IBC related to mass timber products and Type IV construction
- Compare new and existing construction types and recognize inherent differences and conservative approaches for new construction types
- Evaluate new provisions for heights and areas, construction fire safety, fire and connection design and special inspection in tall mass timber construction

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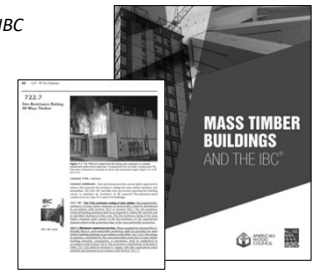
Resources

Mass Timber Buildings & the IBC

- AWC & ICC publication
- Available PDF and Print



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Resources

Tall Mass Timber Special Inspector

- Exam now available
- PRONTO

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2021 I-Codes

Mass Timber and the IBC 409

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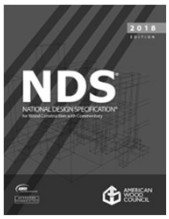
AWC Standards



Mass Timber and the IBC 410

410

AWC Tall Mass Timber Webpage

www.awc.org

Mass Timber and the IBC 411

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AIA

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Mass Timber and the IBC 412

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Copyright Materials

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Thank you for participating!

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AWC Education
202-463-2766
education@awc.org

Mass Timber Buildings
and the IBC

Mass Timber and the IBC 414

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File Attachments for Item:

EC-5 Medical Gas (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

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

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

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

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

New Course Information

Course title: Medical Gas

Course instructor: Scott Winn

Course description:

This session is an introduction to Medical Gas Systems covering basics of source equipment, piping, valves, inlets/outlets, and alarms. A brief discussion and overview of installation, inspection, verification, and maintenance requirements will be included.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

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

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☑ No

☐ On Demand ☐ Webinar

Course Website:

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

Course applicable for the following certifications *

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

Application materials included *

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

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

File Name	Size
Outline_PPT_bio- Medical Gas Basics.pdf	4.16 MB

Applicant Full Name *

Laura Morris

Date of Submission

09/01/2023

Instructions for new Continuing Education Approval form

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

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

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

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

Medical Gas

Description

This session is an introduction to Medical Gas Systems covering basics of source equipment, piping, valves, inlets/outlets, and alarms. A brief discussion and overview of installation, inspection, verification, and maintenance requirements will be included.

Objectives

- Identify the medical gas source of supply system requirements.
- Discuss medical gas system installation requirements.
- Identify Medical gas testing requirements.
- identify medical gas system maintenance requirements.

Outline: 1.5 hours (90 minutes)

Topics:

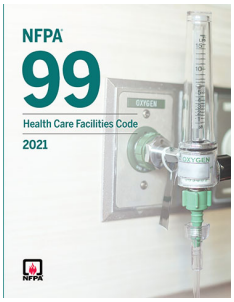
• Source equipment	10 min.
• Piping	10 min.
• Valves	10 min.
• Inlets/Outlets	10 min.
• Alarms	10 min.
• Installation	10 min.
• Inspection	10 min.
• Verification	10 min.
• Maintenance	10 min.

Scott Winn

Scott Winn, Senior Director, ICC Training, began his plumbing experience in 1977. In addition to working in the family plumbing business and operating his own enterprise, he has over 18 years of Medical Gas experience. Scott holds a current TSBPE Inspector License plus a Master Plumbing License with Med Gas Endorsement, Multipurpose Residential Fire Protection Sprinkler Specialist endorsement (MRFPSS), Water Supply Protection Specialist endorsement (WSPS), and carries the following NITC certifications: ASSE 6010 Medical Gas Installer, ASME IX Brazer, ASSE 6030 Medical Gas Verifier, ASSE 6050 Medical Gas Instructor. Scott is not only an active instructor, he leads our day-to-day operations our ICC's contractor training and is actively involved in the development of our future course offerings.

"Medical Gas Basics"
An introduction to Medical Gas Systems

TRAINING



1

"Medical Gas Basics"
An introduction to Medical Gas Systems

Before we get started……

Who are we?

Scott Winn
ICC
Sr Director,
Training

TRAINING

Chad Winn
ICC
Director,
Plumbing/Med Gas Education

2

"Medical Gas Basics"
An introduction to Medical Gas Systems

Before we get started……

What is Med Gas?

Who is NFPA?

Questions?

dswinn@iccsafe.org ccwinn@iccsafe.org

3

"Medical Gas Basics"
An introduction to Medical Gas Systems

Topics:

- Source equipment
- Piping
- Valves
- Inlets/Outlets
- Alarms
- Installation
- Inspection
- Verification
- Maintenance

4

Crisis: Medical Gas

5

Documented Med Gas Mistakes

Gas Delivery Mistakes Continue to Kill

Robert C. Morell, MD

Share

Two recent deaths occurring at a New Haven, Connecticut, hospital serve as a painful reminder that pipeline and gas delivery errors continue to occur with lethal consequences. In these particular cases an oxygen flow meter was altered by the removal of an index pin, allowing it to be connected to a wall source of nitrous oxide. These events took place in a cardiac catheterization suite, reminding us that pipeline and gas delivery errors can occur outside of the operating room, perhaps more easily than within the operating room, since oxygen analyzers are frequently not part of the monitoring modality. Both the New York Times and Anesthesia Malpractice Prevention have highlighted these events. Clearly the hazards of modifying gas delivery connections and altering indexed safety systems must be widely publicized, not just to anesthesiologists. Hospital administrators, medical gas contractors, and physicians and nurses involved in conscious sedation suites and the delivery of supplemental oxygen must be educated as to the risks and lethal consequences of tampering with medical gas connections.

ASPF Newsletter, Volume 17, No. 1 • Spring 2002 https://www.apsf.org/article/gas-delivery-mistakes-continue-to-kill/

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Documented Med Gas Mistakes

On Dec. 7, 2000, a nursing home in Bell- brook, OH, reported two patient deaths and eight patients injured following a mix-up in their oxygen supply system. The nursing home had supposedly received a shipment of four cryogenic vessels, two containing medical-grade oxygen. Included in the delivery, however, was a cryogenic vessel of industrial-grade nitrogen. The nursing home was running low on oxygen and sent a maintenance employee to connect a new oxygen vessel to the oxygen supply system. The employee selected the nitrogen vessel and discovered, correctly, that he was unable to connect the vessel to the oxygen system — as a safeguard, the connectors for oxygen vessels are specially fitted so they are compatible only with oxygen delivery systems. Trying to be helpful, the employee removed a fitting from an empty oxygen vessel and installed it on the nitrogen vessel.

The employee then connected the deadly product to the oxygen system. Several days later, two of the injured patients died from exposure to industrial nitrogen, bringing the death total from this one incident to four.

Relias Media https://www.reliasmedia.com/articles/71409-fda-warns-of-risks-from-medical-gas/

7

Documented Med Gas Mistakes

In 2016, nitrous oxide was mistaken for oxygen during resuscitations, and [a] newborn died, while [another patient] was left with permanent brain damage.
There are now two court cases as a result of the incident — one against [the system tester] and another against [the] contractor, who installed the pipes.
In July 2015, [the installer and the tester] completed test forms that recorded results for oxygen, air and suction outlets in the hospital's operating theatres.
The results indicated there was "100 percent" oxygen flowing from the oxygen pipe, the NSW District Court heard.
[The] Judge today said she believed [the installer] falsified the records by completing paperwork without performing the testing.
The mix-up saw the hospital confuse nitrous oxide for oxygen.
[The tester], meanwhile, had signed off on the forms as having witnessed the testing when he had not done so, and was therefore complicit.
The combination of the falsification of the documents by [the installer] and [the tester] had the most disastrous and tragic consequences," the judge said.
The matter was complicated by the initial mislabeling of a gas pipe carrying medical nitrous oxide as containing oxygen during 1996 renovations.

https://www.abc.net.au/news/2020-04-30/boc-limited-not-responsible-for-sydney-hospital-gas-mix-up/12202292/

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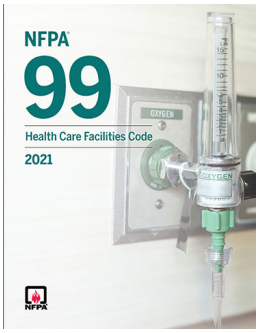
Medical Gas Basics

NFPA 99

HEALTH CARE FACILITIES CODE

2021 EDITION



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Medical Gas Basics

3.3.3 Alarm Systems

- Area Alarm System
- Local Alarm System
- Master Alarm System

Images courtesy of powerexinc.com

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Medical Gas Basics

3.3.19 Bulk Systems

- per NFPA 55
- consist of-
  - Main supply, reserve supply, vaporizers, relief valves, regulators, shutoff valves, alarm switches, etc

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Medical Gas Basics

3.3.21 Central Supply Systems-

- Vacuum pump systems
- Medical Air Compressor systems
- Manifolds

Images courtesy of powerexinc.com

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Medical Gas Basics

3.3.49 EOSC

Mounted on exterior of building

Used to connect temporary supply

Images courtesy of powerexinc.com

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Medical Gas Basics

3.3.104 Manufactured Assemblies

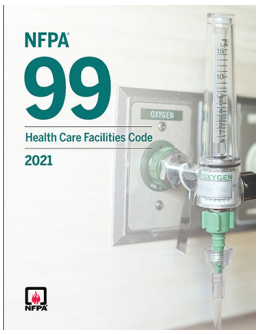
14

Medical Gas Basics

3.3.108 Medical Gas

MEDICAL GASES

Patient	Support
Oxygen	Nitrogen
Medical Air	Instrument Air
Nitrous Oxide	
Carbon Dioxide	
Helium	



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Medical Gas Basics

3.3.130 Oxygen

Gaseous Oxygen

Liquid Oxygen

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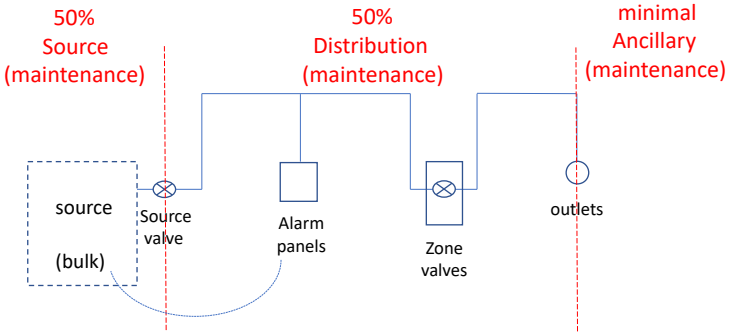
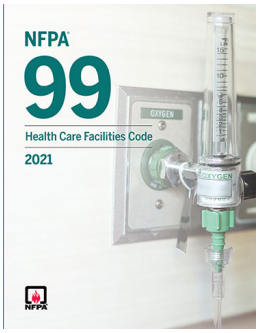
Medical Gas Basics

3.3.145 Piped Distribution System





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Medical Gas Basics

4.1 Risk Categories

Category 1

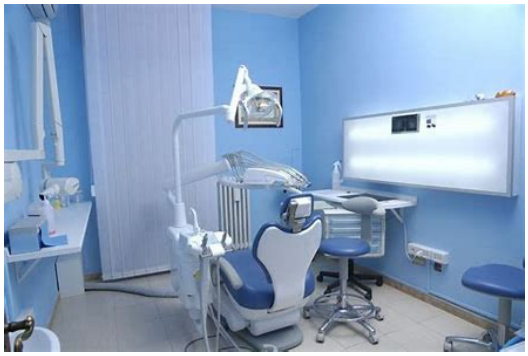
- Risk of major injury or death

Category 2

- Risk of minor injury

Category 3

- Risk of discomfort only



Higher category systems allowed to feed lower category areas

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Medical Gas Basics

Chapter 5- Gas and Vacuum Systems

5.1 Category 1 Piped Gas and Vacuum Systems

- Required when serving Cat 1 areas

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Medical Gas Basics

Central Supply System Locations

5.1.3.3.2 Design and construction

- Access
- Secured
- Enclosure materials (outdoors)
- No prolonged contact w/soil (outdoors)
- Non combustible room materials (indoors)
- 1 hour fire rating (indoors)

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Medical Gas Basics

5.1.3.5.2 Permitted Locations for Medical Gases

Medical Gases may only be used-

(1) Direct patient respiration

(5) Calibration of medical devices

(6) Simulation centers

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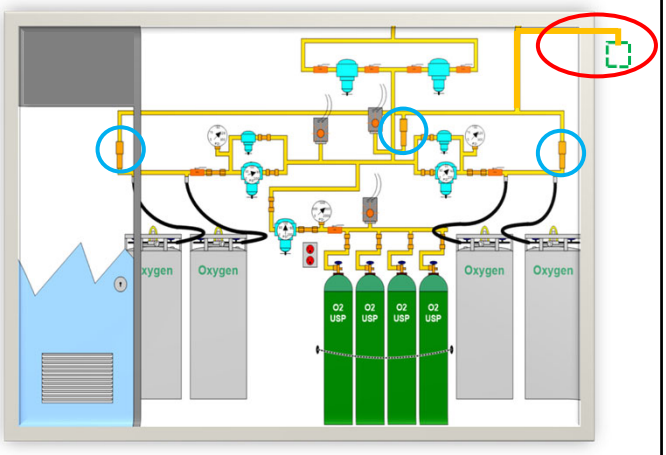
Medical Gas Basics

5.1.3.5.6.1 Relief Valves

(4) Must be vented outside

(8) Turned down / screened



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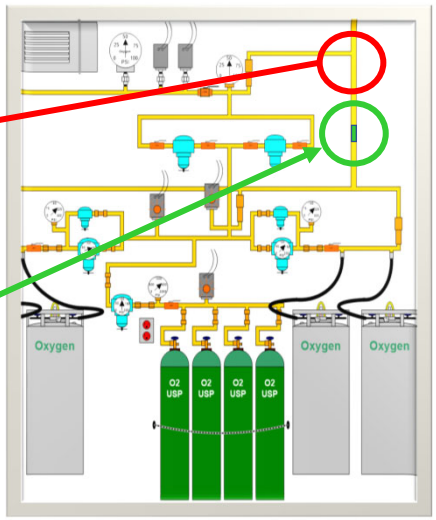
Medical Gas Basics

5.1.3.5.6.3 Vent piping materials

- Same as med gas piping (copper)

5.1.3.5.6.5 Vent pipe labeling

O2 relief vent line



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Medical Gas Basics

5.1.3.5.8.1 Local signals

- Required at manifolds and bulk sources
- (Visual indication only- lights, gauges, etc)
- Indicating condition of equipment

Images courtesy of powerexinc.com

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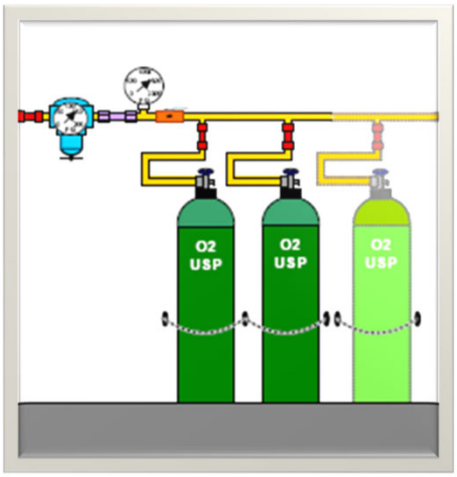
Medical Gas Basics

5.1.3.5.9 Header requirements

Enough connections for 1 full day supply



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Medical Gas Basics

5.1.3.5.10.5 Basic High Pressure Manifold Operation

- Two headers
- Only feeds from one header at a time
- Switches to standby header when header in use empties
- Sounds alarm at Master Alarm panels- “Changeover”

Images courtesy of powerexinc.com

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Medical Gas Basics

5.1.3.5.10.5 Basic Liquid Manifold Operation

- Three headers
- Only feeds from one header at a time
- Switches to standby header when header in use empties
- Sounds alarm at Master Alarm panels- “Changeover”
- Switches to Reserve header when primary/secondary headers empty
- Sounds alarm at Master Alarm panels- “Reserve in Use”

Images courtesy of powerexinc.com

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Medical Gas Basics

5.1.3.5.13 **E**mergency **O**2 **S**upply **C**onnection

- Required for underground O2 main line from Bulks
- When no other reserve is inside building
- In case main line is severed

Images courtesy of powerexinc.com

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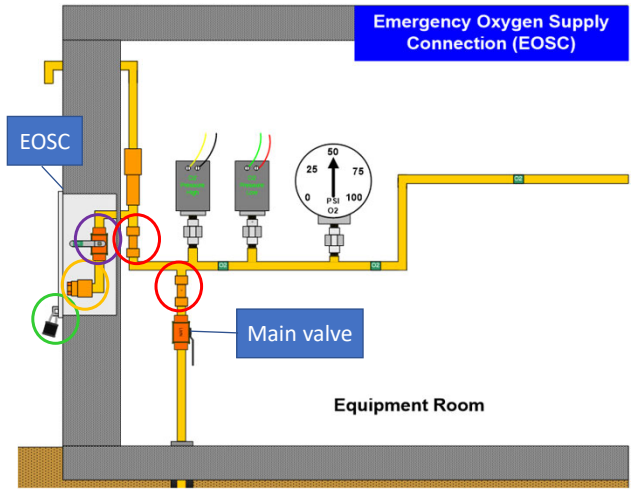
Medical Gas Basics

EOSC Consists of-

- Physical protection
- Inlet connection
- Shutoff valve
- Check valves



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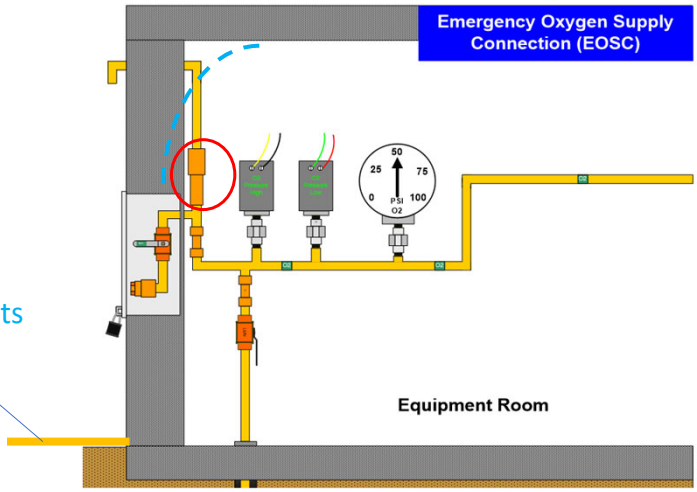
Medical Gas Basics

Relief valve

Clearance

Alarm connection points



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Medical Gas Basics

5.1.3.5.14 IBERs

Not a bulk substitute

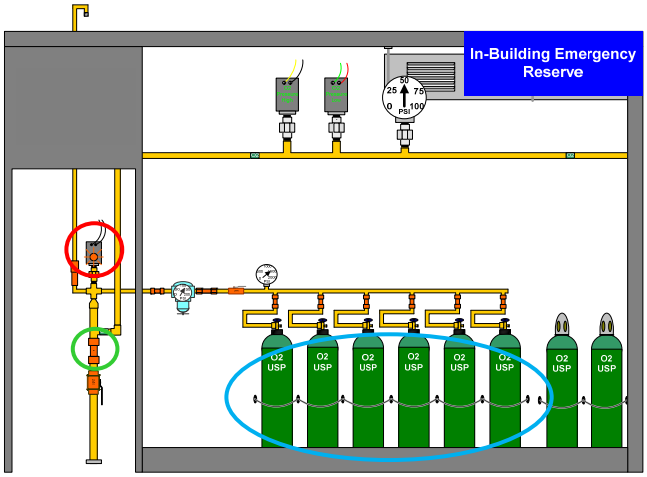
Can be substitute for EOSC

Consist of-

Enough cylinders for full day

Check valve

Signal/alarm



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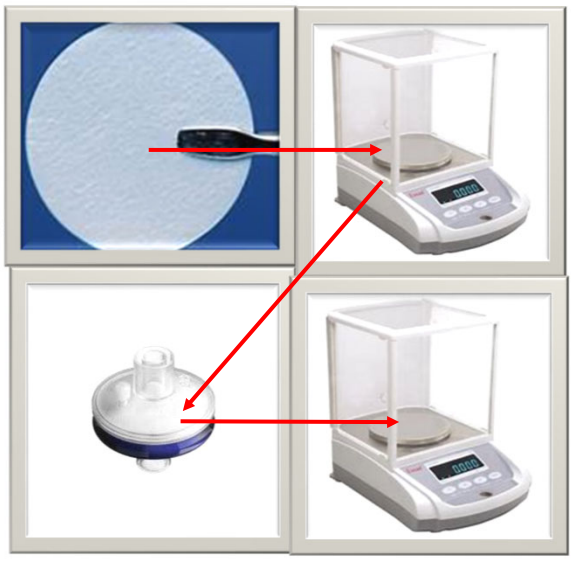
Medical Gas Basics

5.1.3.6 Category 1 Medical Air

- Typically Supplied from cylinders, or air compressors
- USP grade (Pharmacy, Prescription, Medical)
- No Liquid hydrocarbons (oil)
- Minimal Gaseous hydrocarbons (chemical fumes)
- Minimal Particulates

(equal to or less than 1 milligram per cubic meter)



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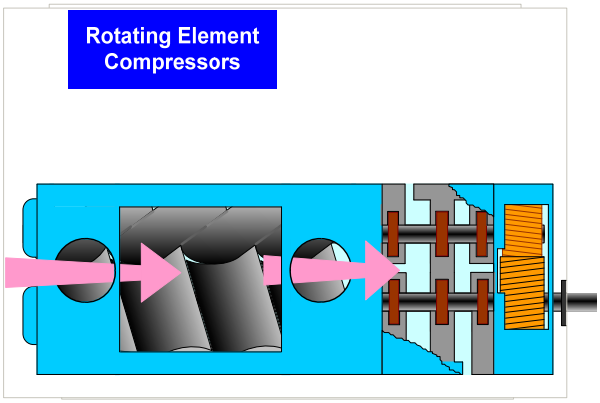
Medical Gas Basics

5.1.3.6.3 Medical Air Compressor Sources

- Must have Air Drying Eqpt

5.1.3.6.3.4 Compressor Types allowed

- Non lubricated
- Lubricated reciprocating
- Rotating element
  - Scroll, blowers, etc



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Medical Gas Basics

5.1.3.6.3.7 Dryers

Required to keep medical air dewpoint* at or below 32 degrees F

* Dewpoint is the temperature at which moisture in the air turns to water droplets

34

Medical Gas Basics

5.1.3.6.3.8 Filters

- Must be 98% efficient at 1 micron
- Must have visual indicator of filter element status

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Medical Gas Basics

5.1.3.6.3.9 Piping arrangement and Redundancies

- Category 1 - at least two compressors (one is backup)
- Piped to allow removal of individual components (compressors, dryers, filters, etc) removed for service yet keep system up and running

Images courtesy of powerexinc.com

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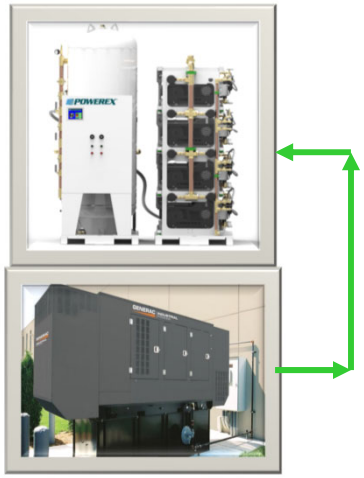
Medical Gas Basics

5.1.3.6.3.10 Electrical Power and Control

Compressor systems must be connected to Emergency power.



Images courtesy of powerexinc.com

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Medical Gas Basics

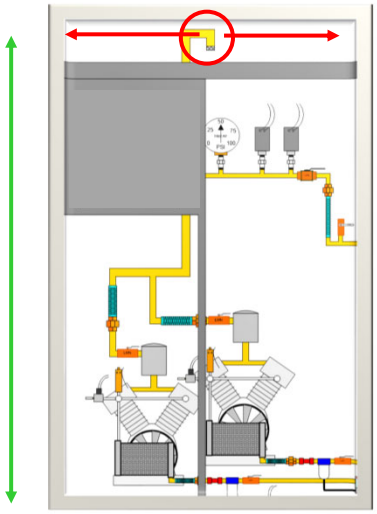
5.1.3.6.3.11 Compressor Intake

(A) Clean location

(B) 25’ from contaminants

(C) 20’ above ground

(D) 10’ from building openings



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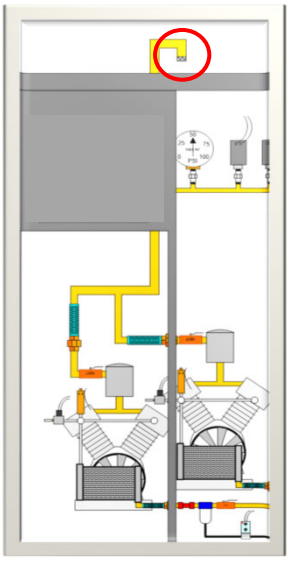
Medical Gas Basics

5.1.3.6.3.11 Compressor Intake

Must be turned down and screened



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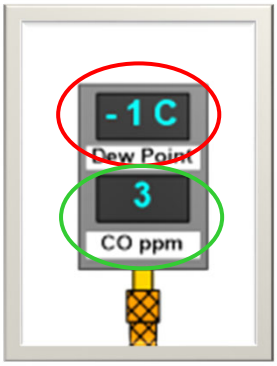
NFPA 99 Healthcare Facilities Code
2021 Edition • Medical Gas Systems

5.1.3.6.3.13 Medical Air Quality Monitoring

Dewpoint must alarm at 35 degrees F

Carbon Monoxide must alarm at 10 ppm



40

Medical Gas Basics

5.1.3.7 Medical-Surgical Vacuum

Category 1 system must consist of at least two pumps (one is backup)

Must be piped to allow removal of one pump for service, yet keep system up and running

Images courtesy of powerexinc.com

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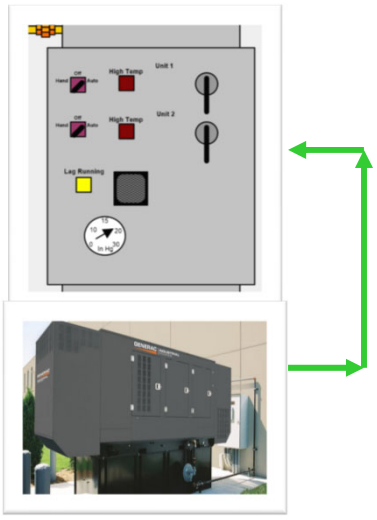
Medical Gas Basics

5.1.3.7.6 Electrical Power and Control

System must be connected to emergency power



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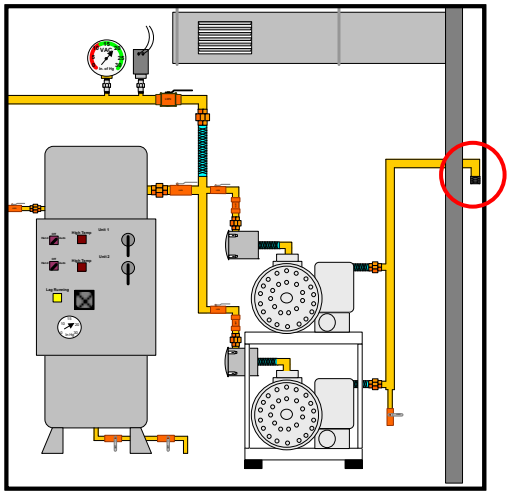
Medical Gas Basics

5.1.3.7.7 Vacuum Exhaust

Must be located-

- outdoors
- non-hazardous location
- 25’ from doors/openings



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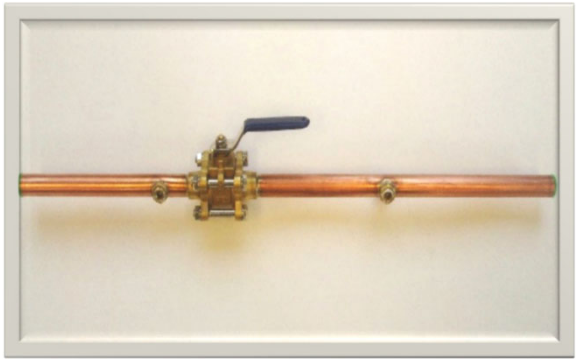
Medical Gas Basics

5.1.4 Valves

Installed in the Distribution system for-

- maintenance
- repair
- future expansion
- testing
- emergencies



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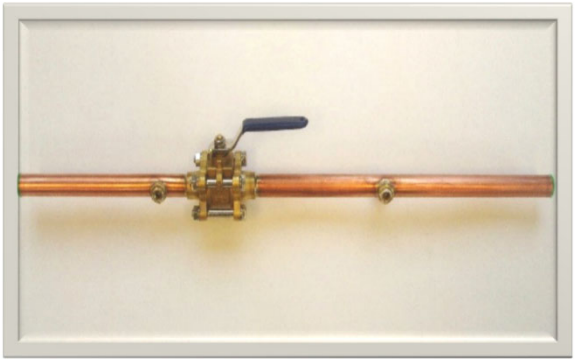
Medical Gas Basics

5.1.4 Valves

- Most valves must be properly secured (locked, in locked area, above ceiling, etc)
  - Except for Zone Valves
- Must be properly labeled



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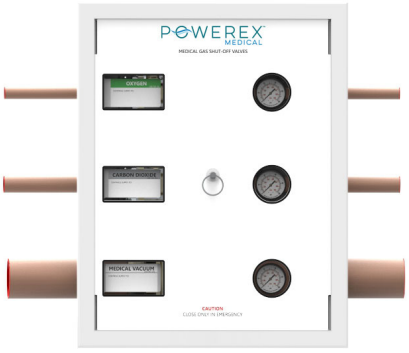
Medical Gas Basics

5.1.4.1.4 Accessibility

Zone valve boxes must be visible and accessible at all times.



Images courtesy of powerexinc.com

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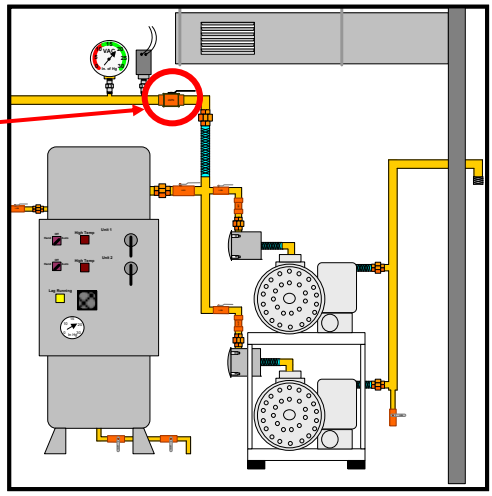
Medical Gas Basics

5.1.4.2 Source valve

- Required for every source system
- Separates source from distribution system



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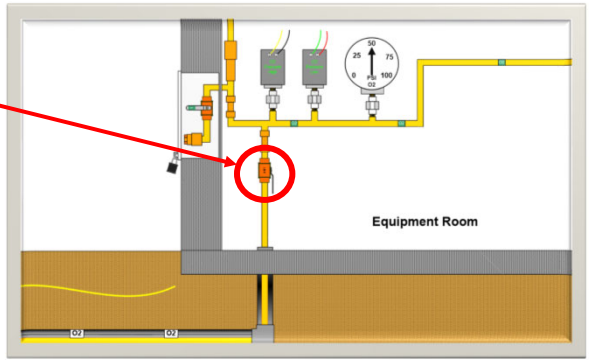
Medical Gas Basics

5.1.4.3 Main Line valve

- Required when source valve is outside building
- Installed on main line, immediately inside building



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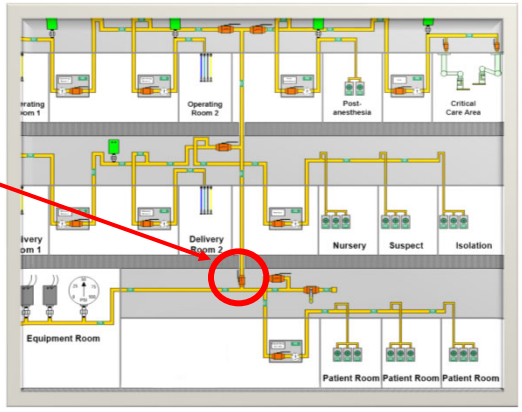
Medical Gas Basics

5.1.4.4 Riser valve

Required at base of each riser



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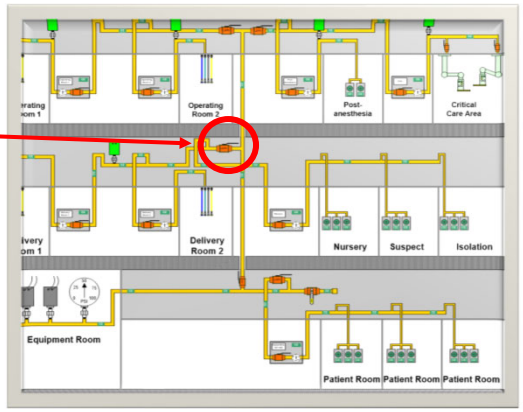
Medical Gas Basics

5.1.4.5 Service valve

Required at each branch



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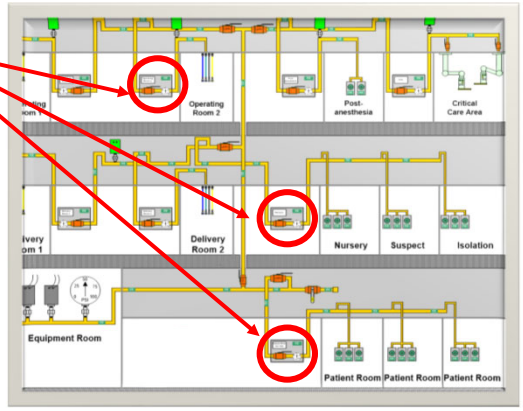
Medical Gas Basics

5.1.4.6 Zone valves

Divide entire distribution system into zones

Dedicated ZVB required outside each Category 1 and Anesthetizing location

Pressure/vacuum indicators required at each zone valve



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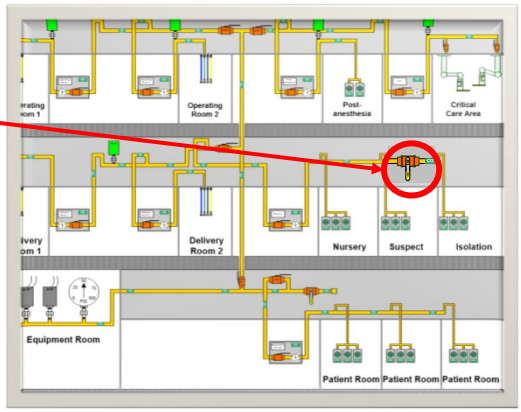
Medical Gas Basics

5.1.4.7 Inline shutoff valves

Optional

To isolate rooms/areas



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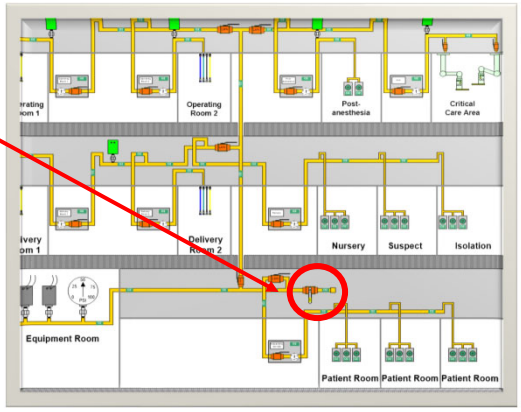
Medical Gas Basics

5.1.4.8 Future connection valve

Optional

Makes expansion easier



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Medical Gas Basics

5.1.5 Station Outlets/Inlets

Must be “gas specific”-

to ensure proper gas is dispensed,

and proper devices can be attached

Images courtesy of powerexinc.com

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Medical Gas Basics

5.1.5.5 Outlet/inlet labeling

Proper labeling (including color coding) is required

Images courtesy of powerexinc.com

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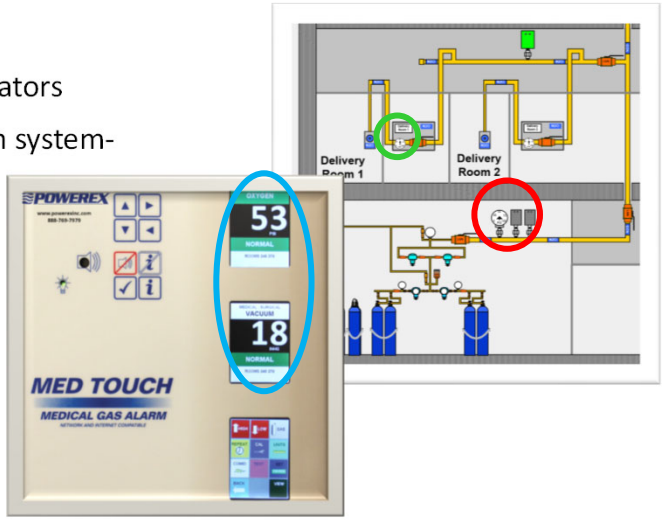
Medical Gas Basics

5.1.8 Pressure and Vacuum Indicators

Locations required in distribution system-

- Adjacent to MAP switches
- at AAP's
- at Zone valves



Images courtesy of powerexinc.com

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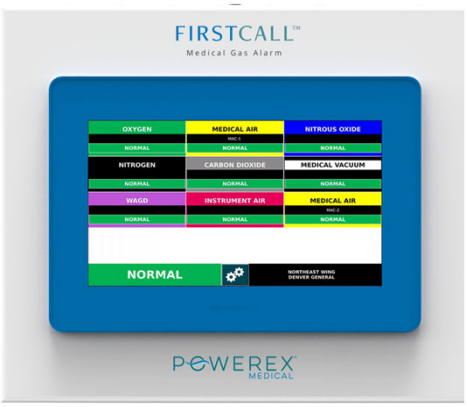
Medical Gas Basics

5.1.9 Category 1 Warning Systems

5.1.9.2 Master Alarms

- Two required for Category 1
- Monitors all source eqpt, and main line med gas/vacuum pressures



Images courtesy of powerexinc.com

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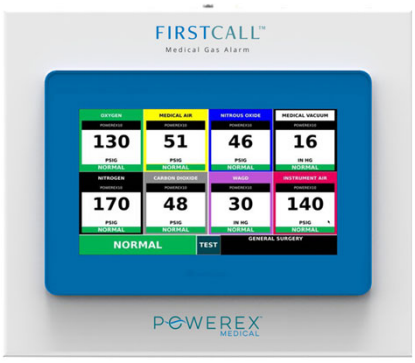
Medical Gas Basics

5.1.9.4 Area Alarms

Required in Category 1 areas and Anesthetizing locations

Monitor pressure in specific area



Images courtesy of powerexinc.com

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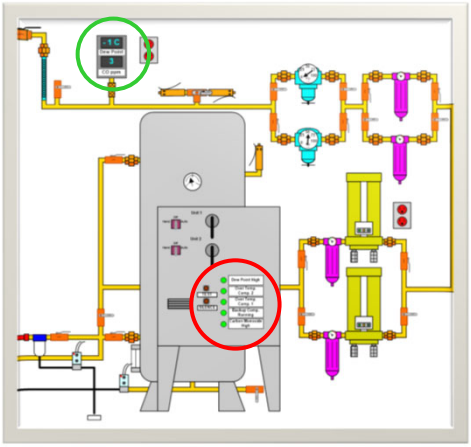
Medical Gas Basics

5.1.9.5 Local Alarms

Monitor pumps, compressors, dewpoint, Carbon Monoxide, etc



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Medical Gas Basics

5.1.10 Category 1 Distribution

Positive pressure piping materials must be

- precleaned
- sealed
- kept sealed until ready to install

60

Medical Gas Basics

5.1.10 Category 1 Distribution

Piping must be-

- ASTM B819 Medical Gas Tube
- CMT (Corrugated Medical Tubing)

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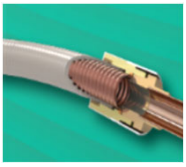
Medical Gas Basics

5.1.10.2 Vacuum/WAGD piping materials

Piping must be-

- Rigid copper
- Stainless steel
- CMT



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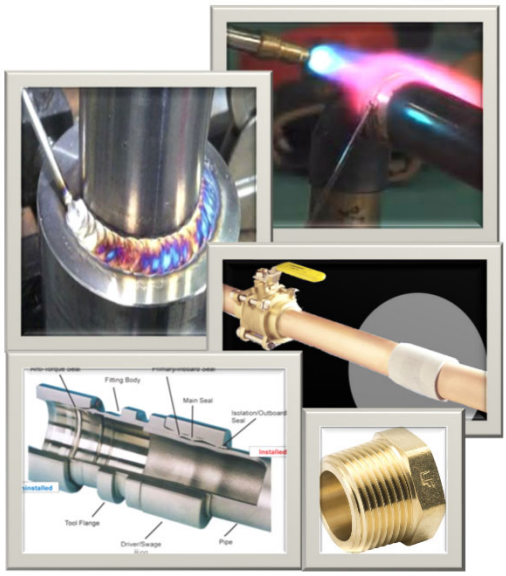
Medical Gas Basics

5.1.10.3.1 Joints for rigid tubing

- Brazing
- Welding
- Memory metal fittings
- Axially swaged fittings
- Threaded



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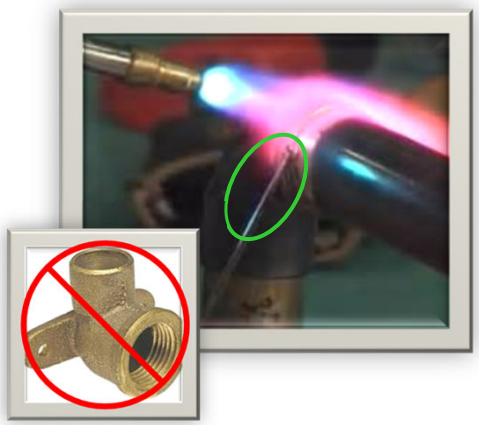
Medical Gas Basics

5.1.10.4 Brazed joints

- Wrought copper fittings
- No cast copper alloy
- Alloy melting temp



64

Medical Gas Basics

5.1.10.4.2 Cutting tube ends

Using tubing cutters only, oil free

Tube end must be deburred

65

Medical Gas Basics

5.1.10.4.3 Cleaning Joints for Brazing

- Clean outside of tube ends
- Using non shedding abrasive pad
- Piping must be brazed within 8 hrs of cleaning

66

Medical Gas Basics

5.1.10.4.5 N2 purge-

Required wile brazing

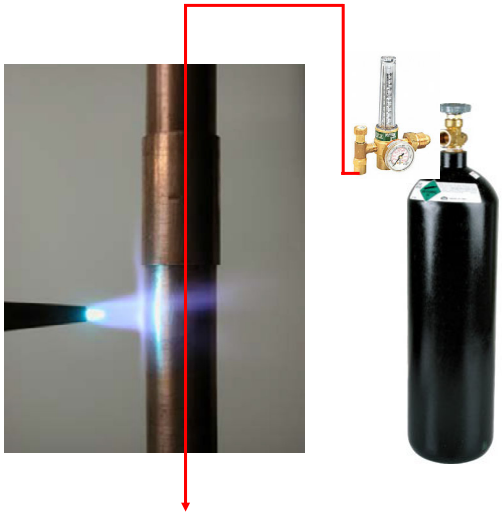
Prevents oxidation inside pipe

67

Medical Gas Basics

While brazing-

- Purge discharge opening while brazing
- Maintain flow
- Reseal after brazing



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Medical Gas Basics

5.1.10.4.7 Inspection of Brazed Joints

- Clean each joint
- Inspect each joint

69

Medical Gas Basics

5.1.10.4.7.4 Not permitted-

- Base metal melted
- Unmelted filler metal
- Exterior gaps in filler metal
- Cracks in tube or component
- Cracks in filler metal
- Leaks

70

Medical Gas Basics

5.1.10.8 Threaded Fittings

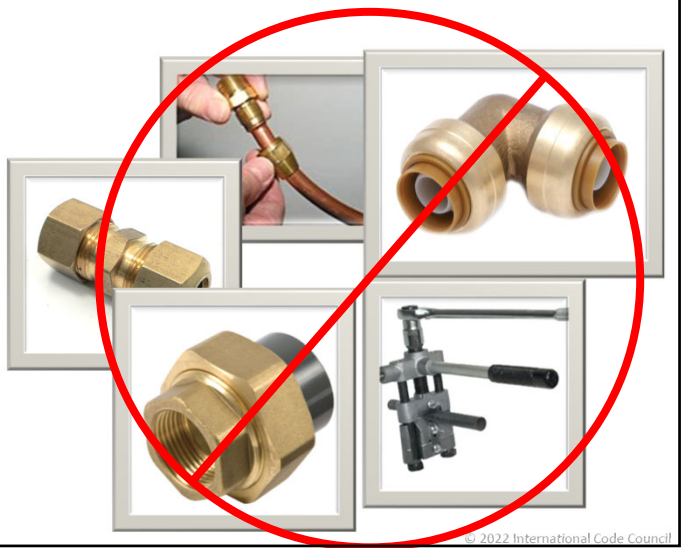
- Limited locations
- Tapered pipe threads
- Teflon tape or equal

71

Medical Gas Basics

5.1.10.10 Prohibited Joints

- Flared / compression
- Straight threads
- Pipe crimping
- Push-fit fittings



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Medical Gas Basics

5.1.10.11.3 Location of Piping

Piping not allowed in-

- kitchens
- stairwells
- elevator shafts
- elevator machine rooms
- areas with open flames
- high voltage areas
  - (with some exceptions)

73

Medical Gas Basics

5.1.10.11.10 Qualification of Installers

Must be ASSE 6010 (minimum)

AHJ (Authority Having Jurisdiction) may have additional requirements

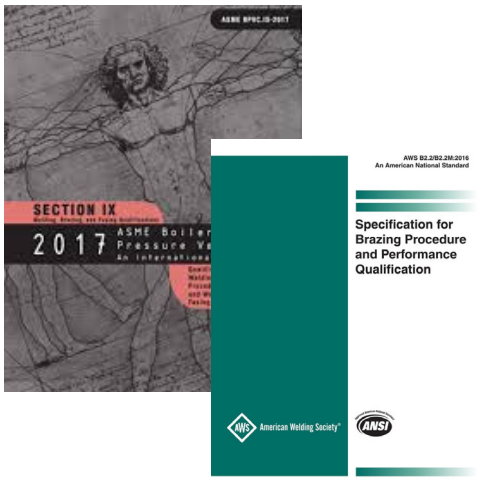
74

Medical Gas Basics

5.1.10.11.11 Qualification of Brazing

Brazing procedure are specified by-

- American Society of Mechanical Engineers
- American Welding Society



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Proper brazing procedures

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Medical Gas Basics

5.1.10.11.12 Breaching/Penetrating Piping

No breaching allowed that creates residual particles

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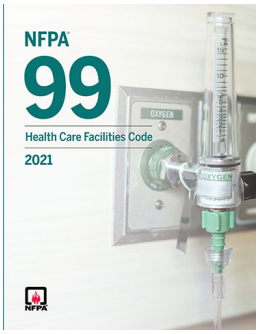
Medical Gas Basics

5.1.11 Labeling, Identification, Operating Pressure

Color and pressure requirements



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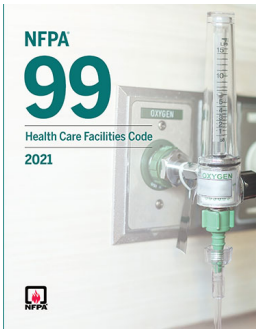
Medical Gas Basics

Table 5.1.11	(standard pressure)
Medical Air	50-55 psig
Carbon Dioxide	50-55 psig
Helium	50-55 psig
Nitrogen	55-185 psig
Nitrous Oxide	50-55 psig
Oxygen	50-55 psig
Medical-Surgical Vacuum	15-30” HgV
WAGD	none
Instrument Air	50-185 psig



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Medical Gas Basics

5.1.11.1 Pipe Labeling

- Piping must be labeling with stenciling or adhesive markers
- Labeling must have correct name or chemical symbol, and color coding (per Table 5.1.11)

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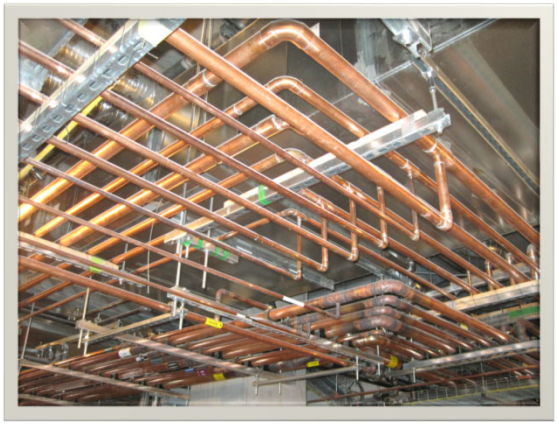
Medical Gas Basics

5.1.11.1.2 Pipe label locations-

- Every 20’
- In/above every room
- Walls penetrated
- Risers



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Medical Gas Basics

5.1.11.2 Shutoff Valve labeling

Valve labels must have-

- Name/chemical symbol
- Rooms/areas served
- Caution for opening/closing

82

Medical Gas Basics

5.1.11.3 Station outlet and inlet labeling

Outlets and inlets must also be labeled with proper gas/vacuum name or chemical symbol

Images courtesy of powerexinc.com

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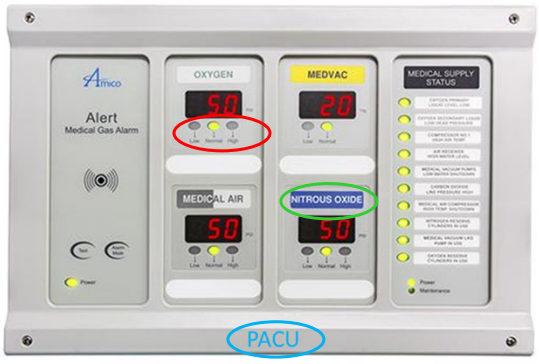
Medical Gas Basics

5.1.11.4 Alarm Panel labeling

Alarm panels must be labeled with

- Conditions monitored
- Gas/vacuum name/chemical symbol
- Area(s) monitored



Images courtesy of powerexinc.com

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Medical Gas Basics

5.1.11.5 Source Equipment labeling

Must include-

- Gas/vacuum name/chemical symbol
- Color code
- Rooms/areas/buildings served
- Emergency contact info

-MEDICAL VACUUM SOURCE-
SERVES ENTIRE FACILITY
IN EMERGENCY CONTACT
ENGINEERING DEPT, ext 100

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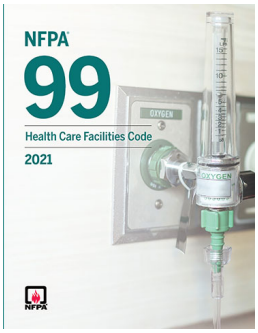
Medical Gas Basics

5.1.12.2 Installer-Performed Tests

Tests to be performed prior to Verifier testing include-

- Initial Piping Blowdown
- Initial Cross-Connection Test
- Initial Piping Purge Test
- Standing Pressure Test- gases
- Standing Vacuum Test- vacuum



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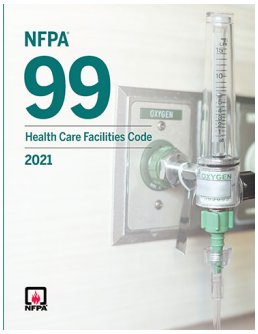
Medical Gas Basics

5.1.12.3 System Inspection

Must be performed prior to concealing piping.

Witnessing Installer Initial Pressure Testing

Check for proper labeling



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Medical Gas Basics

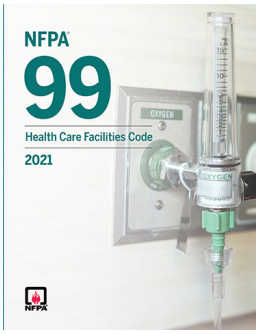
5.1.12.4 System Verification

Must be performed-

After Installer testing

After Inspection

Prior to putting system into service



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Medical Gas Basics

Verification includes-

Standing Pressure Test

Cross-Connection Test

Valve Test

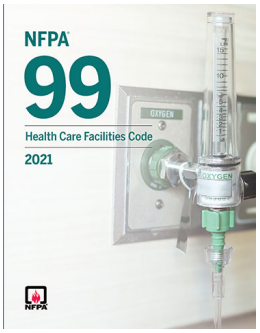
Alarm Test

Piping Purge Test

Piping Particulate Test

Piping Purity Test

Final Tie-In Test



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Medical Gas Basics

Verification includes- (cont'd)

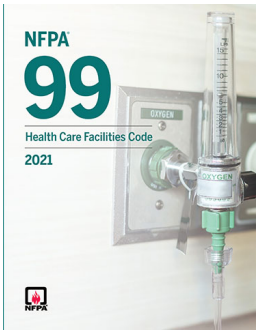
Operational Flow Pressure Drop Test

Medical Gas Concentration Test

Medical Air Purity Test- compressors

Labeling

Source Equipment Verification



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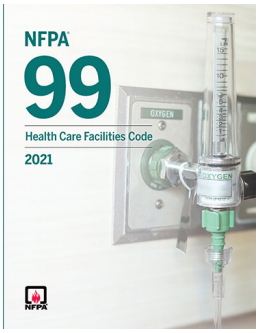
Medical Gas Basics

5.1.14.4 Maintenance of Systems

Maintenance to consist of-

- Inventories of system components
  - Sources, valves, alarms, etc
- Inspection Schedules
- Inspection Procedures
- Maintenance Schedules



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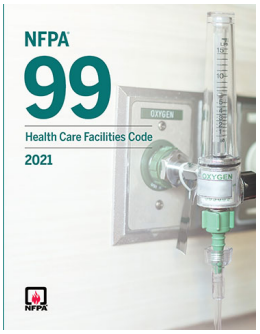
Medical Gas Basics

5.1.14.4.2.5 Qualifications

Maintenance personnel must be properly trained



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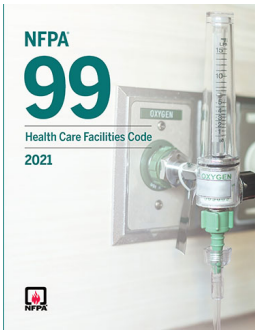
Medical Gas Basics

5.1.14.4.3 Inspection and Testing Operations

All components of system must be inspected, tested, and maintained periodically, including (but not limited to)-

- Source equipment
- Valves
- Alarms
- Hoses
- Labeling
- Outlets/Inlets
- Pressure/vacuum indicators



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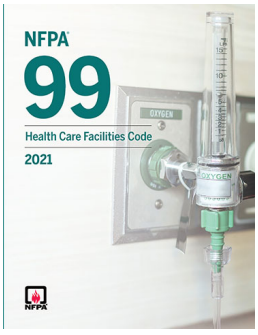
Medical Gas Basics

Chapter 15- Dental Gas and Vacuum Systems

Chapter 15 is now dedicated to Dental Facilities

Setting parameters such as-

- Categories of Dental Facilities
  - 1, 2, 3
- Medical gas and vacuum systems in Dental Facilities
- Dental gas and vacuum systems in Dental Facilities



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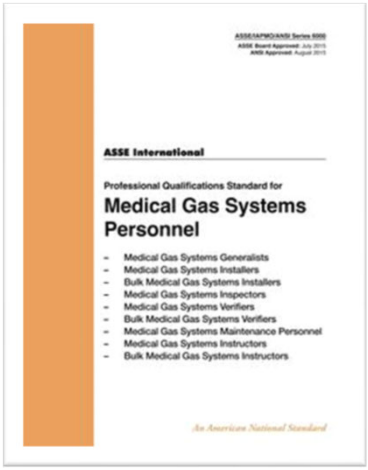
Medical Gas Basics

ASSE Series 6000



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Medical Gas Basics

ASSE Standard 6005- Med Gas Generalist

ASSE Standard 6010- Med Gas Systems Installer

ASSE Standard 6015- Med Gas Bulk Installer

ASSE Standard 6020- Med Gas Systems Inspector

ASSE Standard 6030- Med Gas Systems Verifier

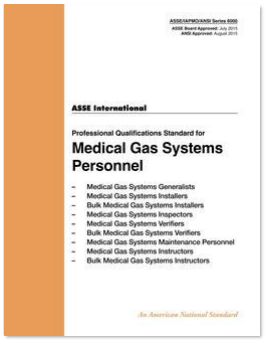
ASSE Standard 6035- Med Gas Bulk Verifier

ASSE Standard 6040- Med Gas Systems Maintenance

ASSE Standard 6050- Med Gas Systems Instructor

ASSE Standard 6055- Med Gas Bulk Instructor

ASSE Standard 6060- (New) Med Gas Systems Designer



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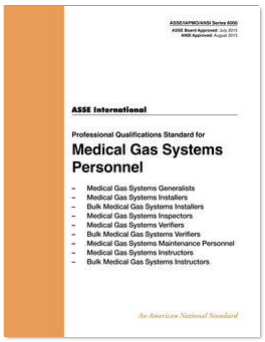
Medical Gas Basics

6005 Medical Gas Systems Generalist

Basic Med Gas certification

Good for-

- New employees
- Supervisors/Superintendents
- Estimators, etc



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Medical Gas Basics

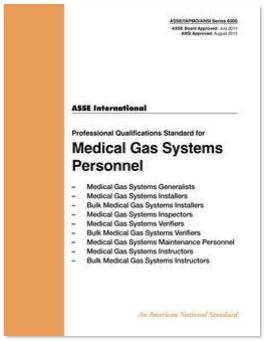
6005 Medical Gas Systems Generalist

Certification requires-

- 24 hr minimum course
- Exam by 3rd party certification agency

Recertification (every 3 years) requires-

- 4 hr minimum course
- Exam by 3rd party certification agency



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Medical Gas Basics

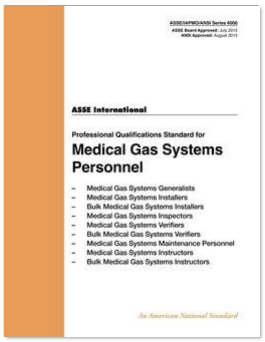
6010 Medical Gas Systems Installer

Med Gas Installer certification*

Good for-

- Installing Med Gas Distribution Systems
  - Valves, piping, outlets, alarms, alarm wiring, etc
- Not for installing Bulk systems

* AHJ may have different/additional requirements



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Medical Gas Basics

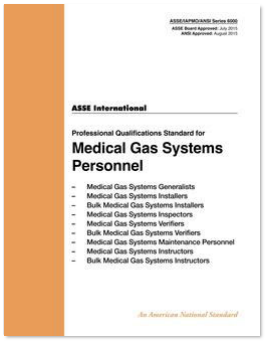
6010 Medical Gas Systems Installer

Certification requires-

- Adequate previous experience
- 32 hr minimum course
- Exam by 3rd party certification agency

Recertification (every 3 years) requires-

- 4 hr minimum course
- Exam by 3rd party certification agency
- Must braze at least once every 6 months



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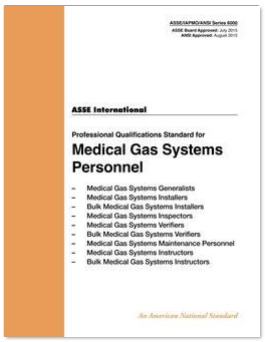
Medical Gas Basics

6020 Medical Gas Inspector

Good for-

- Inspecting Med Gas Distribution Systems*
  - Before systems are concealed
- Monitoring Med Gas construction
- Not for Verifying systems

* AHJ may have different/additional requirements



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Medical Gas Basics

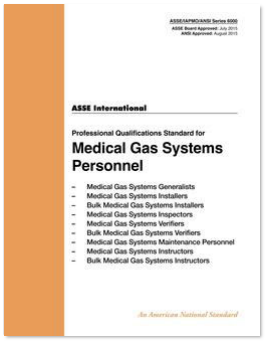
6020 Medical Gas Inspector

Certification requires-

- Adequate previous experience
- 24 hr minimum course
- Exam by 3rd party certification agency

Recertification (every 3 years) requires-

- 4 hr minimum course
- Exam by 3rd party certification agency



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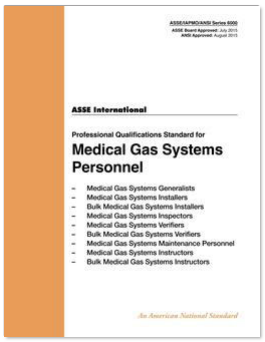
Medical Gas Basics

6030 Medical Gas Systems Verifier

Good for-

- Verifying Med Gas Distribution Systems
  - After everything is installed
  - Prior to use
- Not for Verifying Bulk systems



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Medical Gas Basics

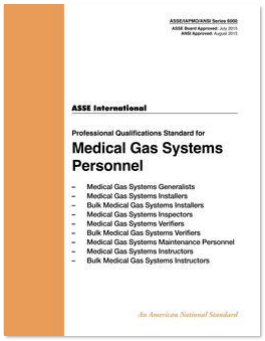
6030 Medical Gas Systems Verifier

Certification requires-

- Adequate previous experience
- 32 hr minimum course
- Exam by 3rd party certification agency

Recertification (every 3 years) requires-

- 4 hr minimum course
- Exam by 3rd party certification agency



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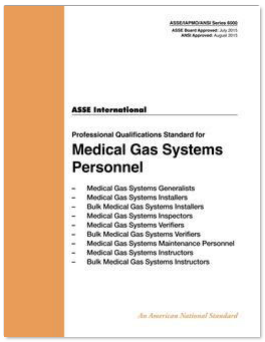
Medical Gas Basics

6035 Medical Gas Bulk Verifier

Good for-

- Verifying Med Gas Bulk Systems
  - After everything is installed
  - Prior to use
- Not for Verifying Distribution systems



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Medical Gas Basics

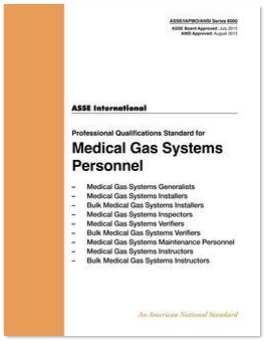
6035 Medical Gas Bulk Verifier

Certification requires-

- Adequate previous experience
- 32 hr minimum course
- Exam by 3rd party certification agency

Recertification (every 3 years) requires-

- 4 hr minimum course
- Exam by 3rd party certification agency



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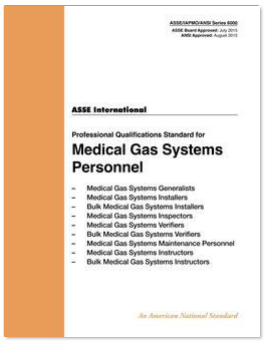
Medical Gas Basics

6040 Medical Gas Maintenance Personnel

Good for-

- Maintenance, periodic testing of systems



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Medical Gas Basics

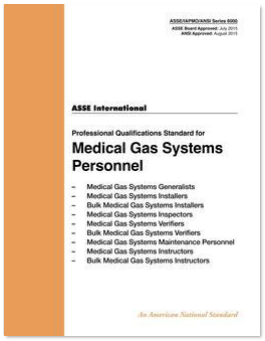
6040 Medical Gas Maintenance Personnel

Certification requires-

- Adequate previous experience
- 24 hr minimum course
- Exam by 3rd party certification agency

Recertification (every 3 years) requires-

- 4 hr minimum course
- Exam by 3rd party certification agency



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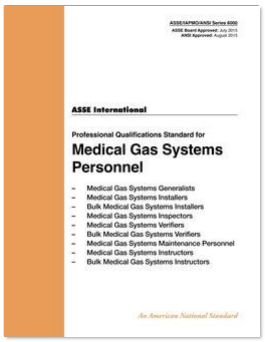
Medical Gas Basics

6050 Medical Gas Systems Instructor

Good for-

- Instructing courses required for-
  - 6005 Generalist
  - 6010 Installer
  - 6020 Inspector
  - 6030 Verifier
  - 6040 Maintenance
  - 6050 Instructor



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Medical Gas Basics

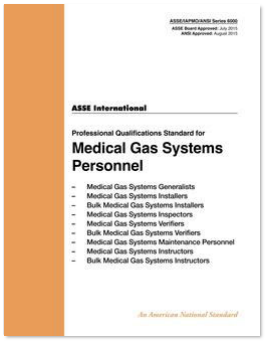
6050 Medical Gas Systems Instructor

Certification requires-

- Adequate previous experience
- 40 hr minimum course
- Exam by 3rd party certification agency

Recertification (every 3 years) requires-

- 4 hr minimum course
- Exam by 3rd party certification agency



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Crisis: Medical Gas

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Proper brazing procedures

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Thank you for attending!

If you have any interest or questions Med Gas related, email dswinn@iccsafe.org or ccwinn@iccsafe.org

For more info on all training provided by ICC, Please visit our website- Training - ICC (iccsafe.org)

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File Attachments for Item:

EC-6 Ohio Plumbing Code Clarification (Assn Plumbing & Hydronics Contractors)

All certifications (2 hours)

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Tracy Jefferies - Exec Director

Organization: APHC

Office Address: 3891 Seabell Ct Columbus OH 43230

E-mail: aphc.contractors@gmail.com Telephone: 614-315-6924

Website: aphcofcentralohio.com

Conference Sponsor (if applicable) — Conference Email: —

Check here if Course Renewal: ☐ Prior course number _____ *(i.e. BBS2018-429)*

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

New Course Information:

Course title: Plumbing Code Clarification

Course instructor: Guy Miller Jr & Darrin Dawson - Bios attached

Course description: See attached doc with description & outline

Classroom location: 653 McCorkle Blvd Suite H Westerville OH 43082

Instructional hours per session: 2 hrs Number of Sessions: TBD

Course Date(s) and Location: Pending Approval for dates

Special Content:

Code Administration: ☐
Existing Buildings: ☐
Electrical Instruction: ☐
Plumbing Instruction: ☒

Conference Course: _____
Conference Name: _____
Conference location: _____

Course to be offered online? ☐ **On Demand** ☐ **Webinar** ☐

Course Website: _____

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

_____

Course applicable for the following certifications

Residential Certifications Only: ☐ Commercial Certifications: ☐
Administrative Course, All Certifications: ☒

Application materials included:

☒ Course Outline or Course Learning Objectives
☒ Presentation Materials/Slides (not required for roundtable courses)
☐ Assessment Materials (for online courses)
☒ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

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OBJECTIVE: A comprehensive review of sections of the state plumbing code, emphasizing code revisions and code clarification.

MATERIALS/BOOKS: State of Ohio plumbing code book, PowerPoint presentation for illustrations.

LENGTH OF COURSE: 2 hours

COURSE TITLE: Plumbing Code Clarification

COURSE OUTLINE:

Part I — Chapters 1-6, 8, 10, 11 - ½ hr.
General review of these chapters highlighting changes from the 2011 code to the 2017 plumbing code

Part II — Chapter 7 & 9 - 1 ½ hrs.
Review of building drain and stack sizing section 710
Explanation of the venting methods explaining sections 903, 906, 907-913, 916

PHYSICAL FACILITIES DESCRIPTION

Classroom at 653 McCorkle Blvd. Suite H in Westerville:

The room is set up in a classroom style with seating for up to 24 individuals at conference tables. The room is well lit using overhead fluorescent lighting. The room is also provided with audio/visual equipment; overhead projector, screen and eraser board for illustrations as needed for presentation purposes. The room is equipped with its own controls to control heating and cooling for comfort. Of course, restroom facilities are available.

This site is also equipped with a lab area consisting of workstations for the backflow prevention certification and recertification classes held. These stations (8) are equipped with different manufacturers' devices to test and repair. All tools and equipment needed for the lab portion of the class are provided as part of the course.

QUALIFICATIONS:

Darrin Dawson has worked 39 years in the plumbing industry. In May of 1990, he received his Master Plumbing Certification.

He has been a State of Ohio Certified Plumbing Inspector since June of 2003. He became a National Certified Medical Gas Inspector in June of 2007.

In April of 2022 he received a State of Ohio Backflow Certification.

Mr. Dawson has been an instructor for The Association of Plumbers and Hydronics Contractors (APHC) apprenticeship program for 16 years.

He is currently employed at The Delaware Public Health District as a Plumbing and Medical Gas inspector.

Guy Miller Jr.
629 Fenchurch Way
Gahanna, OH 43230
Ph. (614) 940-5700
guymillerjr@gmail.com

Certification: Master Plumber, State of Ohio-Id Number #24380 (exp)
Certified Backflow Preventer - Certificate #1300 (State of Ohio – exp)
Certified plumbing inspector - Certificate #K02033 (State of Ohio), 5523 (BBS)
Certified plumbing plans examiner- Certificate #K02033 (State of Ohio), 5523 (BBS)

Teacher: APHC Apprenticeship Program, Fourth Year Instructor
8/08-present

APHC Association - Continuing Education Classes
2021- Present

Work Experience:

1/85 – 1/95 Guy Miller Plumbing

1/95-8/03 Eric Guy Plumbing

8/03 – 2/10 Foreman: Crawford Mechanical Services

2/10-04/17 Foreman/Project Manager: Gutridge Plumbing

4/17-current Plumbing Field Supervisor-City of Columbus

Course applicable for the following certifications

This section represents a major change from previous BBS course approval forms.

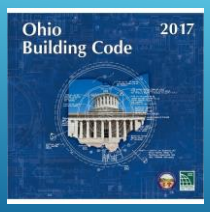
1. If the course is only for residential certifications, check 'Residential Certifications Only'. The course, if approved, will be approved for all residential certifications.
2. If the course is appropriate for any commercial certifications, check Commercial Certifications. The course, if approved, will be approved for all commercial certification **AND** all residential certifications.
3. If the course is intended to meet required instruction in Code Administration (Chapter 1) or Existing Buildings (commercial or residential) check 'Administrative Course, All Certifications'.

Application Materials Included

This is a checklist for the course submitter's use, to be sure all materials necessary for review are included with the application. All materials should be submitted in .pdf format, along with the application, via email to Michael.Lane@com.ohio.gov or BBS@com.ohio.gov

Ohio Code General Requirements

or stuff you should know (The condensed version)



APHC

1

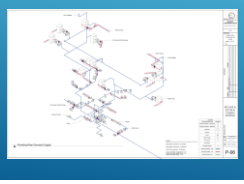
Ohio Plumbing Code online version

https://codes.ohio.gov/ohio-administrative-code/4101:3

2

106.1.1 Information on construction documents.

Construction documents shall be dimensioned and drawn upon suitable material. Electronic media documents are permitted to be submitted when approved by the building official. Construction documents shall be coordinated and of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code. Construction documents, adequate for the scope of the project, shall include information necessary to determine compliance with the building, mechanical, plumbing, fire, electrical, energy, and fuel gas codes



3

107.7 Approved construction document sets.

One set of approved construction documents shall be kept by the building official. The other set(s)shall be returned to the applicant, kept at the work site, along with manufacturers' installation instructions and product information, and shall be available for use by the inspector.

4

108.1 General.

After construction documents have been approved, construction or work may proceed in accordance with the approved documents. Construction or work for which an approval is required shall be subject to inspection. It shall be the duty of the owner or the owner's duly authorized representative to notify the building department when work is ready for inspection. Access to and means for inspection of such work shall be provided for any inspections that are required by this code. It shall be the duty of the owner or the owner's authorized representative to cause the work to remain accessible and exposed for inspection purposes. Such construction or work shall remain accessible and exposed for inspection purposes until the work has been inspected to verify compliance with the approved construction documents, but failure of the inspectors to inspect the work within four days, exclusive of Saturdays, Sundays, and legal holidays, after the work is ready for inspection, allows the work to proceed. Subsequent work is allowed to proceed only to the point of the next required inspection.

5

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6

AIR GAP (Drainage System). The unobstructed vertical distance through the free atmosphere between the outlet of the waste pipe and the flood level rim of the receptacle into which the waste pipe is discharging.

7

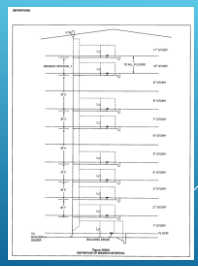
AIR GAP (Water Distribution System). The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of the receptacle.

8

BATHROOM GROUP. A group of fixtures consisting of a **water closet, lavatory, bathtub or shower, including or excluding a bidet, an emergency** floor drain or both. Such fixtures are located together on the same floor level

9

BRANCH INTERVAL. A vertical measurement of distance, 8 feet (2438 mm) or more in developed length, between the connections of horizontal branches to a drainage stack. Measurements are taken down the stack from the highest horizontal branch connection.



10

FIXTURE DRAIN. The drain from the trap of a fixture to a junction with any other drain pipe.

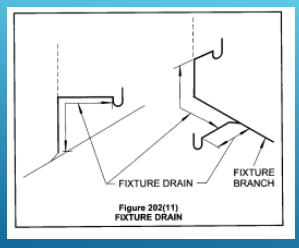


Figure 202(11)
FIXTURE DRAIN

11

FLOOD LEVEL RIM. The edge of the receptacle from which water overflows.

12

HORIZONTAL BRANCH DRAIN. A drainage branch pipe extending laterally from a soil or waste stack or building drain, with or without vertical sections or branches, that receives the discharge from two or more fixture drains or branches and conducts the discharge to the soil or waste stack or to the building drain.

13

INDIRECT WASTE PIPE. A waste pipe that does not connect directly with the drainage system, but that discharges into the drainage system through an air break or air gap into a trap, fixture, receptor or interceptor.

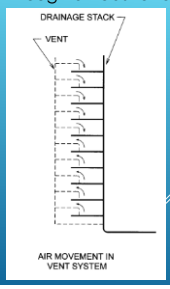
14

DRAINAGE FIXTURE UNIT

A measure of the probable discharge into the drainage system by various types of plumbing fixtures. The drainage fixture-unit value for a particular fixture depends on its volume rate of drainage discharge, on the time duration of a single drainage operation and on the average time between successive operations.

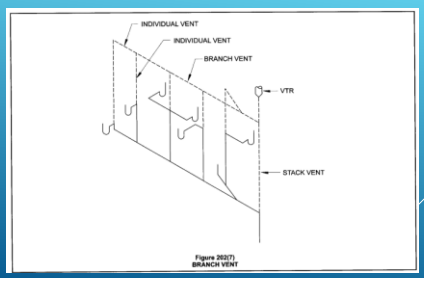
15

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



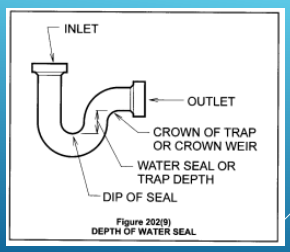
16

STACK VENT. The extension of a soil or waste stack above the highest horizontal drain connected to the stack.



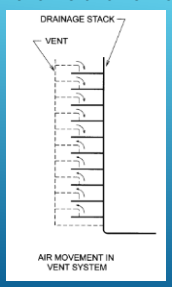
17

TRAP. A fitting or device that provides a liquid seal to prevent the emission of sewer gases without materially affecting the flow of sewage or waste water through the trap.



18

VENT STACK. A vertical vent pipe installed primarily for the purpose of providing circulation of air to and from any part of the drainage system



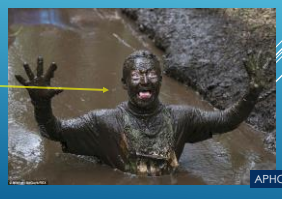
19

SECTION 306
TRENCHING, EXCAVATION AND BACKFILL
306.1 **Support of piping.** Buried piping shall be supported throughout its entire length.

20

306.2.3 **Soft load-bearing materials.** If soft materials of poor load-bearing quality are found at the bottom of the trench, stabilization shall be achieved by overexcavating not less than two pipe diameters and backfilling to the installation level of the bottom of the pipe with fine gravel, crushed stone or a concrete foundation. The concrete foundation shall be bedded with sand tamped into place so as to provide uniform load-bearing support for the pipe between joints.

Plumbing Inspector checking underground piping.



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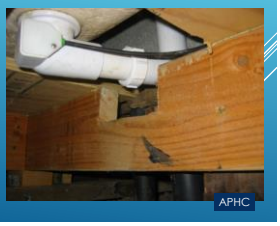
STRUCTURAL SAFETY

307.2 **Cutting, notching or bored holes.** A framing member shall not be cut, notched or bored in excess of limitations specified in the *building code*



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PIPING SUPPORT

308.5 **Interval of support.** Pipe shall be supported in accordance with Table 308.5.

TABLE 308.5
HANGER SPACING

PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING (feet)	MAXIMUM VERTICAL SPACING (feet)
Acrylonitrile butadiene styrene (ABS) pipe	4	10[a]
Aluminum tubing	10	15
Brass pipe	10	10
Cast-iron pipe	5[a]	15
Chlorinated polyvinyl chloride (CPVC) pipe and tubing, 1 inch and smaller	3	10[a]
Chlorinated polyvinyl chloride (CPVC) pipe and tubing, 1¼ inches and larger	4	10[a]
Copper or copper alloy pipe	12	10
Copper or copper alloy tubing, 1 inch diameter and smaller	6	10
Copper or copper alloy tubing, 1¼ inch diameter and larger	10	10
Cross-linked polyethylene (PEX) pipe	2.67 (32 inches)	10[a]
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	2.67 (32 inches)	4
Lead pipe	Continuous	4
Polyethylene/aluminum/polyethylene (PE-AL-PE) pipe	2.67 (32 inches)	4
Polyethylene of raised temperature (PE-RT) pipe	2.67 (32 inches)	10[a]
Polypropylene (PP) pipe or tubing 1 inch and smaller	2.67 (32 inches)	10[a]
Polypropylene (PP) pipe or tubing, 1¼ inches and larger	4	10[a]
Polyvinyl chloride (PVC) pipe	4	10[a]
Stainless steel drainage systems	10	10[a]
Steel pipe	12	15

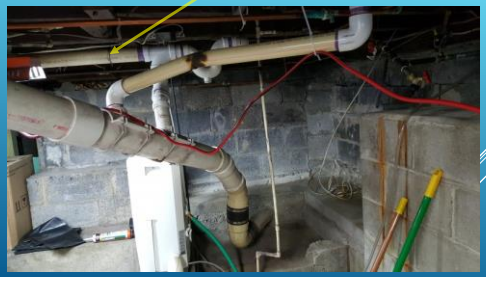
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.

b. For sizes 2 inches and smaller, a guide shall be installed midway between required vertical supports. Such guides shall prevent pipe movement in a direction perpendicular to the axis of the pipe.

23

One Hanger on the drainage system



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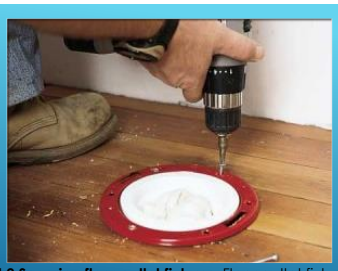


405.4.2 Securing floor outlet fixtures. Floor outlet fixtures shall be secured to the floor or floor flanges by screws or bolts of **corrosion-resistant** material.

25

408.3 Bidet water temperature. The discharge water temperature from a bidet fitting shall be limited to a maximum temperature of 110°F (43°C) by a water temperature limiting device conforming to ASSE 1070 or CSA B125.3.

26

412.2 **Floor drains.** Floor drains shall have removable strainers. The floor drain shall be constructed so that the drain is capable of being cleaned. Access shall be provided to the drain inlet. Ready access shall be provided to floor drains.

Exception: Floor drains serving refrigerated display cases shall be provided with access.

27

416.5 TEMPERED WATER FOR PUBLIC HAND-WASHING FACILITIES. TEMPERED WATER SHALL BE DELIVERED FROM PUBLIC HAND-WASHING FACILITIES. TEMPERED WATER SHALL BE DELIVERED THROUGH AN APPROVED WATER-TEMPERATURE LIMITING DEVICE THAT CONFORMS TO ASSE 1070 OR CSA B125.3

28

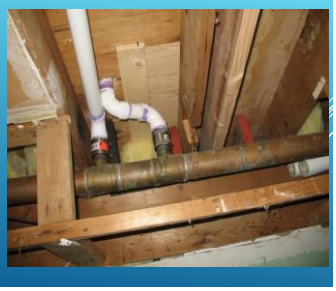
SECTION 610 DISINFECTION OF POTABLE WATER SYSTEM 610.1 General. **New potable water systems** shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the health authority or water purveyor having jurisdiction or, in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652, or as described in this section. This requirement shall apply to "on-site" or "inplant" fabrication of a system or to a modular portion of a system.

1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
2. The system or part thereof shall be filled with a water/chlorine solution containing not less than 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing not less than 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3 hours.
3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.
4. 4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

29

30

705.16 Joints between different materials. Joints between different piping materials shall be made with a mechanical joint of the compression or mechanical-sealing type conforming to ASTM C 1173, ASTM C 1460 or ASTM 4101:3-7-01 12 C 1461. Connectors and adapters shall be approved for the application and such joints shall have an elastomeric seal conforming to ASTM C 425, ASTM C 443, ASTM C 564, ASTM C 1440, ASTM F 477, CSA A257.3M or CSA B602, or as required in Sections 705.16.1 through 705.16.7. Joints between glass pipe and other types of materials shall be made with adapters having a TFE seal. Joints shall be installed in accordance with the manufacturer's instructions.



31

NOPE!

use this

32

706.3 Installation of fittings. Fittings shall be installed to guide sewage and waste in the direction of flow. Change in direction shall be made by fittings installed in accordance with Table 706.3. Change in direction by combination fittings, side inlets or increasers shall be installed in accordance with Table 706.3 based on the pattern of flow created by the fitting. Double sanitary tee patterns shall not receive the discharge of back-to-back water closets and fixtures or appliances with pumping action discharge.

33

No!

and

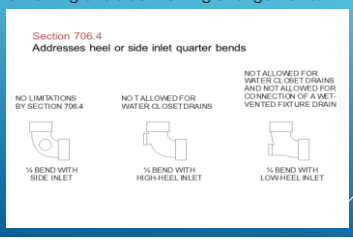
2" Trap

1 1/2 pipe

No!

34

706.4 Heel- or side-inlet quarter bends. Heel-inlet quarter bends shall be an acceptable means of connection, except where the quarter bend serves a water closet. A low-heel inlet shall not be used as a wet-vented connection. Side-inlet quarter bends shall be an acceptable means of connection for drainage, wet venting and stack venting arrangements.



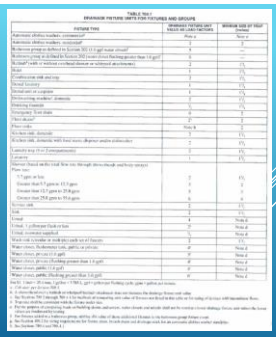
35

SECTION 708
CLEANOUTS
708.1 Cleanouts required. Cleanouts shall be provided for drainage piping in accordance with Sections 708.1.1 through 708.1.11.

Stack Cleanout's no longer required

36

709.1 **Values for fixtures.** Drainage fixture unit values as given in Table 709.1 designate the relative load weight of different kinds of fixtures that shall be employed in estimating the total load carried by a soil or waste pipe, and shall be used in connection with Tables 710.1(1) and 710.1(2) of sizes for soil, waste and vent pipes for which the permissible load is given in terms of fixture units.



37

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

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

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

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

d. Trap size shall be consistent with the fixture outlet size.

e. For the purpose of computing loads on building drains and sewers, water closets and urinals shall not be rated at a lower fixture unit unless the lower values are confirmed by testing.

f. For fixtures added to a dwelling unit bathroom group, add the dfu value of those additional fixtures to the bathroom group count.

g. See Section 406.3 for sizing requirements for fixture drain, branch drain, and drainage stack for an automatic clothes washer standpipe.

h. See Sections 709.4 and 709.4.1.

38

709.2 **Fixtures not listed in Table 709.1.** Fixtures not listed in Table 709.1 shall have a drainage fixture unit load based on the outlet size of the fixture in accordance with Table 709.2. The minimum trap size for unlisted fixtures shall be the size of the drainage outlet but not less than 1¼ inches (32 mm).

TABLE 709.2

DRAINAGE FIXTURE UNITS FOR FIXTURE DRAINS OR TRAPS

FIXTURE DRAIN OR TRAP SIZE (inches)	DRAINAGE FIXTURE UNIT VALUE
1 ¼	1
1 ½	2
2	3
2 ½	4
3	5
4	6

39

709.3 **Values for continuous and semi-continuous flow.** Drainage fixture unit values for continuous and semi-continuous flow into a drainage system shall be computed on the basis that 1 gpm (0.06 L/s) of flow is equivalent to two fixture units.

40

709.4 Values for indirect waste receptor. The drainage fixture unit load of an indirect waste receptor receiving the discharge of indirectly connected fixtures shall be the sum of the drainage fixture unit values of the fixtures that discharge to the receptor, but not less than the drainage fixture unit value given for the indirect waste receptor in Table 709.1 or 709.2

41

709.4.1 Clear-water waste receptors. Where waste receptors such as floor drains, floor sinks and hub drains receive only clear-water waste from display cases, refrigerated display cases, ice bins, coolers and freezers, such receptors shall have a drainage fixture unit value of one-half.

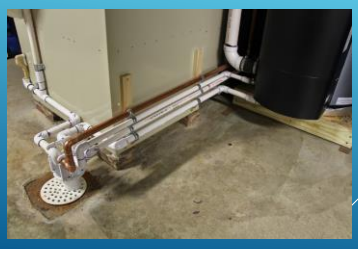


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TABLE 710.1(1) BUILDING DRAINS AND SEWERS
DIAMETER OF PIPE (inches)
MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS CONNECTED TO ANY PORTION OF THE BUILDING DRAIN OR THE BUILDING SEWER, INCLUDING BRANCHES OF THE BUILDING Drain

	Slope per foot			
	1/16 inch	1/8 inch	1/4 inch	1/2 inch
1 ¼	—	—	1	1
1 ½	—	—	3	3
2	—	—	21	26
2 ½	—	—	24	31
3	—	36	42	50
4	—	180	216	250
5	—	390	480	575
6	—	700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,800	3,500	4,200
12	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

For SI: 1 inch = 25.4 mm, 1 inch per foot = 83.3 mm/m.
a. The minimum size of any building drain serving a water closet shall be 3 inches.

43

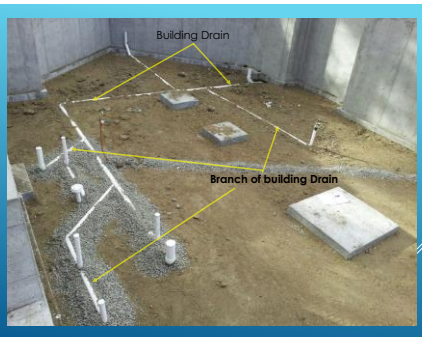

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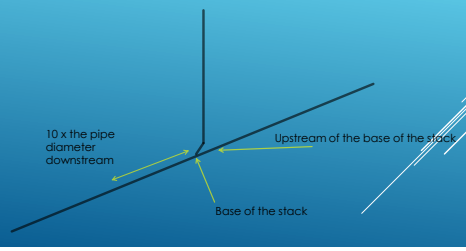
TABLE 710.1(2)
HORIZONTAL FIXTURE BRANCHES AND STACKS[a]

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
	Total for horizontal branch	Stacks[b]		
		Total discharge into one branch interval	Total for stack of three branch intervals or less	Total for stack greater than three branch intervals
1 ¼	3	2	4	8
2	6	6	10	24
2 ½	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Note c	Note c	Note c

For SI: 1 inch = 25.4 mm.
a. Does not include branches of the building drain. Refer to Table 710.1(1).
b. Stacks shall be sized based on the total accumulated connected load at each story or branch interval. As the total accumulated connected load decreases, stacks are permitted to be reduced in size. Stack diameters shall not be reduced to less than one-half of the diameter of the largest stack size required.
c. Sizing load based on design criteria.

45

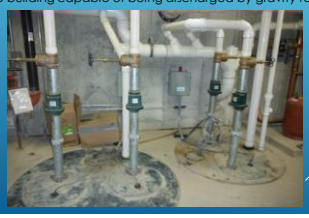
704.3 Connections to offsets and bases of stacks. Horizontal branches shall connect to the bases of stacks at a point located not less than 10 times the diameter of the drainage stack downstream from the stack. Except as prohibited by Section 711.2, horizontal branches shall connect to horizontal stack offsets at a point located not less than 10 times the diameter of the drainage stack downstream from the upper stack.



46

SECTION 712
SUMPS AND EJECTORS
712.1 Building subdrains.

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



47

712.2 Valves required. A check valve and a full open valve located on the discharge side of the check valve shall be installed in the pump or ejector discharge piping between the pump or ejector and the gravity drainage system. Access shall be provided to such valves. Such valves shall be located above the sump cover required by Section 712.1 or, where the discharge pipe from the ejector is below grade, the valves shall be accessibly located outside the sump below grade in an access pit with a removable access cover.

48

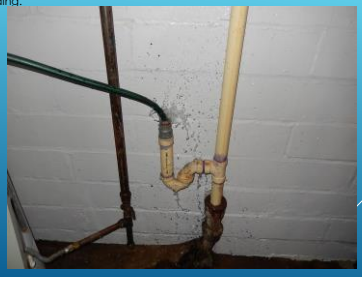
802.1 **Where required.** Food-handling equipment, in other than dwelling units, clear-water waste, dishwashing machines and utensils, pots, pans and dishwashing sinks shall discharge through an indirect waste pipe as specified in Sections 802.1.1 through 802.1.8. Health-care related fixtures, devices and equipment shall discharge to the drainage system through an indirect waste pipe by means of an air gap in accordance with this chapter and Section 713.3. Fixtures not required by this section to be indirectly connected shall be directly connected to the plumbing system in accordance with Chapter 7.

49

802.1.1 **Food handling.** Equipment and fixtures utilized for the storage, preparation and handling of food shall discharge through an indirect waste pipe by means of an air gap. Each well of a multiple-compartment sink shall discharge independently to a waste receptor.

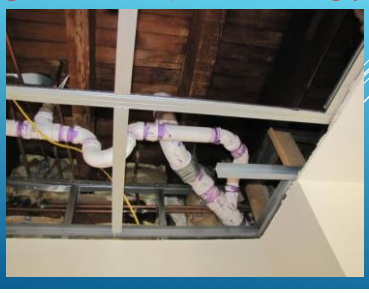
50

802.3.3 **Standpipes.** Standpipes shall be individually trapped. Standpipes shall extend not less than 18 inches (457 mm) but not greater than 42 inches (1066 mm) above the trap weir. Access shall be provided to standpipes and drains for rodding.

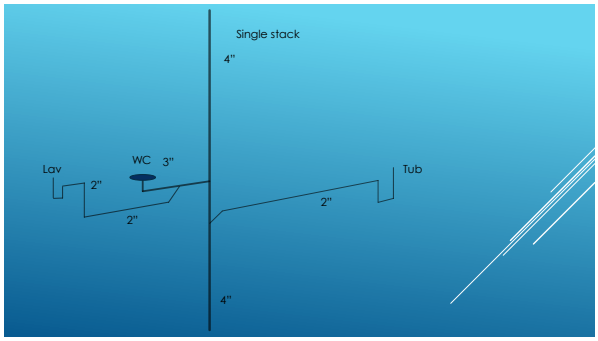


51

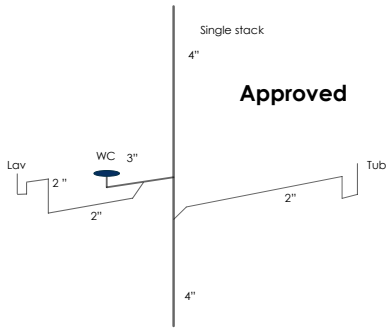
CHAPTER 9 VENTING!



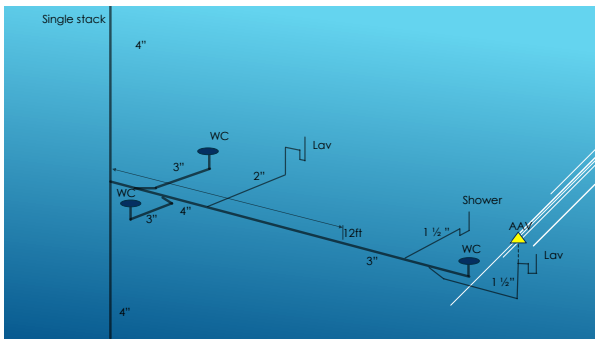
52


Single stack
4"
Lav
WC 3"
Tub
2"
2"
2"
4"

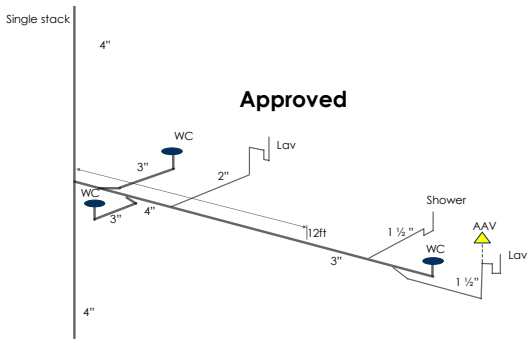
53


Single stack
4"
Approved
Lav
WC 3"
Tub
2 "
2"
2"
4"

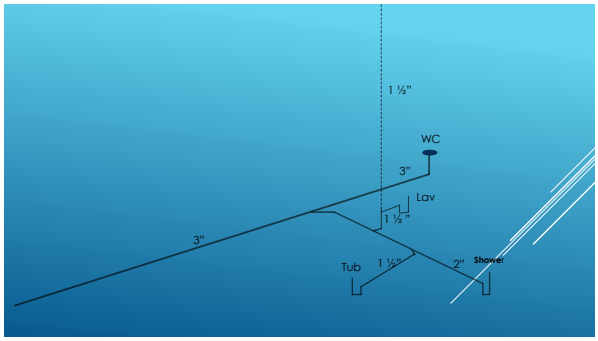
54


Single stack
4"
WC
Lav
3"
2"
WC
3"
4"
12ft
Shower
1 ½ "
AAV
WC
Lav
3"
1 ½"
4"

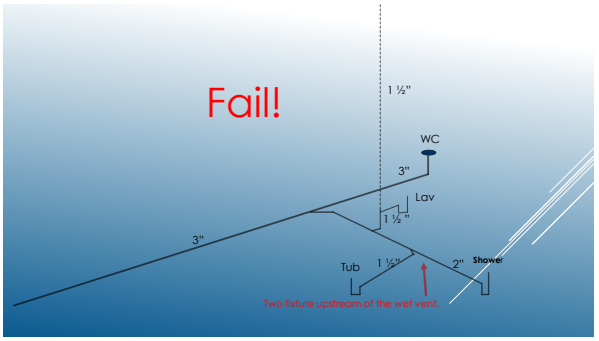
55


Single stack
4"
Approved
WC
Lav
3"
2"
WC
3"
4"
12ft
Shower
1 ½ "
AAV
WC
Lav
3"
1 ½"
4"

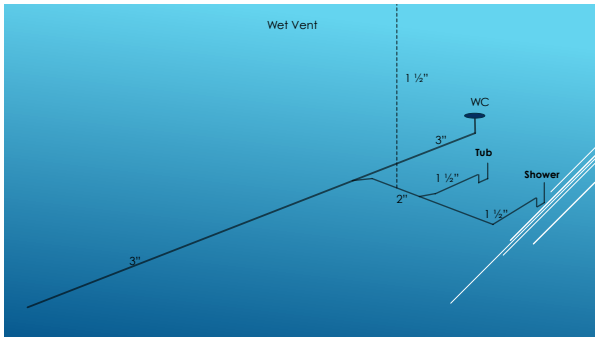
56


1 ½"
WC
3"
Lav
1 ½"
3"
Tub
1 ½"
2"
Shower

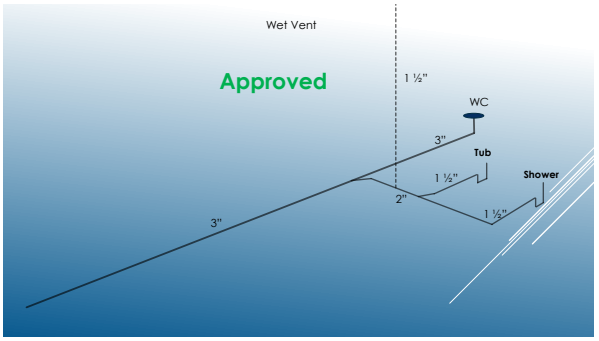
57


Fail!
1 ½"
WC
3"
Lav
1 ½"
3"
Tub
1 ½"
2"
Shower
two fixture upstream of the wet vent.

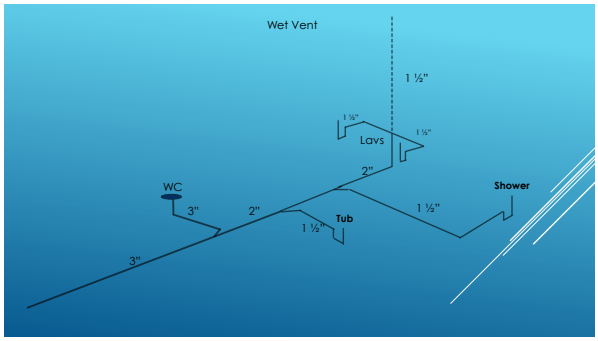
58


Wet Vent
1 ½"
WC
3"
Tub
1 ½"
Shower
2"
1 ½"
3"

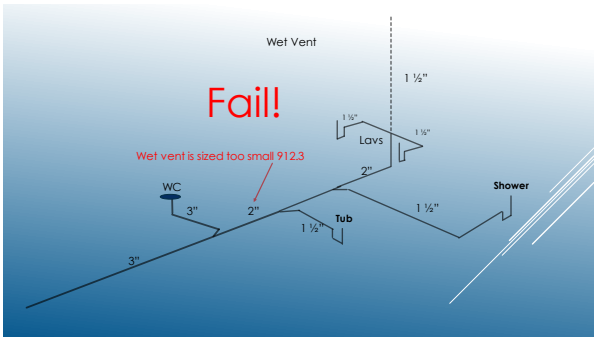
59


Wet Vent
Approved
1 ½"
WC
3"
Tub
1 ½"
Shower
2"
1 ½"
3"

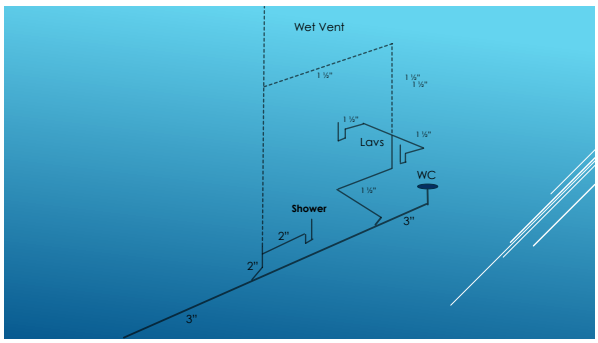
60


Wet Vent
1 ½"
Lavs
2"
WC
3"
2"
Tub
1 ½"
1 ½"
Shower
3"

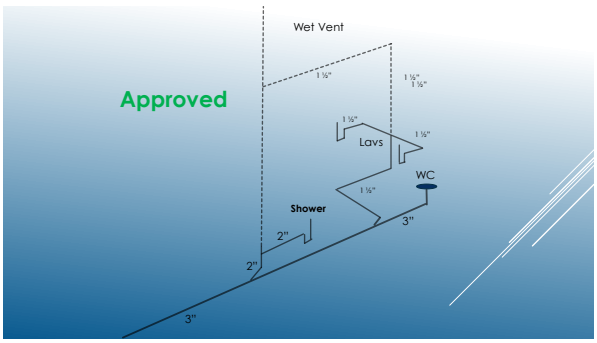
61


Wet Vent
Fail!
Wet vent is sized too small 912.3
1 ½"
Lavs
2"
WC
3"
2"
Tub
1 ½"
1 ½"
Shower
3"

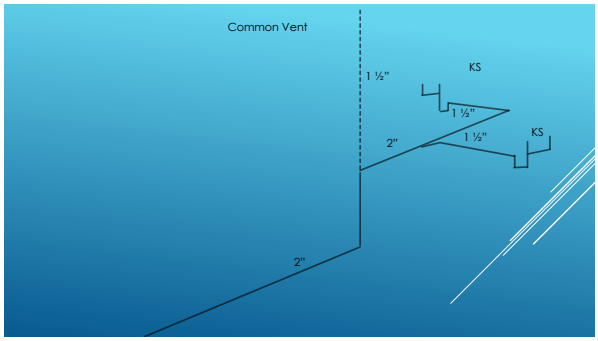
62


Wet Vent
Lavs
WC
Shower
2"
3"
2"
3"

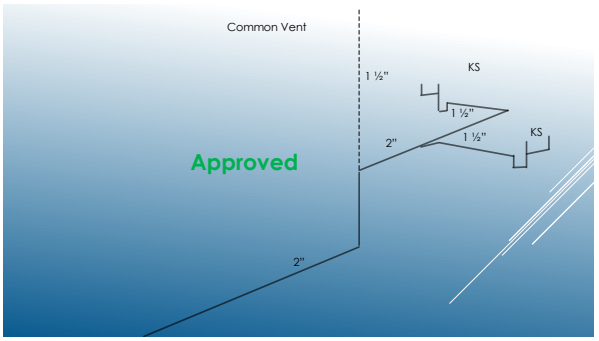
63


Wet Vent
Approved
Lavs
WC
Shower
2"
3"
2"
3"

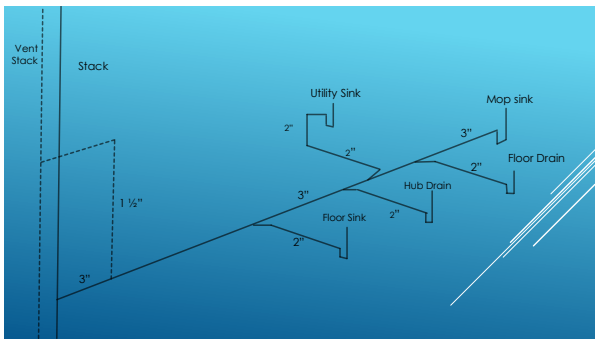
64


Common Vent
1 ½"
KS
1 ½"
2"
1 ½"
KS
2"

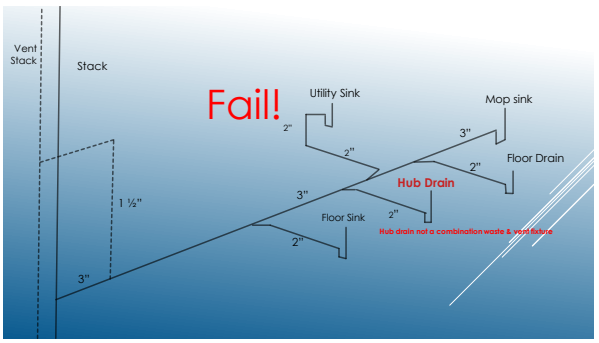
65


Common Vent
Approved
1 ½"
KS
1 ½"
2"
1 ½"
KS
2"

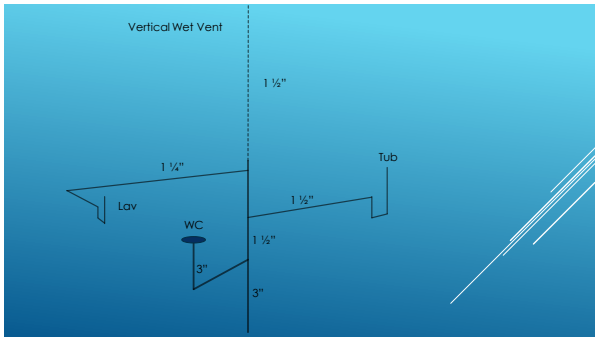
66


Vent Stack
Stack
Utility Sink
Mop sink
2"
3"
2"
Floor Drain
2"
Hub Drain
1 ½"
3"
Floor Sink
2"
2"
3"

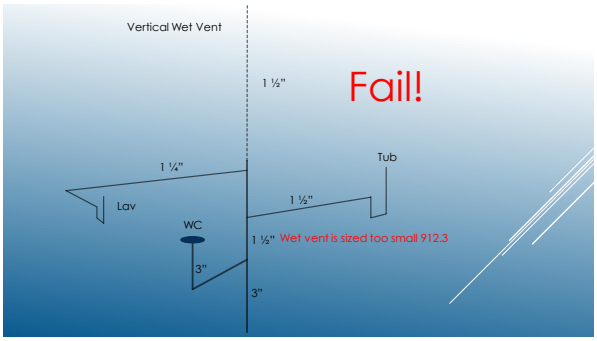
67


Vent Stack
Stack
Fail!
Utility Sink
Mop sink
2"
3"
2"
Floor Drain
2"
Hub Drain
1 ½"
3"
Floor Sink
2"
Hub drain not a combination waste & vent fixture
2"
3"

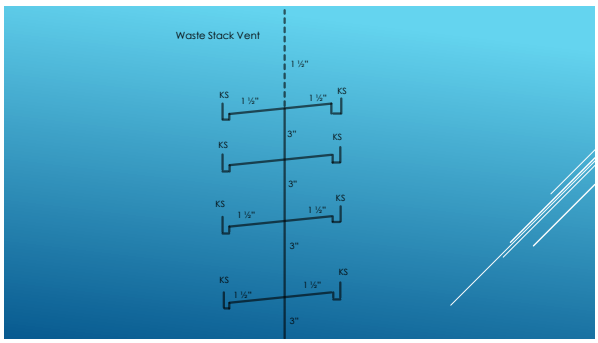
68


Vertical Wet Vent
1 ½"
1 ¼"
Lav
Tub
1 ½"
WC
1 ½"
3"
3"

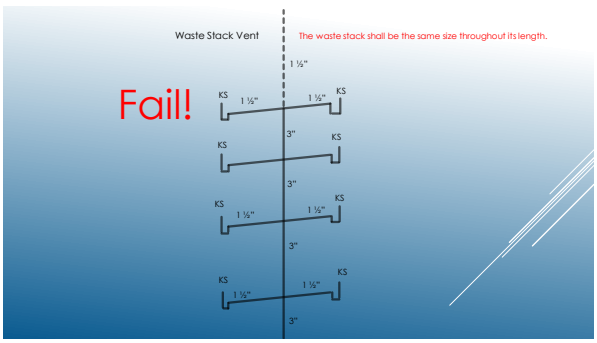
69


Vertical Wet Vent
1 ½"
Fail!
1 ¼"
Tub
Lav
1 ½"
WC
1 ½" Wet vent is sized too small 912.3
3"
3"

70


Waste Stack Vent
1 ½"
KS
1 ½"
1 ½"
KS
3"
KS
KS
3"
KS
1 ½"
1 ½"
KS
3"
KS
1 ½"
1 ½"
KS
3"

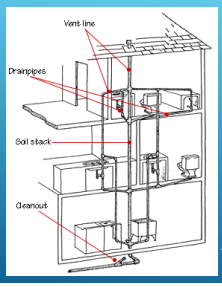
71


Waste Stack Vent
The waste stack shall be the same size throughout its length.
1 ½"
Fail!
KS
1 ½"
1 ½"
KS
3"
KS
KS
3"
KS
1 ½"
1 ½"
KS
3"
KS
1 ½"
1 ½"
KS
3"

72

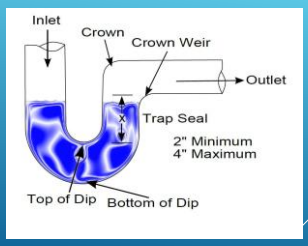
SECTION 901
GENERAL

901.1 Scope. The provisions of this chapter shall govern the materials, design, construction and installation of vent systems.



73

901.2 Trap seal protection. The plumbing system shall be provided with a system of vent piping that will permit the admission or emission of air so that the seal of any fixture trap shall not be subjected to a pneumatic pressure differential of more than 1 inch of water column (249 Pa).



74

901.3 **Chemical waste vent systems.** The vent system for a chemical waste system shall be independent of the sanitary vent system and shall terminate separately through the roof to the outdoors or to an air admittance valve that complies with ASSE 1049. Air admittance valves for chemical waste systems *shall comply with Section 918.8 and* shall be constructed of materials approved in accordance with Section 702.5 and shall be tested for chemical resistance in accordance with ASTM F 1412.

75

901.6 Engineered systems. Engineered venting systems shall conform to the provisions of Section 919

76

903.2 **Frost closure.** Where the 97.5 -percent value for outside design temperature is 0°F (-18°C) or less, vent extensions through a roof or wall shall be not less than 3 inches (76 mm) in diameter. Any increase in the size of the vent shall be made not less than 1 foot (305 mm) inside the thermal envelope of the building.

77

903.5 **Location of vent terminal.** An open vent terminal from a drainage system shall not be located directly beneath any door, openable window, or other air intake opening of the building or of an adjacent building, and any such vent terminal shall not be within 10 feet (3048 mm) horizontally of such an opening unless it is 3 feet (914 mm) or more above the top of such opening.

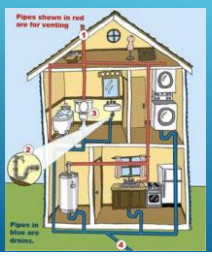
78

903.6 **Extension through the wall.** Vent terminals extending through the wall shall terminate at a point not less than **10 feet (3048 mm) from a lot line** and **not less than 10 feet (3048 mm) above average ground level.** Vent terminals shall not terminate under the overhang of a structure with soffit vents. Side wall vent terminals shall be protected to prevent birds or rodents from entering or blocking the vent opening.

79

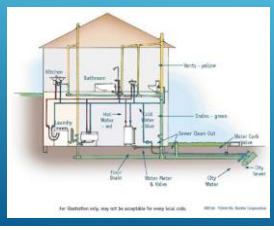
SECTION 904
OUTDOOR VENT EXTENSIONS

904.1 **Required vent extension.** The vent system serving each building drain shall have not less than one vent pipe that extends to the outdoors



80

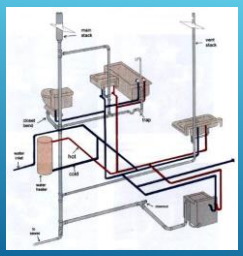
904.1.1 **Installation.** The required vent shall be a dry vent that connects to the building drain or an extension of a drain that connects to the building drain. Such vent shall not be an island fixture vent as allowed by Section 916.



NOT THIS!

81

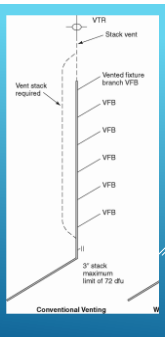
904.1.2 **Size.** The required vent shall be sized in accordance with Section 906.2 based on the **required** size of the building drain.



82

904.2 **Vent stack required.** A vent stack shall be required for every drainage stack that has five branch intervals or more.

Exception: Drainage stacks installed in accordance with Section 913.



APHC

83

904.3 **Vent termination.** Vent stacks or stack vents shall terminate outdoors to the open air or to a stack-type air admittance valve in accordance with Section 918.

APHC

84

905.2 Grade. All vent and branch vent pipes shall be so graded and connected as to drain back to the drainage pipe by gravity.

APHC

85

905.4 Vertical rise of vent. Every dry vent shall rise vertically to a minimum of 6 inches (152 mm) above the flood level rim of the highest trap or trapped fixture being vented.

Exception: Vents for interceptors located outdoors

APHC

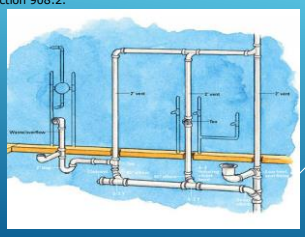
86

905.5 Height above fixtures. A connection between a vent pipe and a vent stack or stack vent shall be made at least 6 inches (152 mm) above the flood level rim of the highest fixture served by the vent. Horizontal vent pipes forming branch vents, relief vents or loop vents shall be at least 6 inches (152 mm) above the flood level rim of the highest fixture served

APHC

87

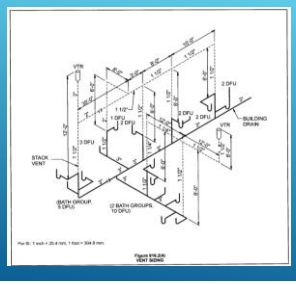
906.2 **Vents other than stack vents or vent stacks.** The diameter of individual vents, branch vents, circuit vents and relief vents shall be not less than one-half the required diameter of the drain served. The required size of the drain shall be determined in accordance with Table 710.1(2). Vent pipes shall not be less than 1¼ inches (32 mm) in diameter. **Vents exceeding 40 feet** (12 192 mm) in developed length shall be increased by one nominal pipe size for the entire developed length of the vent pipe. Relief vents for soil and waste stacks in buildings having more than 10 branch intervals shall be sized in accordance with Section 908.2.



APHC

88

906.3 **Developed length.** The developed length of individual, branch, circuit and relief vents shall be measured from the farthest point of vent connection to the drainage system to the point of connection to the vent stack, stack vent or termination outside of the building.



APHC

89

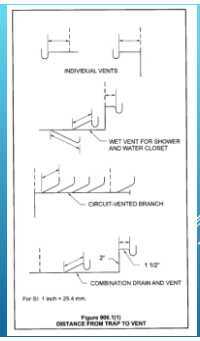
906.5.1 **Sewage pumps and sewage ejectors other than pneumatic.** Drainage piping below *the building sewer* level shall be vented in the same manner as that of a gravity system. Building sump vent sizes for sumps with sewage pumps or sewage ejectors, other than pneumatic, shall be determined in accordance with Table 906.5.1.

APHC

90

SECTION 909
FIXTURE VENTS

906.1 Distance of trap from vent. Each fixture trap shall have a protecting vent located so that the slope and the developed length in the fixture drain from the trap weir to the vent fitting are within the requirements set forth in Table 909.1.

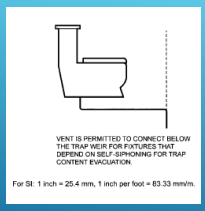


91

EXCEPTION: The developed length of the fixture drain from the trap weir to the vent fitting for self-siphoning fixtures, such as water closets, shall not be limited.
Single stack fixtures are limited to listed code section)

New

Old



Exception: The developed length of the fixture drain from the trap weir to the vent fitting for self-siphoning fixtures, such as water closets, shall not be limited in *individual vent, common vent, and wet vent systems*

92

909.2 Venting of fixture drains. The total fall in a fixture drain due to pipe slope shall not exceed the diameter of the fixture drain, nor shall the vent connection to a fixture drain, except for water closets, be below the weir of the trap

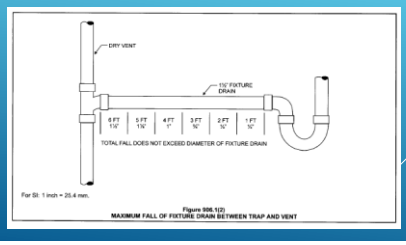


Figure 906.1(2)
MAXIMUM FALL OF FIXTURE DRAIN BETWEEN TRAP AND VENT

93

TABLE 909.1
MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT

SIZE OF TRAP (inches)	SLOPE (inch per foot)	DISTANCE FROM TRAP (feet)
1 ¼	¼	5
1 ½	¼	6
2	¼	8
3	1/8	12
4	1/8	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m.

94

SECTION 910
INDIVIDUAL VENT

910.1 Individual vent permitted. Each trap and trapped fixture is permitted to be provided with an individual vent. The individual vent shall connect to the fixture drain of the trap or trapped fixture being vented.

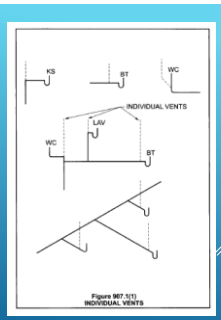


Figure 907.1(1)
INDIVIDUAL VENTS

95

SECTION 911
COMMON VENT

911.1 Individual vent as common vent. An individual vent is permitted to vent two traps or trapped fixtures as a common vent. The traps or trapped fixtures being common vented shall be located on the same floor level.

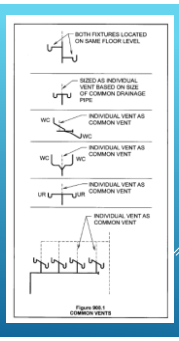


Figure 911.1
COMMON VENTS

96

911.2 Connection at the same level. Where the fixture drains being common vented connect at the same level, the

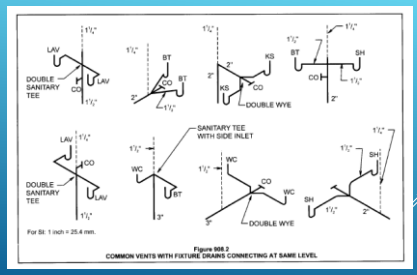


Figure 908.2
COMMON VENTS WITH FIXTURE DRAINS CONNECTING AT SAME LEVEL

97

911.3 Connection at different levels. Where the fixture drains connect at different levels, the vent shall connect as a vertical extension of the vertical drain. The vertical drain pipe connecting the two fixture drains shall be considered the vent for the lower fixture drain, and shall be sized in accordance with Table 908.3. **The upper fixture shall not be a water closet.**

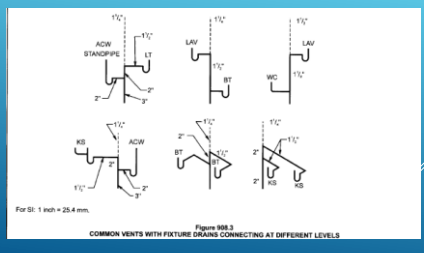


Figure 908.3
COMMON VENTS WITH FIXTURE DRAINS CONNECTING AT DIFFERENT LEVELS

98

TABLE Table 911.3
COMMON VENT SIZES

PIPE SIZE (inches)	MAXIMUM DISCHARGE FROM UPPER FIXTURE DRAIN (dfu)
1 1/2	1
2	4
2 ½ to 3	6

For SI: 1 inch = 25.4 mm.

APHC

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WET VENTING
912.1 Horizontal wet vent permitted. Any combination of fixtures within **two bathroom groups** located on the same floor level is permitted to be vented by a horizontal wet vent. The wet vent shall be considered the vent for the fixtures and shall extend from the of the horizontal wet vent. connection of the dry vent along the direction of the flow in the drain pipe to the most downstream fixture drain connection to the horizontal branch drain. Each wet-vented fixture drain shall connect independently to the horizontal wet vent. Only the fixtures within the bathroom groups shall connect to the wet vented horizontal branch drain. Any additional fixtures shall discharge downstream

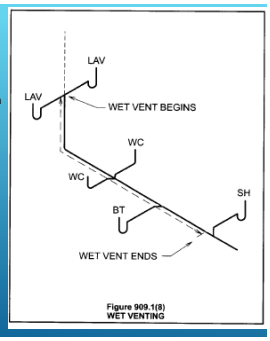
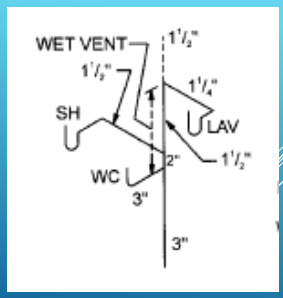


Figure 909.1(8)
WET VENTING

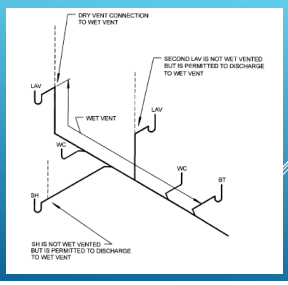
100

912.1.1 Vertical wet vent permitted. Any combination of fixtures within two bathroom groups located on the same floor level is permitted to be vented by a vertical wet vent. The vertical wet vent shall be considered the vent for the fixtures and shall extend from the connection of the dry vent down to the lowest fixture drain connection. Each wet-vented fixture shall connect independently to the vertical wet vent. Water closet drains shall connect at the same elevation. Other fixture drains shall connect above or at the same elevation as the water closet fixture drains. The dry-vent connection to the vertical wet vent shall be an individual or common vent serving one or two fixtures



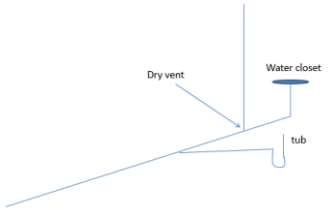
101

912.2 Dry vent connection. The required dry-vent connection for wet-vented systems shall
comply with Sections 909.2.1 and 909.2.2



102

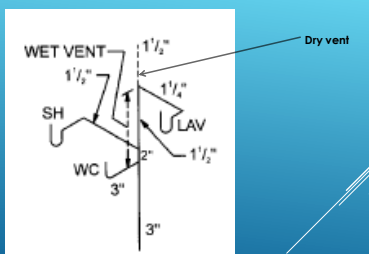
912.2.1 Horizontal wet vent. The dry-vent connection for a horizontal wet-vent system shall be an individual vent or a common vent for any bathroom group fixture, except an emergency floor drain. Where the dry-vent connects to a water closet fixture drain, the drain shall connect horizontally to the horizontal wet-vent system. Not more than one wet-vented fixture drain shall discharge upstream of the dry-vented fixture drain connection.



APHC

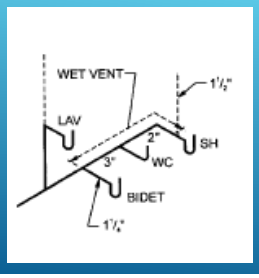
103

912.2.2 Vertical wet vent. The dry-vent connection for a vertical wet-vent system shall be an individual vent or common vent for the most upstream fixture drain



104

912.3 Size. The dry vent serving the wet vent shall be sized based on the largest required diameter of pipe within the wet-vent system served by the dry vent. The wet vent shall be of a minimum size as specified in Table 909.3, based on the fixture unit discharge to the wet vent.



105

Table 912.3

WET VENT SIZE

WET VENT PIPE SIZE (inches)	DRAINAGE FIXTURE UNIT LOAD (dfu)
1 ½	1
2	4
2 ½	6
3	12

For SI: 1 inch = 25.4 mm.

APHC

106

SECTION 910
WASTE STACK VENT

913.1 Waste stack vent permitted. A waste stack shall be considered a vent for all of the fixtures discharging to the stack where installed in accordance with the requirements of this section.

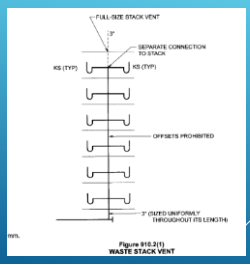
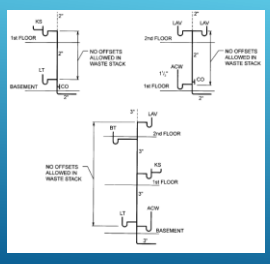


Figure 910.2(1)
WASTE STACK VENT

107

912.2 Stack installation. The waste stack shall be vertical, and both horizontal and vertical offsets shall be prohibited between the lowest fixture drain connection and the highest fixture drain connection. Every fixture drain shall connect separately to the waste stack. The stack shall not receive the discharge of water closets or urinals



108

913.4 Waste stack size. The waste stack shall be sized based on the total discharge to the stack and the discharge within a branch interval in accordance with Table 910.4. The waste stack shall be the same size throughout its length.

TABLE 910.4
WASTE STACK VENT SIZE

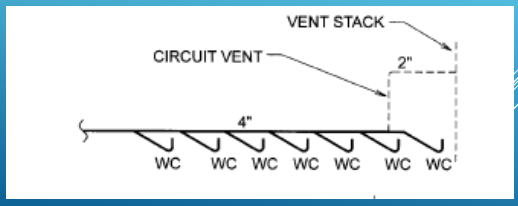
STACK SIZE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Total discharge into one branch interval	Total discharge for stack
1½	1	2
2	2	4
2½	No limit	8
3	No limit	24
4	No limit	50
5	No limit	75
6	No limit	100

For SI: 1 inch = 25.4 mm.

109

SECTION 911
CIRCUIT VENTING

914.1 Circuit vent permitted. A maximum of eight fixtures connected to a horizontal branch drain shall be permitted to be circuit vented. Each fixture drain shall connect horizontally to the horizontal branch being circuit vented. The horizontal branch drain shall be classified as a vent from the most downstream fixture drain connection to the most upstream fixture drain connection to the horizontal branch.



110

914.1.1 Multiple circuit-vented branches. Circuit-vented horizontal branch drains are permitted to be connected together. Each group of a maximum of eight fixtures shall be considered a separate circuit vent and shall conform to the requirements of this section.

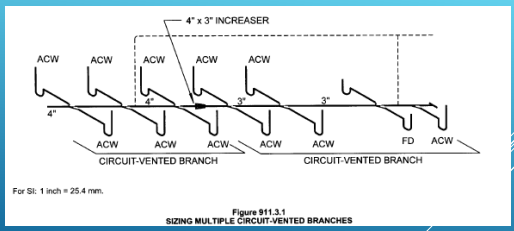
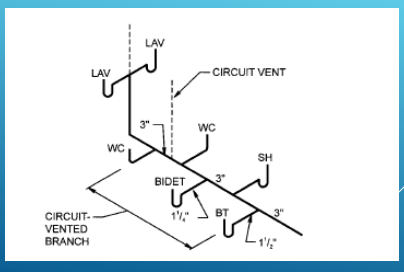


Figure 911.3.1
SIZING MULTIPLE CIRCUIT-VENTED BRANCHES

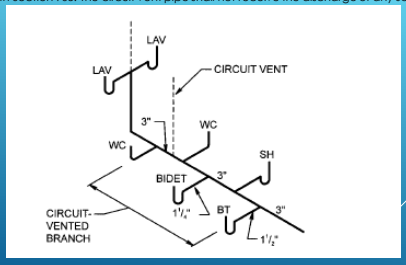
111

914.2 Vent connection. The circuit vent connection shall be located between the two most upstream fixture drains. The vent shall connect to the horizontal branch and shall be installed in accordance with Section 905. The circuit vent pipe shall not receive the discharge of any soil or waste.



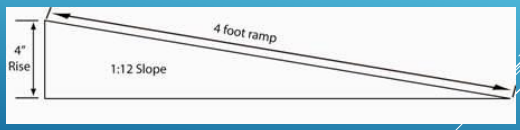
112

914.2 Vent connection. The circuit vent connection shall be located between the two most upstream fixture drains. The vent shall connect to the horizontal branch and shall be installed in accordance with Section 905. The circuit vent pipe shall not receive the discharge of any soil or waste.



113

914.3 Slope and size of horizontal branch. The maximum slope of the vent section of the horizontal branch drain shall be one unit vertical in 12 units horizontal (8-percent slope). The entire length of the vent section of the horizontal branch drain shall be sized for the total drainage discharge to the branch



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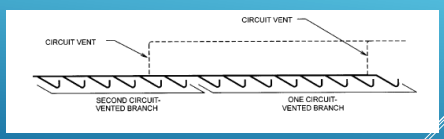
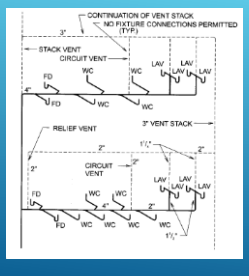
114

914.3.1 Size of multiple circuit vent. Each separate circuit-vented horizontal branch that is interconnected shall be sized independently in accordance with Section 911.3. The downstream circuit-vented horizontal branch shall be sized for the total discharge into the branch, including the upstream branches and the fixtures within the branch.



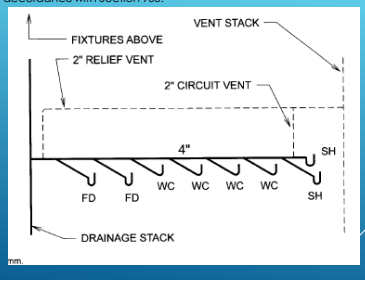
115

914.4 Relief vent. A relief vent shall be provided for circuit-vented horizontal branches receiving the discharge of four or more water closets and connecting to a drainage stack that receives the discharge of soil or waste from upper horizontal branches



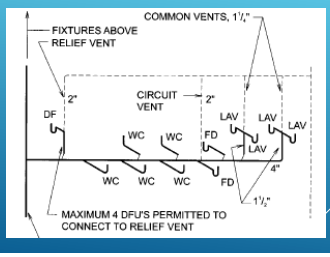
116

914.4.1 Connection and installation. The relief vent shall connect to the horizontal branch drain between the stack and the most downstream fixture drain of the circuit vent. The relief vent shall be installed in accordance with Section 905.



117

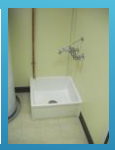
914.5 Additional fixtures. Fixtures, other than the circuit-vented fixtures, are permitted to discharge to the horizontal branch drain. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.



118

SECTION 915
COMBINATION DRAIN AND VENT SYSTEM

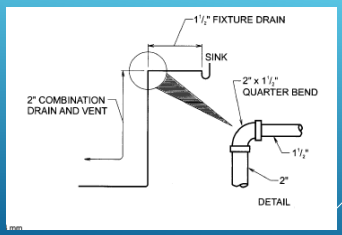
915.1 Type of fixtures. A combination drain and vent system shall not serve fixtures other than floor drains, sinks, lavatories and drinking fountains.

Combination drain and vent systems shall not receive the discharge from a food waste grinder or clinical sink.


119

915.2 Installation. The only vertical pipe of a combination drain and vent system shall be the connection between the fixture drain of a sink, lavatory or drinking fountain, and the horizontal combination drain and vent pipe. The maximum vertical distance shall be 8 feet (2438 mm).



120

915.2.1 Slope. The horizontal combination drain and vent pipe shall have a maximum slope of one-half unit vertical in 12 units horizontal (4-percent slope). The minimum slope shall be in accordance with Table 704.1.

¼ inch per foot minim ½ per foot maximum

APHC

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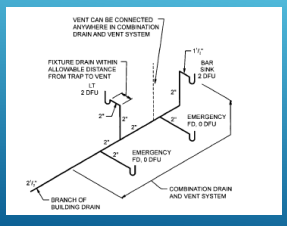
915.2.2 Connection. The combination drain and vent system shall be provided with a dry vent connected at any point within the system or the system shall connect to a horizontal drain that is vented in accordance with one of the venting methods specified in this chapter. Combination drain and vent systems connecting to building drains receiving only the discharge from a stack or stacks shall be provided with a dry vent. The vent connection to the combination drain and vent pipe shall extend vertically a minimum of 6 inches (152 mm) above the flood level rim of the highest fixture being vented before offsetting horizontally



122

915.2.3 Vent size. The vent shall be sized for the total drainage fixture unit load in accordance with Section 916.2.

TABLE 916.1
SIZE AND DEVELOPED LENGTH OF STACK VENTS AND VENT STACKS

DIAMETER OF SOIL OR WASTE STACK (inches)	TOTAL FIXTURE UNITS BEING VENTED (dfu)	MAXIMUM DEVELOPED LENGTH OF VENT (feet)* DIAMETER OF VENT (inches)										
		1¼	1½	2	2½	3	4	5	6	8	10	12
1¼	2	50										
1½	8	50	150	—	—	—	—	—	—	—	—	—
1½	10	30	100									
2	12	30	75	200								
2	20	26	50	150		—	—	—	—	—	—	—
2½	42		30	100	300							
3	10		42	150	360	1,040						
3	21	—	32	110	270	810	—	—	—	—	—	—
3	53		27	94	230	680						
3	102		25	86	210	620						
4	43	—		35	85	250	980	—	—	—	—	—
4	140			27	65	200	750					
4	320	—	—	23	55	170	640		—	—	—	—
4	540			21	50	150	580	—				
5	190				28	82	320	990				
5	680	—	—	—	21	63	250	760	—	—	—	—
5	960				18	53	210	670				
5	1,400				16	49	190	590				
6	500	—	—	—	—	33	130	400	1,000	—	—	—
6	1,100					26	100	310	780			
6	2,000					22	84	260	660			
6	2,900	—	—	—	—	20	77	240	600	—	—	—
8	1,800						31	95	240	940	—	—
8	3,400						24	73	190	720		

(continued)

123

915.2.4 Fixture branch or drain. The fixture branch or fixture drain shall connect to the combination drain and vent within a distance specified in Table 906.1. The combination drain and vent pipe shall be considered the vent for the fixture

TABLE 906.1
MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT

SIZE OF TRAP (inches)	SLOPE (inch per foot)	DISTANCE FROM TRAP (feet)
1¼	¼	5
1½	¼	6
2	¼	8
3	⅛	12
4	⅛	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm,
1 inch per foot = 83.3 mm/m.

124

915.3 Size. The minimum size of a combination drain and vent pipe shall be in accordance with Table 912.3.

TABLE 912.3
SIZE OF COMBINATION DRAIN AND VENT PIPE

DIAMETER PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Connecting to a horizontal branch or stack	Connecting to a building drain or building subdrain
2	3	4
2 ½	6	26
3	12	31
4	20	50
5	160	250
6	360	575

For SI: 1 inch = 25.4 mm.

125

SECTION 916
ISLAND FIXTURE VENTING

916.1 Limitation. Island fixture venting shall not be permitted for fixtures other than sinks and lavatories. Residential kitchen sinks with a dishwasher waste connection, a food waste grinder, or both, in combination with the kitchen sink waste, shall be permitted to be vented in accordance with this section.

126

916.2 Vent connection. The island fixture vent shall connect to the fixture drain as required for an individual or common vent. The vent shall rise vertically to above the drainage outlet of the fixture being vented before offsetting horizontally or vertically downward. The vent or branch vent for multiple island fixture vents shall extend to a minimum of 6 inches (152 mm) above the highest island fixture being vented before connecting to the outside vent terminal.

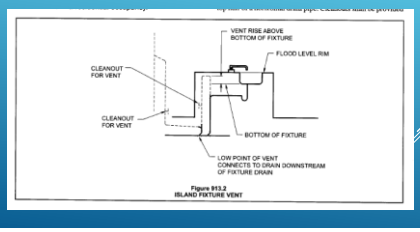


Figure 913.2
ISLAND FIXTURE VENT

127

SECTION 917
SINGLE STACK VENT SYSTEM

917.1 Where permitted. A drainage stack shall serve as a single stack vent system where sized and installed in accordance with Sections 917.2 through 917.9. The drainage stack and branch piping shall be the vents for the drainage system. The drainage stack shall have a stack vent.

128

917.2 Stack size.

Drainage stacks shall be sized in accordance with Table 917.2. Stacks shall be uniformly sized based on the total connected drainage fixture unit load. The stack vent shall be the same size as the drainage stack. A 3inch (76 mm) stack shall serve not more than two water closets.

129

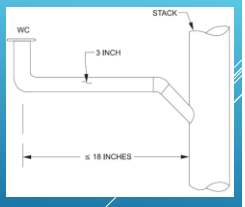
917.2 STACK SIZE.

Stack Size (inches)	Maximum Connected Drainage Fixture Units		
	Stacks less than 75 ft. in height	Stacks 75 ft. up to less than 160 ft. in height	Stacks 160 ft. and greater in height
3	24	NP	NP
4	225	24	NP
5	480	225	24
6	1015	480	225
8	2320	1015	480
10	4500	2320	1015
12	8100	4500	2320
15	13,600	8100	4500

130

917.3 BRANCH SIZE.

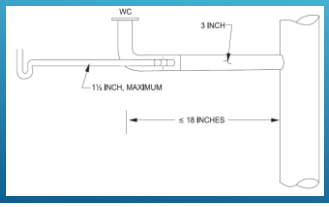
Horizontal branches connecting to a single stack vent system shall be sized in accordance with Table 710.1(2). Not more than **one** water closet shall discharge into a 3-inch (76 mm) horizontal branch at a point within a *developed length* of 18 inches (457 mm) measured horizontally from the *stack*.



131

917.3 BRANCH SIZE. (CONTINUED)

Where a water closet is within 18 inches (457 mm) measured horizontally from the *stack* and not more than one fixture with a drain size of not more than 1-1/2 inches (38 mm) connects to a 3-inch (76 mm) horizontal *branch*, the branch drain connection to the *stack* shall be made with a sanitary tee.



132

SINGLE STACK VENT SYSTEM
STACK AND BRANCH SIZING CHARTS

Table 710.1(2)

Diameter of Pipe (inches)	Total for Horizontal Branch
1-1/2	3
2	6
2-1/2	12
3	20
4	160
5	360
6	620
8	1,400
10	2,500
12	3,900
15	7,000

Table 917.2

Stack Size (inches)	Stacks less than 75 ft. in height	Stacks 75 ft. to less than 160 feet in height	Stacks greater than 160 ft. in height
3	24	NP	NP
4	225	24	NP
5	480	225	24
6	1,015	480	225
8	2,320	1,015	480
10	4,500	2,320	1,015
12	8,100	4,500	2,320
15	13,600	8,100	4,500

133

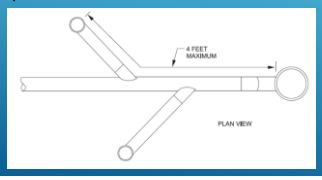
917.4 LENGTH OF HORIZONTAL BRANCHES.

The length of horizontal *branches* shall conform to the requirements of Sections 917.4.1 through 917.4.3.

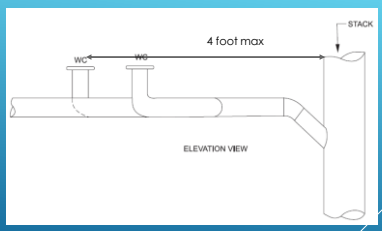
134

917.4.1 WATER CLOSET CONNECTION.

Water closet connections shall be not greater than 4 feet (1219 mm) in *developed length* measured horizontally from the *stack*.



135

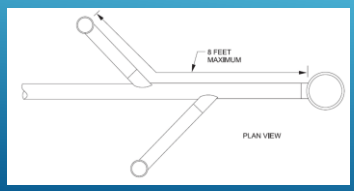


136

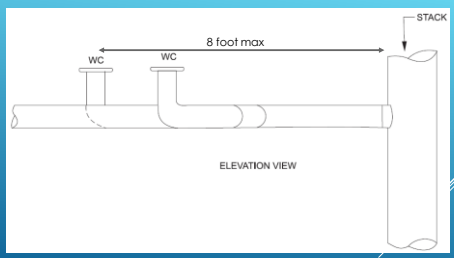
917.4.1 WATER CLOSET CONNECTION.

Exception:

Where the connection is made with a sanitary tee, the maximum ***developed length*** shall be 8 feet (2438 mm).



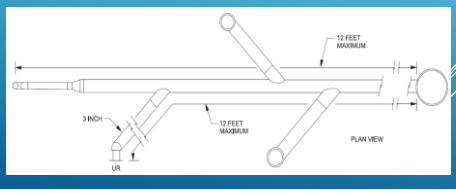
137



138

917.4.2 FIXTURE CONNECTIONS.

Fixtures other than water closets shall be located not greater than 12 feet (3657 mm) in ***developed length***, measured horizontally from the ***stack***.



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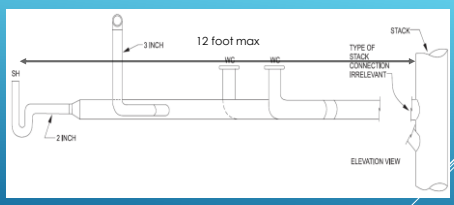


140

917.4.3 VERTICAL PIPING IN BRANCH.

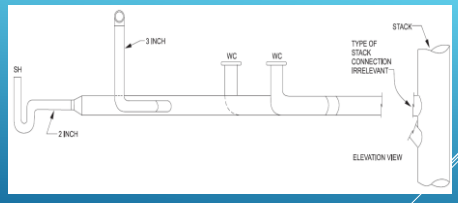
The length of vertical piping in a fixture drain connecting to a horizontal *branch* shall not be considered in computing the fixture's distance in *developed length* measured horizontally from the *stack*.

141

917.5 MINIMUM VERTICAL PIPING SIZE FROM FIXTURE.

The vertical portion of piping in a fixture drain to a horizontal *branch* shall be 2 inches (51 mm). The minimum size of the vertical portion of piping for a water-supplied urinal or *standpipe* shall be 3 inches (76 mm). The maximum vertical drop shall be 4 feet (1219 mm). *Fixture drains* that are not increased in size, or have a vertical drop in excess of 4 feet (1219 mm), shall be individually vented.

142



143

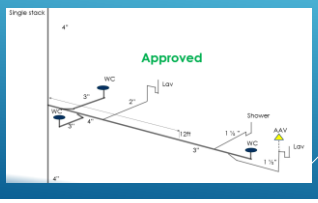
917.6 ADDITIONAL VENTING REQUIRED.

Additional venting shall be provided where more than one water closet discharges to a horizontal *branch* and where the distance from a fixture *trap* to the *stack* exceeds the limits in Section 917.4. Where additional venting is required, the fixture(s) shall be vented by *individual vents, common vents, wet vents, circuit vents,* or a *combination waste and vent pipe*.

144

917.6 ADDITIONAL VENTING REQUIRED. (CONTINUED)

The dry vent extensions for the additional venting shall connect to a *branch vent*, *vent stack*, *stack vent*, *air admittance valve*, or shall terminate outdoors.



145

917.7 STACK OFFSETS.

Where fixture drains are not connected below a horizontal offset in a *stack*, a horizontal offset shall not be required to be vented. Where horizontal *branches* or *fixture drains* are connected below a horizontal offset in a *stack*, the offset shall be vented in accordance with Section 907. Fixture connections shall not be made to a *stack* within 2 feet (610 mm) above or below a horizontal offset.

146

917.7 STACK OFFSETS.

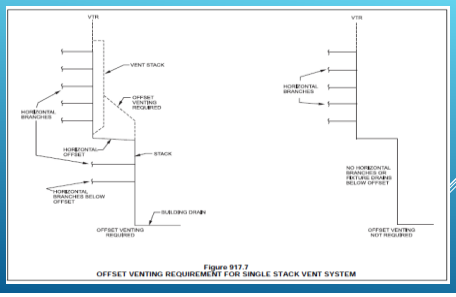


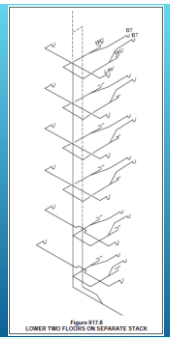
Figure 917.7
OFFSET VENTING REQUIREMENT FOR SINGLE STACK VENT SYSTEM

147

917.8 PROHIBITED LOWER CONNECTIONS.

Stacks greater than 2 *branch intervals* in height shall not receive the discharge of horizontal *branches* on the lower two floors. There shall be no connections to the *stack* between the lower two floors and a distance of not less than 10 pipe diameters downstream from the base of the single stack vented system.

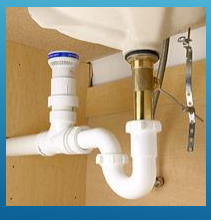
148



149

SECTION 918
AIR ADMITTANCE VALVES

918.1 **General.** Vent systems utilizing air admittance valves shall comply with this section. Stack-type air admittance valves shall conform to ASSE 1050. Individual and branch type air admittance valves shall conform to ASSE 1051.



150

918.2 **Installation.** The valves shall be installed in accordance with the requirements of this section and the manufacturer's instructions. Air admittance valves shall be installed after the DWV testing required by Section 312.2 or 312.3 has been performed.

151

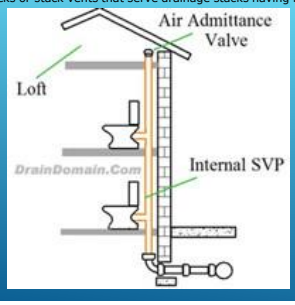
918.3 **Where permitted.** Individual, branch and circuit vents shall be permitted to terminate with a connection to an individual or branch-type air admittance valve in accordance with Section 918.3.1. Stack vents and vent stacks shall be permitted to terminate to stack-type air admittance valves in accordance with Section 918.3.2

152

918.3.1 **Horizontal branches.** Individual and branch-type air admittance valves shall vent only fixtures that are on the same floor level and connect to a **horizontal branch drain**. Where the horizontal branch is located more than four branch intervals from the top of the stack, the horizontal branch shall be provided with a relief vent that shall connect to a vent stack or stack vent, or extend outdoors to the open air. The relief vent shall connect to the horizontal branch drain between the stack and the most downstream fixture drain connected to the horizontal branch drain. The relief vent shall be sized in accordance with Section 906.2 and installed in accordance with Section 905. The relief vent shall be permitted to serve as the vent for other fixtures.

153

918.3.2 **Stack.** Stack-type air admittance valves shall be prohibited from serving as the vent terminal for vent stacks or stack vents that serve drainage stacks having more than six branch intervals



154

918.4 **Location.** Individual and branch-type air admittance valves shall be located a minimum of 4 inches (102 mm) above the horizontal branch drain or fixture drain being vented. Stack-type air admittance valves shall be located not less than 6 inches (152 mm) above the flood level rim of the highest fixture being vented. The air admittance valve shall be located within the maximum developed length permitted for the vent. The air admittance valve shall be installed not less than 6 inches (152 mm) above insulation materials.

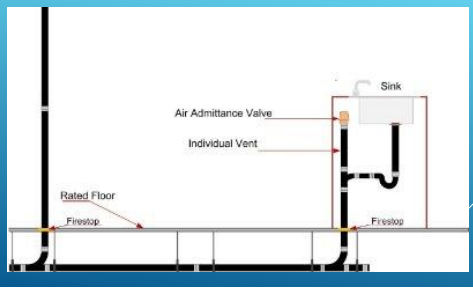
155

918.5 **Access and ventilation.** Access shall be provided to all air admittance valves. Such valves shall be installed in a location that allows air to enter the valve.

918.6 **Size.** The air admittance valve shall be rated in accordance with the standard for the size of the vent to which the valve is connected.

156

918.7 **Vent required.** Within each plumbing system, not less than one stack vent or vent stack shall extend outdoors to the open air.



157

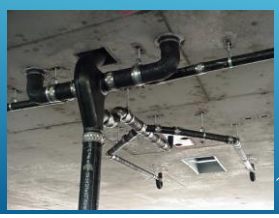
918.8 **Prohibited installations.** Air admittance valves shall not be installed in nonneutralized special waste systems as described in Chapter 8 except where such valves are in compliance with ASSE 1049, are constructed of materials approved in accordance with Section 702.5 and are tested for chemical resistance in accordance with ASTM F 1412. Air admittance valves shall not be located in spaces utilized as supply or return air plenums *or where limited by the manufacturer's installation instructions*. Air admittance valves without an engineered design shall not be utilized to vent sumps or tanks of any type.

158

SECTION 919
ENGINEERED VENT SYSTEMS

919.1 **General.** Engineered vent systems shall comply with this section and the design, submittal, approval, inspection and testing requirements of Section *106.5 of the building code*.

919.2 **Individual branch fixture and individual fixture header vents.** The maximum developed length of individual fixture vents to vent branches and vent headers shall be determined in accordance with Table 919.2 for the minimum pipe diameters at the indicated vent airflow rates. The individual vent airflow rate shall be determined in accordance with the following:



159

SECTION 1001
GENERAL

1001.1 Scope. This chapter shall govern the material and installation of traps, interceptors and separators *when installed inside a building and not on the building sewer. The rules of the "Ohio Environmental Protection Agency" may also govern the design and installation of pretreatment devices such as traps, interceptors, and separators*

160

SECTION 1002
TRAP REQUIREMENTS

1002.1 Fixture traps. Each plumbing fixture shall be separately trapped by a liquid-seal trap, except as otherwise permitted by this code. The vertical distance from the fixture outlet to the trap weir shall not exceed 24 inches (610 mm), and the horizontal distance shall not exceed 30 inches (610 mm) measured from the centerline of the fixture outlet to the centerline of the inlet of the trap. The height of a clothes washer standpipe above a trap shall conform to Section 802.4. A fixture shall not be double trapped.

161

Exceptions:
1. This section shall not apply to fixtures with integral traps.
2. A combination plumbing fixture is permitted to be installed on one trap, provided that one compartment is not more than 6 inches (152 mm) deeper than the other compartment and the waste outlets are not more than 30 inches (762 mm) apart.
3. A grease interceptor intended to serve as a fixture trap in accordance with the manufacturer's installation instructions shall be permitted to serve as the trap for a single fixture or a combination sink of not more than three compartments where the vertical distance from the fixture outlet to the inlet of the interceptor does not exceed 30 inches (762 mm) and the developed length of the waste pipe from the most upstream fixture outlet to the inlet of the interceptor does not exceed 60 inches (1524 mm).

162

1002.2 Design of traps. Fixture traps shall be self-scouring. Fixture traps shall not have interior partitions, except where such traps are integral with the fixture or where such traps are constructed of an approved material that is resistant to corrosion and degradation. Slip joints shall be made with an approved elastomeric gasket and shall be installed only on the trap inlet, trap outlet and within the trap seal

163

1002.3 Prohibited traps. The following types of traps are prohibited:
1. Traps that depend on moving parts to maintain the seal.
2. Bell traps.
3. Crown-vented traps.

164

4. Traps not integral with a fixture and that depend on interior partitions for the seal, except those traps constructed of an approved material that is resistant to corrosion and degradation.
5. "S" traps.
6. Drum traps.

Exception: Drum traps used as solids interceptors and drum traps serving chemical waste systems shall not be prohibited

165

1002.4 Trap seals. Each fixture trap shall have a liquid seal of not less than 2 inches (51 mm**)** and not more than 4 inches (102 mm), or deeper for special designs relating to accessible fixtures. Where a trap seal is subject to loss by evaporation, a trap seal primer valve shall be installed. Trap seal primer valves shall connect to the trap at a point above the level of the trap seal. A trap seal primer valve shall conform to ASSE 1018 or ASSE 1044

166

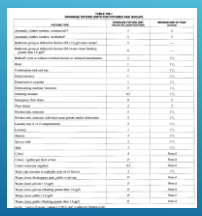
Exception: *Where a fixture trap is supplied with water on a regular basis, a trap seal primer valve shall not be required*

167

ASSE 1072

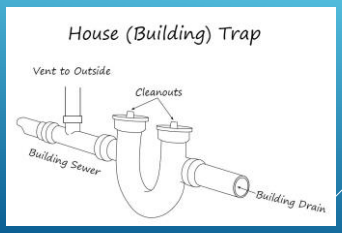
168

1002.5 Size of fixture traps. Fixture trap size shall be sufficient to drain the fixture rapidly and not less than the size indicated in Table 709.1. A trap shall not be larger than the drainage pipe into which the trap discharges



169

1002.6 Building traps. Building (house) traps shall be prohibited, except where local conditions necessitate such traps. Building traps shall be provided with a cleanout and a relief vent or fresh air intake on the inlet side of the trap. The size of the relief vent or fresh air intake shall not be less than one-half the diameter of the drain to which the relief vent or air intake connects. Such relief vent or fresh air intake shall be carried above grade and shall be terminated in a screened outlet located outside the building



170

1002.7 Trap setting and protection. Traps shall be set level with respect to the trap seal and, where necessary, shall be protected from freezing

171

1002.8 Recess for trap connection. A recess provided for connection of the underground trap, such as one serving a bathtub in slab-type construction, shall have sides and a bottom of corrosion-resistant, insect- and vermin proof construction

172

1002.9 Acid-resisting traps. Where a vitrified clay or other brittleware, acid-resisting trap is installed underground, such trap shall be embedded in concrete extending 6 inches (152 mm) beyond the bottom and sides of the trap.

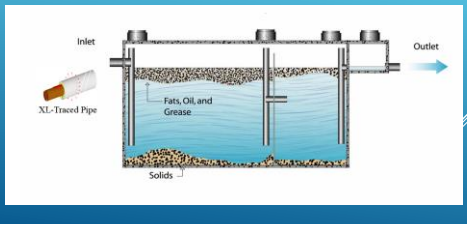
173

1002.10 Plumbing in mental health centers. In mental health centers, pipes and traps shall not be exposed.

174

SECTION 1003
INTERCEPTORS AND SEPARATORS

1003.1 Where required. *Where required by the local sewer purveyor or as otherwise required in this section, interceptors and separators shall be provided to prevent the discharge of oil,* grease, sand and other substances harmful or hazardous to the building drainage system, the public sewer, the private sewage disposal system or the sewage treatment plant or processes



175

1003.1.1 Industrial processes, meat packing and food processing facilities. *Wastes from industrial processes, meat packing and food processing facilities and similar processing plants shall be drained in accordance with the rules of the "Ohio Environmental Protection Agency", or the authority in charge of the sewerage system into which the wastes are to be discharged. (See sections 6111.44 and 6111.45 of the Revised Code.)*

176

1003.2 Approval. The size, type and location of each interceptor and of each separator shall be designed and installed in accordance with the manufacturer's instructions and the requirements of this section based on the anticipated conditions of use. Wastes that do not require treatment or separation shall not be discharged into any interceptor or separator

177

1003.3.1 Grease interceptors and automatic grease removal devices required. A grease interceptor or automatic grease removal device shall be required to receive the drainage from fixtures and equipment with grease-laden waste located in food preparation areas, such as in restaurants, hotel kitchens, hospitals, school kitchens, bars, factory cafeterias and clubs. Fixtures and equipment shall include pot sinks, prerinse sinks; soup kettles or similar devices; wok stations; floor drains or sinks into which kettles are drained; automatic hood wash units and dishwashers without prerinse sinks. Grease interceptors and automatic grease removal devices shall receive waste only from fixtures and equipment that allow fats, oils or grease to be discharged

178

1003.3.2 Food waste grinders. Where food waste grinders connect to grease interceptors, a solids interceptor shall separate the discharge before connecting to the grease interceptor. Solids interceptors and grease interceptors shall be sized and rated for the discharge of the food waste grinder. Emulsifiers, chemicals, enzymes and bacteria shall not discharge into the food waste grinder

179

1003.3.3 Grease interceptors and automatic grease removal devices not required. A grease interceptor or an automatic grease removal device shall not be required for individual dwelling units or any private living quarters

180

1003.3.4 Grease interceptors and automatic grease removal devices. Grease interceptors and automatic grease removal devices shall be sized in accordance with PDI G101, ASME A112.14.3 Appendix A, or ASME A112.14.4. Grease interceptors and automatic grease removal devices shall be designed and tested in accordance with PDI G101, ASME A112.14.3 or ASME A112.14.4. Grease interceptors and automatic grease removal devices shall be installed in accordance with the manufacturer's instructions.
Exception: Interceptors that have a volume of not less than 500 gallons (1893 L) and that are located outdoors shall not be required to meet the requirements of this section

181

1003.3.4.1 Grease interceptor capacity. Grease interceptors shall have the grease retention capacity indicated in Table 1003.3.4.1 for the flow-through rates indicated
1003.3.4.2 Rate of flow controls. Grease interceptors shall be equipped with devices to control the rate of water flow so that the water flow does not exceed the rated flow. The flow-control device shall be vented and terminate not less than 6 inches (152 mm) above the flood rim level or be installed in accordance with the manufacturer's instructions

TABLE 1003.3.4.1
CAPACITY OF GREASE INTERCEPTORS[a]

TOTAL FLOW THROUGH RATING (gpm)	GREASE RETENTION CAPACITY (pounds)
4	8
6	12
7	14
9	18
10	20
11	22
14	28
15	30
18	36
21	42
25	50
35	70
50	100
75	150
100	200

182

1003.3.5 Automatic grease removal devices. Where automatic grease removal devices are installed, such devices shall be located downstream of each fixture or multiple fixtures in accordance with the manufacturer's instructions. The automatic grease removal device shall be sized to pretreat the measured or calculated flows for all connected fixtures or equipment. **Ready access shall** be provided for inspection and maintenance

183

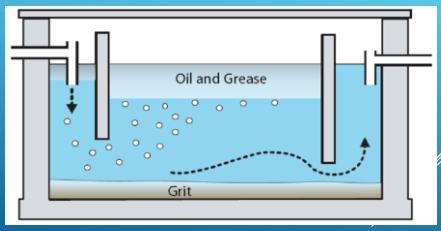
1003.4 Oil separators required. At repair garages, car-washing facilities, and at factories where oily and flammable liquid wastes are produced, separators shall be installed into which all oilbearing, grease-bearing or flammable wastes shall be discharged before emptying into the building drainage system or other point of disposal

184

1003.4.1 Separation of liquids. A mixture of treated or untreated light and heavy liquids with various specific gravities shall be separated in an approved receptacle

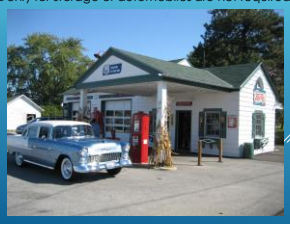
185

1003.4.2.1 General design requirements. Oil separators shall have a depth of not less than 2 feet (610 mm) below the invert of the discharge drain. The outlet opening of the separator shall have not less than an 18-inch (457 mm) water seal



186

1003.4.2.2 Garages and service stations. Where automobiles are serviced, greased, repaired or washed or where gasoline is dispensed, oil separators shall have a minimum capacity of 6 cubic feet (0.168 m3) for the first 100 square feet (9.3 m2) of area to be drained, plus 1 cubic foot (0.28 m3) for each additional 100 square feet (9.3 m2) of area to be drained into the separator. Parking garages in which servicing, repairing or washing is not conducted, and in which gasoline is not dispensed, shall not require a separator. Areas of commercial garages utilized only for storage of automobiles are not required to be drained through a separator



187

1003.5 Sand interceptors in commercial establishments. Sand and similar interceptors for heavy solids shall be designed and located so as to be provided with ready access for cleaning, and shall have a water seal of not less than 6 inches (152 mm).

188

1003.6 Laundries. Laundry facilities not installed within an individual dwelling unit or intended for individual family use shall be equipped with an interceptor with a wire basket or similar device, removable for cleaning, that prevents passage into the drainage system of solids 1/**2 inch** (12.7 mm) or larger in size, string, rags, buttons or other materials detrimental to the public sewage system.

189

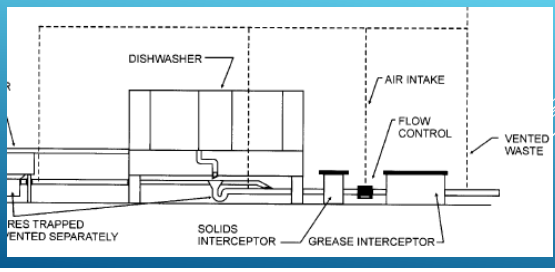
1003.7 Bottling establishments. Bottling plants shall discharge process wastes into an interceptor that will provide for the separation of broken glass or other solids before discharging waste into the drainage system.

190

1003.8 Slaughterhouses. Slaughtering room and dressing room drains shall be equipped with approved separators. The separator shall prevent the discharge into the drainage system of feathers, entrails and other materials that cause clogging

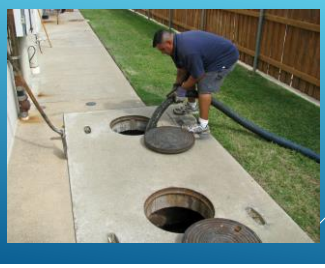
191

1003.9 Venting of interceptors and separators. Interceptors and separators shall be designed so as not to become air bound where tight covers are utilized. Each interceptor or separator shall be vented where subject to a loss of trap seal.



192

1003.10 Access and maintenance of interceptors and separators. Access shall be provided to each interceptor and separator for service and maintenance. Interceptors and separators shall be maintained by periodic removal of accumulated grease, scum, oil, or other floating substances and solids deposited in the interceptor or separator



193

SECTION 1004
MATERIALS, JOINTS AND CONNECTIONS

1004.1 General. The materials and methods utilized for the construction and installation of traps, interceptors and separators shall comply with this chapter and the applicable provisions of Chapters 4 and 7. The fittings shall not have ledges, shoulders or reductions capable of retarding or obstructing flow of the piping.

194

File Attachments for Item:

EC-7 Preparing for the 2024-26 Code Cycle (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *	Organization	Email *	Phone Number *
Laura Morris	International Code Council	lmorris@iccsafe.org	(888) 422-7233

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

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

☐ Check here if Course Renewal

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

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

New Course Information

Course title

Preparing for the 2024 - 2026 Code Development Cycle

Course instructor

Russ Manning

Course description

Join the ICC Technical Services team and building safety professionals as they dive into the code development process that helps create the codes and standards that safeguard and strengthen our communities. Hear from experts as they give an overview of the process, discuss what's changing in 2024-2026, learn how to get involved, and understand the importance of staying informed on code

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

Special Content

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

Conference Course	Conference Name	Conference location

Course to be offered online?

- ☐ Yes
- ☑ No

☐ On Demand ☐ Webinar

Course Website

266

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

Course applicable for the following certifications *

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

Application materials included *

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

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

File Name	Size
Preparing for the 2024 -2026.pdf	549.27 kB

Applicant Full Name *

Laura Morris

Date of Submission

09/01/2023

Instructions for new Continuing Education Approval form

Provider Information

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

Course Renewal

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

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

New Course Information

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

Special Content

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

Title: Preparing for the 2024 – 2026 Code Development Cycle

Join the ICC Technical Services team and building safety professionals as they dive into the code development process that helps create the codes and standards that safeguard and strengthen our communities. Hear from experts as they give an overview of the process, discuss what's changing in 2024-2026, learn how to get involved, and understand the importance of staying informed on code initiatives.

Objectives

1. Identify & understand upcoming changes in the Codes Development Process.
2. Identify & understand upcoming changes in the Standards Development Process.
3. Identify & understand upcoming changes in the Guide Development Process.
4. Articulate the methods of involvement to influence each process.

Outline: 90 minutes / 1.5 hrs.

1. Primary Topic Delivery
    1. Codes Development Process, 20 minutes
    2. Standards Development Process, 10 minutes
    3. Guide Development Process, 10 minutes
    4. Methods of Involvement, 10 minutes
    5. Question & Answer session, 10 minutes

2. Small Group Rotating Breakout Sessions
    1. Codes Development Process, 10 minutes
    2. Standards Development Process, 10 minutes
    3. Guide Development Process, 10 minutes

Russ Manning Bio for ICC purposes

Dr. Russ Manning is the Senior Vice President for Technical Services at ICC. His team focusses on code, standard and guideline development at the Code Council. Russ has over 25 years working the AEC+OM industry across the facilities life cycle with an emphasis in healthcare, research laboratory, and academia for planning, programming, design and construction project and program management, and facility operation and maintenance. He has served in roles as a project and program manager, virtual design and construction (VDC) engineer, and executive roles in the Department of Defense Defense Health Agency (DoD DHA) facilities division and Kaiser Permanente National Facility Services (NFS). Russ graduated from the Pennsylvania State University with a bachelor's degree in Architectural Engineering focused on mechanical systems, and a Doctorate in Architectural Engineering focusing on acquisition strategies related to the healthcare market sector. Russ also serves on the National Institute of Building Sciences (NIBS) board of directors.

He lives in the Denver area with his wife and four children. Russ Manning | LinkedIn

ICC INTERNATIONAL CODE COUNCIL®

Discussion of Codes, Standards, and Guides

Highlighting the 2024-2026 Code Development Process

April 30, 2023

1

ICC Code Development Committees (CDC)

Your participation matters!

Next 3-Year Cycle Applications Open **March – 1 June 2023**

2

2

Codes Development Discussion
- Panel Discussion
- Q&A Session

Standards Development Discussion
- Panel Discussion
- Q&A Session

Guide Development Discussion
- Panel Discussion
- Q&A Session

Closing Remarks

Agenda

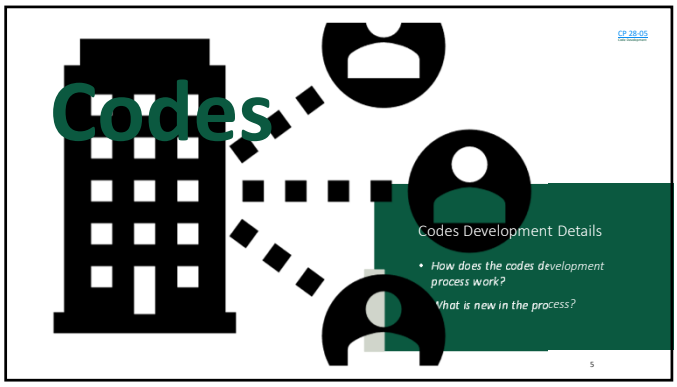
3

3

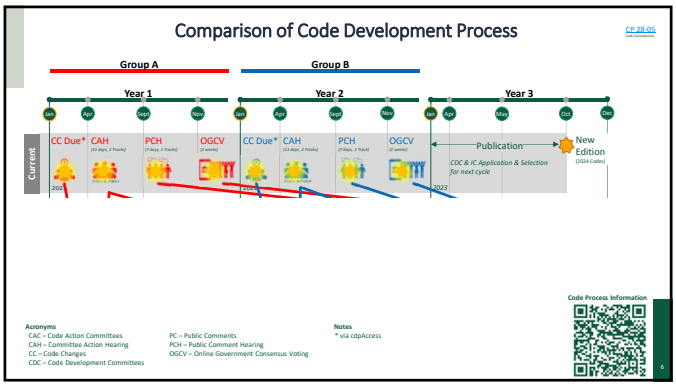
Got a Question?

4

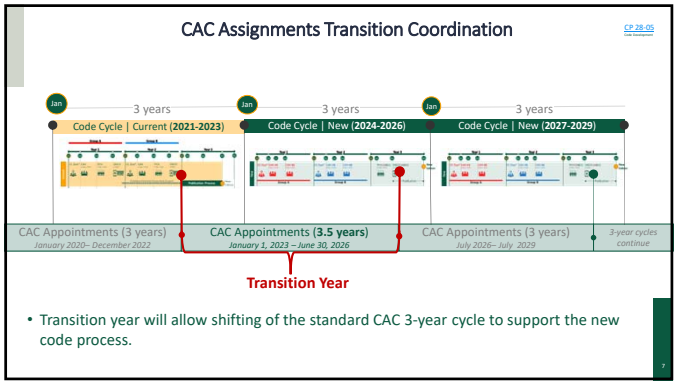
4


CP 28-05
Codes
Codes Development Details
• How does the codes development process work?
• What is new in the process?
5

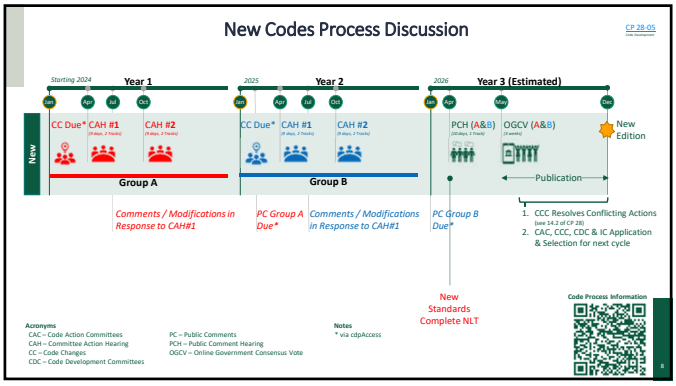
5


Comparison of Code Development Process
CP 28-05
Group A
Group B
Year 1
Year 2
Year 3
Current
CC Due*
CAH
PCH
OGCV
Publication
New Edition
CDC & IC Application & Selection for next cycle
Acronyms
CAC – Code Action Committees
CAH – Committee Action Hearing
CC – Code Changes
CDC – Code Development Committees
PC – Public Comments
PCH – Public Comment Hearing
OGCV – Online Government Consensus Voting
Notes
* via cdpAccess
Code Process Information
6

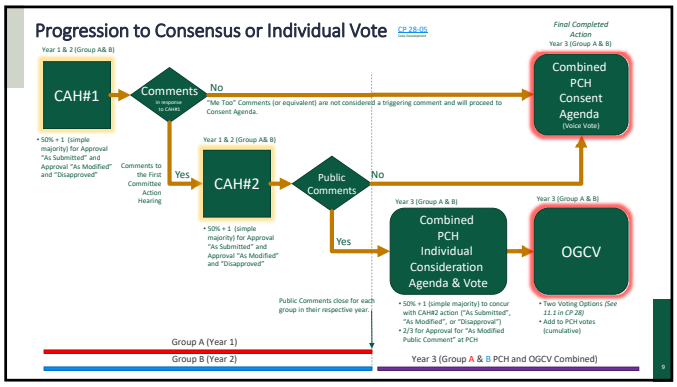
6


CAC Assignments Transition Coordination
CP 28-05
3 years
Code Cycle | Current (2021-2023)
Code Cycle | New (2024-2026)
Code Cycle | New (2027-2029)
CAC Appointments (3 years)
January 2020– December 2022
CAC Appointments (3.5 years)
January 1, 2023 – June 30, 2026
CAC Appointments (3 years)
July 2026– July 2029
3-year cycles continue
Transition Year
• Transition year will allow shifting of the standard CAC 3-year cycle to support the new code process.
7

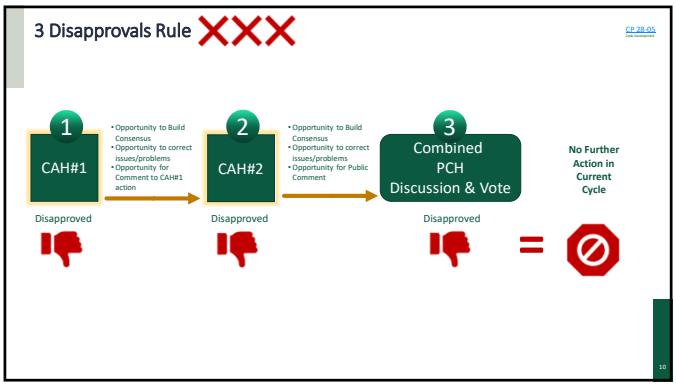
7


New Codes Process Discussion
CP 28-05
Starting 2024
2025
2026
Year 1
Year 2
Year 3 (Estimated)
New
CC Due*
CAH #1
CAH #2
PCH (A&B)
OGCV (A&B)
New Edition
Publication
Group A
Group B
Comments / Modifications in Response to CAH#1
PC Group A Due*
Comments / Modifications in Response to CAH#1
PC Group B Due*
1. CCC Resolves Conflicting Actions (see 14.2 of CP 28)
2. CAC, CCC, CDC & IC Application & Selection for next cycle
New Standards Complete NLT
Acronyms
CAC – Code Action Committees
CAH – Committee Action Hearing
CC – Code Changes
CDC – Code Development Committees
PC – Public Comments
PCH – Public Comment Hearing
OGCV – Online Government Consensus Vote
Notes
* via cdpAccess
Code Process Information
8

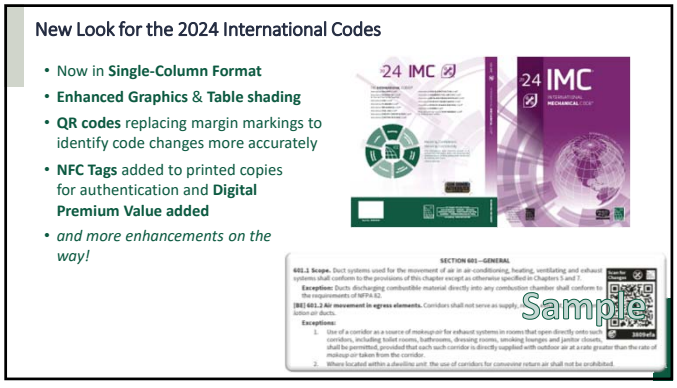
8


Progression to Consensus or Individual Vote
CP 28-05
Final Completed Action
Year 3 (Group A & B)
Year 1 & 2 (Group A& B)
CAH#1
Comments
(in response to CAH#1)
No
"Me Too" Comments (or equivalent) are not considered a triggering comment and will proceed to Consent Agenda.
Combined PCH Consent Agenda
(Voice Vote)
• 50% + 1 (simple majority) for Approval "As Submitted" and Approval "As Modified" and "Disapproved"
Comments to the First Committee Action Hearing
Yes
Year 1 & 2 (Group A& B)
CAH#2
Public Comments
No
Year 3 (Group A & B)
Year 3 (Group A & B)
• 50% + 1 (simple majority) for Approval "As Submitted" and Approval "As Modified" and "Disapproved"
Yes
Combined PCH Individual Consideration Agenda & Vote
OGCV
Public Comments close for each group in their respective year
• 50% + 1 (simple majority) to concur with CAH#2 action ("As Submitted", "As Modified", or "Disapproval")
• 2/3 for Approval for "As Modified Public Comment" at PCH
• Two Voting Options (See 11.1 in CP 28)
• Add to PCH votes (cumulative)
Group A (Year 1)
Group B (Year 2)
Year 3 (Group A & B PCH and OGCV Combined)
9

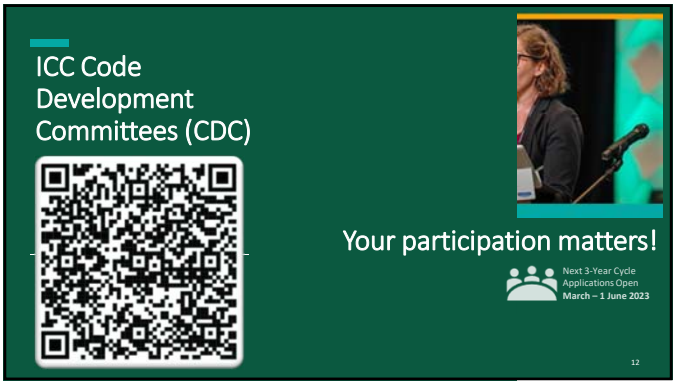
9


3 Disapprovals Rule XXX
CP 28-05
1
CAH#1
• Opportunity to Build Consensus
• Opportunity to correct issues/problems
• Opportunity for Comment to CAH#1 action
2
CAH#2
• Opportunity to Build Consensus
• Opportunity to correct issues/problems
• Opportunity for Public Comment
3
Combined PCH Discussion & Vote
No Further Action in Current Cycle
Disapproved
Disapproved
Disapproved
=
10

10

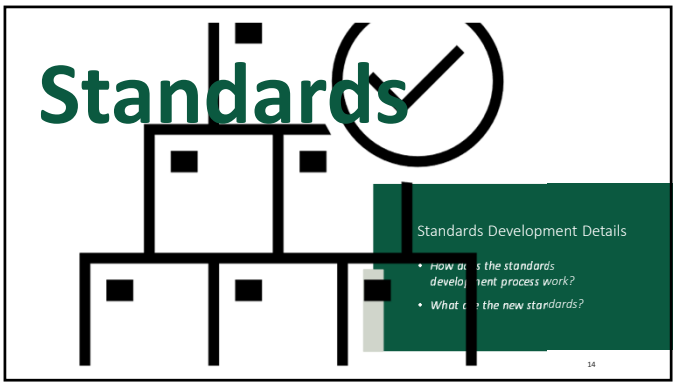

New Look for the 2024 International Codes
• Now in Single-Column Format
• Enhanced Graphics & Table shading
• QR codes replacing margin markings to identify code changes more accurately
• NFC Tags added to printed copies for authentication and Digital Premium Value added
• and more enhancements on the way!
24 IMC
24 IMC
SECTION 601—GENERAL
Sample

11


ICC Code Development Committees (CDC)
Your participation matters!
Next 3-Year Cycle Applications Open
March – 1 June 2023
12

12

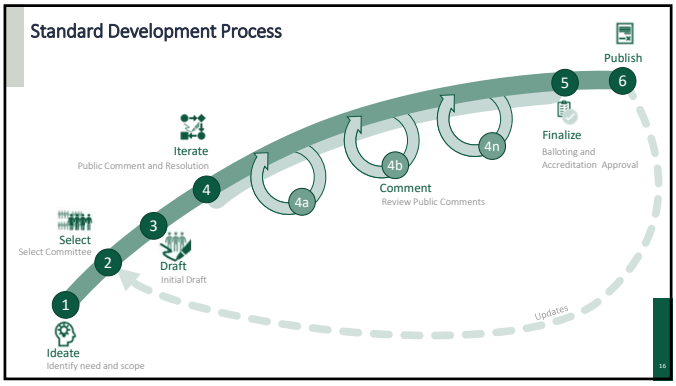
13



14

Standards Video

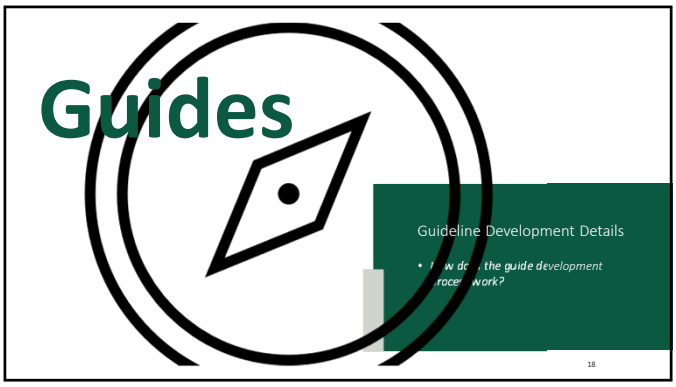
15



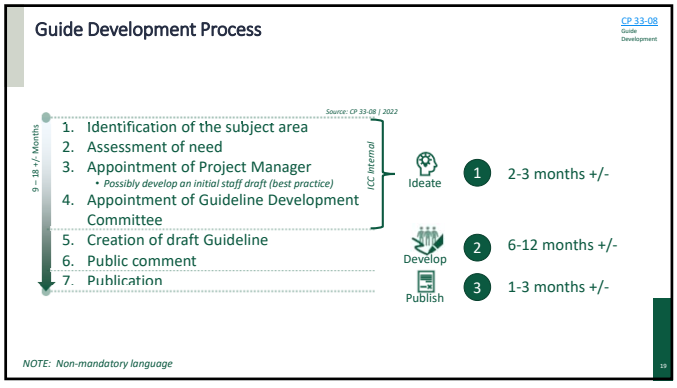
16


Got a Question?
17

17


Guides
Guideline Development Details
18

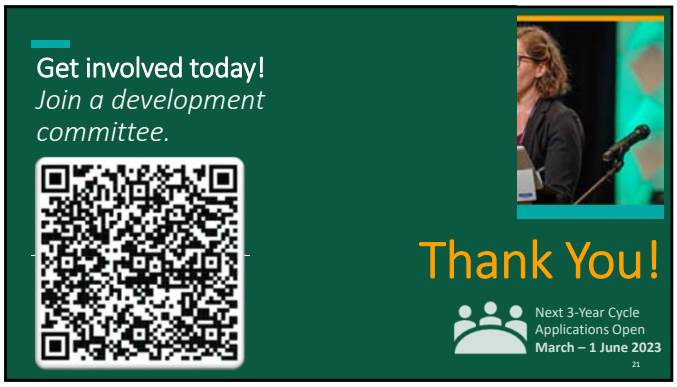
18


Guide Development Process
CP 33-08
Source: CP 33-08 | 2022
9 – 18 +/- Months
1. Identification of the subject area
2. Assessment of need
3. Appointment of Project Manager
• Possibly develop an initial staff draft (best practice)
4. Appointment of Guideline Development Committee
5. Creation of draft Guideline
6. Public comment
7. Publication
ICC Internal
Ideate
Develop
Publish
1 2-3 months +/-
2 6-12 months +/-
3 1-3 months +/-
NOTE: Non-mandatory language

19


Got a Question?
20

20


Get involved today!
Join a development committee.
Thank You!
Next 3-Year Cycle Applications Open
March – 1 June 2023
21

21

File Attachments for Item:

EC-8 Quick Hits on Emerging Building Safety Topics (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

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

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

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

☐ Check here if Course Renewal

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

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

New Course Information

Course title

Quick Hits on Emerging Building Safety Topics

Course instructor

Lesley Garland

Course description

Building safety professionals are increasingly at the forefront of policy ini a ves and technological advances. This session will feature short, quick-hit discussions on emerging issues, including the growing prevalence of lithium-ion bateries and associated safety considera ons, tackling environmental risks facing aging infrastructure and, given a sharp up ck in prefabricated construc on, best prac ces for modular construc on programs. Discussions will also be held on rebu ng legisla ve efforts to limit the voice of code professionals in building code updates along with successful effort to strengthen codes statewide. With billions in federal funding available from FEMA, DOE, and HUD to support the adop on and implementa on of energy efficient and resilient building codes, this session will conclude with small group breakout sessions with agency representa ves to discuss available resources and how best to access them.

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

Special Content

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

Conference Course	Conference Name	Conference location

- [ ] Plumbing Instruction

Course to be offered online?

- [ ] Yes
- [x] No

- [ ] On Demand
- [ ] Webinar

Course Website

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

Course applicable for the following certifications *

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

Application materials included *

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

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

File Name	Size
Quick hits.pdf	4.79 MB

Applicant Full Name *

Laura Morris

Date of Submission

09/01/2023

Instructions for new Continuing Education Approval form

Provider Information

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

Course Renewal

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

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

New Course Information

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

Special Content

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

Quick Hits on Emerging Building Safety Topics

Description: Building safety professionals are increasingly at the forefront of policy initiatives and technological advances. This session will feature short, quick-hit discussions on emerging issues, including the growing prevalence of lithium-ion batteries and associated safety considerations, tackling environmental risks facing aging infrastructure and, given a sharp uptick in prefabricated construction, best practices for modular construction programs. Discussions will also be held on rebutting legislative efforts to limit the voice of code professionals in building code updates along with successful effort to strengthen codes statewide. With billions in federal funding available from FEMA, DOE, and HUD to support the adoption and implementation of energy efficient and resilient building codes, this session will conclude with small group breakout sessions with agency representatives to discuss available resources and how best to access them.

Learning objectives:

1) Provide an overview of the FL Reinspection of Existing Building Program and the ICC Existing Building Guideline effort.
2) Describe the various types of off-site construction, approaches to compliance, and the role of codes and standards in facilitating off-site construction's effective use.
3) Discuss safety concerns around lithium-ion batteries experiencing thermal runaway and deflagration events and how current codes and standards address these issues.
4) Communicate the legislative opportunities and challenges associated with advancing building code adoptions.
5) Address developing actions regarding extreme heat and opportunities to share knowledge on best practices in developing and enforcing minimum cooling requirements.
6) Highlight code-related federal grant opportunities to increase community resilience, safety, and sustainability.

Timed Outline:

Welcome and Introductions	5 min
Segment 1 – Existing Buildings	20 min
Segment 2 – Off-Site Construction	20 min
Segment 3 - Batteries and Energy Storage Systems	20 min
Segment 4 – Legislative Opportunities and Challenges	20 min
Segment 5 – Addressing Extreme Heat in Codes and Standards	20 min
Segment 6 – Federal Funding Forum	
5a – IIJA/IRA Energy Codes Funding	25 min
5b – BRIC	25 min
5c - CDBG-DR/MIT	25 min
Q&A Breakouts with federal guests	
Total	**180**

Lesley Brown Garland is Vice President, State and Local Relations for the International Code Council, where she manages a team of state government affairs managers across the country. Prior to joining ICC, Lesley served as Senior Vice President, State Affairs for the National Propane Gas Association in Washington, DC, where she revitalized the association's state government relations program and coordinated activities with 38 affiliated industry state and regional associations. From 2006-2014, she was president and CEO of the Western Propane Gas Association in Sacramento, CA. She also served as Editorial and Publications Manager of the Propane Education & Research Council, Director of Communication of the Truck Renting and Leasing Association, and was an award-winning newspaper reporter and magazine editor. She is a graduate of the University of Alabama.

Lithium-ion Batteries and Energy Storage Systems

ICC Board of Directors Meeting

Tampa, FL | April 29, 2023

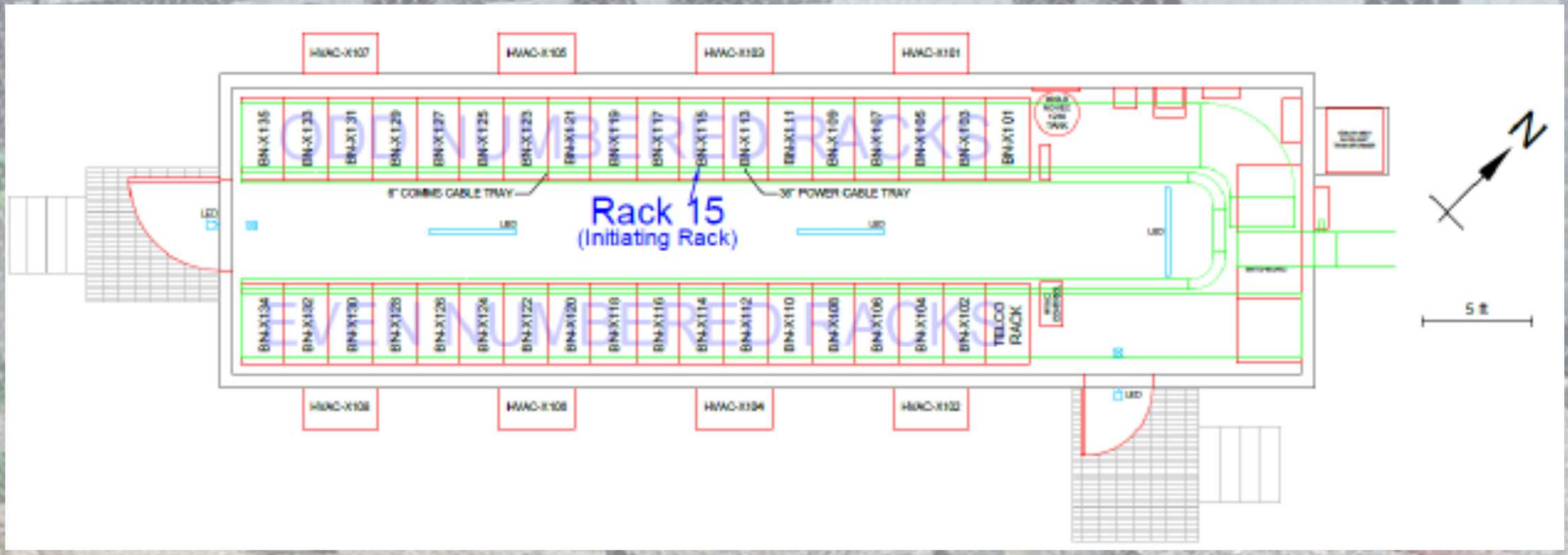
Background

- Fire departments are experiencing increased demands for emergency response originating from lithium-ion batteries
  - Use, storage, transportation, recycle
- Building code and fire prevention officials are receiving inquiries about code requirements in new and existing buildings
- Current codes and standards have just begun to address lithium-ion batteries and energy storage systems
- Significant safety concerns around lithium-ion batteries experiencing thermal runaway and deflagration events

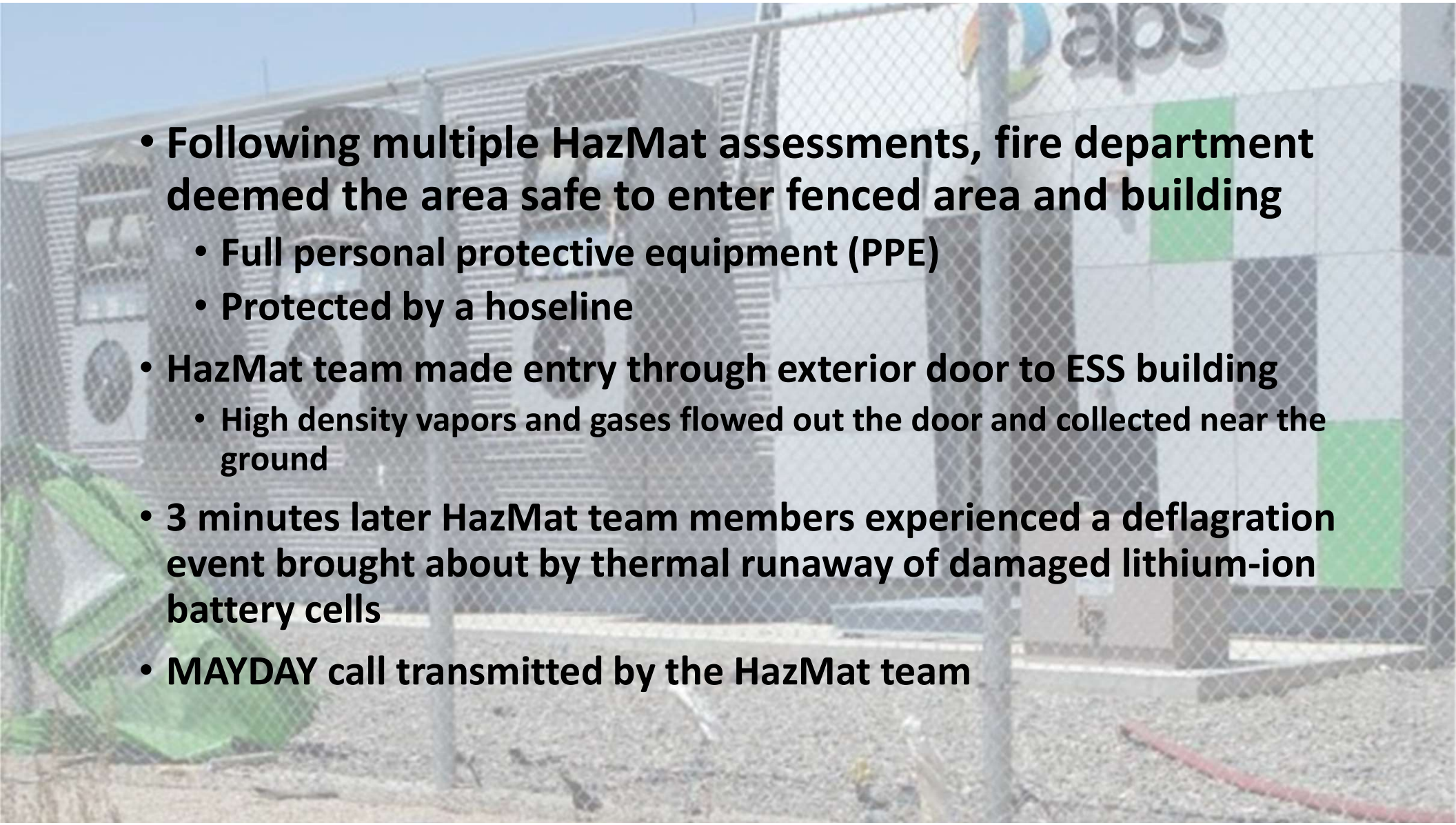
Lithium-ion Batteries and Energy Storage Systems

ESS Incident (L-ion Battery)
Surprise, AZ
April 19, 2019

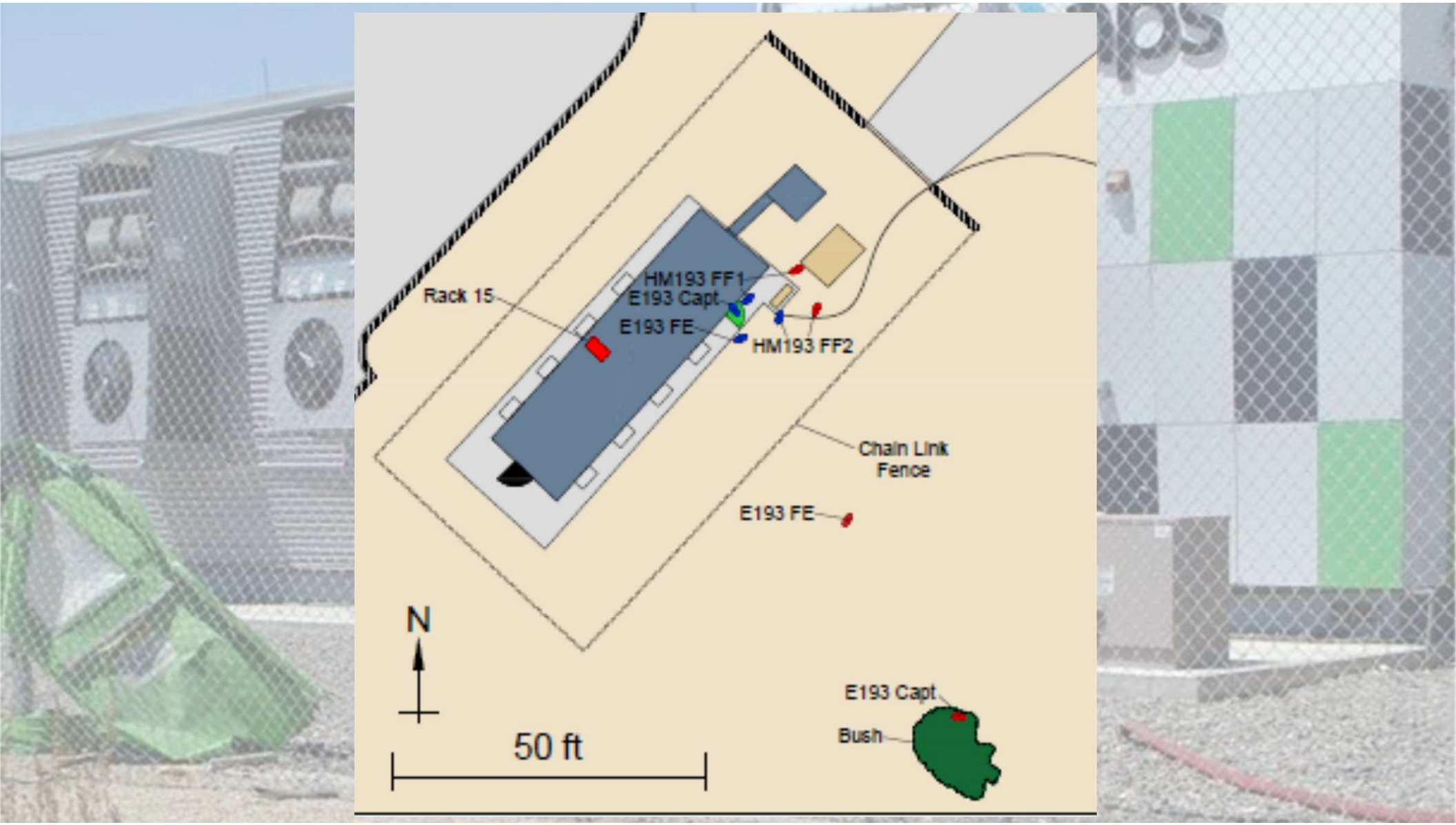
- **2 MW/2.16 MWh Lithium-Ion Battery ESS**
  - **Average home in AZ consumes 1 MWh/month**
- **27 racks of lithium-ion battery modules**
  - **14 modules per rack | 28 lithium-ion NMC cells per module**
  - **10,584 total individual cells**



- Fire department initially dispatched for a smoke alarm activation
  - All circuit breakers and contacts opened
  - Fire suppression system discharged
- Fire department upgraded incident to hazardous materials assignment after performing initial assessment
  - HazMat team monitored air around perimter for hydrogen cyanide (HCN) and carbon monoxide (CO) concentrations



- Following multiple HazMat assessments, fire department deemed the area safe to enter fenced area and building
  - Full personal protective equipment (PPE)
  - Protected by a hoseline
- HazMat team made entry through exterior door to ESS building
  - High density vapors and gases flowed out the door and collected near the ground
- 3 minutes later HazMat team members experienced a deflagration event brought about by thermal runaway of damaged lithium-ion battery cells
- MAYDAY call transmitted by the HazMat team


HM193 FF1
E193 Capt
Rack 15
E193 FE
HM193 FF2
Chain Link
Fence
E193 FE
N
50 ft
E193 Capt
Bush

Summary

- **E193 Capt suffered a traumatic brain injury, an eye injury, spine damage, broken ribs, a broken scapula, thermal and chemical burns, internal bleeding, two broken ankles, and a broken foot**
- **E193 FE suffered a traumatic brain injury, a collapsed lung, broken ribs, a broken leg, a separated shoulder, laceration of the liver, thermal and chemical burns, a missing tooth, and facial lacerations**
- **HM193 FF1 suffered an injured Achilles tendon, a fractured patella, a broken leg, nerve damage in his leg, spine damage, thermal burns, tooth damage, and facial lacerations**
- **HM193 FF2 suffered facial lacerations**

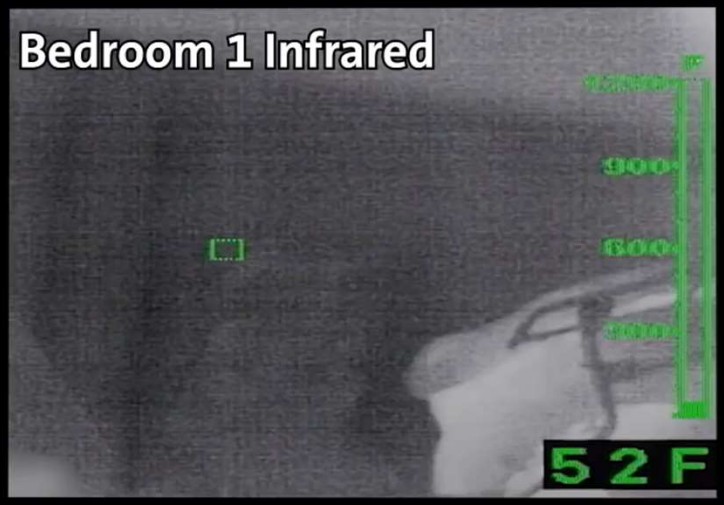
Lithium-ion Batteries and Micromobility Devices

Intentional E-Scooter Overcharge: Closed Bedroom

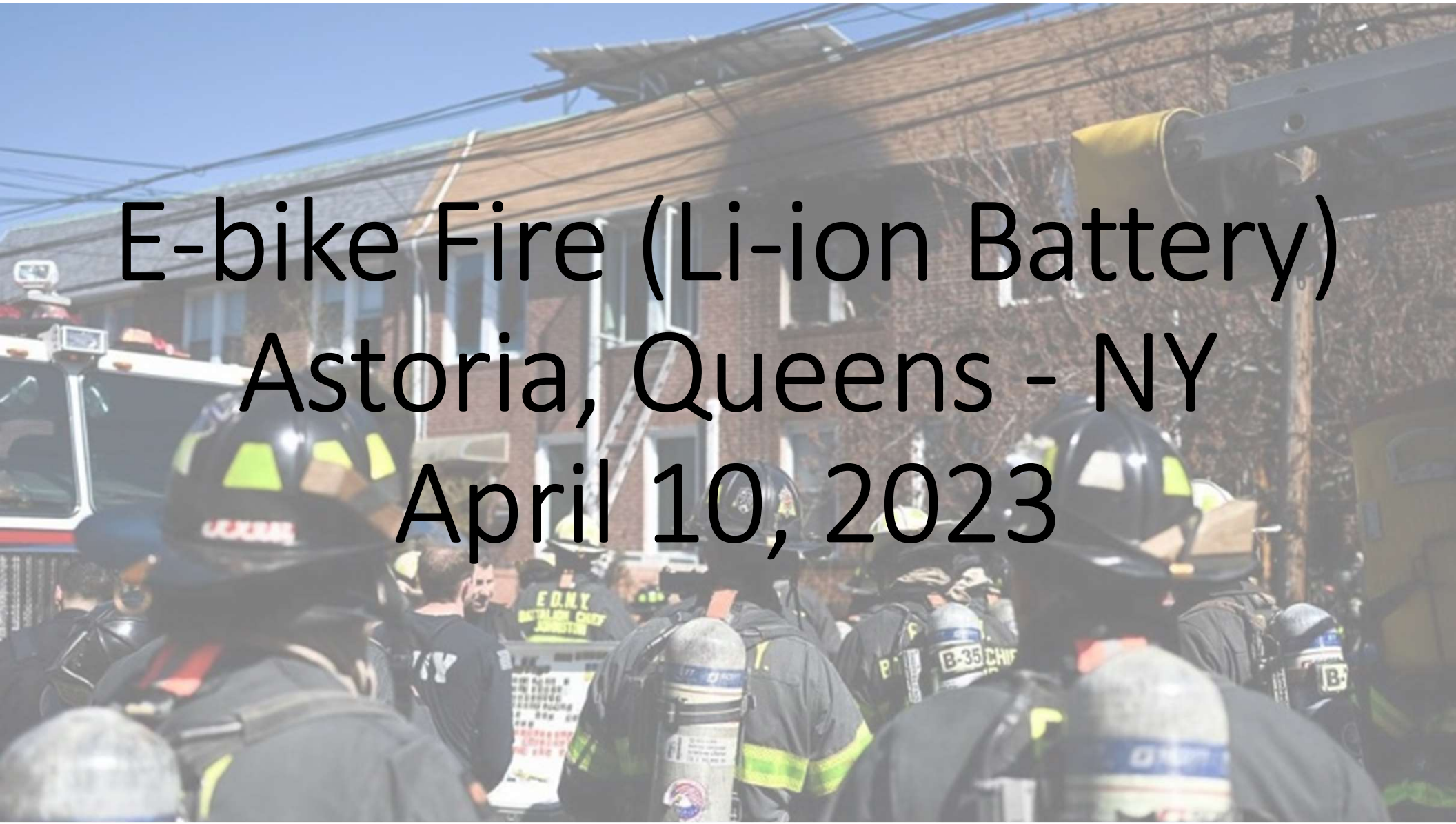
Overcharge Time:

01:43:00

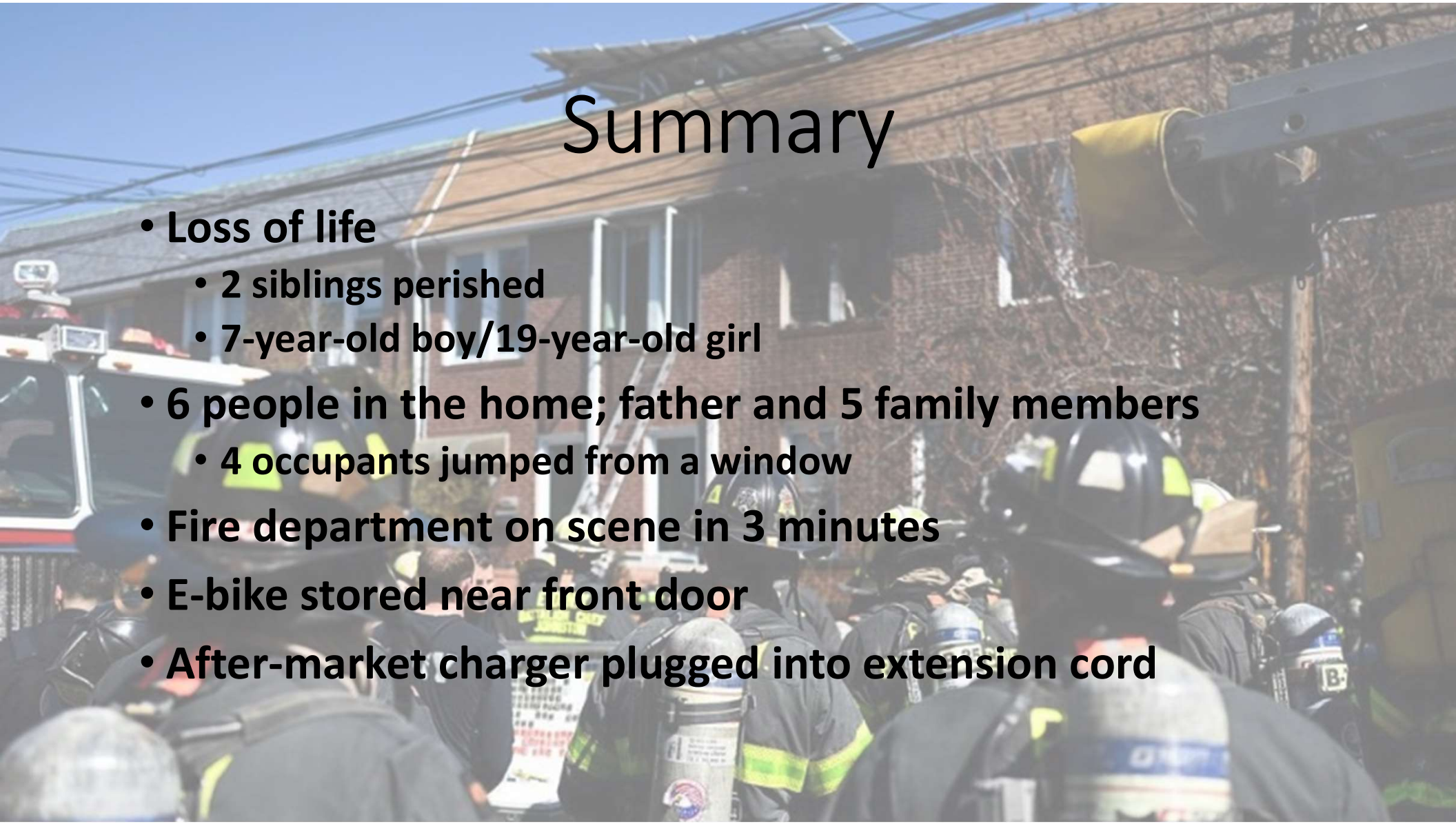
Bedroom 1



This experiment was designed to intentionally drive a lithium-ion battery into failure to examine the potential hazards of storing and charging e-mobility devices, which have been known to catch on fire and cause explosions.


E-bike Fire (Li-ion Battery)
Astoria, Queens - NY
April 10, 2023


CBS NEWS
NEW YORK
55°
11:01 PM
THE NEWS IS ALWAYS STREAMING ON CBS NEWS NEW YORK AND CBSNEWYORK.COM

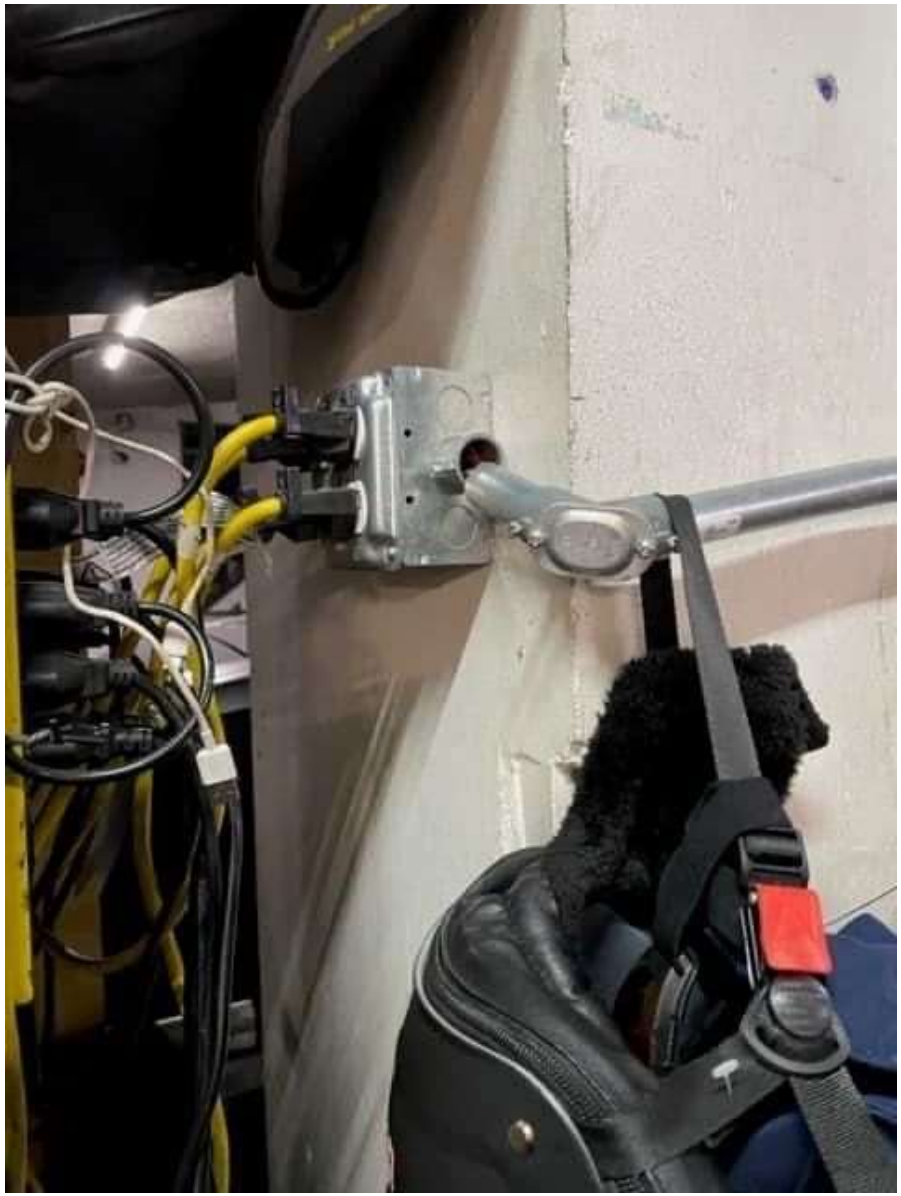


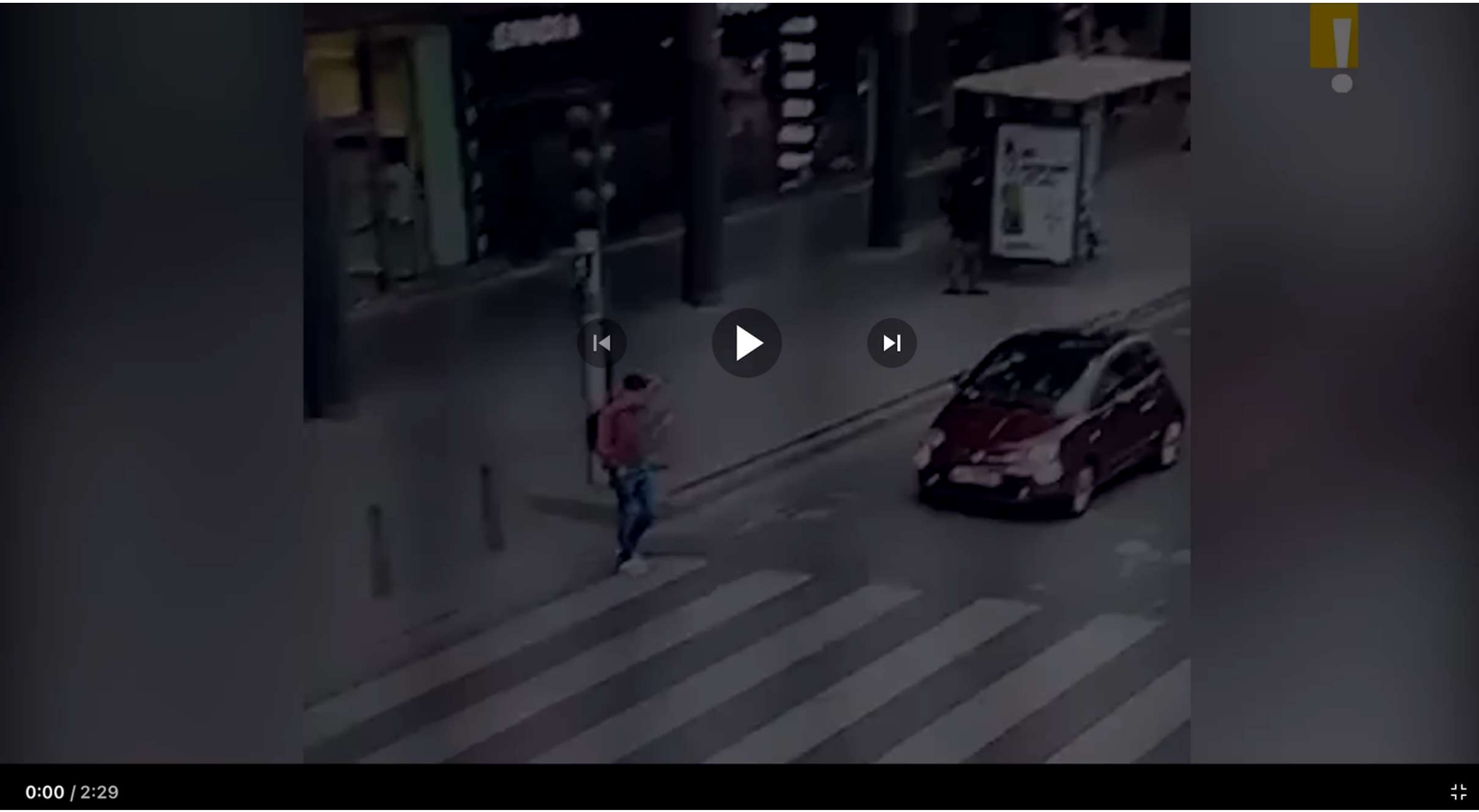
Summary

- Loss of life
  - 2 siblings perished
  - 7-year-old boy/19-year-old girl
- 6 people in the home; father and 5 family members
  - 4 occupants jumped from a window
- Fire department on scene in 3 minutes
- E-bike stored near front door
- After-market charger plugged into extension cord


GRUBHUF


GRUBHUF
DIG




0:00 / 2:29

Lithium-Ion Battery Considerations for Building and Fire Code Officials

- Lithium-ion batteries and energy storage are evolving rapidly
- Batteries and energy storage introduced to the I-Codes in 2018
- Charging occurring in occupancies not designed for them
- Questions building and fire code officials are beginning to ask:
  - Where are Li-ion batteries being manufactured, stored?
  - How are Li-ion batteries being transported and recycled?
  - What structural and fire risks do EVs with Li-ion batteries pose to parking structures?
  - How much water is needed to control a Li-ion battery fire?
  - What provisions are currently in codes and standards to help protect occupants and fire/EMS personnel?
  - What resources are available for us to use today?

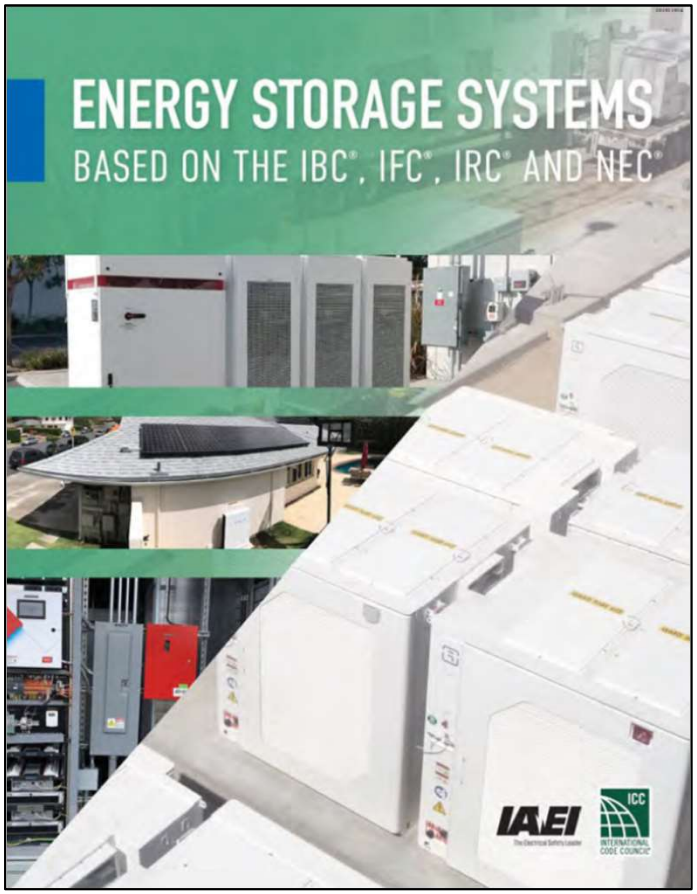
Battery and Energy Storage Resources for Code Officials

International Fire Code
Chapter 12 - Energy Systems

- New for 2024 - Storage of lithium-ion and lithium metal batteries (Section 320)
- New for 2024 - Powered Micro-mobility devices (Section 322)
- Energy Storage Systems (ESS) (Section 1207)
- Fire protection requirements Chapter 9

Battery and Energy Storage Resources for Code Officials

IAEI / ICC
Energy Storage Systems
Based on the IBC, IFC, IRC,
and NEC



Li-ion Batteries and the International Codes (I-Codes)

- Considerable implications for the I-Codes
  - IBC, IFC, IEBC, IMC, IPMC, and the IRC
- ICC members and communities need tools and resources for lithium-ion batteries and ESS
- Codes and standards development for Li-ion and ESS will likely take 10 years or more to fully address

Fire Service Membership Council Recommendations

- Receive a detailed briefing from national subject matter experts at July ICC board meeting
- Consider forming an ad-hoc committee on Lithium-ion Batteries and Energy Storage Systems

Mike O'Brian
IAFC

Kevin Sehlmeyer
NASFM

Sean DeCrane
IAFF

Existing Building Inspections

1

Existing Building Inspections

- Pre Surfside Existing Building Inspections
  - Short history (Miami-Dade/Broward County)
    - 40-year inspection
    - SFR Duplex (OL < 10 and 2000 SF exempt)
    - (*need to check on Broward Co.)*
  - Surfside, Florida
    - Champlain Towers South Collapse – June 21, 2021 at 1:25am
    - 98 Fatalities
    - Approximately 102 evacuated prior to collapse
    - NIST preparing investigative report
      - Pool Deck was not built to code

2

Existing Building Inspections

- Florida Senate Bill SB-4
  - Following Surfside Building collapse
    - Legislative Process
    - Date signed/effective
  - Statewide structural inspection program for condo and cooperative buildings
  - Scope/inspection and reoccurrence interval
    - Phase 1 - Visual inspection of major structural components
    - Phase 2 inspection required if SSD is discovered in Phase 1
  - Definition of milestone inspection, substantial structural deterioration
  - Report Submittal requirements
  - Require Structural Integrity Reserve Study
    - Useful life/replacement costs

3

Existing Building Inspections

- Florida Senate Bill SB-154
  - 3-Story or > Condo/Cooperative Buildings
  - 30 years (deletes 25 years from coastline but allows local AHJ at 25 years).
  - Florida Building Commission to establish project by 12/31/24
    - Inspection criteria
    - Testing protocols
    - Standardized inspection and reporting forms
  - Clarifies requirements for Structural Integrity Reserve Study
  - Provides presale notice
  - ICC-CDS Municity Digital Management Resource to aid FL municipalities

4

Existing Building Inspections

- Florida – Existing Building Inspection Work Group
  - Develop a Chapter 18 of the FBCEB 2020
  - ASCE/ICC/Florida Building Officials/Academia
  - Mandatory Milestone Inspection
    - Baseline guidance
    - Minimum requirements
  - Includes
    - Condition ratings
    - Phase 1 – Visual Assessment
    - Phase 2 – Detailed Assessment

5

Existing Building Inspections

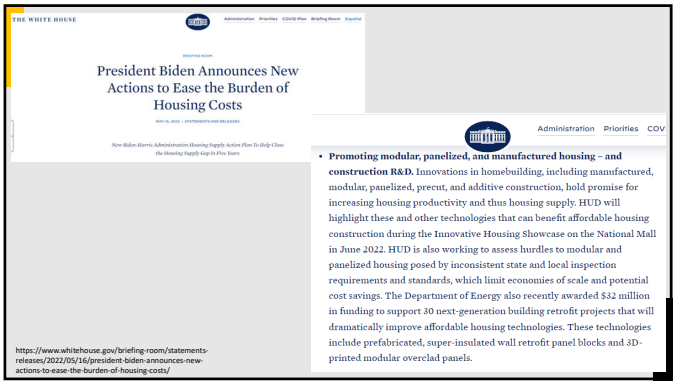
- ICC – Existing Building Inspection Guideline
  - Initial Guideline developed internally by ICC staff
  - Guideline intended to be resource document for 24 IPMC
  - Multi-Disciplined inspection guideline
    - Structural, Envelope, Electrical
    - Active/Passive Fire Protection, Life Safety MOE
    - Trades (PMG)
  - Frequency based on Risk/Occupancy/OL/Building Size
  - G7 Guideline Committee
    - Code Officials/Trade Partners/Industry Reps & Interested Parties (30 total)
    - Committee Draft for Review (current goal early October)
  - Reserved ICC 1500 for potential Standard Committee

6

ICC INTERNATIONAL CODE COUNCIL®

Driving Offsite Construction Solutions: From Tiny Houses to Shipping Containers and Beyond

7



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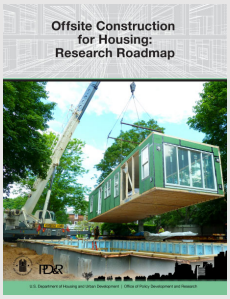
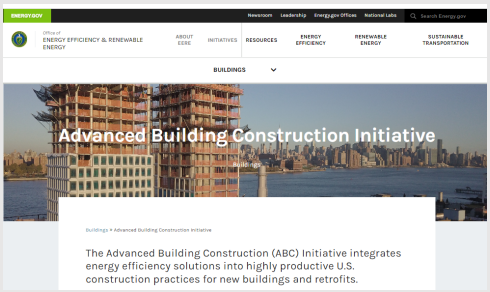
HUD Off-Site Research Roadmap



Source MOD X

9

DOE Advanced Building Construction Initiative



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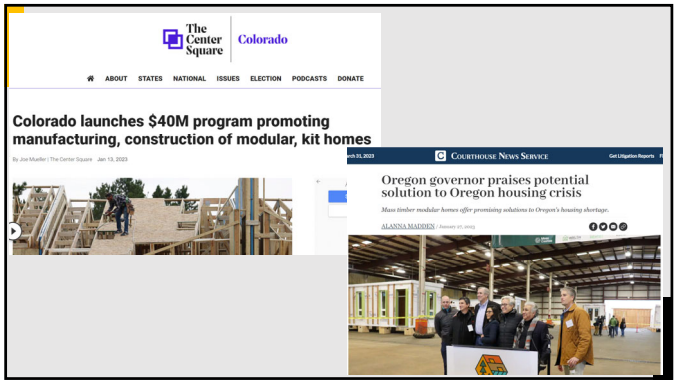


11

What is Off-Site Construction?

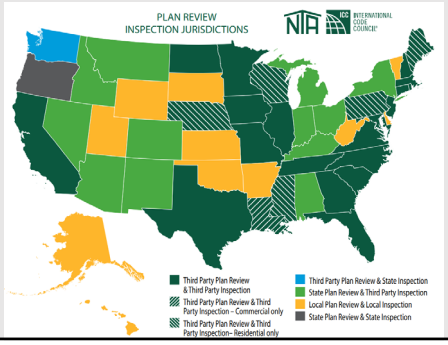
OFF-SITE CONSTRUCTION. A modular building, modular component or panelized system which is designed and constructed in compliance with this standard and is wholly or in substantial part fabricated or assembled in manufacturing plants for installation - or assembly and installation - on a separate building site and has been manufactured in such a manner that all parts or processes cannot be inspected at the installation site without disassembly, damage to, or destruction thereof.

- ICC/MBI Standard 1200/1205

12

13

Regulation of Off-Site Construction



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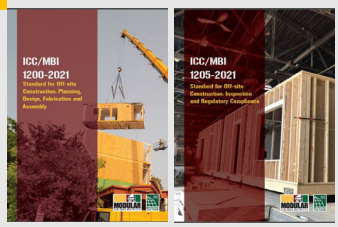
Off-Site Construction Standards



Developed by the ICC/MBI Off-Site and Modular Construction Standard Consensus Committee (IS-OSMC)

ICC/MBI Standard 1210 (upcoming)
Mechanical, Electrical, Plumbing Systems, Energy Efficiency and Water Conservation

https://www.iccsafe.org/offsite

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ICC/MBI 1200 – Standard for Off-Site Construction

Planning, Design, Fabrication and Assembly

- Provides planning and preparation requirements for:
  - The role of the architect/modular manufacturer/construction manager/general contractor;
  - Location of plant vs. construction site;
  - A controlled manufacturing environment;
  - Supply chain integration;
  - The fabrication process and on-site assembly.

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ICC/MBI 1205 - Standard for Off-Site Construction

Inspection and Regulatory Compliance

- Includes compliance requirements for:
  - Permitting;
  - In-plant and on-site final inspections;
  - Third party inspections;
  - The role of Industrialized Building Departments, state modular programs and the Authority Having Jurisdiction.

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Adopting ICC/MBI 1200 & 1205

- Jurisdictions can adopt now as stand-alone effort or part of code adoption.
- Incorporate into Building Code & Residential Code:
  - IBC Section 429 (new)
  - IRC Section 301.1.5 (new)
- Salt Lake City, UT adopted March 2021
- Virginia nearing final adoption

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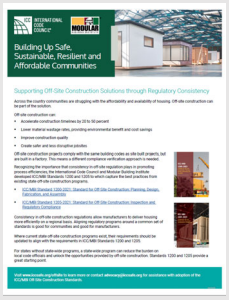
Join Us in a National Adoption Campaign



- Leverage off-site construction to achieve housing and sustainability goals
- Regulatory consistency unlocks even more efficiency!
- Align existing state programs with ICC/MBI Standards 1200 and 1205
- Establish programs in states without them based on 1200 & 1205

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"On a large scale, widespread adoption of the standards effectively reduces the burden of navigating the current patchwork of regional regulations and promotes industry standardization, allowing manufacturers to operate more efficiently and expand their markets."

https://advancedbuildingconstruction.org/codes-working-group-brief-new-off-site-construction-standards/

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Credential of Learning Achievement

- Demonstrate knowledge on Standards 1200 & 1205
  - Complete training course
  - Take an Exam
- Code Officials, QA Personnel, Third Parties
- Open this Summer
- Developed by ICC and MBI

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ICC/MBI Standard 1210

The new ICC 1210-202X standard would address requirements for the energy efficiency and water conservation of off-site construction projects and the planning, designing, fabricating, transporting, and assembling, of commercial and residential building MEP system elements. This includes the componentization and modularization of elements of MEP systems, the incorporation of MEP systems in componentized, panelized or modularized building elements, and the achievement of energy efficiency and water conservation requirements in off-site construction. This standard would not apply to HUD manufactured housing.

Get involved

- Public Comment Draft Open Soon
  - https://www.iccsafe.org/products-and-services/standards/is-osmc/
- Participate in Workgroups
  - Mechanical, Electrical, Plumbing, Energy Efficiency & Water Conservation

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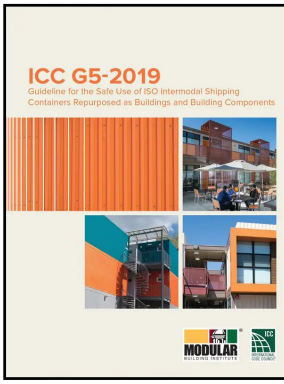

ICC G5-2019

- Guideline for Safe Use of ISO Intermodal Shipping Containers Repurposed as Buildings and Building Components

23

Tiny House Resources

Model Tiny House Legislation provides model language for AHJs to ensure the use of affordable, safe, sustainable and efficient tiny homes.

Navigating Certification and Regulation for Tiny Houses resource outlines the applicability of existing codes, standards and other criteria that should be followed to create safe, sustainable and resilient tiny houses.

The 2021 International Tiny House Provisions outlines the existing codes, standards and compliance mechanisms available for tiny houses. Here is a guide to help navigate when specific requirements should apply to a tiny house.

Iccsafe.org/tinyhomes

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2021 International Tiny House Provisions

- Single source of codes, standards & other guidance for tiny houses
  - Introduction to tiny houses
  - Model legislation
  - IRC with Appendix AQ integrated including commentary
  - HUD Manufactured Housing Standards
  - ICC/MBI Standards 1200 & 1205
  - References to recreational vehicle standards

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ICC/THIA Standard 1215 on the Design, Construction, Inspection and Regulation of Tiny Houses for Permanent Occupancy

This standard will provide minimum requirements for the design, construction, inspection, certification and regulatory compliance of tiny houses used for permanent occupancy to assure public safety, sustainability and resilience. The standard will include: consensus definitions for tiny houses and related terminology; prescriptive and performance-based compliance methods for tiny house foundations and chassis; and plan review, inspection and certification requirements for tiny houses constructed on-site and off-site. The standard will address tiny houses built on a foundation and those with wheels and a permanent chassis intended for permanent occupancy. The 2021 International Residential Code (including Appendix AQ), and ICC/MBI Standards 1200 and 1205 will serve as the initial base documents with references to other existing standards. The standard will be written in mandatory code-intended language to support use by manufacturers and adoption by jurisdictions globally. This standard will not address tiny houses used for temporary or seasonal occupancy, or tiny house community development or microgrids.

Get involved

- Participate in Workgroups
- Look for Public Comment drafts

www.iccsafe.org/products-and-services/standards-development/1215-standard/

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ICC Guideline 6: Advanced Panelization

- In development
- Two key topics of focus:
  - Verification of compliance based on level of automation and documentation
  - Approval of panelized systems made up of pre-approved sub-panels
- Anticipated late 2023

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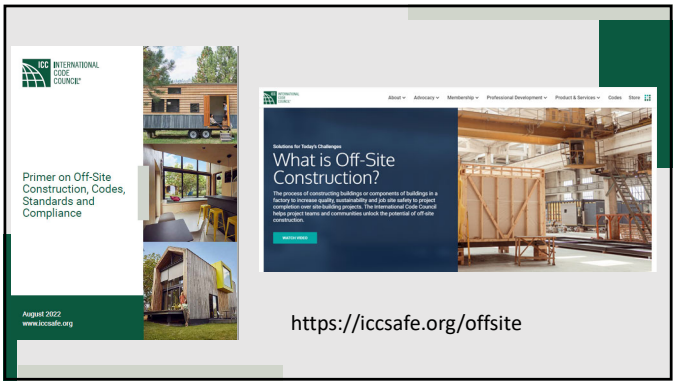

https://iccsafe.org/offsite

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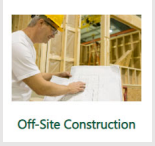
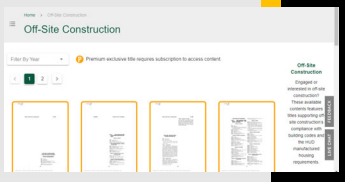
Additional Off-Site Resources

ICC TRAINING



ICC DIGITAL CODES PREMIUM



- Introduction to Off-Site Construction
- Standards 1200 & 1205

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File Attachments for Item:

EC-9 Review of OPC 3-7 and 9 (Assn Plumbing & Hydronics Contractors)

All certifications (4 hours)

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Tracy Jefferies — Exec Director

Organization: APHC

Office Address: 3891 Seabell Ct Columbus OH 43230

E-mail: aphc.contractors@gmail.com Telephone: 614-315-6924

Website: aphc of central ohio.com

Conference Sponsor (if applicable)_____ Conference Email:_____

Check here if Course Renewal:_____ Prior course number _____ *(i.e. BBS2018-429)*

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

New Course Information:

Course title: Reviewing the Plumbing Code Chapters 3-7,9

Course instructor: Guy Miller Jr & Darrin Dawson

Course description: See attached doc with description & outline

Instructional hours per session: 4 hrs Number of Sessions: TBD

Course Date(s) and Location: Pending Approval for dates
653 McCorkle Blvd Suite H Westerville OH 43082

Special Content:

Code Administration: ☐
Existing Buildings: ☐
Electrical Instruction: ☐
Plumbing Instruction: ☒

Conference Course: _____
Conference Name: _____
Conference location: _____

Course to be offered online? ☐ **On Demand** ☐ **Webinar** ☐

Course Website: _____

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

Course applicable for the following certifications

Residential Certifications Only: ☐
Administrative Course, All Certifications: ☒

Commercial Certifications: ☐

Application materials included:

☒ Course Outline or Course Learning Objectives
☒ Presentation Materials/Slides (not required for roundtable courses)
☐ Assessment Materials (for online courses)
☒ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

APHC

OBJECTIVE: A review of sections of the state plumbing code, emphasizing proper code interpretation and understanding.

MATERIALS/BOOKS: State of Ohio plumbing code book, overheads for illustrations, worksheets that students will answer provide answers to.

LENGTH OF COURSE: 4 hours

COURSE TITLE: Reviewing the Plumbing Code Chapters 3-7, 9

COURSE OUTLINE:

Part I — Chapter 3-6 1 hour
Focused review 306 and 307 rough plumbing installation requirements. Understanding 312 testing requirements. Chapter 4 Basic fixture requirements. Chapter 5 Basic water heater installation code. Proper backflow application.

Part II — Chapter 7 1 hour
Determining drain fixture values based on the tables 709.1 and 709.2. Sizing stacks, branches, and building drains based on table 710.1(1) and 710.1(2).

Part III — Chapter 9 2 hours.
Understanding venting basics.901.1-905.6
Venting methods explained. 910.1-917.9
Venting sizing. 906-906.5.2

PHYSICAL FACILITIES DESCRIPTION

Classroom at 653 McCorkle Blvd. Suite H in Westerville:

The room is set up in a classroom style with seating for up to 24 individuals at conference tables. The room is well lit using overhead fluorescent lighting. The room is also provided with audio/visual equipment; overhead projector, screen and eraser board for illustrations as needed for presentation purposes. The room is equipped with its own controls to control heating and cooling for comfort. Of course, restroom facilities are available.

This site is also equipped with a lab area consisting of workstations for the backflow prevention certification and recertification classes held. These stations (8) are equipped with different manufacturers' devices to test and repair. All tools and equipment needed for the lab portion of the class are provided as part of the course.

QUALIFICATIONS:

Darrin Dawson has worked 39 years in the plumbing industry. In May of 1990, he received his Master Plumbing Certification.

He has been a State of Ohio Certified Plumbing Inspector since June of 2003. He became a National Certified Medical Gas Inspector in June of 2007.

In April of 2022 he received a State of Ohio Backflow Certification.

Mr. Dawson has been an instructor for The Association of Plumbers and Hydronics Contractors (APHC) apprenticeship program for 16 years.

He is currently employed at The Delaware Public Health District as a Plumbing and Medical Gas inspector.

Guy Miller Jr.
629 Fenchurch Way
Gahanna, OH 43230
Ph. (614) 940-5700
guymillerjr@gmail.com

Certification: Master Plumber, State of Ohio-Id Number #24380 (exp)
Certified Backflow Preventer - Certificate #1300 (State of Ohio – exp)
Certified plumbing inspector - Certificate #K02033 (State of Ohio), 5523 (BBS)
Certified plumbing plans examiner- Certificate #K02033 (State of Ohio), 5523 (BBS)

Teacher: APHC Apprenticeship Program, Fourth Year Instructor
8/08-present

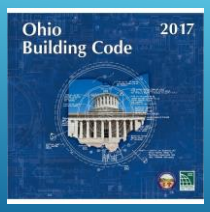
APHC Association - Continuing Education Classes
2021- Present

Work Experience:

1/85 – 1/95	Guy Miller Plumbing
1/95-8/03	Eric Guy Plumbing
8/03 – 2/10	Foreman: Crawford Mechanical Services
2/10-04/17	Foreman/Project Manager: Gutridge Plumbing
4/17-current	Plumbing Field Supervisor-City of Columbus

Ohio Code Requirements

or stuff you should know



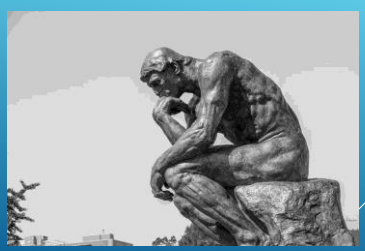
APHC

1

COMING SOON
NEW CODE CHANGES

2

ESSENTIAL CODE DEFINITIONS



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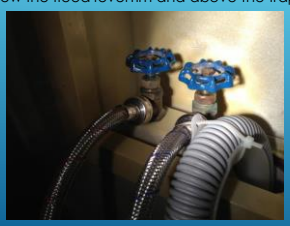
AIR BREAK (Drainage System). A piping arrangement in which a drain from a fixture, appliance or device discharges indirectly into another fixture, receptacle or interceptor at a point below the flood level rim and above the trap seal.



4

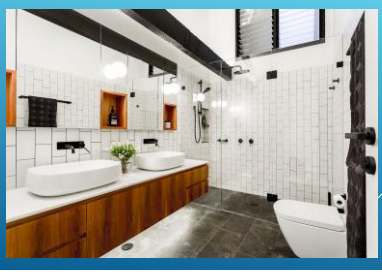
AIR GAP (Drainage System). The unobstructed vertical distance through the free atmosphere between the outlet of the waste pipe and the flood level rim of the receptacle into which the waste pipe is discharging.

5

AIR GAP (Water Distribution System). The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of the receptacle.

6

BATHROOM GROUP. A group of fixtures consisting of a water closet, lavatory, bathtub or shower, including or excluding a bidet, an emergency floor drain or both. Such fixtures are located together on the same floor level



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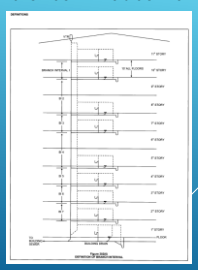
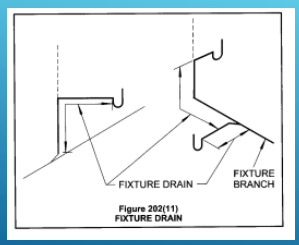
BRANCH INTERVAL. A vertical measurement of distance, 8 feet (2438 mm) or more in developed length, between the connections of horizontal branches to a drainage stack. Measurements are taken down the stack from the highest horizontal branch connection.



8

FIXTURE DRAIN. The drain from the trap of a fixture to a junction with any other drain pipe.



9

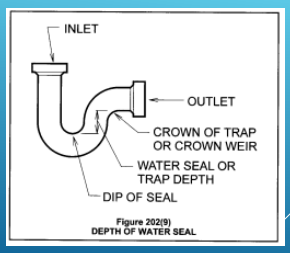
HORIZONTAL BRANCH DRAIN. A drainage branch pipe extending laterally from a soil or waste stack or building drain, with or without vertical sections or branches, that receives the discharge from two or more fixture drains or branches and conducts the discharge to the soil or waste stack or to the building drain.

10

INDIRECT WASTE PIPE. A waste pipe that does not connect directly with the drainage system, but that discharges into the drainage system through an air break or air gap into a trap, fixture, receptor or interceptor.

11

TRAP. A fitting or device that provides a liquid seal to prevent the emission of sewer gases without materially affecting the flow of sewage or waste water through the trap.



12

Chapter 3

13

301.3 **Connections to drainage system.** Plumbing fixtures, drains, appurtenances and appliances used to receive or discharge liquid waste or sewage shall be directly connected to the sanitary drainage system of the building or premises, in accordance with the requirements of this code *and the requirements of the department of the city engineer, in cities having such departments, the boards of health of health districts, or the sewer purveyor, as appropriate (see division (D) of section 3781.03 of the Revised Code)*. This section shall not be construed to prevent indirect waste systems required by Chapter 8.

APHC

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Exception

2. *Wastes from dental or cuspidor fountains, drinking fountains, bar sinks, soda fountains, floor drains or shower drains may be indirectly connected by means of an air break to the sanitary drainage system. Each indirectly connected item listed above shall individually discharge to a directly connected floor drain, waste receptor or standpipe.*

APHC

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SECTION 306
TRENCHING, EXCAVATION AND BACKFILL
306.1 **Support of piping.** Buried piping shall be supported throughout its entire length.

APHC

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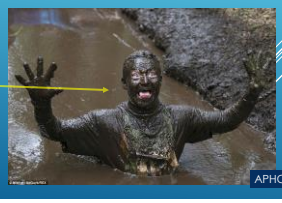
306.2.3 **Soft load-bearing materials.** If soft materials of poor load-bearing quality are found at the bottom of the trench, stabilization shall be achieved by overexcavating not less than two pipe diameters and backfilling to the installation level of the bottom of the pipe with fine gravel, crushed stone or a concrete foundation. The concrete foundation shall be bedded with sand tamped into place so as to provide uniform load-bearing support for the pipe between joints.

Plumbing Inspector checking underground piping.

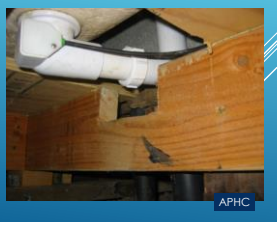


APHC

17

STRUCTURAL SAFETY

307.2 **Cutting, notching or bored holes.** A framing member shall not be cut, notched or bored in excess of limitations specified in the *building code*



APHC

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PIPING SUPPORT

308.5 **Interval of support.** Pipe shall be supported in accordance with Table 308.5.

TABLE 308.5
HANGER SPACING

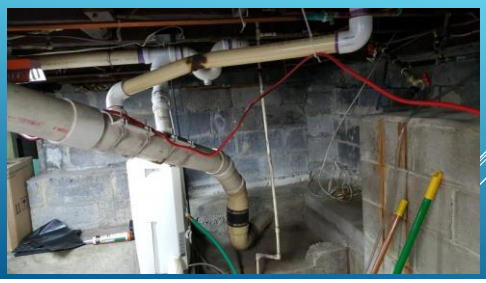
PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING (feet)	MAXIMUM VERTICAL SPACING (feet)
Acrylonitrile butadiene styrene (ABS) pipe	4	10[a]
Aluminum tubing	10	15
Brass pipe	10	10
Cast-iron pipe	5[a]	15
Chlorinated polyvinyl chloride (CPVC) pipe and tubing, 1 inch and smaller	3	10[a]
Chlorinated polyvinyl chloride (CPVC) pipe and tubing, 1¼ inches and larger	4	10[a]
Copper or copper alloy pipe	12	10
Copper or copper alloy tubing, 1¼ inch diameter and smaller	6	10
Copper or copper alloy tubing, 1¼ inch diameter and larger	10	10
Cross-linked polyethylene (PEX) pipe	2.67 (32 inches)	10[a]
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	2.67 (32 inches)	4
Lead pipe	Continuous	4
Polyethylene/aluminum/polyethylene (PE-AL-PE) pipe	2.67 (32 inches)	4
Polyethylene of raised temperature (PE-RT) pipe	2.67 (32 inches)	10[a]
Polypropylene (PP) pipe or tubing 1 inch and smaller	2.67 (32 inches)	10[a]
Polypropylene (PP) pipe or tubing, 1¼ inches and larger	4	10[a]
Polyvinyl chloride (PVC) pipe	4	10[a]
Stainless steel drainage system	10	10[a]
Steel pipe	12	15

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.

b. For sizes 2 inches and smaller, a guide shall be installed midway between required vertical supports. Such guides shall prevent pipe movement in a direction perpendicular to the axis of the pipe.

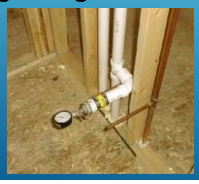
19



20

SECTION 312
TESTS AND INSPECTIONS

Always check with the local inspector for requirements regarding test media.



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There are three testing methods listed in the Ohio Plumbing Code

1. Water (10ft head pressure)
2. Air pressure 5PSI for 15 minutes
3. Vacuum (unspecified)

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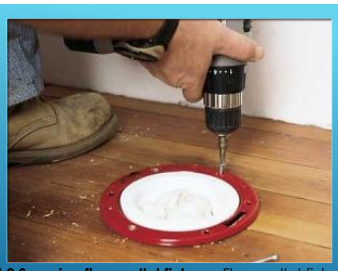
405.3.3 **Location of fixtures and piping.** Piping, fixtures or equipment shall not be located in such a manner as to interfere with the normal operation of windows, doors or other means of egress openings.

24

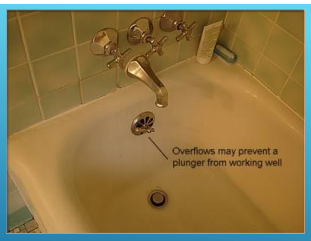


405.4.2 Securing floor outlet fixtures. Floor outlet fixtures shall be secured to the floor or floor flanges by screws or bolts of **corrosion-resistant** material.

25

405.5 Water-tight joints. Joints formed where fixtures come in contact with walls or floors shall be sealed

26



405.7 Design of overflows. Where any fixture is provided with an overflow, the waste shall be designed and installed so that standing water in the fixture will not rise in the overflow when the stopper is closed, and no water will remain in the overflow when the fixture is empty

27

406.2 **Waste connection.** The waste from an automatic clothes washer shall discharge through an air break into a standpipe in accordance with Section 802.4 or into a laundry sink. The trap and fixture drain for an automatic clothes washer standpipe shall be not less than 2 inches (51 mm) in diameter. The fixture drain for the standpipe serving an automatic clothes washer shall connect to a 3-inch (76 mm) or larger diameter fixture branch or stack. Automatic clothes washers that discharge by gravity shall be permitted to drain to a waste receptor or an approved trench drain.

28

412.2 **Floor drains.** Floor drains shall have removable strainers. The floor drain shall be constructed so that the drain is capable of being cleaned. Access shall be provided to the drain inlet. Ready access shall be provided to floor drains.

Exception: Floor drains serving refrigerated display cases shall be provided with access.

29

416.5 TEMPERED WATER FOR PUBLIC HAND-WASHING FACILITIES. TEMPERED WATER SHALL BE DELIVERED FROM PUBLIC HAND-WASHING FACILITIES. TEMPERED WATER SHALL BE DELIVERED THROUGH AN APPROVED WATER-TEMPERATURE LIMITING DEVICE THAT CONFORMS TO ASSE 1070 OR CSA B125.3

30

504.2 Vacuum relief valve. Bottom fed water heaters and bottom fed tanks connected to water heaters shall have a vacuum relief valve installed. The vacuum relief valve shall comply with ANSI Z21.22.

31

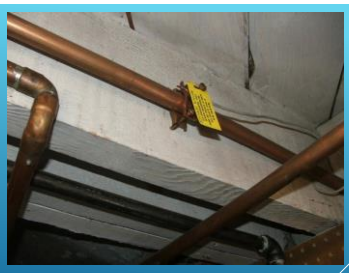
Relief valve

504.4.1 Installation. Such valves shall be installed in the shell of the water heater tank. Temperature relief valves shall be so located in the tank as to be actuated by the water in the top 6 inches (152 mm) of the tank served. For installations with separate storage tanks, the valves shall be installed on the tank and there shall not be any type of valve installed between the water heater and the storage tank. There shall not be a check valve or shutoff valve between a relief valve and the heater or tank served.

32

504.7.2 Pan drain termination. The pan drain shall extend full-size and terminate over a suitably located indirect waste receptor or floor drain or extend to the exterior of the building and terminate not less than 6 inches (152 mm) and not more than 24 inches (610 mm) above the adjacent ground surface.

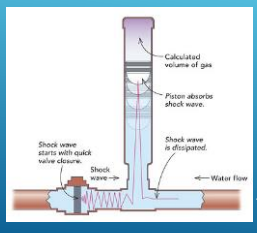
33



601.3 Existing piping used for grounding. Existing metallic water service piping used for electrical grounding shall not be replaced with nonmetallic pipe or
tubing until other approved means of grounding is provided.

34

604.9 **Water hammer**. The flow velocity of the water distribution system shall be controlled to reduce the possibility of water hammer. A water-hammer arrestor shall be installed where quick-closing valves are utilized. Water-hammer arrestors shall be installed in accordance with the manufacturer's specifications. Water-hammer arrestors shall conform to ASSE 1010.



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605.2 ***Lead content of drinking water pipe and fittings.*** *Pipe, pipe fittings, joints, valves, faucets, and fixture fittings utilized to supply water for drinking or cooking purposes shall comply with NSF 372 and shall have a weighted average lead content of0.25 percent lead or less.*
Exceptions:*The following items are exempt from the lead content limitations of this section (even though the potable water supply pipe which serves the fixture or supplies the nonpotable water system is not exempt):*
1. Pipes, pipe fittings, plumbing fittings, or fixtures, including backflow preventers that are used exclusively for nonpotable services such as process piping, irrigation piping, and outdoor watering piping.
2. Toilets, bidets, urinals, fill valves, flushometer valves, tub fillers, shower valves, and service saddles.
3. Water distribution main gate valves two inches in diameter or larger.

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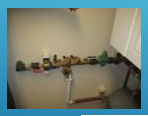
607.3 **Thermal expansion control.** Where a storage water heater is supplied with cold water that passes through a check valve, pressure reducing valve or backflow preventer, a thermal expansion tank shall be connected to the water heater cold water supply pipe at a point that is downstream of all check valves, pressure reducing valves and backflow preventers. Thermal expansion tanks shall be sized in accordance with the tank manufacturer's instructions and shall be sized such that the pressure in the water distribution system shall not exceed that required by Section 604.8.

37

608.3 Devices, appurtenances, appliances and apparatus. All devices, appurtenances, appliances and apparatus intended to serve some special function, such as sterilization, distillation, processing, cooling, or storage of ice or foods, and that connect to the water supply system, shall be provided with protection against backflow and contamination of the water supply system. Water pumps, *water-powered sump pumps, filters, softeners, tanks and all other appliances and devices* that handle or treat potable water shall be protected against contamination

38

608.3.1 Special equipment, water supply protection. The water supply for hospital fixtures shall be protected against backflow with a reduced pressure principle backflow preventer, an atmospheric or spill-proof vacuum breaker, or an air gap. Vacuum breakers for bedpan washer hoses shall not be located less than 5 feet (1524 mm) above the floor. Vacuum breakers for hose connections in health care or laboratory areas shall not be less than 6 feet(1829 mm) above the floor



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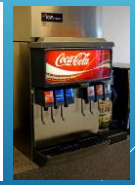
608.16 Connections to the potable water system. Connections to the potable water system shall conform to Sections 608.16.1 through 608.16.10.

608.16.1 Beverage dispensers. The water supply connection to beverage dispensers shall be protected against backflow by a backflow preventer conforming to ASSE 1022 or by an air gap. The portion of the backflow preventer device downstream from the second check valve and the piping downstream there from shall not be affected by carbon dioxide gas.



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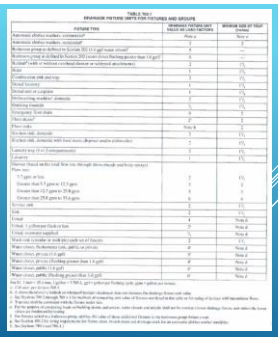
608.16.2 Connections to boilers. The potable supply to the boiler shall be equipped with a backflow preventer with an intermediate atmospheric vent complying with ASSE 1012 or CAN/CSA B64.3. Where conditioning chemicals are introduced into the system, the potable water connection shall be protected by an air gap or a reduced pressure principle backflow preventer, complying with ASSE 1013, CAN/CSA B64.4 or AWWA C511.

41

608.16.10 Coffee machines and noncarbonated beverage dispensers. The water supply connection to coffee machines and noncarbonated beverage dispensers shall be protected against backflow by a backflow preventer conforming
to ASSE 1022 or by an air gap

42

709.1 **Values for fixtures.** Drainage fixture unit values as given in Table 709.1 designate the relative load weight of different kinds of fixtures that shall be employed in estimating the total load carried by a soil or waste pipe, and shall be used in connection with Tables 710.1(1) and 710.1(2) of sizes for soil, waste and vent pipes for which the permissible load is given in terms of fixture units.



43

709.2 **Fixtures not listed in Table 709.1.** Fixtures not listed in Table 709.1 shall have a drainage fixture unit load based on the outlet size of the fixture in accordance with Table 709.2. The minimum trap size for unlisted fixtures shall be the size of the drainage outlet but not less than 1¼ inches (32 mm).

TABLE 709.2
DRAINAGE FIXTURE UNITS FOR FIXTURE DRAINS OR TRAPS

FIXTURE DRAIN OR TRAP SIZE (inches)	DRAINAGE FIXTURE UNIT VALUE
1 ¼	1
1 ½	2
2	3
2 ½	4
3	5
4	6

709.3 **Values for continuous and semicontinuous flow.** Drainage fixture unit values for continuous and semicontinuous flow into a drainage system shall be computed on the basis that 1 gpm (0.06 L/s) of flow is equivalent to two fixture units.

44

TABLE 710.1(1) BUILDING DRAINS AND SEWERS
DIAMETER OF PIPE (inches)
MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS CONNECTED TO ANY PORTION OF THE BUILDING DRAIN OR THE BUILDING SEWER, INCLUDING BRANCHES OF THE BUILDING Drain

	Slope per foot			
	1/16 inch	1/8 inch	1/4 inch	1/2 inch
1 ¼	—	—	1	1
1 ½	—	—	3	3
2	—	—	21	26
2 ½	—	—	24	31
3	—	36	42	50
4	—	180	216	250
5	—	390	480	575
6	—	700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

For SI: 1 inch = 25.4 mm, 1 inch per foot = 83.3 mm/m.
a. The minimum size of any building drain serving a water closet shall be 3 inches.

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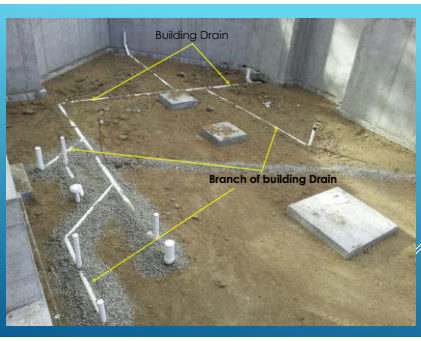

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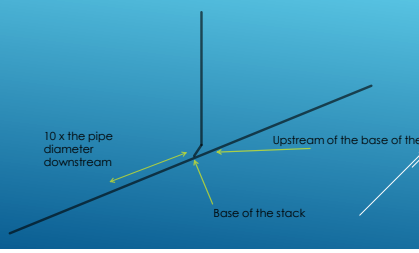
TABLE 710.1(2)
HORIZONTAL FIXTURE BRANCHES AND STACKS[a]

DIAMETER OF PIPE (Inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
		Stacks[b]		
	Total for horizontal branch	Total discharge into one branch interval	Total for stack of three branch intervals or less	Total for stack greater than three branch intervals
1 ¼	1	2	4	8
2	6	6	10	24
2 ½	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Note c	Note c	Note c

For SI: 1 inch = 25.4 mm.
a. Does not include branches of the building drain. Refer to Table 710.1(1).
b. Stacks shall be sized based on the total accumulated connected load at each story or branch interval. As the total accumulated connected load decreases, stacks are permitted to be reduced in size. Stack diameters shall not be reduced to less than one-half of the diameter of the largest stack size required.
c. Sizing load based on design criteria.

47

704.3 Connections to offsets and bases of stacks. Horizontal branches shall connect to the bases of stacks at a point located not less than 10 times the diameter of the drainage stack downstream from the stack. Except as prohibited by Section 711.2, horizontal branches shall connect to horizontal stack offsets at a point located not less than 10 times the diameter of the drainage stack downstream from the upper stack.



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SECTION 712
SUMPS AND EJECTORS
712.1 Building subdrains.

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

49

712.2 Valves required. A check valve and a full open valve located on the discharge side of the check valve shall be installed in the pump or ejector discharge piping between the pump or ejector and the gravity drainage system. Access shall be provided to such valves. Such valves shall be located above the sump cover required by Section 712.1 or, where the discharge pipe from the ejector is below grade, the valves shall be accessibly located outside the sump below grade in an access pit with a removable access cover.

50

SECTION 715
BACKWATER VALVES

715.1 Sewage backflow. *If required by the "Ohio Environmental Protection Agency" or local sewer purveyor, a backwater valve shall be installed only for plumbing fixtures where the flood* level rims of *the lowest plumbing fixtures are below the elevation of the manhole cover of the* next upstream manhole in the public sewer. *Such fixtures shall be protected by a backwater* valve installed in the building drain, branch of the building drain or horizontal branch serving such fixtures. Plumbing fixtures having flood level rims above the elevation of the manhole cover of the next upstream manhole in the public

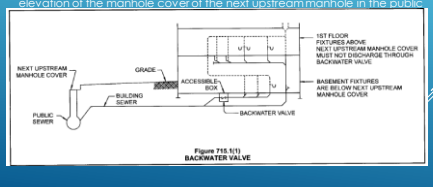


Figure 715.1(1)
BACKWATER VALVE

51

715.5 Location. Backwater valves shall be installed so that access is provided to the working parts for service and repair.

52

802.1 **Where required.** Food-handling equipment, in other than dwelling units, clear-water waste, dishwashing machines and utensils, pots, pans and dishwashing sinks shall discharge through an indirect waste pipe as specified in Sections 802.1.1 through 802.1.8. Health-care related fixtures, devices and equipment shall discharge to the drainage system through an indirect waste pipe by means of an air gap in accordance with this chapter and Section 713.3. Fixtures not required by this section to be indirectly connected shall be directly connected to the plumbing system in accordance with

53

802.1.1 **Food handling.** Equipment and fixtures utilized for the storage, preparation and handling of food shall discharge through an indirect waste pipe by means of an air gap. Each well of a multiple-compartment sink shall discharge independently to a waste receptor.

54

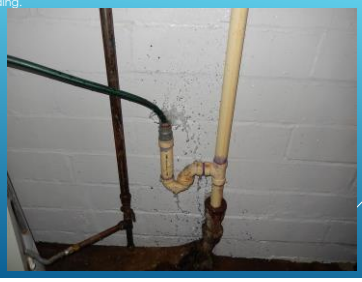
802.2.1 Air gap. The air gap between the indirect waste pipe and the flood level rim of the waste receptor shall be a minimum of twice the effective opening of the indirect waste pipe

55

802.2.2 Air break. An air break shall be provided between the indirect waste pipe and the trap seal of the waste receptor or standpipe

56

802.3.3 **Standpipes.** Standpipes shall be individually trapped. Standpipes shall extend not less than 18 inches (457 mm) but not greater than 42 inches (1066 mm) above the trap weir. Access shall be provided to standpipes and drains for rodding.



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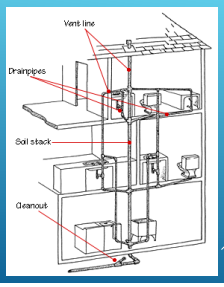
SECTION 901
GENERAL

901.1 Scope. The provisions of this chapter shall govern the materials, design, construction and installation of vent systems.



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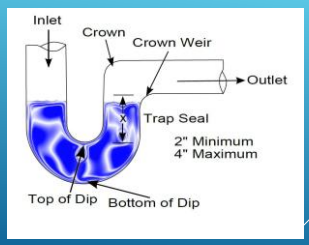
901.2 Trap seal protection. The plumbing system shall be provided with a system of vent piping that will permit the admission or emission of air so that the seal of any fixture trap shall not be subjected to a pneumatic pressure differential of more than 1 inch of water column (249 Pa).



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901.3 **Chemical waste vent systems.** The vent system for a chemical waste system shall be independent of the sanitary vent system and shall terminate separately through the roof to the outdoors or to an air admittance valve that complies with ASSE 1049. Air admittance valves for chemical waste systems *shall comply with Section 918.8 and* shall be constructed of materials approved in accordance with Section 702.5 and shall be tested for chemical resistance in accordance with ASTM F 1412.

60

901.6 Engineered systems. Engineered venting systems shall conform to the provisions of Section 919

61

903.2 **Frost closure.** Where the 97.5 -percent value for outside design temperature is 0°F (-18°C) or less, vent extensions through a roof or wall shall be not less than 3 inches (76 mm) in diameter. Any increase in the size of the vent shall be made not less than 1 foot (305 mm) inside the thermal envelope of the building.

62

903.5 **Location of vent terminal.** An open vent terminal from a drainage system shall not be located directly beneath any door, openable window, or other air intake opening of the building or of an adjacent building, and any such vent terminal shall not be within 10 feet (3048 mm) horizontally of such an opening unless it is 3 feet (914 mm) or more above the top of such opening.

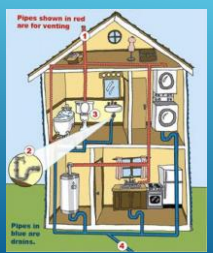
63

903.6 **Extension through the wall.** Vent terminals extending through the wall shall terminate at a point not less than 10 feet (3048 mm) from a lot line and not less than 10 feet (3048 mm) above average ground level. Vent terminals shall not terminate under the overhang of a structure with soffit vents. Side wall vent terminals shall be protected to prevent birds or rodents from entering or blocking the vent opening.

64

SECTION 904
OUTDOOR VENT EXTENSIONS

904.1 **Required vent extension.** The vent system serving each building drain shall have not less than one vent pipe that extends to the outdoors



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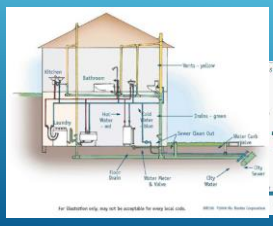
904.1.1 **Installation.** The required vent shall be a dry vent that connects to the building drain or an extension of a drain that connects to the building drain. Such vent shall not be an island fixture vent as allowed by Section 916.



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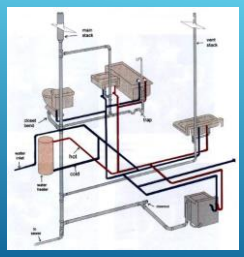
904.1.2 **Size.** The required vent shall be sized in accordance with Section 906.2 based on the required size of the building drain.



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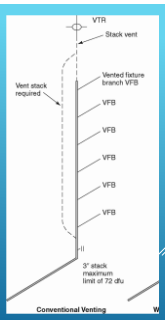
904.2 **Vent stack required.** A vent stack shall be required for every drainage stack that has five branch intervals or more.

Exception: Drainage stacks installed in accordance with Section 913.



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904.3 **Vent termination.** Vent stacks or stack vents shall terminate outdoors to the open air or to a stack-type air admittance valve in accordance with Section 918.

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905.2 Grade. All vent and branch vent pipes shall be so graded and connected as to drain back to the drainage pipe by gravity.

APHC

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905.4 Vertical rise of vent. Every dry vent shall rise vertically to a minimum of 6 inches (152 mm) above the flood level rim of the highest trap or trapped fixture being vented.

Exception: Vents for interceptors located outdoors

APHC

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905.5 Height above fixtures. A connection between a vent pipe and a vent stack or stack vent shall be made at least 6 inches (152 mm) above the flood level rim of the highest fixture served by the vent. Horizontal vent pipes forming branch vents, relief vents or loop vents shall be at least 6 inches (152 mm) above the flood level rim of the highest fixture served.

APHC

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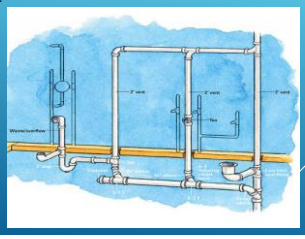
906.2 **Vents other than stack vents or vent stacks.** The diameter of individual vents, branch vents, circuit vents and relief vents shall be not less than one-half the required diameter of the drain served. The required size of the drain shall be determined in accordance with Table 710.1(2). Vent pipes shall not be less than 1¼ inches (32 mm) in diameter. Vents exceeding 40 feet (12 192 mm) in developed length shall be increased by one nominal pipe size for the entire developed length of the vent pipe. Relief vents for soil and waste stacks in buildings having more than 10 branch intervals shall be sized in accordance with Section 908.2.



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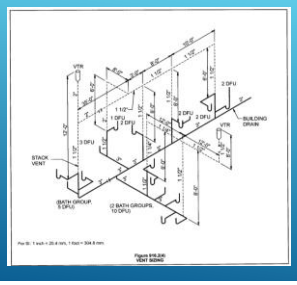
906.3 **Developed length.** The developed length of individual, branch, circuit and relief vents shall be measured from the farthest point of vent connection to the drainage system to the point of connection to the vent stack, stack vent or termination outside of the building.



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906.5.1 **Sewage pumps and sewage ejectors other than pneumatic.** Drainage piping below *the building sewer* level shall be vented in the same manner as that of a gravity system. Building sump vent sizes for sumps with sewage pumps or sewage ejectors, other than pneumatic, shall be determined in accordance with Table 906.5.1.

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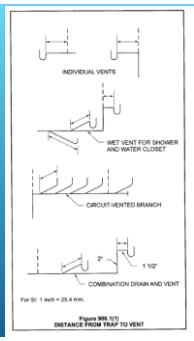
SECTION 909
FIXTURE VENTS

906.1 Distance of trap from vent. Each fixture trap shall have a protecting vent located so that the slope and the developed length in the fixture drain from the trap weir to the vent fitting are within the requirements set forth in Table 909.1.



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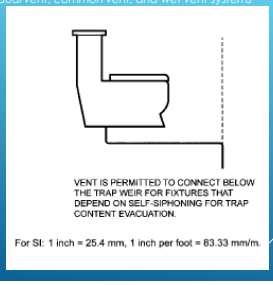
Exception: The developed length of the fixture drain from the trap weir to the vent fitting for self-siphoning fixtures, such as water closets, shall not be limited *in individual vent, common vent, and wet vent systems*



VENT IS PERMITTED TO CONNECT BELOW THE TRAP WEIR FOR FIXTURES THAT DEPEND ON SELF-SIPHONING FOR TRAP CONTENT EVACUATION.

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

77

909.2 Venting of fixture drains. The total fall in a fixture drain due to pipe slope shall not exceed the diameter of the fixture drain, nor shall the vent connection to a fixture drain, except for water closets, be below the weir of the trap

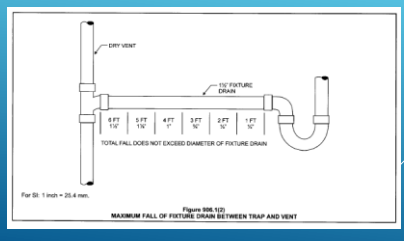


Figure 909.1(2)
MAXIMUM FALL OF FIXTURE DRAIN BETWEEN TRAP AND VENT

78

TABLE 909.1
MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT

SIZE OF TRAP (inches)	SLOPE (inch per foot)	DISTANCE FROM TRAP (feet)
1 ¼	¼	5
1 ½	¼	6
2	¼	8
3	1/8	12
4	1/8	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m.

79

SECTION 910
INDIVIDUAL VENT

910.1 Individual vent permitted. Each trap and trapped fixture is permitted to be provided with an individual vent. The individual vent shall connect to the fixture drain of the trap or trapped fixture being vented.

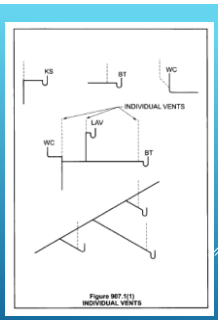
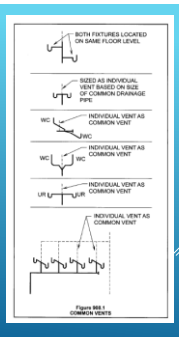


Figure 907.1(1)
INDIVIDUAL VENTS

80

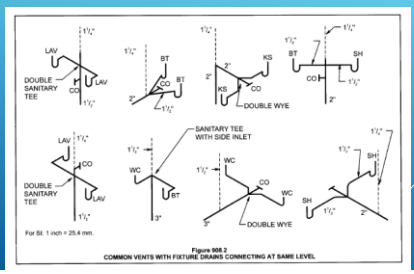
SECTION 911
COMMON VENT

911.1 Individual vent as common vent. An individual vent is permitted to vent two traps or trapped fixtures as a common vent. The traps or trapped fixtures being common vented shall be located on the same floor level.



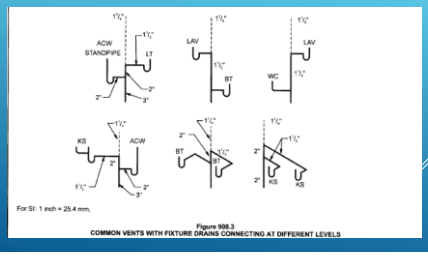
81

911.2 Connection at the same level. Where the fixture drains being common vented connect at the same level, the vent connection shall be at the interconnection of the fixture drains or downstream of the interconnection. *Common vent on the horizontal shall be a double pattern fitting*



82

911.3 Connection at different levels. Where the fixture drains connect at different levels, the vent shall connect as a vertical extension of the vertical drain. The vertical drain pipe connecting the two fixture drains shall be considered the vent for the lower fixture drain, and shall be sized in accordance with Table 908.3. The upper fixture shall not be a water closet.



83

Table 911.3
COMMON VENT SIZES

PIPE SIZE (inches)	MAXIMUM DISCHARGE FROM UPPER FIXTURE DRAIN (dfu)
1 1/2	1
2	4
2 ½ to 3	6

For SI: 1 inch = 25.4 mm.

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WET VENTING

912.1 Horizontal wet vent permitted. Any combination of fixtures within two bathroom groups located on the same floor level is permitted to be vented by a horizontal wet vent. The wet vent shall be considered the vent for the fixtures and shall extend from the of the horizontal wet vent. connection of the dry vent along the direction of the flow in the drain pipe to the most downstream fixture drain connection to the horizontal branch drain. Each wet-vented fixture drain shall connect independently to the horizontal wet vent. Only the fixtures within the bathroom groups shall connect to the wet vented horizontal branch drain. Any additional fixtures shall discharge downstream

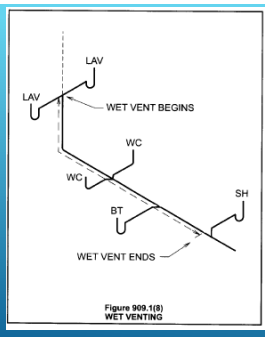
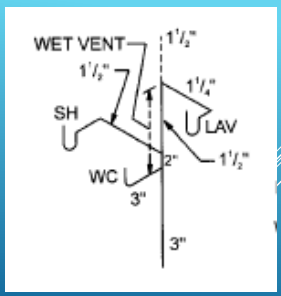


Figure 909.1(8)
WET VENTING

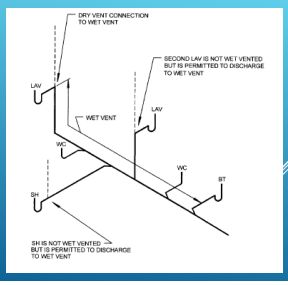
85

912.1.1 Vertical wet vent permitted. Any combination of fixtures within two bathroom groups located on the same floor level is permitted to be vented by a vertical wet vent. The vertical wet vent shall be considered the vent for the fixtures and shall extend from the connection of the dry vent down to the lowest fixture drain connection. Each wet-vented fixture shall connect independently to the vertical wet vent. Water closet drains shall connect at the same elevation. Other fixture drains shall connect above or at the same elevation as the water closet fixture drains. The dry-vent connection to the vertical wet vent shall be an individual or common vent serving one or two fixtures



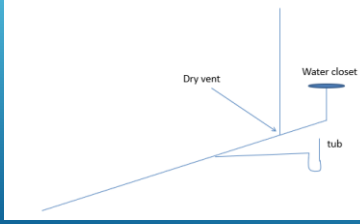
86

912.2 Dry vent connection. The required dry-vent connection for wet-vented systems shall
comply with Sections 909.2.1 and 909.2.2



87

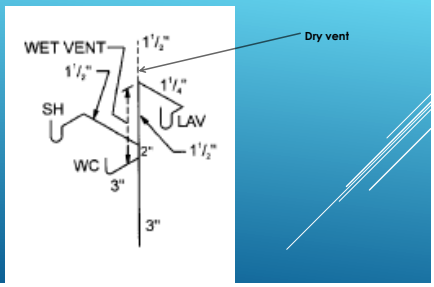
912.2.1 Horizontal wet vent. The dry-vent connection for a horizontal wet-vent system shall be an individual vent or a common vent for any bathroom group fixture, except an emergency floor drain. Where the dry-vent connects to a water closet fixture drain, the drain shall connect horizontally to the horizontal wet-vent system. Not more than one wet-vented fixture drain shall discharge upstream of the dry-vented fixture drain connection.



APHC

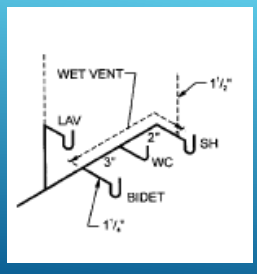
88

912.2.2 Vertical wet vent. The dry-vent connection for a vertical wet-vent system shall be an individual vent or common vent for the most upstream fixture drain



89

912.3 Size. The dry vent serving the wet vent shall be sized based on the largest required diameter of pipe within the wet-vent system served by the dry vent. The wet vent shall be of a minimum size as specified in Table 909.3, based on the fixture unit discharge to the wet vent.



90

Table 912.3

WET VENT SIZE

WET VENT PIPE SIZE (inches)	DRAINAGE FIXTURE UNIT LOAD (dfu)
1 ½	1
2	4
2 ½	6
3	12

For SI: 1 inch = 25.4 mm.

APHC

91

SECTION 910
WASTE STACK VENT

913.1 Waste stack vent permitted. A waste stack shall be considered a vent for all of the fixtures discharging to the stack where installed in accordance with the requirements of this section.

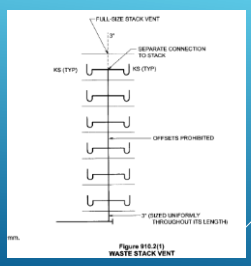
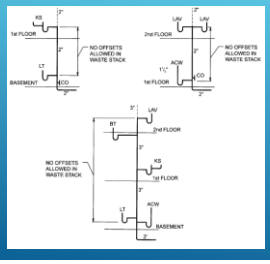


Figure 910.2(1)
WASTE STACK VENT

92

912.2 Stack installation. The waste stack shall be vertical, and both horizontal and vertical offsets shall be prohibited between the lowest fixture drain connection and the highest fixture drain connection. Every fixture drain shall connect separately to the waste stack. The stack shall not receive the discharge of water closets or urinals



93

913.4 Waste stack size. The waste stack shall be sized based on the total discharge to the stack and the discharge within a branch interval in accordance with Table 910.4. The waste stack shall be the same size throughout its length.

TABLE 910.4
WASTE STACK VENT SIZE

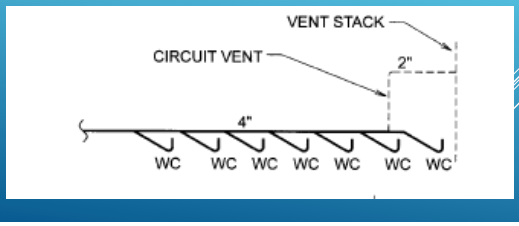
STACK SIZE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Total discharge into one branch interval	Total discharge for stack
1 ½	1	2
2	2	4
2 ½	No limit	8
3	No limit	24
4	No limit	50
5	No limit	75
6	No limit	100

For SI: 1 inch = 25.4 mm.

94

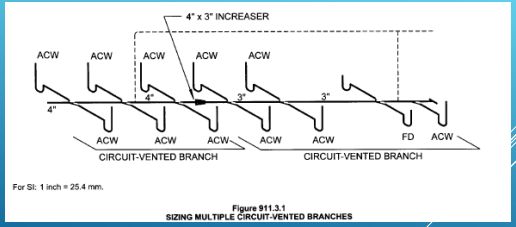
SECTION 911
CIRCUIT VENTING

914.1 Circuit vent permitted. A maximum of eight fixtures connected to a horizontal branch drain shall be permitted to be circuit vented. Each fixture drain shall connect horizontally to the horizontal branch being circuit vented. The horizontal branch drain shall be classified as a vent from the most downstream fixture drain connection to the most upstream fixture drain connection to the horizontal branch.



95

914.1.1 Multiple circuit-vented branches. Circuit-vented horizontal branch drains are permitted to be connected together. Each group of a maximum of eight fixtures shall be considered a separate circuit vent and shall conform to the requirements of this section.

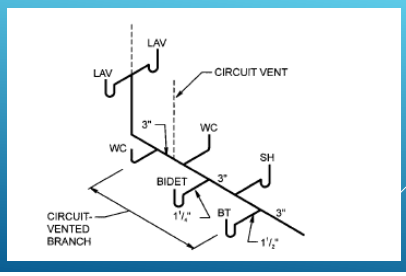


For SI: 1 inch = 25.4 mm.

Figure 911.3.1
SIZING MULTIPLE CIRCUIT-VENTED BRANCHES

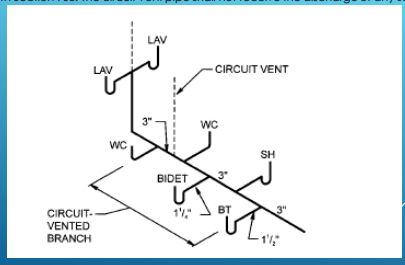
96

914.2 Vent connection. The circuit vent connection shall be located between the two most upstream fixture drains. The vent shall connect to the horizontal branch and shall be installed in accordance with Section 905. The circuit vent pipe shall not receive the discharge of any soil or waste.



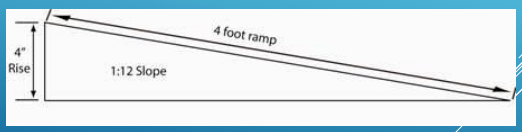
97

914.2 Vent connection. The circuit vent connection shall be located between the two most upstream fixture drains. The vent shall connect to the horizontal branch and shall be installed in accordance with Section 905. The circuit vent pipe shall not receive the discharge of any soil or waste.



98

914.3 Slope and size of horizontal branch. The maximum slope of the vent section of the horizontal branch drain shall be one unit vertical in 12 units horizontal (8-percent slope). The entire length of the vent section of the horizontal branch drain shall be sized for the total drainage discharge to the branch



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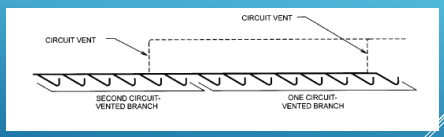
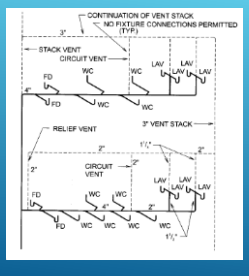
99

914.3.1 Size of multiple circuit vent. Each separate circuit-vented horizontal branch that is interconnected shall be sized independently in accordance with Section 911.3. The downstream circuit-vented horizontal branch shall be sized for the total discharge into the branch, including the upstream branches and the fixtures within the branch



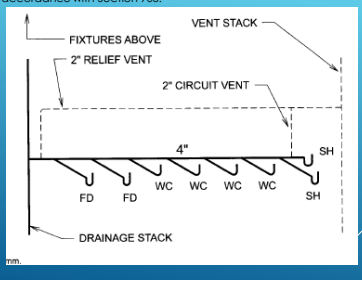
100

914.4 Relief vent. A relief vent shall be provided for circuit-vented horizontal branches receiving the discharge of four or more water closets and connecting to a drainage stack that receives the discharge of soil or waste from upper horizontal branches



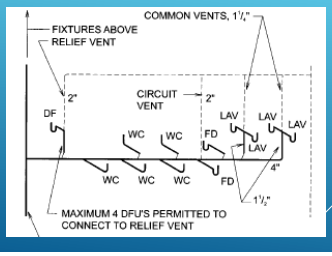
101

914.4.1 Connection and installation. The relief vent shall connect to the horizontal branch drain between the stack and the most downstream fixture drain of the circuit vent. The relief vent shall be installed in accordance with Section 905.



102

914.5 Additional fixtures. Fixtures, other than the circuit-vented fixtures, are permitted to discharge to the horizontal branch drain. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.



103

SECTION 915
COMBINATION DRAIN AND VENT SYSTEM

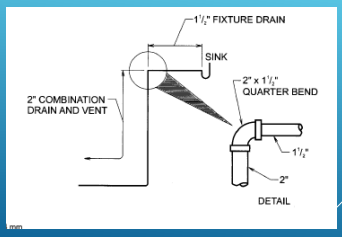
915.1 Type of fixtures. A combination drain and vent system shall not serve fixtures other than floor drains, sinks, lavatories and drinking fountains.




Combination drain and vent systems shall not receive the discharge from a food waste grinder or clinical sink.


104

915.2 Installation. The only vertical pipe of a combination drain and vent system shall be the connection between the fixture drain *of a sink, lavatory or drinking fountain, and the horizontal* combination drain and vent pipe. The maximum vertical distance shall be 8 feet (2438 mm).



105

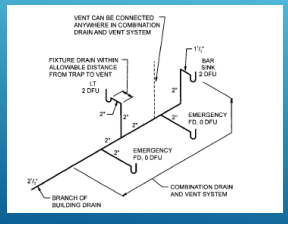
915.2.1 Slope. The horizontal combination drain and vent pipe shall have a maximum slope of one-half unit vertical in 12 units horizontal (4-percent slope). The minimum slope shall be in accordance with Table 704.1.

¼ inch per foot minim ½ per foot maximum

APHC

106

915.2.2 Connection. The combination drain and vent system shall be provided with a dry vent connected at any point within the system or the system shall connect to a horizontal drain that is vented in accordance with one of the venting methods specified in this chapter. Combination drain and vent systems connecting to building drains receiving only the discharge from a stack or stacks shall be provided with a dry vent. The vent connection to the combination drain and vent pipe shall extend vertically a minimum of 6 inches (152 mm) above the flood level rim of the highest fixture being vented before offsetting horizontally



107

915.2.3 Vent size. The vent shall be sized for the total drainage fixture unit load in accordance with Section 916.2.

TABLE 916.1
SIZE AND DEVELOPED LENGTH OF STACK VENTS AND VENT STACKS

DIAMETER OF SOIL OR WASTE STACK (inches)	TOTAL FIXTURE UNITS BEING VENTED (dfu)	MAXIMUM DEVELOPED LENGTH OF VENT (feet)* DIAMETER OF VENT (inches)									
		1¼	1½	2	2½	3	4	5	6	8	10	12
1¼	2	30										
1½	8	50	150	—	—	—	—	—	—	—	—	—
1½	10	30	100									
2	12	30	75	200								
2	20	26	50	150		—	—	—	—	—	—	—
2½	42		30	100	300							
3	10		42	150	360	1,040						
3	21	—	32	110	270	810	—	—	—	—	—	—
3	53		27	94	230	680						
3	102		25	86	210	620						
4	43	—		35	85	250	980	—	—	—	—	—
4	140			27	65	200	750					
4	320			23	55	170	640					
4	540	—	—	21	50	150	580	—	—	—	—	—
5	190				28	82	320	990				
5	690				21	63	250	760				
5	960	—	—	—	18	53	210	670	—	—	—	—
5	1,400				16	49	190	590				
6	500					72	130	400	1,000			
6	1,100	—	—	—	—	26	100	310	780	—	—	—
6	2,000					22	84	260	660			
6	2,900					20	77	240	600			
8	1,800	—	—	—	—		31	95	240	940	—	—
8	3,400						24	73	190	720		

(continued)

108

915.2.4 Fixture branch or drain. The fixture branch or fixture drain shall connect to the combination drain and vent within a distance specified in Table 906.1. The combination drain and vent pipe shall be considered the vent for the fixture

TABLE 906.1
MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT

SIZE OF TRAP (Inches)	SLOPE (inch per foot)	DISTANCE FROM TRAP (feet)
1 1/4	1/4	5
1 1/2	1/4	6
2	1/4	8
3	1/8	12
4	1/8	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm,
1 inch per foot = 83.3 mm/m.

109

915.3 Size. The minimum size of a combination drain and vent pipe shall be in accordance with Table 912.3.

TABLE 912.3
SIZE OF COMBINATION DRAIN AND VENT PIPE

DIAMETER PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Connecting to a horizontal branch or stack	Connecting to a building drain or building subdrain
2	3	4
2 ½	6	26
3	12	31
4	20	50
5	160	250
6	360	575

For SI: 1 inch = 25.4 mm

110

SECTION 916
ISLAND FIXTURE VENTING

916.1 Limitation. Island fixture venting shall not be permitted for fixtures other than sinks and lavatories. Residential kitchen sinks with a dishwasher waste connection, a food waste grinder, or both, in combination with the kitchen sink waste, shall be permitted to be vented in accordance with this section.

111

916.2 Vent connection. The island fixture vent shall connect to the fixture drain as required for an individual or common vent. The vent shall rise vertically to above the drainage outlet of the fixture being vented before offsetting horizontally or vertically downward. The vent or branch vent for multiple island fixture vents shall extend to a minimum of 6 inches (152 mm) above the highest island fixture being vented before connecting to the outside vent terminal.

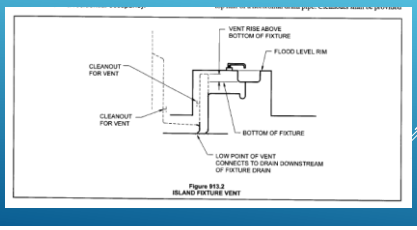


Figure 913.2
ISLAND FIXTURE VENT

112

916.3 Vent installation below the fixture flood level rim. The vent located below the flood level rim of the fixture being vented shall be installed as required for drainage piping in accordance with Chapter 7, except for sizing. The vent shall be sized in accordance with Section 916.2. The lowest point of the island fixture vent shall connect full size to the drainage system. The connection shall be to a vertical drain pipe or to the top half of a horizontal drain pipe. Cleanouts shall be provided in the island fixture vent to permit rodding of all vent piping located below the flood level rim of the fixtures. Rodding in both directions shall be permitted through a cleanout

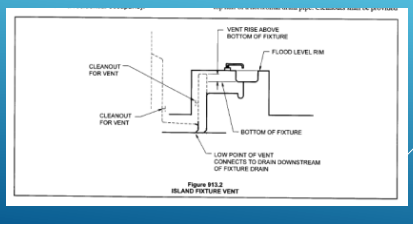
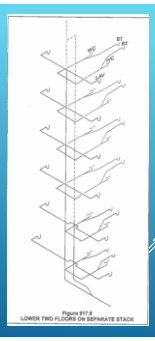


Figure 913.2
ISLAND FIXTURE VENT

113

SECTION 917
SINGLE STACK VENT SYSTEM

917.1 **Where permitted.** A drainage stack shall serve as a single stack vent system where sized and installed in accordance with Sections 917.2 through 917.9. The drainage stack and branch piping shall be the vents for the drainage system. The drainage stack shall have a stack vent.



114

917.2 **Stack size.** Drainage stacks shall be sized in accordance with Table 917.2. Stacks shall be uniformly sized based on the total connected drainage fixture unit load. The stack vent shall be the same size as the drainage stack. A 3inch (76 mm) stack shall serve not more than two water closets.

115

TABLE 917.2 SINGLE STACK SIZE

STACK SIZE	MAXIMUM CONNECTED DRAINAGE FIXTURE UNITS		
(inches)	Stacks less than 75 feet heightin	Stacks 75 feet to less than 160 feet in height	Stacks 160 feet and greater in height
3	24	NP	NP
4	225	24	NP
5	480	225	24
6	1,015	480	225
8	2,320	1,015	480
10	4,500	2,320	1,015
12	8,100	4,500	2,320
15	13,600	8,100	4,500

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

116

917.3 **Branch size.** Horizontal branches connecting to a single stack vent system shall be sized in accordance with Table 710.1(2). Not more than one water closet shall discharge into a 3-inch (76 mm) horizontal branch at a point within a developed length of 18 inches (457 mm) measured horizontally from the stack. Where a water closet is within 18 inches (457 mm) measured horizontally from the stack and not more than one fixture with a drain size of not more than 1½ inches (38 mm) connects to a 3-inch (76 mm) horizontal branch, the branch drain connection to the stack shall be made with a sanitary tee.

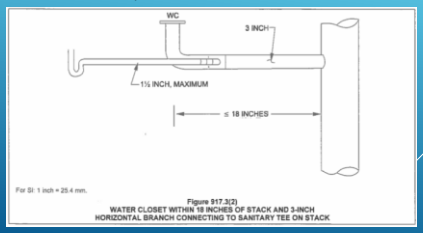


Figure 917.3(2)
WATER CLOSET WITHIN 18 INCHES OF STACK AND 3-INCH HORIZONTAL BRANCH CONNECTING TO SANITARY TEE ON STACK

117

917.4 **Length of horizontal branches.** The length of horizontal branches shall conform to the requirements of Sections 917.4.1 through 917.4.3.

118

917.4.1 **Water closet connection.** Water closet connections shall be not greater than 4 feet (1219 mm) in developed length measured horizontally from the stack.

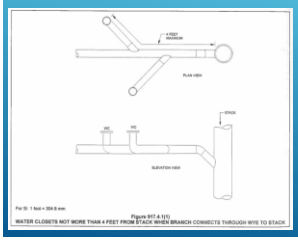


Figure 917.4.1(1)
WATER CLOSETS NOT MORE THAN 4 FEET FROM STACK WHEN BRANCH CONNECTS THROUGH WYE TO STACK

Exception: Where the connection is made with a sanitary tee, the maximum developed length shall be 8 feet (2438 mm).

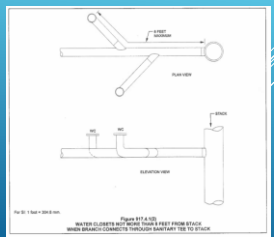


Figure 917.4.1(2)
WATER CLOSETS NOT MORE THAN 8 FEET FROM STACK WHEN BRANCH CONNECTS THROUGH SANITARY TEE TO STACK

119

917.4.2 **Fixture connections.** Fixtures other than water closets shall be located not greater than 12 feet (3657 mm) in developed length, measured horizontally from the stack.

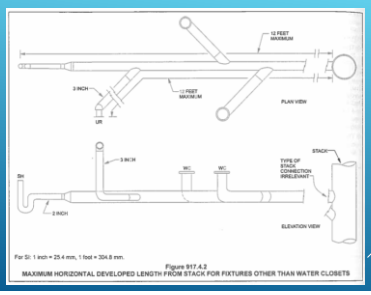


Figure 917.4.2
MAXIMUM HORIZONTAL DEVELOPED LENGTH FROM STACK FOR FIXTURES OTHER THAN WATER CLOSETS

120

917.4.3 **Vertical piping in branch.** The length of vertical piping in a fixture drain connecting to a horizontal branch shall not be considered in computing the fixture's distance in developed length measured horizontally from the stack.

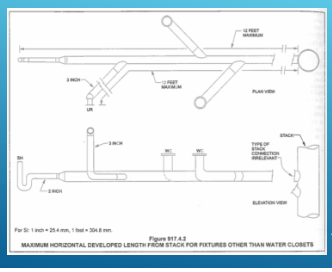


Figure 917.4.3
MAXIMUM HORIZONTAL DEVELOPED LENGTH FROM STACK FOR FIXTURES OTHER THAN WATER CLOSETS

121

917.5 **Minimum vertical piping size from fixture.** The vertical portion of piping in a fixture drain to a horizontal branch shall be 2 inches (51 mm). The minimum size of the vertical portion of piping for a water-supplied urinal or standpipe shall be 3 inches (76 mm). The maximum vertical drop shall be 4 feet (1219 mm). Fixture drains that are not increased in size, or have a vertical drop in excess of 4 feet (1219 mm), shall be individually vented.

122

917.6 **Additional venting required.** Additional venting shall be provided where more than one water closet discharges to a horizontal branch and where the distance from a fixture trap to the stack exceeds the limits in Section 917.4. Where additional venting is required, the fixture(s) shall be vented by individual vents, common vents, wet vents, circuit vents, or a combination waste and vent pipe. The dry vent extensions for the additional venting shall connect to a branch vent, vent stack, stack vent, air admittance valve, or shall terminate outdoors.

123

917.7 **Stack offsets.** Where fixture drains are not connected below a horizontal offset in a stack, a horizontal offset shall not be required to be vented. Where horizontal branches or fixture drains are connected below a horizontal offset in a stack, the offset shall be vented in accordance with Section 907. Fixture connections shall not be made to a stack within 2 feet (610 mm) above or below a horizontal offset.

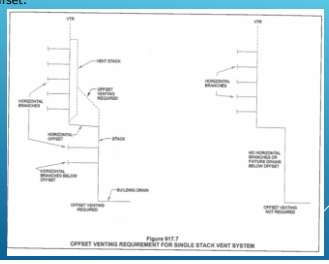


Figure 917.7
OFFSET VENTING REQUIREMENT FOR SINGLE STACK VENT SYSTEM

124

917.8 **Prohibited lower connections.** Stacks greater than 2 branch intervals in height shall not receive the discharge of horizontal branches on the lower two floors. There shall be no connections to the stack between the lower two floors and a distance of not less than 10 pipe diameters downstream from the base of the single stack vented system.

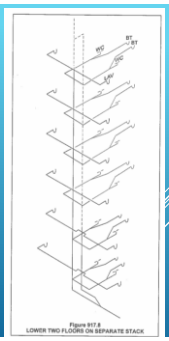


Figure 917.8
LOWER TWO FLOORS ON SEPARATE STACK

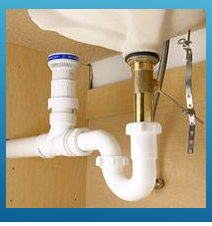
125

917.9 **Sizing building drains and sewers.** The building drain and building sewer receiving the discharge of a single stack vent system shall be sized in accordance with Table 710.1(1).

126

SECTION 918
AIR ADMITTANCE VALVES

918.1 **General.** Vent systems utilizing air admittance valves shall comply with this section. Stack-type air admittance valves shall conform to ASSE 1050. Individual and branch type air admittance valves shall conform to ASSE 1051.



127

918.2 **Installation.** The valves shall be installed in accordance with the requirements of this section and the manufacturer's instructions. Air admittance valves shall be installed after the DWV testing required by Section 312.2 or 312.3 has been performed.

128

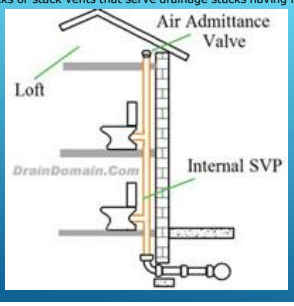
918.3 **Where permitted.** Individual, branch and circuit vents shall be permitted to terminate with a connection to an individual or branch-type air admittance valve in accordance with Section 918.3.1. Stack vents and vent stacks shall be permitted to terminate to stack-type air admittance valves in accordance with Section 918.3.2

129

918.3.1 **Horizontal branches.** Individual and branch-type air admittance valves shall vent only fixtures that are on the same floor level and connect to a horizontal branch drain. Where the horizontal branch is located more than four branch intervals from the top of the stack, the horizontal branch shall be provided with a relief vent that shall connect to a vent stack or stack vent, or extend outdoors to the open air. The relief vent shall connect to the horizontal branch drain between the stack and the most downstream fixture drain connected to the horizontal branch drain. The relief vent shall be sized in accordance with Section 906.2 and installed in accordance with Section 905. The relief vent shall be permitted to serve as the vent for other fixtures.

130

918.3.2 **Stack.** Stack-type air admittance valves shall be prohibited from serving as the vent terminal for vent stacks or stack vents that serve drainage stacks having more than six branch intervals



131

918.4 **Location.** Individual and branch-type air admittance valves shall be located a minimum of 4 inches (102 mm) above the horizontal branch drain or fixture drain being vented. Stack-type air admittance valves shall be located not less than 6 inches (152 mm) above the flood level rim of the highest fixture being vented. The air admittance valve shall be located within the maximum developed length permitted for the vent. The air admittance valve shall be installed not less than 6 inches (152 mm) above insulation materials.

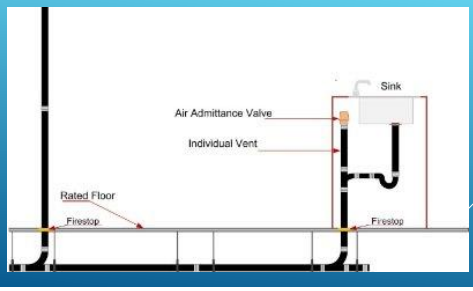
132

918.5 **Access and ventilation.** Access shall be provided to all air admittance valves. Such valves shall be installed in a location that allows air to enter the valve.

918.6 **Size.** The air admittance valve shall be rated in accordance with the standard for the size of the vent to which the valve is connected.

133

918.7 **Vent required.** Within each plumbing system, not less than one stack vent or vent stack shall extend outdoors to the open air.



134

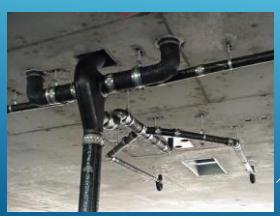
918.8 **Prohibited installations.** Air admittance valves shall not be installed in non-neutralized special waste systems as described in Chapter 8 except where such valves are in compliance with ASSE 1049, are constructed of materials approved in accordance with Section 702.5 and are tested for chemical resistance in accordance with ASTM F 1412. Air admittance valves shall not be located in spaces utilized as supply or return air plenums *or where limited by the manufacturer's installation instructions*. Air admittance valves without an engineered design shall not be utilized to vent sumps or tanks of any type.

135

SECTION 919
ENGINEERED VENT SYSTEMS

919.1 **General.** Engineered vent systems shall comply with this section and the design, submittal, approval, inspection and testing requirements of Section *106.5 of the building code*.

919.2 **Individual branch fixture and individual fixture header vents.** The maximum developed length of individual fixture vents to vent branches and vent headers shall be determined in accordance with Table 919.2 for the minimum pipe diameters at the indicated vent airflow rates. The individual vent airflow rate shall be determined in accordance with the following:



136

File Attachments for Item:

EC-10 Review of OPC Chapters 1-11 (Assn Plumbing & Hydronics Contractors)

4 hours all certifications.

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Tracy Lefferies - Exec Director

Organization: APHC

Official Address: 3891 Seabell Ct Columbus OH 43230

E-mail: aphc.contractors@gmail.com Telephone: 614-315-6924

Website: aphc of Central Ohio.com

Conference Sponsor (if applicable)_____ Conference Email:_____

Check here if Course Renewal:_____ Prior course number _____ (*i.e. BBS2018-429*)

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

New Course Information:

Course title: Review of Chapters 1-11 of Plumbing Code

Course instructor: Guy Fuller Jr & Darrin Dawson

Course description: See attached doc with description & outline.

Instructional hours per session: 4hrs Number of Sessions: TBD

Course Date(s) and Location: Pending Approval for date
6053 McCorkle Blvd Suite H Westerville OH 43081

Special Content:

Code Administration: ☐
Existing Buildings: ☐
Electrical Instruction: ☐
Plumbing Instruction: ☒

Conference Course: _____
Conference Name: _____
Conference location: _____

Course to be offered online? ☐ **On Demand** ☐ **Webinar** ☐

Course Website: _____

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

_____

Course applicable for the following certifications

Residential Certifications Only: ☐
Administrative Course, All Certifications: ☒

Commercial Certifications: ☐

Application materials included:

☒ Course Outline or Course Learning Objectives
☒ Presentation Materials/Slides (not required for roundtable courses)
☐ Assessment Materials (for online courses)
☒ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

APHC

OBJECTIVE: A comprehensive review of sections of the state plumbing code, emphasizing code revisions and code clarification.

MATERIALS/BOOKS: State of Ohio plumbing code book, overheads for illustrations.

LENGTH OF COURSE: 4 hours

COURSE TITLE: Review of Chapters 1-11 of the Plumbing Code

COURSE OUTLINE:

Part I — Chapter 1-6 -1 hour
General review of these chapters highlighting
major changes that are of importance

Part II — Chapter 8, 10, 11 -1hour
Indirect waste, Traps and Interceptors, and Storm piping

Part III — Chapter 7 - 1 hour
Discussing the fixture unit table.
Sizing of building drains, stacks, and branches.
Sewage ejector systems

Part IV — Chapter 9 - 1 hour
Vents, trap vent distance, vent connections.
Overview of venting requirements and vent stacks.
Explanation of the venting methods.

PHYSICAL FACILITIES DESCRIPTION

Classroom at 653 McCorkle Blvd. Suite H in Westerville:

The room is set up in a classroom style with seating for up to 24 individuals at conference tables. The room is well lit using overhead fluorescent lighting. The room is also provided with audio/visual equipment; overhead projector, screen and eraser board for illustrations as needed for presentation purposes. The room is equipped with its own controls to control heating and cooling for comfort. Of course, restroom facilities are available.

This site is also equipped with a lab area consisting of workstations for the backflow prevention certification and recertification classes held. These stations (8) are equipped with different manufacturers' devices to test and repair. All tools and equipment needed for the lab portion of the class are provided as part of the course.

QUALIFICATIONS:

Darrin Dawson has worked 39 years in the plumbing industry. In May of 1990, he received his Master Plumbing Certification.

He has been a State of Ohio Certified Plumbing Inspector since June of 2003. He became a National Certified Medical Gas Inspector in June of 2007.

In April of 2022 he received a State of Ohio Backflow Certification.

Mr. Dawson has been an instructor for The Association of Plumbers and Hydronics Contractors (APHC) apprenticeship program for 16 years.

He is currently employed at The Delaware Public Health District as a Plumbing and Medical Gas inspector.

Guy Miller Jr.
629 Fenchurch Way
Gahanna, OH 43230
Ph. (614) 940-5700
guymillerjr@gmail.com

Certification: Master Plumber, State of Ohio-Id Number #24380 (exp)
Certified Backflow Preventer - Certificate #1300 (State of Ohio – exp)
Certified plumbing inspector - Certificate #K02033 (State of Ohio), 5523 (BBS)
Certified plumbing plans examiner- Certificate #K02033 (State of Ohio), 5523 (BBS)

Teacher: APHC Apprenticeship Program, Fourth Year Instructor
8/08-present

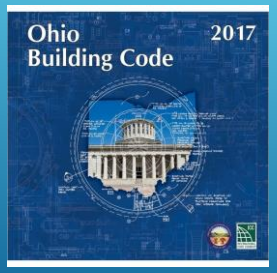
APHC Association - Continuing Education Classes
2021- Present

Work Experience:

1/85 – 1/95	Guy Miller Plumbing
1/95-8/03	Eric Guy Plumbing
8/03 – 2/10	Foreman: Crawford Mechanical Services
2/10-04/17	Foreman/Project Manager: Gutridge Plumbing
4/17-current	Plumbing Field Supervisor-City of Columbus

Ohio Code General Requirements

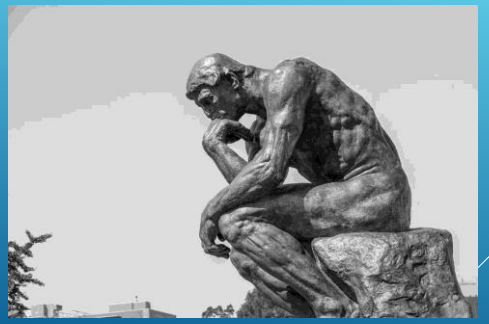
or stuff you should know



APHC

1

ESSENTIAL CODE DEFINITIONS



2

AIR BREAK (Drainage System). A piping arrangement in which a drain from a fixture, appliance or device discharges indirectly into another fixture, receptacle or interceptor at a point below the flood level rim and above the trap seal.

3

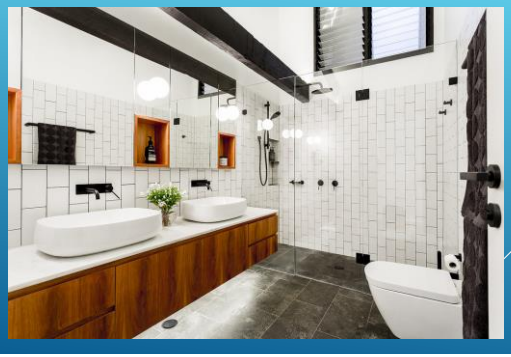
AIR GAP (Drainage System). The unobstructed vertical distance through the free atmosphere between the outlet of the waste pipe and the flood level rim of the receptacle into which the waste pipe is discharging.

4

AIR GAP (Water Distribution System). The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of the receptacle.

5

BATHROOM GROUP. A group of fixtures consisting of a water closet, lavatory, bathtub or shower, including or excluding a bidet, an emergency floor drain or both. Such fixtures are located together on the same floor level

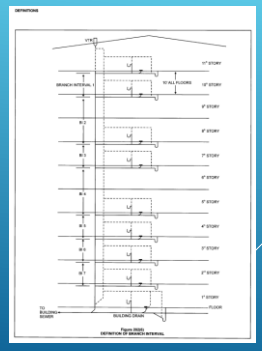


6

BRANCH. Any part of the piping system except a riser, main or stack.

7

BRANCH INTERVAL. A vertical measurement of distance, 8 feet (2438 mm) or more in developed length, between the connections of horizontal branches to a drainage stack. Measurements are taken down the stack from the highest horizontal branch connection.

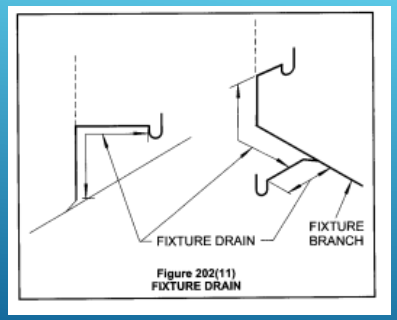


8

CONSTRUCTION DOCUMENTS. All of the written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of the project necessary for obtaining plan approval in accordance with section 106 of rule 4101:1-1-01 of the Administrative code.

9

FIXTURE DRAIN. The drain from the trap of a fixture to a junction with any other drain pipe.



10

FLOOD LEVEL RIM. The edge of the receptacle from which water overflows.

11

HORIZONTAL BRANCH DRAIN. A drainage branch pipe extending laterally from a soil or waste stack or building drain, with or without vertical sections or branches, that receives the discharge from two or more fixture drains or branches and conducts the discharge to the soil or waste stack or to the building drain.

12

INDIRECT WASTE PIPE. A waste pipe that does not connect directly with the drainage system, but that discharges into the drainage system through an air break or air gap into a trap, fixture, receptor or interceptor.

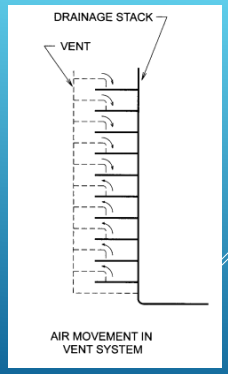
13

DRAINAGE FIXTURE UNIT

A measure of the probable discharge into the drainage system by various types of plumbing fixtures. The drainage fixture-unit value for a particular fixture depends on its volume rate of drainage discharge, on the time duration of a single drainage operation and on the average time between successive operations.

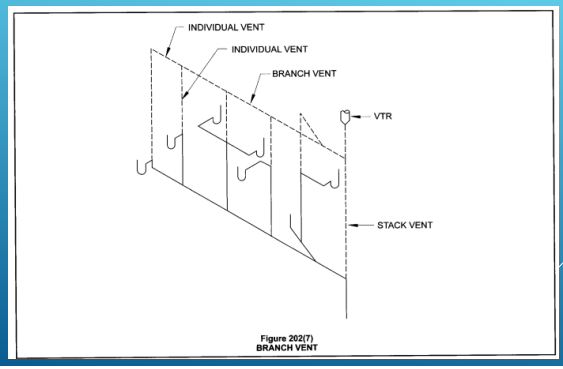
14

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



15

STACK VENT. The extension of a soil or waste stack above the highest horizontal drain connected to the stack.



16

TRAP. A fitting or device that provides a liquid seal to prevent the emission of sewer gases without materially affecting the flow of sewage or waste water through the trap.

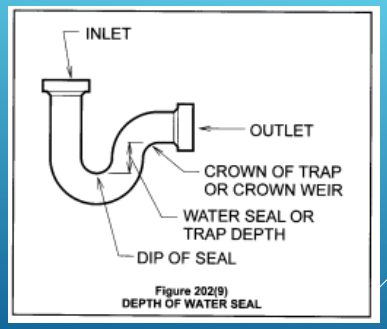
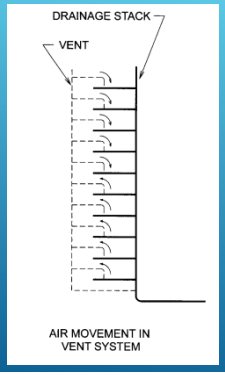


Figure 202(9)
DEPTH OF WATER SEAL

17

VENT STACK. A vertical vent pipe installed primarily for the purpose of providing circulation of air to and from any part of the drainage system



18

SECTION 306
TRENCHING, EXCAVATION AND BACKFILL
306.1 **Support of piping.** Buried piping shall be supported throughout its entire length.

19

306.2.3 **Soft load-bearing materials.** If soft materials of poor load-bearing quality are found at the bottom of the trench, stabilization shall be achieved by overexcavating not less than two pipe diameters and backfilling to the installation level of the bottom of the pipe with fine gravel, crushed stone or a concrete foundation. The concrete foundation shall be bedded with sand tamped into place so as to provide uniform load-bearing support for the pipe between joints.

Plumbing Inspector checking underground piping.

20

STRUCTURAL SAFETY

307.2 **Cutting, notching or bored holes.** A framing member shall not be cut, notched or bored in excess of limitations specified in the *building code*

APHC

21

PIPING SUPPORT

308.5 **Interval of support.** Pipe shall be supported in accordance with Table 308.5.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.

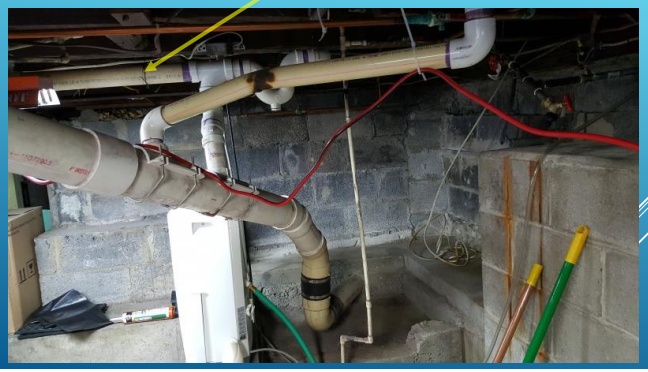
b. For sizes 2 inches and smaller, a guide shall be installed midway between required vertical supports. Such guides shall prevent pipe movement in a direction perpendicular to the axis of the pipe.

TABLE 308.5
HANGER SPACING

PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING (feet)	MAXIMUM VERTICAL SPACING (feet)
Acrylonitrile butadiene styrene (ABS) pipe	4	10[a]
Aluminum tubing	10	15
Brass pipe	10	10
Cast-iron pipe	5[b]	15
Chlorinated polyvinyl chloride (CPVC) pipe and tubing, 1 inch and smaller	3	10[a]
Chlorinated polyvinyl chloride (CPVC) pipe and tubing, 1¼ inches and larger	4	10[a]
Copper or copper-alloy pipe	12	10
Copper or copper-alloy tubing, 1¼-inch diameter and smaller	6	10
Copper or copper-alloy tubing, 1¼-inch diameter and larger	10	10
Cross-linked polyethylene (PEX) pipe	2.67 (32 inches)	10[a]
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	2.67 (32 inches)	4
Lead pipe	Continuous	4
Polyethylene/aluminum/polyethylene (PE-AL-PE) pipe	2.67 (32 inches)	4
Polyethylene of raised temperature (PE-RT) pipe	2.67 (32 inches)	10[a]
Polypropylene (PP) pipe or tubing 1 inch and smaller	2.67 (32 inches)	10[a]
Polypropylene (PP) pipe or tubing, 1¼ inches and larger	4	10[a]
Polyvinyl chloride (PVC) pipe	4	10[a]
Stainless steel drainage systems	10	10[a]
Steel pipe	12	15

22

One Hanger on the drainage system



23

405.4.2 Securing floor outlet fixtures. Floor outlet fixtures shall be secured to the floor or floor flanges by screws or bolts of **corrosion-resistant** material.

24

405.5 Water-tight joints. Joints formed where fixtures come in contact with walls or floors shall be sealed

25

405.7 Design of overflows. Where any fixture is provided with an overflow, the waste shall be designed and installed so that standing water in the fixture will not rise in the overflow when the stopper is closed, and no water will remain in the overflow when the fixture is empty

26

406.2 **Waste connection.** The waste from an automatic clothes washer shall discharge through an air break into a standpipe in accordance with Section 802.4 or into a laundry sink. The trap and fixture drain for an automatic clothes washer standpipe shall be not less than 2 inches (51 mm) in diameter. The fixture drain for the standpipe serving an automatic clothes washer shall connect to a 3-inch (76 mm) or larger diameter fixture branch or stack. Automatic clothes washers that discharge by gravity shall be permitted to drain to a waste receptor or an approved trench drain.

27

408.3 Bidet water temperature. The discharge water temperature from a bidet fitting shall be limited to a maximum temperature of 110°F (43°C) by a water temperature limiting device conforming to ASSE 1070 or CSA B125.3.

28

412.2 **Floor drains.** Floor drains shall have removable strainers. The floor drain shall be constructed so that the drain is capable of being cleaned. Access shall be provided to the drain inlet. Ready access shall be provided to floor drains.

Exception: Floor drains serving refrigerated display cases shall be provided with access.

29

416.5 TEMPERED WATER FOR PUBLIC HAND-WASHING FACILITIES. TEMPERED WATER SHALL BE DELIVERED FROM PUBLIC HAND-WASHING FACILITIES. TEMPERED WATER SHALL BE DELIVERED THROUGH AN APPROVED WATER-TEMPERATURE LIMITING DEVICE THAT CONFORMS TO ASSE 1070 OR CSA B125.3

30

417.5.2 Shower lining. Floors under shower compartments, except where prefabricated receptors have been provided, shall be lined and made water tight utilizing material complying with Sections 417.5.2.1 through 417.5.2.6. Such liners shall turn up on all sides not less than 2 inches (51 mm) above the finished threshold level. Liners shall be recessed and fastened to an approved backing so as not to occupy the space required for wall covering, and shall not be nailed or perforated at any point less than 1 inch (25 mm) above the finished threshold. Liners shall be pitched one-fourth unit vertical in 12 units horizontal (2-percent slope) and shall be sloped toward the fixture drains and be securely fastened to the waste outlet at the seepage entrance, making a water-tight joint between the liner and the outlet. The completed liner shall be tested in accordance with Section 312.9.

31

Exceptions: 1. Floor surfaces under shower heads provided for rinsing laid directly on the ground are not required to comply with this section.

2. Where a sheet-applied, load-bearing, bonded, waterproof membrane is installed as the shower lining, the membrane shall not be required to be recessed.

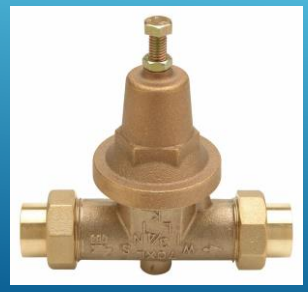
32

3. The shower liner test is not required for one-, two-, or three-family dwellings unless required by the shower liner manufacturer's installation instructions.

33

604.8 Water pressure-reducing valve or regulator. Where water pressure within a building exceeds 80 psi (552 kPa) static, an approved water pressurereducing valve conforming to ASSE 1003 or CSA B356 with strainer shall be 4101:3-6-01 6 installed to reduce the pressure in the building water distribution piping to not greater than 80 psi (552 kPa) static.

Exception: Service lines to sill cocks and outside hydrants, and main supply risers where pressure from the mains is reduced to 80 psi (552 kPa) or less at individual fixtures



34

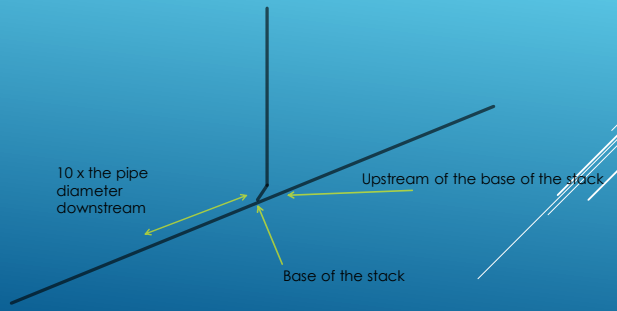
SECTION 610 DISINFECTION OF POTABLE WATER SYSTEM 610.1 General. **New potable water systems** shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the health authority or water purveyor having jurisdiction or, in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652, or as described in this section. This requirement shall apply to "on-site" or "inplant" fabrication of a system or to a modular portion of a system.

1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
2. The system or part thereof shall be filled with a water/chlorine solution containing not less than 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing not less than 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3 hours.
3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.
4. 4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

35

36

704.3 Connections to offsets and bases of stacks. Horizontal branches shall connect to the bases of stacks at a point located not less than 10 times the diameter of the drainage stack downstream from the stack. Except as prohibited by Section 711.2, horizontal branches shall connect to horizontal stack offsets at a point located not less than 10 times the diameter of the drainage stack downstream from the upper stack.



37

705.16 Joints between different materials. Joints between different piping materials shall be made with a mechanical joint of the compression or mechanical-sealing type conforming to ASTM C 1173, ASTM C 1460 or ASTM 4101:3-7-01 12 C 1461. Connectors and adapters shall be approved for the application and such joints shall have an elastomeric seal conforming to ASTM C 425, ASTM C 443, ASTM C 564, ASTM C 1440, ASTM F 477, CSA A257.3M or CSA B602, or as required in Sections 705.16.1 through 705.16.7. Joints between glass pipe and other types of materials shall be made with adapters having a TFE seal. Joints shall be installed in accordance with the manufacturer's instructions.

38

NOPE!

use this

39

706.3 Installation of fittings. Fittings shall be installed to guide sewage and waste in the direction of flow. Change in direction shall be made by fittings installed in accordance with Table 706.3. Change in direction by combination fittings, side inlets or increasers shall be installed in accordance with Table 706.3 based on the pattern of flow created by the fitting. Double sanitary tee patterns shall not receive the discharge of back-to-back water closets and fixtures or appliances with pumping action discharge.

40

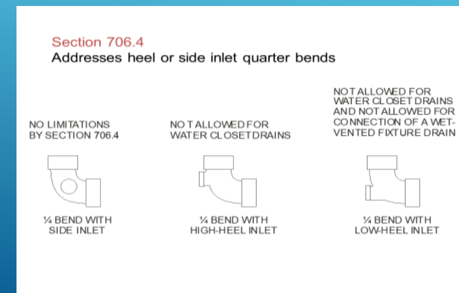
2" Trap

1 1/2 pipe

and

41

706.4 Heel- or side-inlet quarter bends. Heel-inlet quarter bends shall be an acceptable means of connection, except where the quarter bend serves a water closet. A low-heel inlet shall not be used as a wet-vented connection. Side-inlet quarter bends shall be an acceptable means of connection for drainage, wet venting and stack venting arrangements.



42

SECTION 708
CLEANOUTS
708.1 Cleanouts required. Cleanouts shall be provided for drainage piping in accordance with Sections 708.1.1 through 708.1.11.

Stack Cleanout's no longer required

43

709.1 **Values for fixtures.** Drainage fixture unit values as given in Table 709.1 designate the relative load weight of different kinds of fixtures that shall be employed in estimating the total load carried by a soil or waste pipe, and shall be used in connection with Tables 710.1(1) and 710.1(2) of sizes for soil, waste and vent pipes for which the permissible load is given in terms of fixture units.

TABLE 709.1
DRAINAGE FIXTURE UNITS FOR FIXTURES AND GROUPS

FIXTURE TYPE	DRAINAGE FIXTURE UNIT VALUE AS LOAD FACTORS	MINIMUM SIZE OF TRAP (inches)
Automatic clothes washers, commercial[g]	Note a	Note a
Automatic clothes washers, residential[g]	2	2
Bathroom group as defined in Section 202 (1.6 gpf water closet)[f]	5	—
Bathroom group as defined in Section 202 (water closet flushing greater than 1.6 gpf)[f]	6	—
Bathtub[b] (with or without overhead shower or whirpool attachments)	2	1½
Bidet	1	1¼
Combination sink and tray	2	1½
Dental lavatory	1	1¼
Dental unit or cuspidor	1	1¼
Dishwashing machine[c], domestic	2	1½
Drinking fountain	½	1¼
Emergency floor drain	0	2
Floor drains[h]	2[h]	2
Floor sinks	Note h	2
Kitchen sink, domestic	2	1½
Kitchen sink, domestic with food waste disposer and/or dishwasher	2	1½
Laundry tray (1 or 2 compartments)	2	1½
Lavatory	1	1¼
Shower (based on the total flow rate through showerheads and body sprays) Flow rate: 5.7 gpm or less Greater than 5.7 gpm to 12.3 gpm Greater than 12.3 gpm to 25.8 gpm Greater than 25.8 gpm to 55.6 gpm	 2 3 5 6	 1½ 2 3 4
Service sink	2	1½
Sink	2	1½
Urinal	4	Note d
Urinal, 1 gallon per flush or less	2[e]	Note d
Urinal, nonwater supplied	½	Note d
Wash sink (circular or multiple) each set of faucets	2	1½
Water closet, flushometer tank, public or private	4[e]	Note d
Water closet, private (1.6 gpf)	3[e]	Note d
Water closet, private (flushing greater than 1.6 gpf)	4[e]	Note d
Water closet, public (1.6 gpf)	4[e]	Note d
Water closet, public (flushing greater than 1.6 gpf)	6[e]	Note d

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L, gpf = gallon per flushing cycle, gpm = gallon per minute.
a. Calculate per Section 709.3.
b. A showerhead over a bathtub or whirlpool bathtub attachment does not increase the drainage fixture unit value.
c. See Sections 709.2 through 709.4.1 for methods of computing unit value of fixtures not listed in this table or for rating of devices with intermittent flows.
d. Trap size shall be consistent with the fixture outlet size.
e. For the purpose of computing loads on building drains and sewers, water closets and urinals shall not be rated at a lower drainage fixture unit unless the lower values are confirmed by testing.
f. For fixtures added to a bathroom group, add the dfu value of those additional fixtures to the bathroom group fixture count.
g. See Section 406.2 for sizing requirements for fixture drain, branch drain and drainage stack for an automatic clothes washer standpipe.
h. See Sections 709.4 and 709.4.1.

44

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

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

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

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

d. Trap size shall be consistent with the fixture outlet size.

e. For the purpose of computing loads on building drains and sewers, water closets and urinals shall not be rated at a lower fixture unit unless the lower values are confirmed by testing.

f. For fixtures added to a dwelling unit bathroom group, add the dfu value of those additional fixtures to the bathroom group count.

g. See Section 406.3 for sizing requirements for fixture drain, branch drain, and drainage stack for an automatic clothes washer standpipe.

h. See Sections 709.4 and 709.4.1.

45

709.2 **Fixtures not listed in Table 709.1.** Fixtures not listed in Table 709.1 shall have a drainage fixture unit load based on the outlet size of the fixture in accordance with Table 709.2. The minimum trap size for unlisted fixtures shall be the size of the drainage outlet but not less than 1¼ inches (32 mm).

TABLE 709.2

DRAINAGE FIXTURE UNITS FOR FIXTURE DRAINS OR TRAPS

FIXTURE DRAIN OR TRAP SIZE (inches)	DRAINAGE FIXTURE UNIT VALUE
1 ¼	1
1 ½	2
2	3
2 ½	4
3	5
4	6

46

709.3 **Values for continuous and semi-continuous flow.** Drainage fixture unit values for continuous and semi-continuous flow into a drainage system shall be computed on the basis that 1 gpm (0.06 L/s) of flow is equivalent to two fixture units.

47

709.4 Values for indirect waste receptor. The drainage fixture unit load of an indirect waste receptor receiving the discharge of indirectly connected fixtures shall be the sum of the drainage fixture unit values of the fixtures that discharge to the receptor, but not less than the drainage fixture unit value given for the indirect waste receptor in Table 709.1 or 709.2

48

709.4.1 Clear-water waste receptors. Where waste receptors such as floor drains, floor sinks and hub drains receive only clear-water waste from display cases, refrigerated display cases, ice bins, coolers and freezers, such receptors shall have a drainage fixture unit value of one-half.

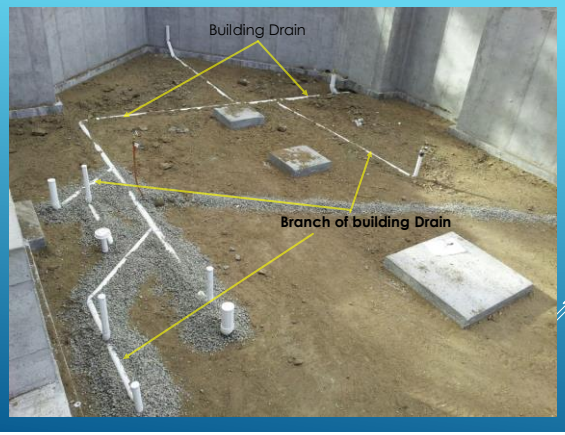
49

TABLE 710.1(1) BUILDING DRAINS AND SEWERS
DIAMETER OF PIPE (inches)
MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS CONNECTED TO ANY PORTION OF THE BUILDING DRAIN OR THE BUILDING SEWER, INCLUDING BRANCHES OF THE BUILDING Drain

	Slope per foot			
	1/16 inch	1/8 inch	1/4 inch	1/2 inch
1 ¼	—	—	1	1
1 ½	—	—	3	3
2	—	—	21	26
2 ½	—	—	24	31
3	—	36	42	50
4	—	180	216	250
5	—	390	480	575
6	—	700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

For SI: 1 inch = 25.4 mm, 1 inch per foot = 83.3 mm/m.
a. The minimum size of any building drain serving a water closet shall be 3 inches.

50



51

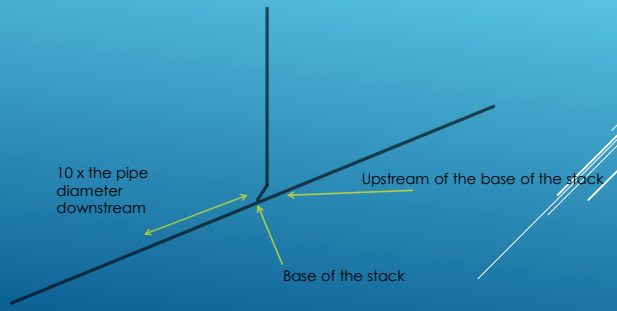
TABLE 710.1(2)
HORIZONTAL FIXTURE BRANCHES AND STACKS[a]

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
	Total for horizontal branch	Stacks[b]		
		Total discharge into one branch interval	Total for stack of three branch intervals or less	Total for stack greater than three branch intervals
1 ½	3	2	4	8
2	6	6	10	24
2 ½	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Note c	Note c	Note c

For SI: 1 inch = 25.4 mm.
a. Does not include branches of the building drain. Refer to Table 710.1(1).
b. Stacks shall be sized based on the total accumulated connected load at each story or branch interval. As the total accumulated connected load decreases, stacks are permitted to be reduced in size. Stack diameters shall not be reduced to less than one-half of the diameter of the largest stack size required.
c. Sizing load based on design criteria.

52

704.3 Connections to offsets and bases of stacks. Horizontal branches shall connect to the bases of stacks at a point located not less than 10 times the diameter of the drainage stack downstream from the stack. Except as prohibited by Section 711.2, horizontal branches shall connect to horizontal stack offsets at a point located not less than 10 times the diameter of the drainage stack downstream from the upper stack.



53

SECTION 712
SUMPS AND EJECTORS
712.1 Building subdrains.

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

54

712.2 Valves required. A check valve and a full open valve located on the discharge side of the check valve shall be installed in the pump or ejector discharge piping between the pump or ejector and the gravity drainage system. Access shall be provided to such valves. Such valves shall be located above the sump cover required by Section 712.1 or, where the discharge pipe from the ejector is below grade, the valves shall be accessibly located outside the sump below grade in an access pit with a removable access cover.

55

715.5 Location. Backwater valves shall be installed so that access is provided to the working parts for service and repair.

56

802.1 **Where required.** Food-handling equipment, in other than dwelling units, clear-water waste, dishwashing machines and utensils, pots, pans and dishwashing sinks shall discharge through an indirect waste pipe as specified in Sections 802.1.1 through 802.1.8. Health-care related fixtures, devices and equipment shall discharge to the drainage system through an indirect waste pipe by means of an air gap in accordance with this chapter and Section 713.3. Fixtures not required by this section to be indirectly connected shall be directly connected to the plumbing system in accordance with Chapter 7.

57

802.1.1 **Food handling.** Equipment and fixtures utilized for the storage, preparation and handling of food shall discharge through an indirect waste pipe by means of an air gap. Each well of a multiple-compartment sink shall discharge independently to a waste receptor.

58

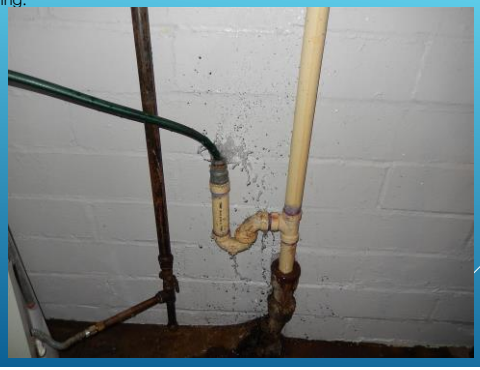
802.2.1 Air gap. The air gap between the indirect waste pipe and the flood level rim of the waste receptor shall be a minimum of twice the effective opening of the indirect waste pipe

59

802.2.2 Air break. An air break shall be provided between the indirect waste pipe and the trap seal of the waste receptor or standpipe

60

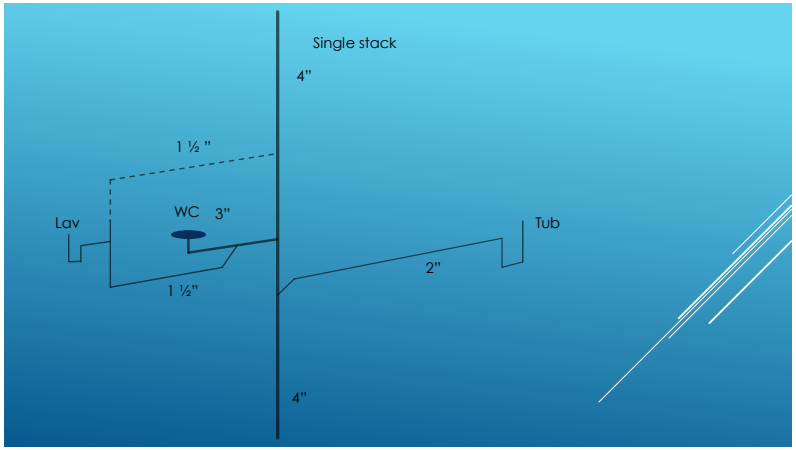
802.3.3 **Standpipes.** Standpipes shall be individually trapped. Standpipes shall extend not less than 18 inches (457 mm) but not greater than 42 inches (1066 mm) above the trap weir. Access shall be provided to standpipes and drains for rodding.



61

CHAPTER 9 VENTING!

62



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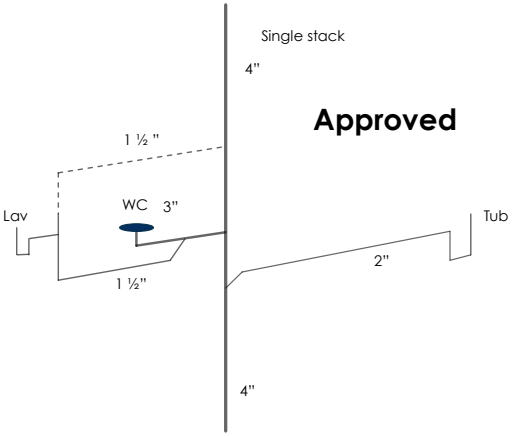

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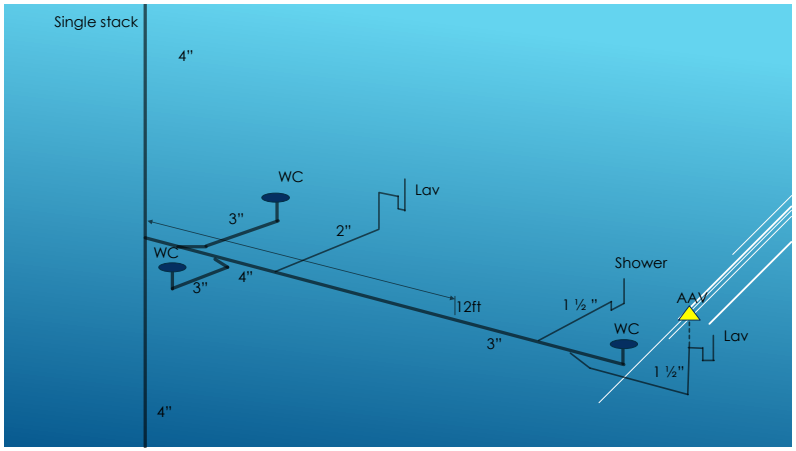
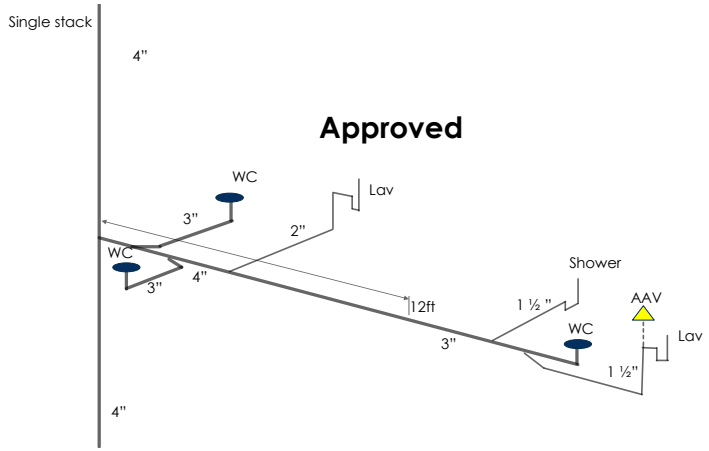
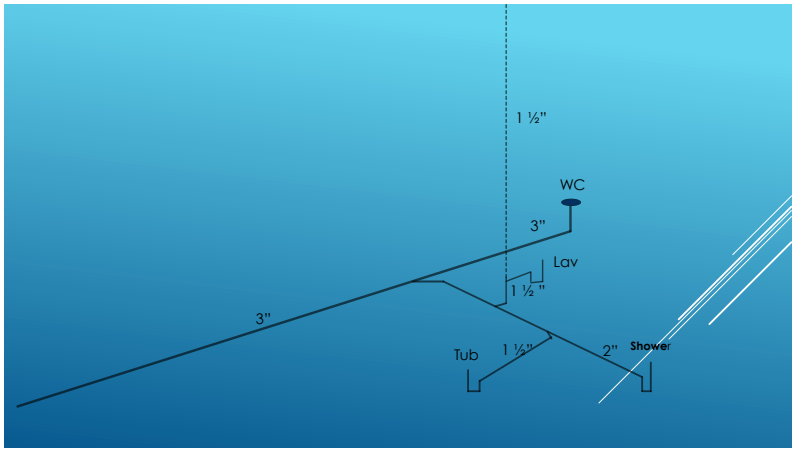

Single stack
4"
WC
Lav
3"
2"
WC
3"
4"
12ft
1 ½ "
Shower
AAV
WC
Lav
3"
1 ½"
4"

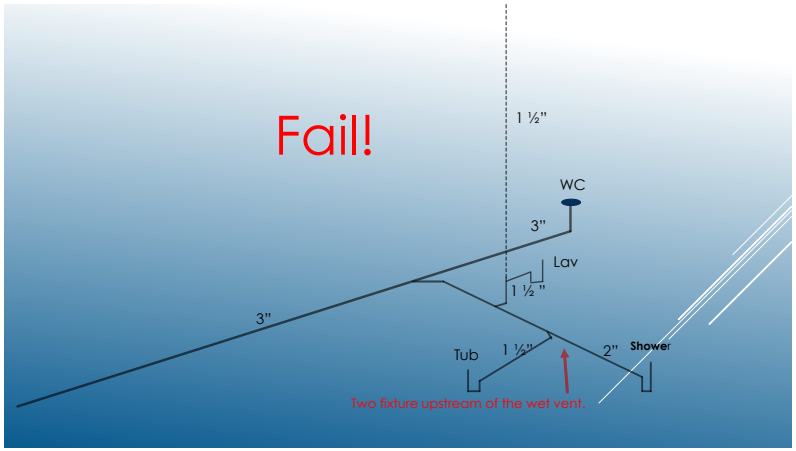
65


Single stack
4"
Approved
WC
Lav
3"
2"
WC
3"
4"
12ft
1 ½ "
Shower
AAV
WC
Lav
3"
1 ½"
4"

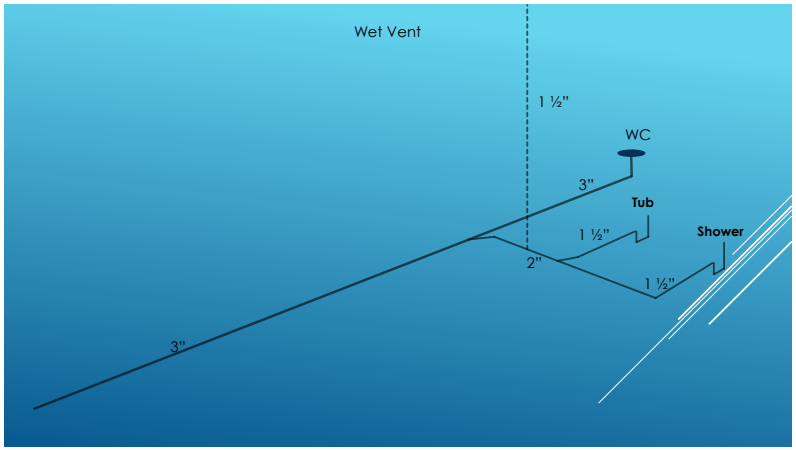
66


1 ½"
WC
3"
Lav
1 ½ "
3"
Tub
1 ½"
2"
Shower

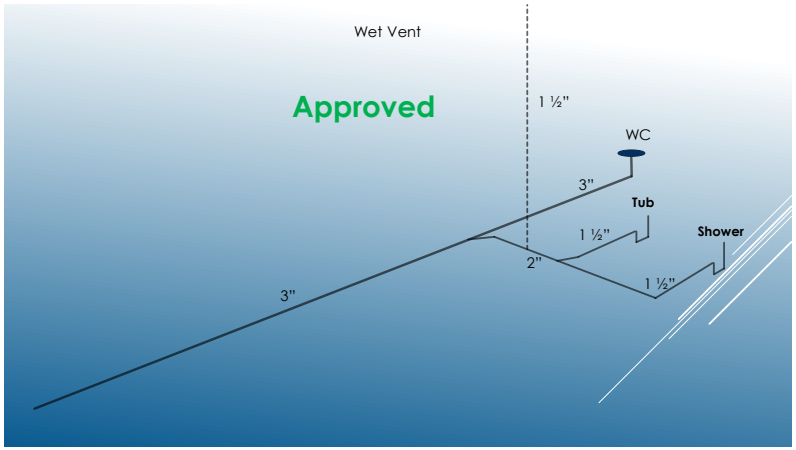
67


Fail!
1 ½"
WC
3"
Lav
1 ½ "
3"
Tub
1 ½"
2"
Shower
Two fixture upstream of the wet vent.

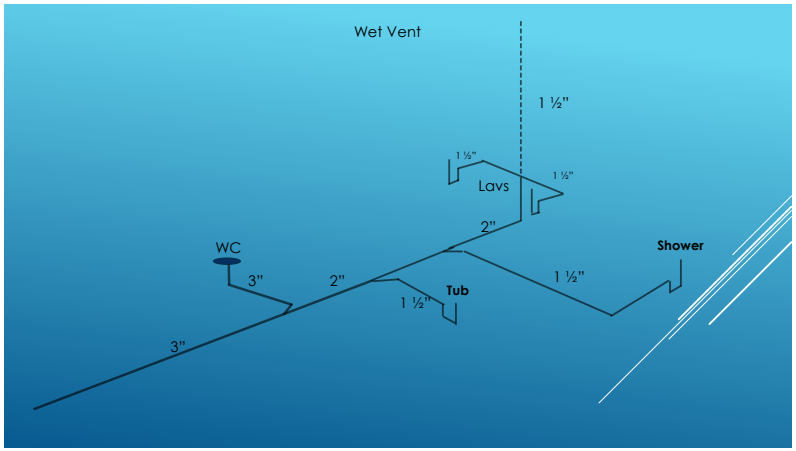
68


Wet Vent
1 ½"
WC
3"
Tub
1 ½"
Shower
2"
1 ½"
3"

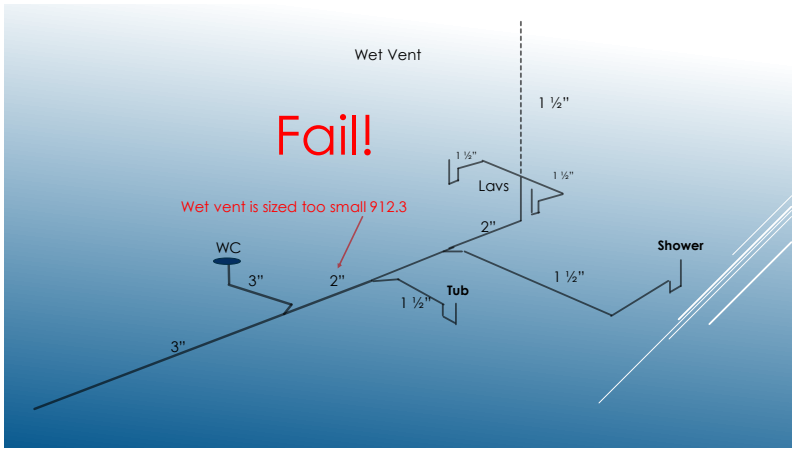
69


Wet Vent
Approved
1 ½"
WC
3"
Tub
1 ½"
Shower
2"
1 ½"
3"

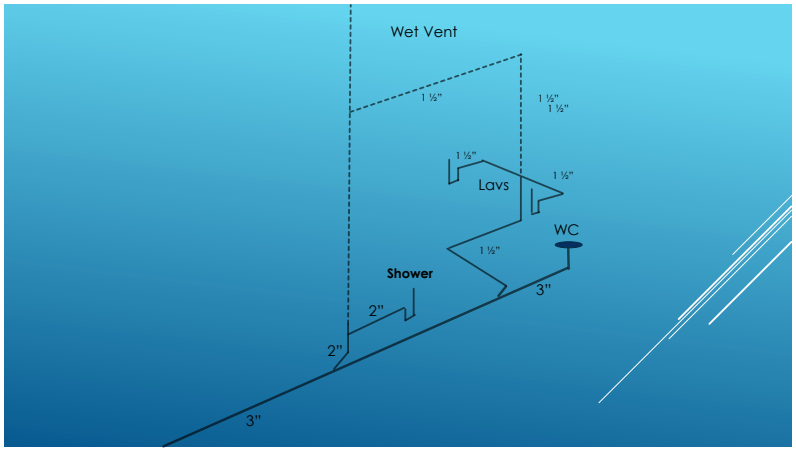
70


Wet Vent
1 ½"
1 ½"
Lavs
1 ½"
2"
WC
3"
2"
Shower
Tub
1 ½"
1 ½"
3"

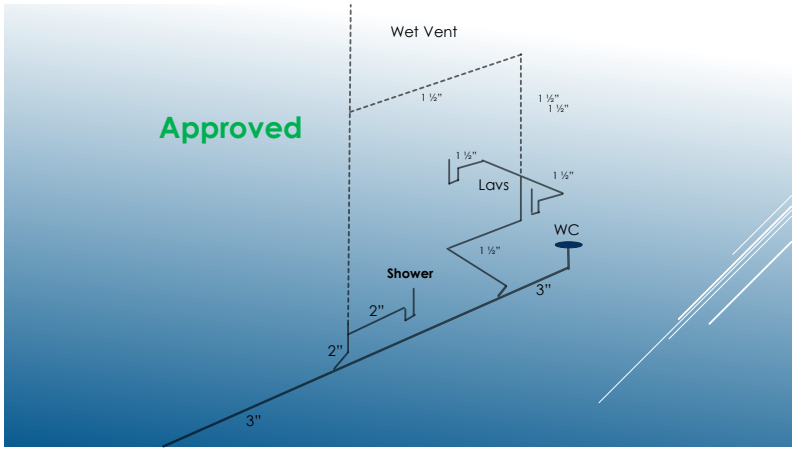
71


Wet Vent
Fail!
1 ½"
1 ½"
Lavs
1 ½"
Wet vent is sized too small 912.3
2"
WC
3"
2"
Shower
Tub
1 ½"
1 ½"
3"

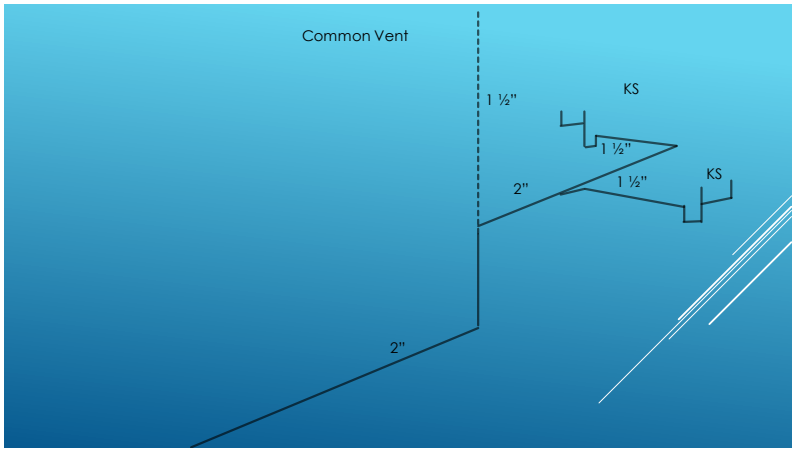
72


Wet Vent
1 ½"
1 ½"
1 ½"
1 ½"
Lavs
1 ½"
WC
1 ½"
Shower
2"
3"
2"
3"

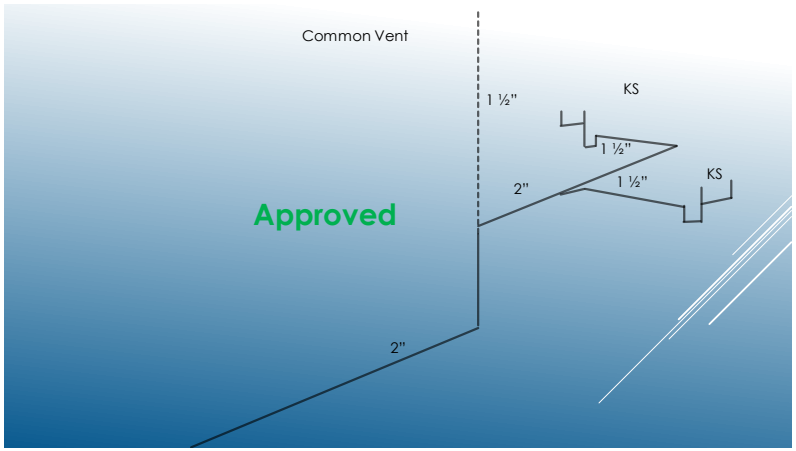
73


Approved
Wet Vent
1 ½"
1 ½"
1 ½"
Lavs
1 ½"
WC
1 ½"
Shower
2"
3"
2"
3"

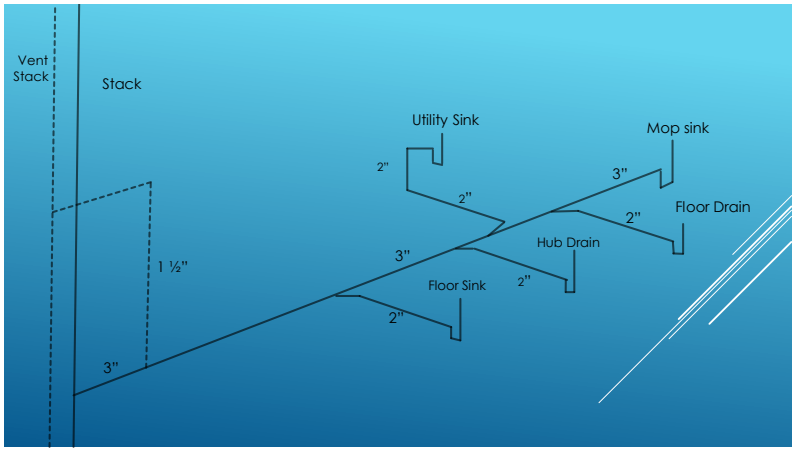
74


Common Vent
1 ½"
KS
1 ½"
2"
1 ½"
KS
2"

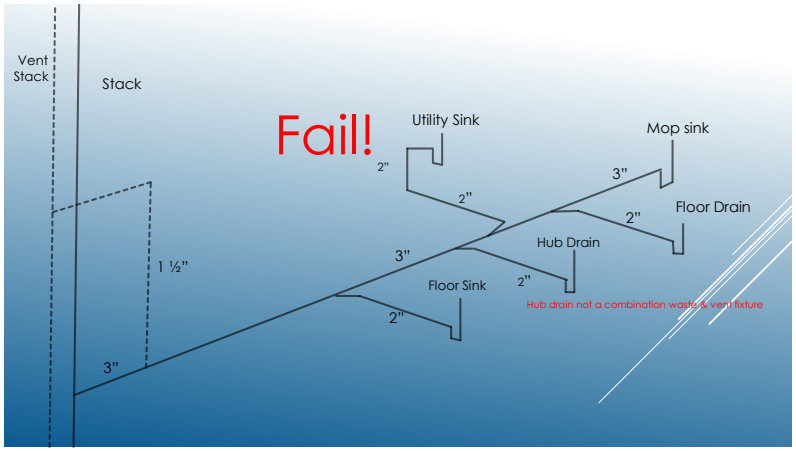
75


Approved
Common Vent
1 ½"
KS
1 ½"
2"
1 ½"
KS
2"

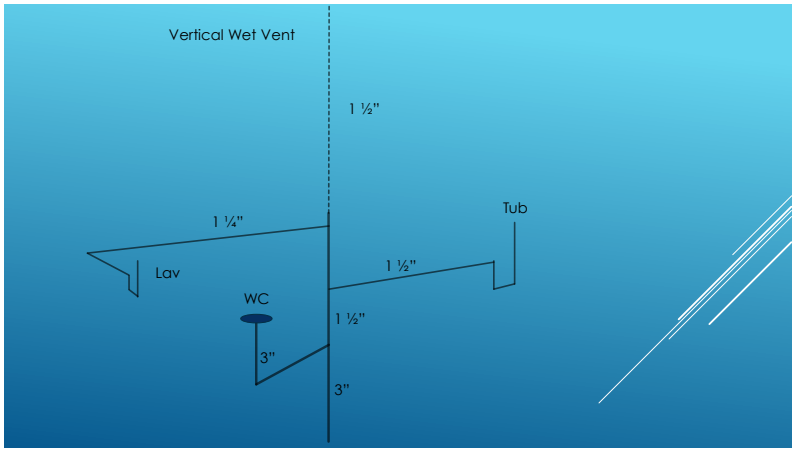
76


Vent Stack
Stack
Utility Sink
Mop sink
2"
2"
3"
2"
Floor Drain
Hub Drain
1 ½"
3"
Floor Sink
2"
2"
3"

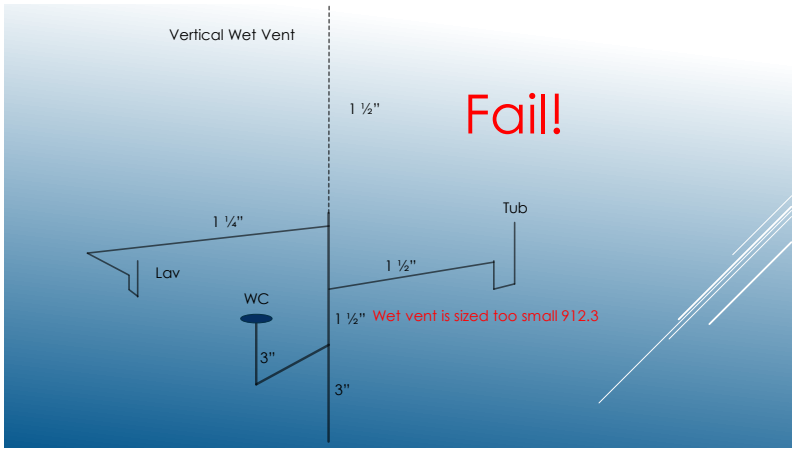
77


Vent Stack
Stack
Fail!
Utility Sink
Mop sink
2"
2"
3"
2"
Floor Drain
Hub Drain
1 ½"
3"
Floor Sink
2"
2"
Hub drain not a combination waste & vent fixture
3"

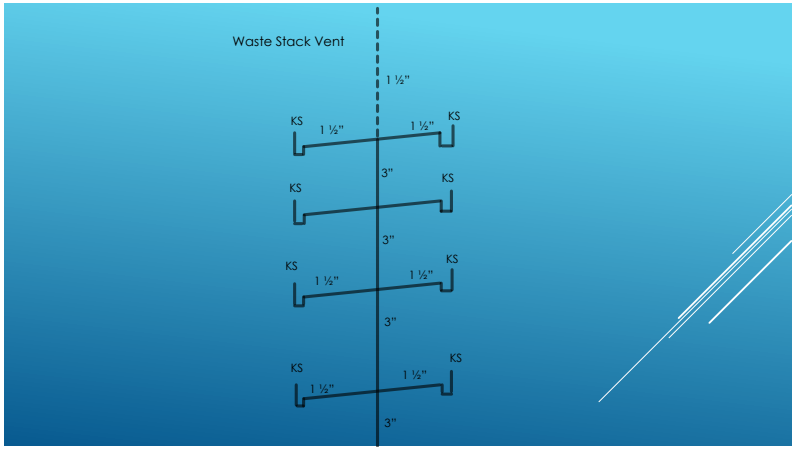
78


Vertical Wet Vent
1 ½"
1 ¼"
Tub
Lav
1 ½"
WC
1 ½"
3"
3"

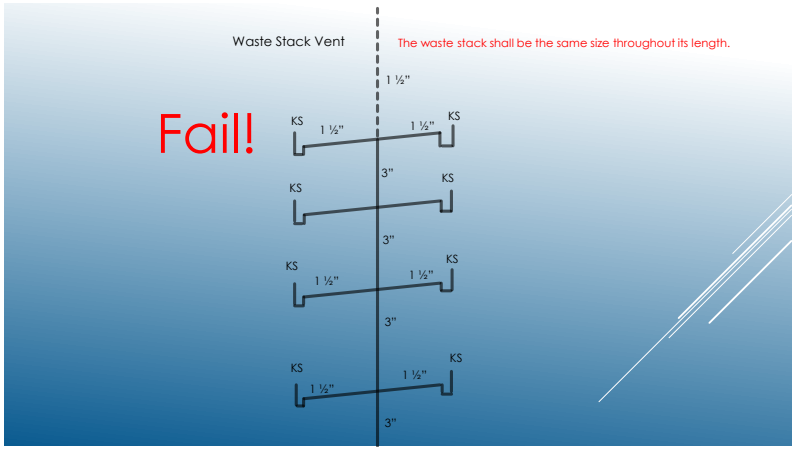
79


Vertical Wet Vent
1 ½"
Fail!
1 ¼"
Tub
Lav
1 ½"
WC
1 ½"
Wet vent is sized too small 912.3
3"
3"

80



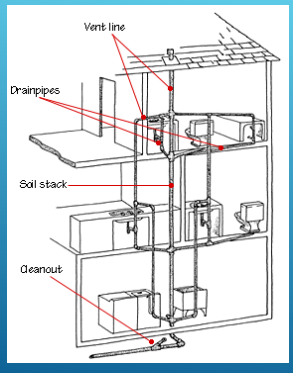
81



82

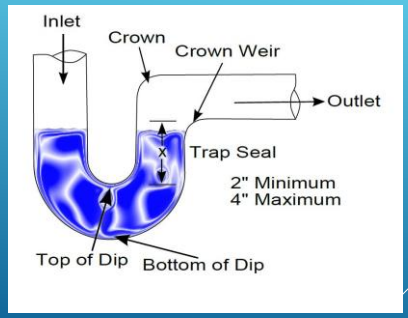
SECTION 901
GENERAL

901.1 Scope. The provisions of this chapter shall govern the materials, design, construction and installation of vent systems.



83

901.2 Trap seal protection. The plumbing system shall be provided with a system of vent piping that will permit the admission or emission of air so that the seal of any fixture trap shall not be subjected to a pneumatic pressure differential of more than 1 inch of water column (249 Pa).



84

901.3 **Chemical waste vent systems.** The vent system for a chemical waste system shall be independent of the sanitary vent system and shall terminate separately through the roof to the outdoors or to an air admittance valve that complies with ASSE 1049. Air admittance valves for chemical waste systems *shall comply with Section 918.8 and* shall be constructed of materials approved in accordance with Section 702.5 and shall be tested for chemical resistance in accordance with ASTM F 1412.

85

901.6 Engineered systems. Engineered venting systems shall conform to the provisions of
Section 919

86

903.2 **Frost closure.** Where the 97.5 -percent value for outside design temperature is 0°F (-18°C) or less, vent extensions through a roof or wall shall be not less than 3 inches (76 mm) in diameter. Any increase in the size of the vent shall be made not less than 1 foot (305 mm) inside the thermal envelope of the building.

87

903.5 **Location of vent terminal.** An open vent terminal from a drainage system shall not be located directly beneath any door, openable window, or other air intake opening of the building or of an adjacent building, and any such vent terminal shall not be within 10 feet (3048 mm) horizontally of such an opening unless it is 3 feet (914 mm) or more above the top of such opening.

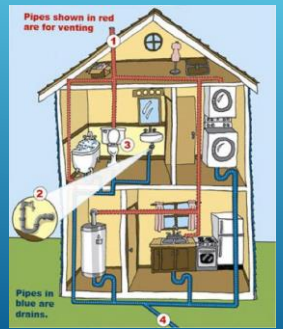
88

903.6 **Extension through the wall.** Vent terminals extending through the wall shall terminate at a point not less than 10 feet (3048 mm) from a lot line and not less than 10 feet (3048 mm) above average ground level. Vent terminals shall not terminate under the overhang of a structure with soffit vents. Side wall vent terminals shall be protected to prevent birds or rodents from entering or blocking the vent opening.

89

SECTION 904
OUTDOOR VENT EXTENSIONS

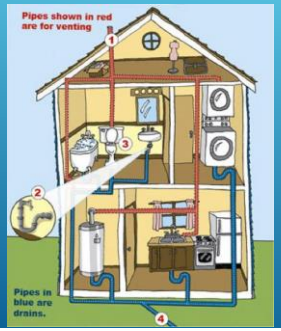
904.1 **Required vent extension.** The vent system serving each building drain shall have not less than one vent pipe that extends to the outdoors



90

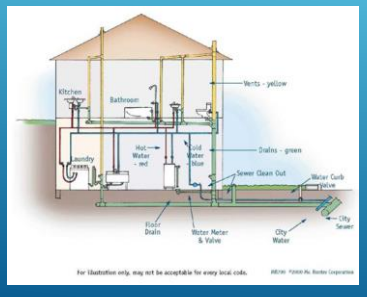
SECTION 904
OUTDOOR VENT EXTENSIONS

904.1 **Required vent extension.** The vent system serving each building drain shall have not less than one vent pipe that extends to the outdoors



91

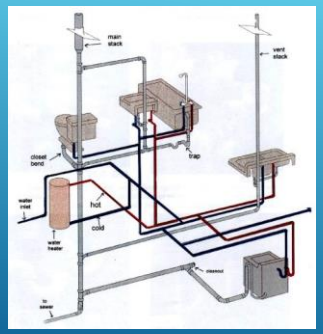
904.1.1 **Installation.** The required vent shall be a dry vent that connects to the building drain or an extension of a drain that connects to the building drain. Such vent shall not be an island fixture vent as allowed by Section 916.



NOT THIS!

92

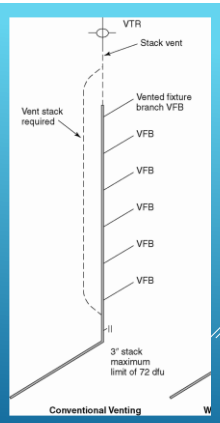
904.1.2 **Size.** The required vent shall be sized in accordance with Section 906.2 based on the required size of the building drain.



93

904.2 **Vent stack required.** A vent stack shall be required for every drainage stack that has five branch intervals or more.

Exception: Drainage stacks installed in accordance with Section 913.



APHC

94

904.3 **Vent termination.** Vent stacks or stack vents shall terminate outdoors to the open air or to a stack-type air admittance valve in accordance with Section 918.

APHC

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905.2 Grade. All vent and branch vent pipes shall be so graded and connected as to drain back to the drainage pipe by gravity.

APHC

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905.4 Vertical rise of vent. Every dry vent shall rise vertically to a minimum of 6 inches (152 mm) above the flood level rim of the highest trap or trapped fixture being vented.

Exception: Vents for interceptors located outdoors

APHC

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905.5 Height above fixtures. A connection between a vent pipe and a vent stack or stack vent shall be made at least 6 inches (152 mm) above the flood level rim of the highest fixture served by the vent. Horizontal vent pipes forming branch vents, relief vents or loop vents shall be at least 6 inches (152 mm) above the flood level rim of the highest fixture served

APHC

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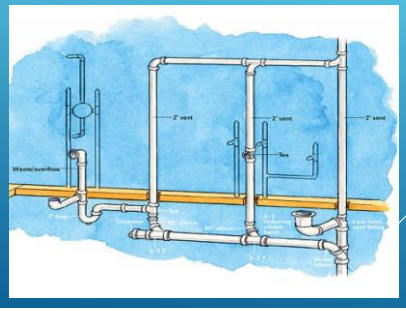
906.2 **Vents other than stack vents or vent stacks.** The diameter of individual vents, branch vents, circuit vents and relief vents shall be not less than one-half the required diameter of the drain served. The required size of the drain shall be determined in accordance with Table 710.1(2). Vent pipes shall not be less than 1¼ inches (32 mm) in diameter. Vents exceeding 40 feet (12 192 mm) in developed length shall be increased by one nominal pipe size for the entire developed length of the vent pipe. Relief vents for soil and waste stacks in buildings having more than 10 branch intervals shall be sized in accordance with Section 908.2.



APHC

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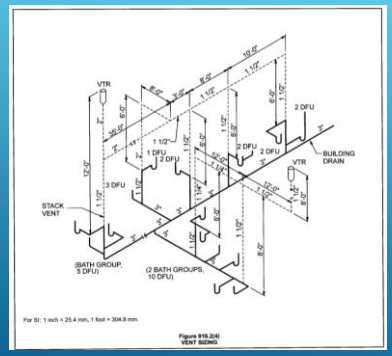
906.3 **Developed length.** The developed length of individual, branch, circuit and relief vents shall be measured from the farthest point of vent connection to the drainage system to the point of connection to the vent stack, stack vent or termination outside of the building.



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906.5.1 **Sewage pumps and sewage ejectors other than pneumatic.** Drainage piping below *the building sewer* level shall be vented in the same manner as that of a gravity system. Building sump vent sizes for sumps with sewage pumps or sewage ejectors, other than pneumatic, shall be determined in accordance with Table 906.5.1.

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SECTION 909
FIXTURE VENTS

906.1 Distance of trap from vent. Each fixture trap shall have a protecting vent located so that the slope and the developed length in the fixture drain from the trap weir to the vent fitting are within the requirements set forth in Table 909.1.

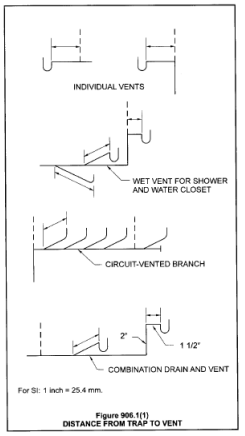
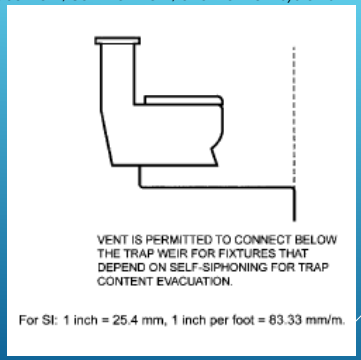


Figure 906.1(1)
DISTANCE FROM TRAP TO VENT

102

Exception: The developed length of the fixture drain from the trap weir to the vent fitting for self-siphoning fixtures, such as water closets, shall not be limited *in individual vent, common vent, and wet vent systems*



103

909.2 Venting of fixture drains. The total fall in a fixture drain due to pipe slope shall not exceed the diameter of the fixture drain, nor shall the vent connection to a fixture drain, except for water closets, be below the weir of the trap

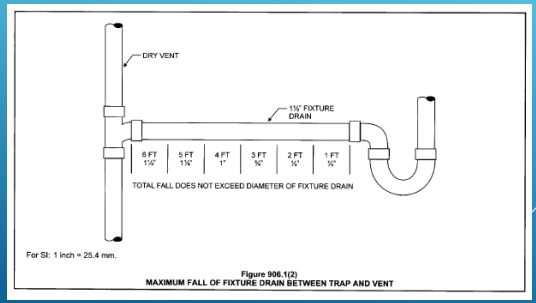


Figure 906.1(2)
MAXIMUM FALL OF FIXTURE DRAIN BETWEEN TRAP AND VENT

104

TABLE 909.1
MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT

SIZE OF TRAP (inches)	SLOPE (inch per foot)	DISTANCE FROM TRAP (feet)
1 ¼	¼	5
1 ½	¼	6
2	¼	8
3	1/8	12
4	1/8	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m.

105

SECTION 910
INDIVIDUAL VENT

910.1 Individual vent permitted. Each trap and trapped fixture is permitted to be provided with an individual vent. The individual vent shall connect to the fixture drain of the trap or trapped fixture being vented.

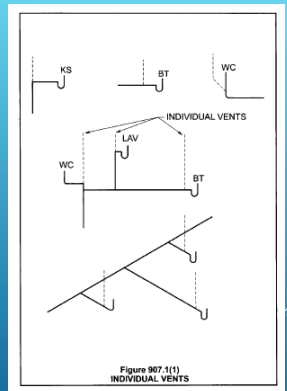


Figure 907.1(1)
INDIVIDUAL VENTS

106

SECTION 911
COMMON VENT

911.1 Individual vent as common vent. An individual vent is permitted to vent two traps or trapped fixtures as a common vent. The traps or trapped fixtures being common vented shall be located on the same floor level.

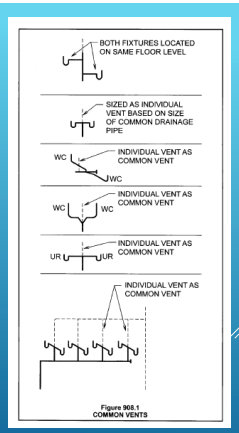


Figure 908.1
COMMON VENTS

107

911.2 Connection at the same level. Where the fixture drains being common vented connect at the same level, the vent connection shall be at the interconnection of the fixture drains or downstream of the interconnection. *Common vent on the horizontal shall be a double pattern fitting*

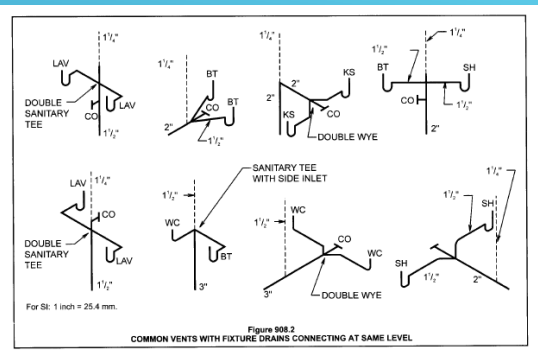


Figure 908.2
COMMON VENTS WITH FIXTURE DRAINS CONNECTING AT SAME LEVEL

108

911.3 Connection at different levels. Where the fixture drains connect at different levels, the vent shall connect as a vertical extension of the vertical drain. The vertical drain pipe connecting the two fixture drains shall be considered the vent for the lower fixture drain, and shall be sized in accordance with Table 908.3. The upper fixture shall not be a water closet.

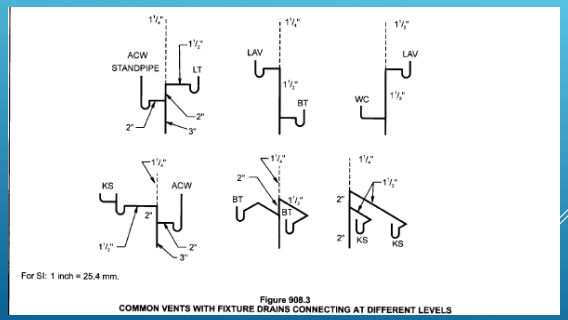


Figure 908.3
COMMON VENTS WITH FIXTURE DRAINS CONNECTING AT DIFFERENT LEVELS

109

TABLE Table 911.3
COMMON VENT SIZES

PIPE SIZE (inches)	MAXIMUM DISCHARGE FROM UPPER FIXTURE DRAIN (dfu)
11/2	1
2	4
2 ½ to 3	6

For SI: 1 inch = 25.4 mm.

APHC

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WET VENTING
912.1 Horizontal wet vent permitted. Any combination of fixtures within two bathroom groups located on the same floor level is permitted to be vented by a horizontal wet vent. The wet vent shall be considered the vent for the fixtures and shall extend from the of the horizontal wet vent. connection of the dry vent along the direction of the flow in the drain pipe to the most downstream fixture drain connection to the horizontal branch drain. Each wet-vented fixture drain shall connect independently to the horizontal wet vent. Only the fixtures within the bathroom groups shall connect to the wet vented horizontal branch drain. Any additional fixtures shall discharge downstream

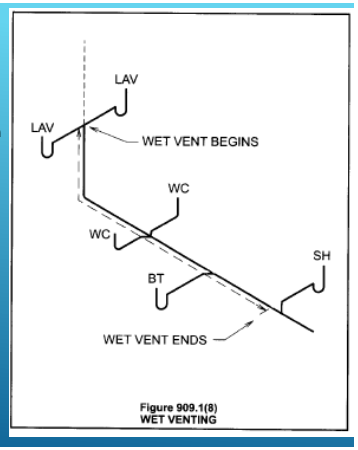
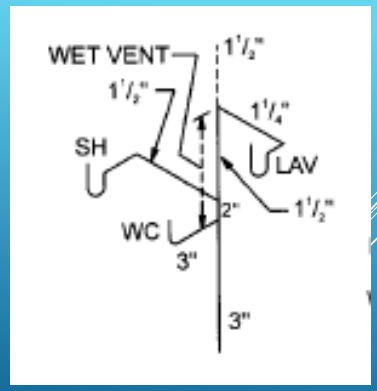


Figure 909.1(8)
WET VENTING

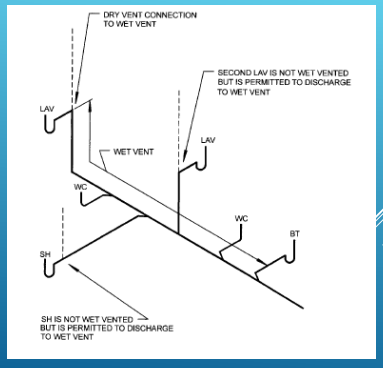
111

912.1.1 Vertical wet vent permitted. Any combination of fixtures within two bathroom groups located on the same floor level is permitted to be vented by a vertical wet vent. The vertical wet vent shall be considered the vent for the fixtures and shall extend from the connection of the dry vent down to the lowest fixture drain connection. Each wet-vented fixture shall connect independently to the vertical wet vent. Water closet drains shall connect at the same elevation. Other fixture drains shall connect above or at the same elevation as the water closet fixture drains. The dry-vent connection to the vertical wet vent shall be an individual or common vent serving one or two fixtures



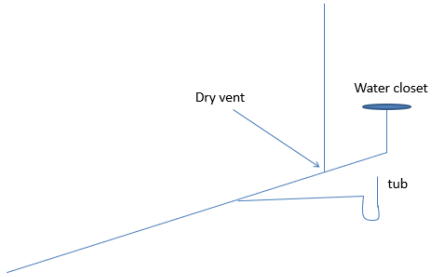
112

912.2 Dry vent connection. The required dry-vent connection for wet-vented systems shall
comply with Sections 909.2.1 and 909.2.2



113

912.2.1 Horizontal wet vent. The dry-vent connection for a horizontal wet-vent system shall be an individual vent or a common vent for any bathroom group fixture, except an emergency floor drain. Where the dry-vent connects to a water closet fixture drain, the drain shall connect horizontally to the horizontal wet-vent system. Not more than one wet-vented fixture drain shall discharge upstream of the dry-vented fixture drain connection.



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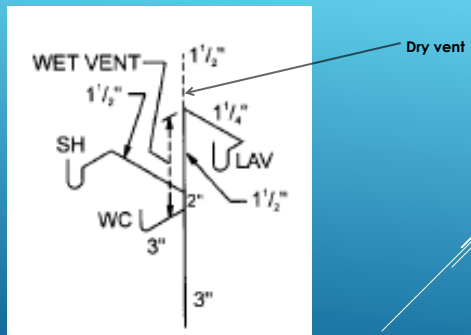
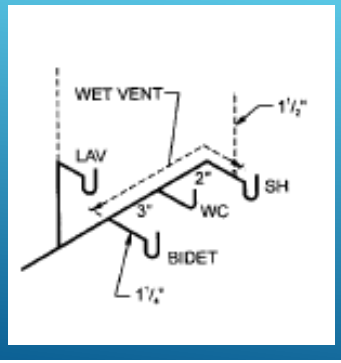
114

912.2.2 Vertical wet vent. The dry-vent connection for a vertical wet-vent system shall be an individual vent or common vent for the most upstream fixture drain



115

912.3 Size. The dry vent serving the wet vent shall be sized based on the largest required diameter of pipe within the wet-vent system served by the dry vent. The wet vent shall be of a minimum size as specified in Table 909.3, based on the fixture unit discharge to the wet vent.



116

384

Table 912.3

WET VENT SIZE

WET VENT PIPE SIZE (inches)	DRAINAGE FIXTURE UNIT LOAD (dfu)
1 ½	1
2	4
2 ½	6
3	12

For SI: 1 inch = 25.4 mm.

APHC

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SECTION 910
WASTE STACK VENT

913.1 Waste stack vent permitted. A waste stack shall be considered a vent for all of the fixtures discharging to the stack where installed in accordance with the requirements of this section.

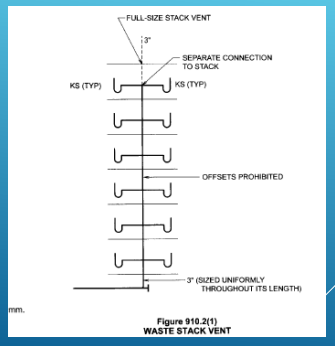
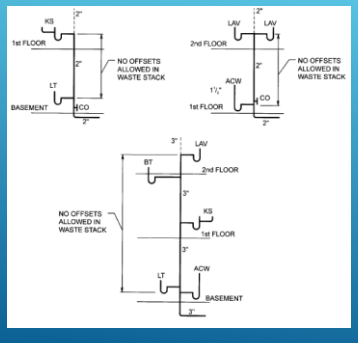


Figure 910.2(1)
WASTE STACK VENT

118

912.2 Stack installation. The waste stack shall be vertical, and both horizontal and vertical offsets shall be prohibited between the lowest fixture drain connection and the highest fixture drain connection. Every fixture drain shall connect separately to the waste stack. The stack shall not receive the discharge of water closets or urinals



119

913.4 Waste stack size. The waste stack shall be sized based on the total discharge to the stack and the discharge within a branch interval in accordance with Table 910.4. The waste stack shall be the same size throughout its length.

TABLE 910.4
WASTE STACK VENT SIZE

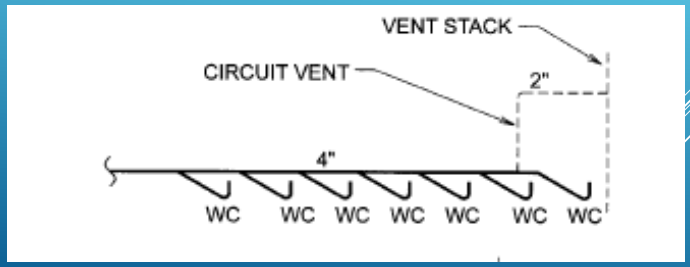
STACK SIZE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Total discharge into one branch interval	Total discharge for stack
1 ½	1	2
2	2	4
2 ½	No limit	8
3	No limit	24
4	No limit	50
5	No limit	75
6	No limit	100

For SI: 1 inch = 25.4 mm.

120

SECTION 911
CIRCUIT VENTING

914.1 Circuit vent permitted. A maximum of eight fixtures connected to a horizontal branch drain shall be permitted to be circuit vented. Each fixture drain shall connect horizontally to the horizontal branch being circuit vented. The horizontal branch drain shall be classified as a vent from the most downstream fixture drain connection to the most upstream fixture drain connection to the horizontal branch.



121

914.1.1 Multiple circuit-vented branches. Circuit-vented horizontal branch drains are permitted to be connected together. Each group of a maximum of eight fixtures shall be considered a separate circuit vent and shall conform to the requirements of this section.

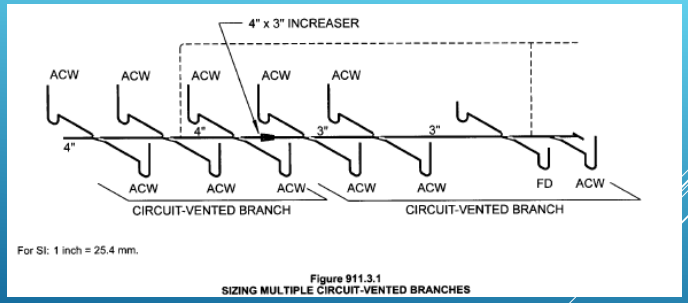
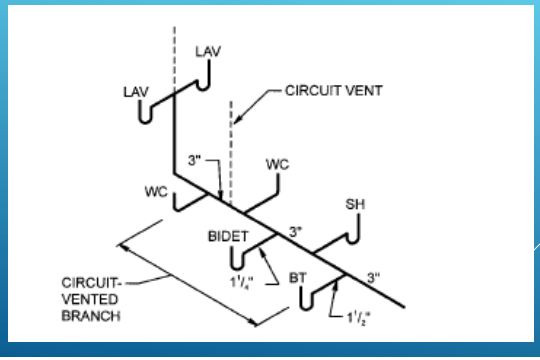


Figure 911.3.1
SIZING MULTIPLE CIRCUIT-VENTED BRANCHES

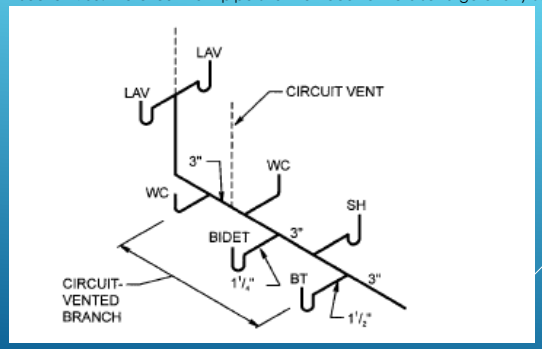
122

914.2 Vent connection. The circuit vent connection shall be located between the two most upstream fixture drains. The vent shall connect to the horizontal branch and shall be installed in accordance with Section 905. The circuit vent pipe shall not receive the discharge of any soil or waste.



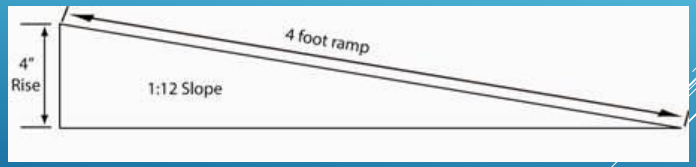
123

914.2 Vent connection. The circuit vent connection shall be located between the two most upstream fixture drains. The vent shall connect to the horizontal branch and shall be installed in accordance with Section 905. The circuit vent pipe shall not receive the discharge of any soil or waste.



124

914.3 Slope and size of horizontal branch. The maximum slope of the vent section of the horizontal branch drain shall be one unit vertical in 12 units horizontal (8-percent slope). The entire length of the vent section of the horizontal branch drain shall be sized for the total drainage discharge to the branch



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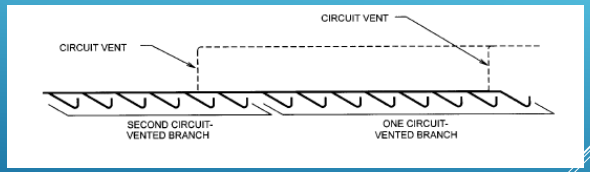
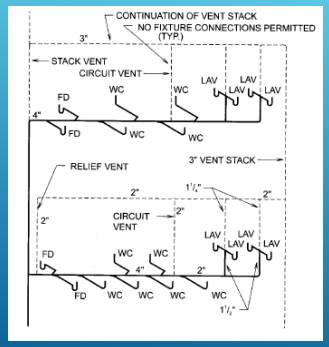
914.3.1 Size of multiple circuit vent. Each separate circuit-vented horizontal branch that is interconnected shall be sized independently in accordance with Section 911.3. The downstream circuit-vented horizontal branch shall be sized for the total discharge into the branch, including the upstream branches and the fixtures within the branch



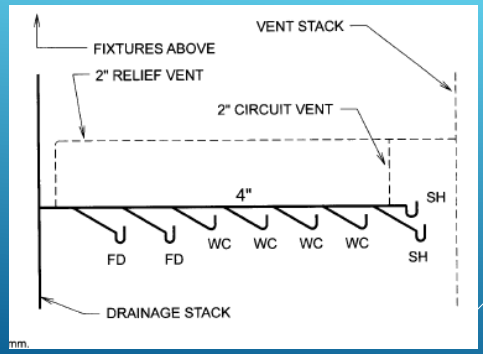
126

914.4 Relief vent. A relief vent shall be provided for circuit-vented horizontal branches receiving the discharge of four or more water closets and connecting to a drainage stack that receives the discharge of soil or waste from upper horizontal branches



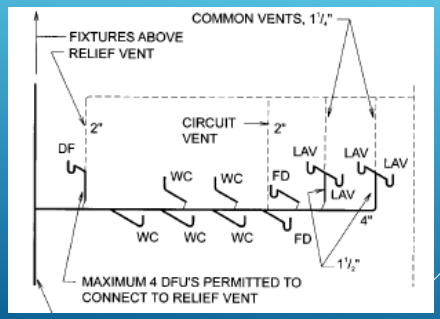
127

914.4.1 Connection and installation. The relief vent shall connect to the horizontal branch drain between the stack and the most downstream fixture drain of the circuit vent. The relief vent shall be installed in accordance with Section 905.



128

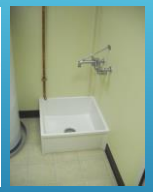
914.5 Additional fixtures. Fixtures, other than the circuit-vented fixtures, are permitted to discharge to the horizontal branch drain. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.



129

SECTION 915
COMBINATION DRAIN AND VENT SYSTEM

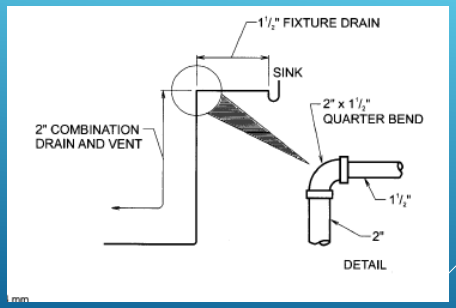
915.1 Type of fixtures. A combination drain and vent system shall not serve fixtures other than floor drains, sinks, lavatories and drinking fountains.

Combination drain and vent systems shall not receive the discharge from a food waste grinder or clinical sink.


130

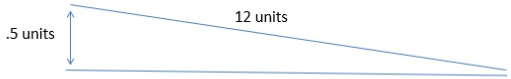
915.2 Installation. The only vertical pipe of a combination drain and vent system shall be the connection between the fixture drain *of a sink, lavatory or drinking fountain, and the horizontal* combination drain and vent pipe. The maximum vertical distance shall be 8 feet (2438 mm).



131

915.2.1 Slope. The horizontal combination drain and vent pipe shall have a maximum slope of one-half unit vertical in 12 units horizontal (4-percent slope). The minimum slope shall be in accordance with Table 704.1.

¼ inch per foot minim ½ per foot maximum



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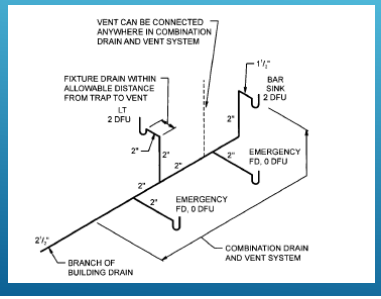
132

915.2.2 Connection. The combination drain and vent system shall be provided with a dry vent connected at any point within the system or the system shall connect to a horizontal drain that is vented in accordance with one of the venting methods specified in this chapter. Combination drain and vent systems connecting to building drains receiving only the discharge from a stack or stacks shall be provided with a dry vent. The vent connection to the combination drain and vent pipe shall extend vertically a minimum of 6 inches (152 mm) above the flood level rim of the highest fixture being vented before offsetting horizontally



133

915.2.3 Vent size. The vent shall be sized for the total drainage fixture unit load in accordance with Section 916.2.

TABLE 916.1
SIZE AND DEVELOPED LENGTH OF STACK VENTS AND VENT STACKS

DIAMETER OF SOIL OR WASTE STACK (inches)	TOTAL FIXTURE UNITS BEING VENTED (dfu)	MAXIMUM DEVELOPED LENGTH OF VENT (feet)[a] DIAMETER OF VENT (inches)									
		1¼	1½	2	2½	3	4	5	6	8	10	12
1¼	2	30										
1½	8	50	150	—	—	—	—	—	—	—	—	—
1½	10	30	100									
2	12	30	75	200								
2	20	26	50	150		—	—	—	—	—	—	—
2½	42		30	100	300							
3	10		42	150	360	1,040						
3	21	—	32	110	270	810	—	—	—	—	—	—
3	53		27	94	230	680						
3	102		25	86	210	620						
4	43	—		35	85	250	980	—	—	—	—	—
4	140			27	65	200	750					
4	320			23	55	170	640					
4	540	—	—	21	50	150	580		—	—	—	—
5	190				28	82	320	990				
5	490				21	63	250	760				
5	940	—	—	—	18	53	210	670	—	—	—	—
5	1,400				16	49	190	590				
6	500					33	130	400	1,000			
6	1,100	—	—	—	—	26	100	310	780	—	—	—
6	2,000					22	84	260	660			
6	2,900					20	77	240	600			
8	1,800	—	—	—	—		31	95	240	940	—	—
8	3,400						24	73	190	720		

(continued)

134

915.2.4 Fixture branch or drain. The fixture branch or fixture drain shall connect to the combination drain and vent within a distance specified in Table 906.1. The combination drain and vent pipe shall be considered the vent for the fixture

TABLE 906.1
MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT

SIZE OF TRAP (inches)	SLOPE (inch per foot)	DISTANCE FROM TRAP (feet)
1¼	¼	5
1½	¼	6
2	¼	8
3	⅛	12
4	⅛	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm,
1 inch per foot = 83.3 mm/m.

135

915.3 Size. The minimum size of a combination drain and vent pipe shall be in accordance with Table 912.3.

TABLE 912.3
SIZE OF COMBINATION DRAIN AND VENT PIPE

DIAMETER PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Connecting to a horizontal branch or stack	Connecting to a building drain or building subdrain
2	3	4
2 ½	6	26
3	12	31
4	20	50
5	160	250
6	360	575

For SI: 1 inch = 25.4 mm.

136

SECTION 916
ISLAND FIXTURE VENTING

916.1 Limitation. Island fixture venting shall not be permitted for fixtures other than sinks and lavatories. Residential kitchen sinks with a dishwasher waste connection, a food waste grinder, or both, in combination with the kitchen sink waste, shall be permitted to be vented in accordance with this section.

137

916.2 Vent connection. The island fixture vent shall connect to the fixture drain as required for an individual or common vent. The vent shall rise vertically to above the drainage outlet of the fixture being vented before offsetting horizontally or vertically downward. The vent or branch vent for multiple island fixture vents shall extend to a minimum of 6 inches (152 mm) above the highest island fixture being vented before connecting to the outside vent terminal.

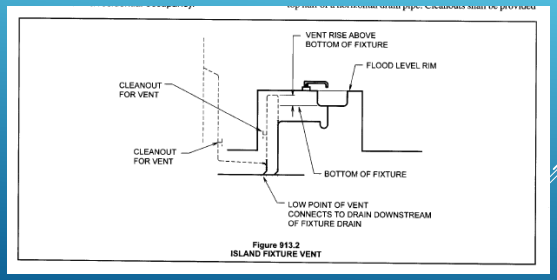


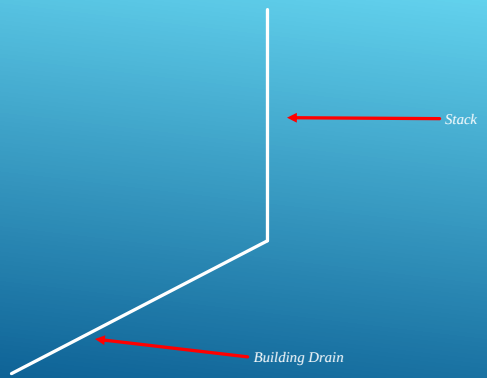
Figure 913.2
ISLAND FIXTURE VENT

138

917.1 WHERE PERMITTED.

A drainage *stack* shall serve as a single *stack vent* system where sized and installed in accordance with Sections 917.2 through 917.9. The drainage *stack* and *branch* piping shall be the vents for the drainage system. The drainage *stack* shall have a *stack vent*.

139

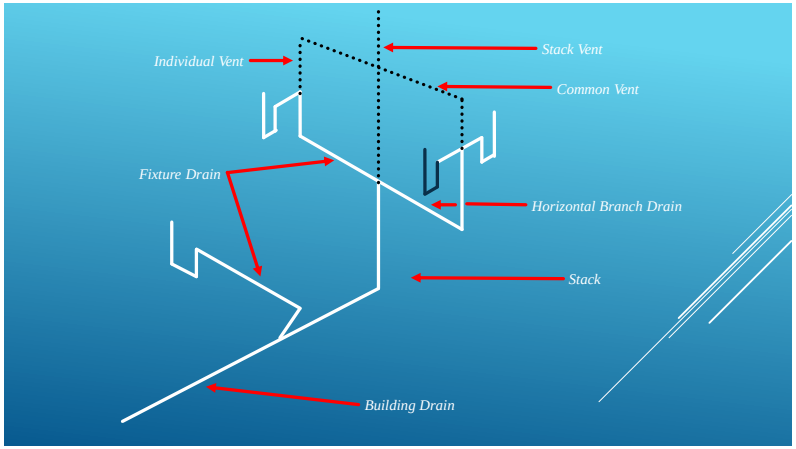


140

STACK VENT

The extension of a soil or waste *stack* above the highest horizontal drain connected to the *stack*.

141



142

917.2 STACK SIZE.

Drainage *stacks* shall be sized in accordance with Table 917.2. *Stacks* shall be uniformly sized based on the total connected *drainage fixture unit* load. The *stack vent* shall be the same size as the drainage *stack*. A 3-inch (76 mm) *stack* shall serve not more than two water closets.

143

917.2 STACK SIZE.

Stack Size (inches)	Maximum Connected Drainage Fixture Units		
	Stacks less than 75 ft. in height	Stacks 75 ft. up to less than 160 ft. in height	Stacks 160 ft. and greater in height
3	24	NP	NP
4	225	24	NP
5	480	225	24
6	1015	480	225
8	2320	1015	480
10	4500	2320	1015
12	8100	4500	2320
15	13,600	8100	4500

144

917.3 BRANCH SIZE.

Horizontal branches connecting to a single stack vent system shall be sized in accordance with Table 710.1(2). Not more than one water closet shall discharge into a 3-inch (76 mm) horizontal branch at a point within a *developed length* of 18 inches (457 mm) measured horizontally from the *stack*.

145

917.3 BRANCH SIZE. (CONTINUED)

Where a water closet is within 18 inches (457 mm) measured horizontally from the *stack* and not more than one fixture with a drain size of not more than 1-1/2 inches (38 mm) connects to a 3-inch (76 mm) horizontal *branch*, the branch drain connection to the *stack* shall be made with a sanitary tee.

146

SINGLE STACK VENT SYSTEM
STACK AND BRANCH SIZING CHARTS

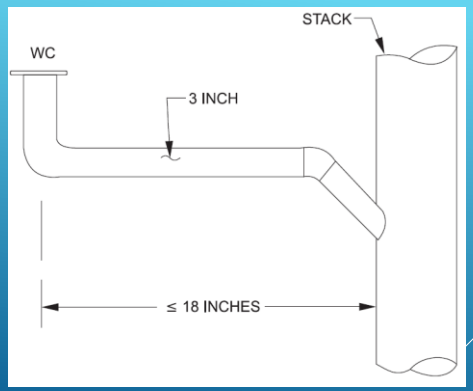
Table 710.1(2)

Diameter of Pipe (inches)	Total for Horizontal Branch
1-1/2	3
2	6
2-1/2	12
3	20
4	160
5	360
6	620
8	1,400
10	2,500
12	3,900
15	7,000

Table 917.2

Stack Size (inches)	Stacks less than 75 ft. in height	Stacks 75 ft. to less than 160 feet in height	Stacks greater than 160 ft. in height
3	24	NP	NP
4	225	24	NP
5	480	225	24
6	1,015	480	225
8	2,320	1,015	480
10	4,500	2,320	1,015
12	8,100	4,500	2,320
15	13,600	8,100	4,500

147



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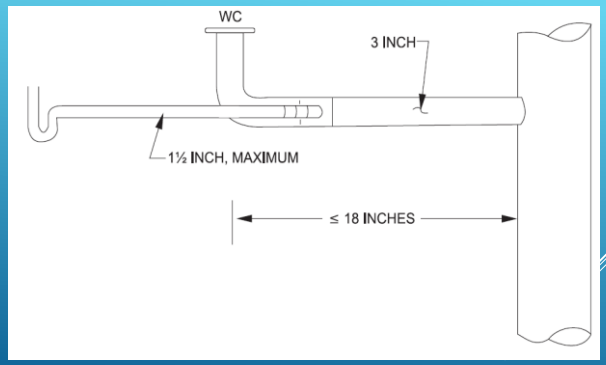


149

917.4 LENGTH OF HORIZONTAL BRANCHES.

The length of horizontal *branches* shall conform to the requirements of Sections 917.4.1 through 917.4.3.

150

917.4.1 WATER CLOSET CONNECTION.

Water closet connections shall be not greater than 4 feet (1219 mm) in *developed length* measured horizontally from the *stack*.

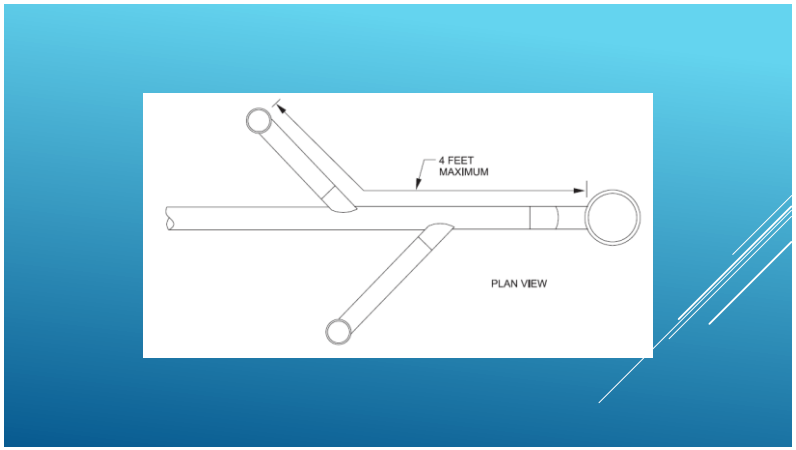
151

917.4.1 WATER CLOSET CONNECTION.

Exception:

Where the connection is made with a sanitary tee, the maximum *developed length* shall be 8 feet (2438 mm).

152



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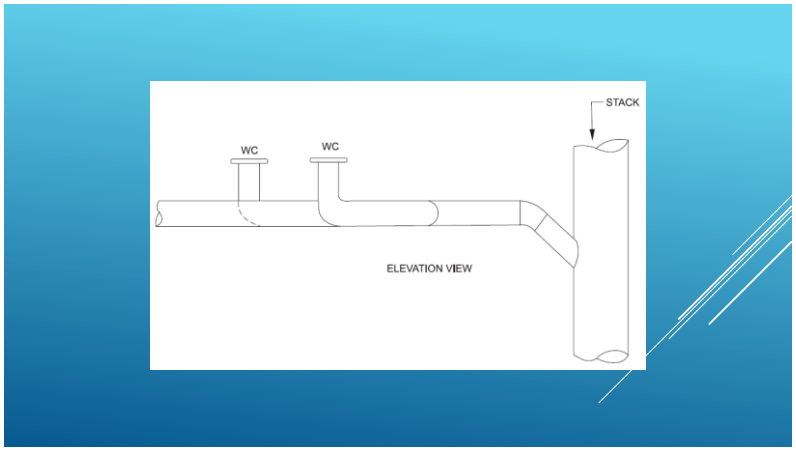

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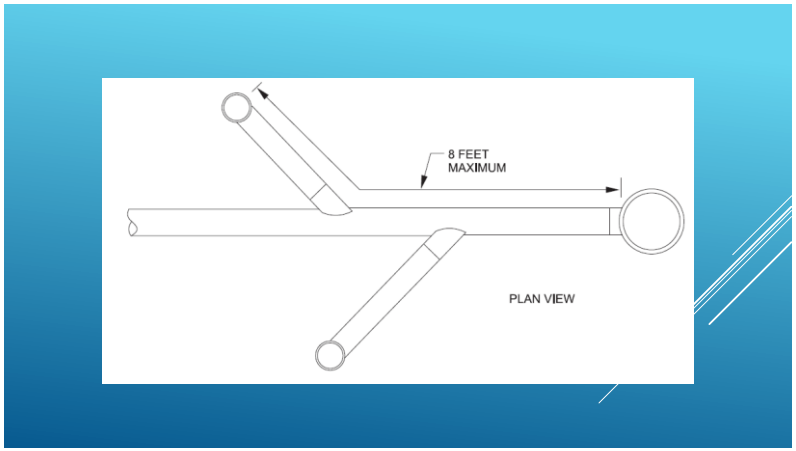

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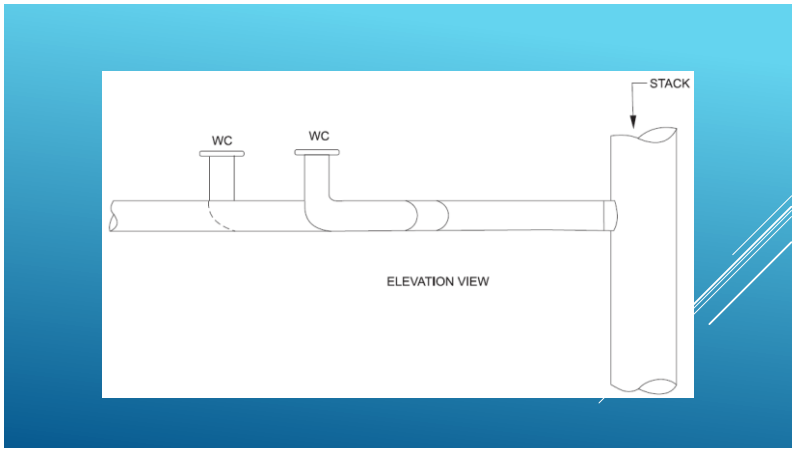
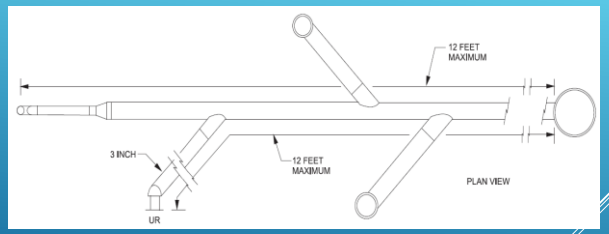


156

917.4.2 FIXTURE CONNECTIONS.

Fixtures other than water closets shall be located not greater than 12 feet (3657 mm) in *developed length*, measured horizontally from the *stack*.

157



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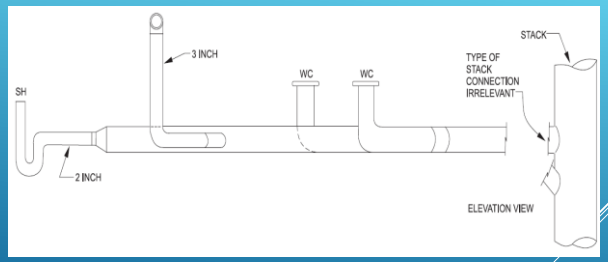


159

917.4.3 VERTICAL PIPING IN BRANCH.

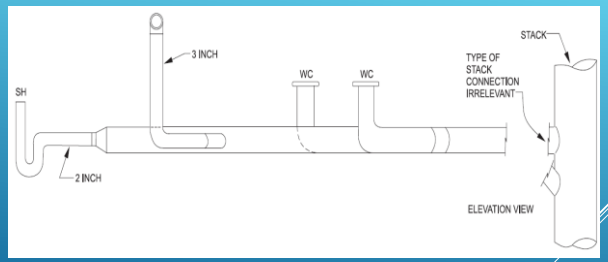
The length of vertical piping in a fixture drain connecting to a horizontal *branch* shall not be considered in computing the fixture's distance in *developed length* measured horizontally from the *stack*.

160

917.5 MINIMUM VERTICAL PIPING SIZE FROM FIXTURE.

The vertical portion of piping in a fixture drain to a horizontal *branch* shall be 2 inches (51 mm). The minimum size of the vertical portion of piping for a water-supplied urinal or *standpipe* shall be 3 inches (76 mm). The maximum vertical drop shall be 4 feet (1219 mm). *Fixture drains* that are not increased in size, or have a vertical drop in excess of 4 feet (1219 mm), shall be individually vented.

161



162

917.6 ADDITIONAL VENTING REQUIRED.

Additional venting shall be provided where more than one water closet discharges to a horizontal *branch* and where the distance from a fixture *trap* to the *stack* exceeds the limits in Section 917.4. Where additional venting is required, the fixture(s) shall be vented by *individual vents*, *common vents*, *wet vents*, *circuit vents*, or a *combination waste and vent pipe*.

163

917.6 ADDITIONAL VENTING REQUIRED. (CONTINUED)

The dry vent extensions for the additional venting shall connect to a *branch vent*, *vent stack*, *stack vent*, *air admittance valve*, or shall terminate outdoors.

164

917.7 STACK OFFSETS.

Where fixture drains are not connected below a horizontal offset in a *stack*, a horizontal offset shall not be required to be vented. Where horizontal *branches* or *fixture drains* are connected below a horizontal offset in a *stack*, the offset shall be vented in accordance with Section 907. Fixture connections shall not be made to a *stack* within 2 feet (610 mm) above or below a horizontal offset.

165

917.7 STACK OFFSETS.

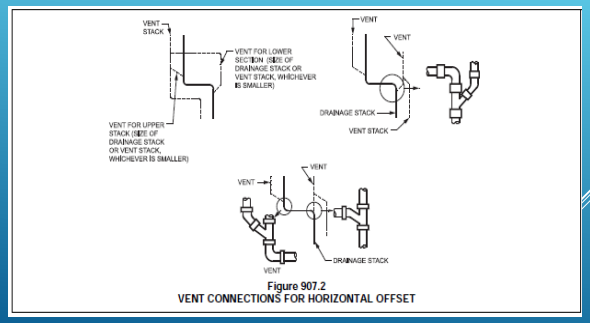


Figure 907.2
VENT CONNECTIONS FOR HORIZONTAL OFFSET

166

917.7 STACK OFFSETS.

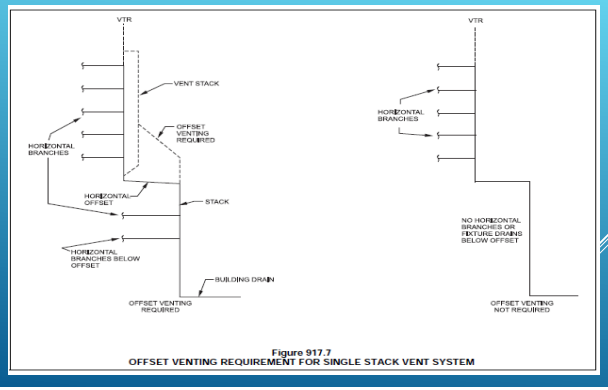


Figure 917.7
OFFSET VENTING REQUIREMENT FOR SINGLE STACK VENT SYSTEM

167

917.8 PROHIBITED LOWER CONNECTIONS.

Stacks greater than 2 *branch intervals* in height shall not receive the discharge of horizontal *branches* on the lower two floors. There shall be no connections to the *stack* between the lower two floors and a distance of not less than 10 pipe diameters downstream from the base of the single stack vented system.

168

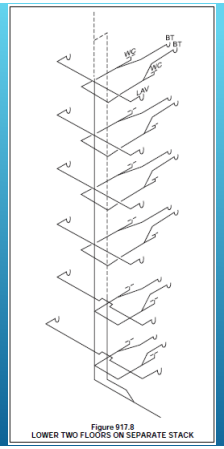


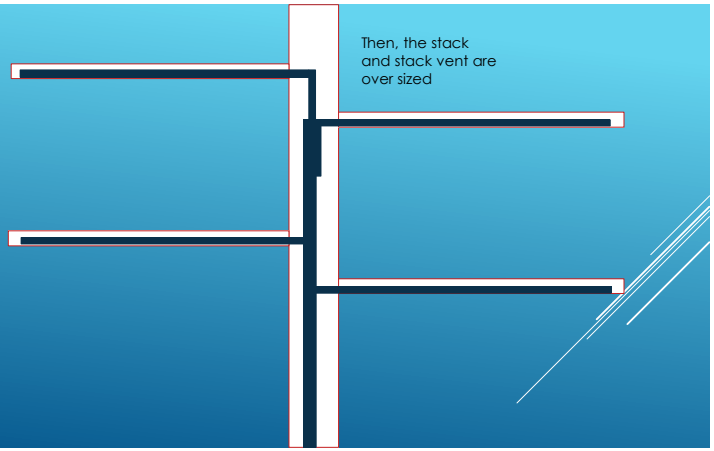
Figure 917.8
LOWER TWO FLOORS ON SEPARATE STACK

169

THE CODE COMMENTARY EXPLAINS *SINGLE STACK VENT SYSTEMS* IT LIKE THIS……

"the venting of the drainage stack and fixtures is accomplished by oversizing of the drainage stack and the vertical sections of fixture drains so that sufficient venting air is available for the fixtures located within relative close proximity of the stack."

170



171

SECTION 918
AIR ADMITTANCE VALVES

918.1 **General.** Vent systems utilizing air admittance valves shall comply with this section. Stack-type air admittance valves shall conform to ASSE 1050. Individual and branch type air admittance valves shall conform to ASSE 1051.

172

918.2 **Installation.** The valves shall be installed in accordance with the requirements of this section and the manufacturer's instructions. Air admittance valves shall be installed after the DWV testing required by Section 312.2 or 312.3 has been performed.

173

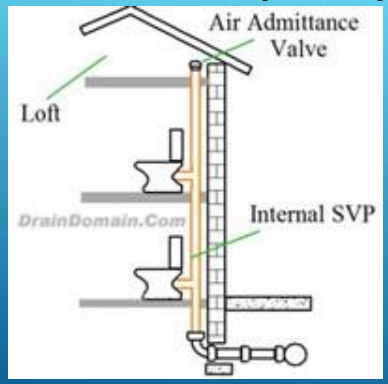
918.3 **Where permitted.** Individual, branch and circuit vents shall be permitted to terminate with a connection to an individual or branch-type air admittance valve in accordance with Section 918.3.1. Stack vents and vent stacks shall be permitted to terminate to stack-type air admittance valves in accordance with Section 918.3.2

174

918.3.1 **Horizontal branches.** Individual and branch-type air admittance valves shall vent only fixtures that are on the same floor level and connect to a horizontal branch drain. Where the horizontal branch is located more than four branch intervals from the top of the stack, the horizontal branch shall be provided with a relief vent that shall connect to a vent stack or stack vent, or extend outdoors to the open air. The relief vent shall connect to the horizontal branch drain between the stack and the most downstream fixture drain connected to the horizontal branch drain. The relief vent shall be sized in accordance with Section 906.2 and installed in accordance with Section 905. The relief vent shall be permitted to serve as the vent for other fixtures.

175

918.3.2 **Stack.** Stack-type air admittance valves shall be prohibited from serving as the vent terminal for vent stacks or stack vents that serve drainage stacks having more than six branch intervals



176

918.4 **Location.** Individual and branch-type air admittance valves shall be located a minimum of 4 inches (102 mm) above the horizontal branch drain or fixture drain being vented. Stack-type air admittance valves shall be located not less than 6 inches (152 mm) above the flood level rim of the highest fixture being vented. The air admittance valve shall be located within the maximum developed length permitted for the vent. The air admittance valve shall be installed not less than 6 inches (152 mm) above insulation materials.

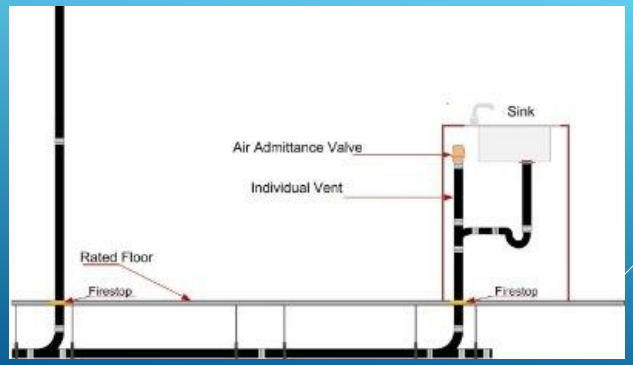
177

918.5 **Access and ventilation.** Access shall be provided to all air admittance valves. Such valves shall be installed in a location that allows air to enter the valve.

918.6 **Size.** The air admittance valve shall be rated in accordance with the standard for the size of the vent to which the valve is connected.

178

918.7 **Vent required.** Within each plumbing system, not less than one stack vent or vent stack shall extend outdoors to the open air.



179

918.8 **Prohibited installations.** Air admittance valves shall not be installed in nonneutralized special waste systems as described in Chapter 8 except where such valves are in compliance with ASSE 1049, are constructed of materials approved in accordance with Section 702.5 and are tested for chemical resistance in accordance with ASTM F 1412. Air admittance valves shall not be located in spaces utilized as supply or return air plenums *or where limited by the manufacturer's installation instructions*. Air admittance valves without an engineered design shall not be utilized to vent sumps or tanks of any type.

180

SECTION 919
ENGINEERED VENT SYSTEMS

919.1 **General.** Engineered vent systems shall comply with this section and the design, submittal, approval, inspection and testing requirements of Section *106.5 of the building code*.

919.2 **Individual branch fixture and individual fixture header vents.** The maximum developed length of individual fixture vents to vent branches and vent headers shall be determined in accordance with Table 919.2 for the minimum pipe diameters at the indicated vent airflow rates. The individual vent airflow rate shall be determined in accordance with the following:

181

SECTION 1001
GENERAL

1001.1 Scope. This chapter shall govern the material and installation of traps, interceptors and separators *when installed inside a building and not on the building sewer. The rules of the "Ohio Environmental Protection Agency" may also govern the design and installation of pretreatment devices such as traps, interceptors, and separators*

182

SECTION 1002
TRAP REQUIREMENTS

1002.1 Fixture traps. Each plumbing fixture shall be separately trapped by a liquid-seal trap, except as otherwise permitted by this code. The vertical distance from the fixture outlet to the trap weir shall not exceed 24 inches (610 mm), and the horizontal distance shall not exceed 30 inches (610 mm) measured from the centerline of the fixture outlet to the centerline of the inlet of the trap. The height of a clothes washer standpipe above a trap shall conform to Section 802.4. A fixture shall not be double trapped.

183

Exceptions:

1. This section shall not apply to fixtures with integral traps.
2. A combination plumbing fixture is permitted to be installed on one trap, provided that one compartment is not more than 6 inches (152 mm) deeper than the other compartment and the waste outlets are not more than 30 inches (762 mm) apart.
3. A grease interceptor intended to serve as a fixture trap in accordance with the manufacturer's installation instructions shall be permitted to serve as the trap for a single fixture or a combination sink of not more than three compartments where the vertical distance from the fixture outlet to the inlet of the interceptor does not exceed 30 inches (762 mm) and the developed length of the waste pipe from the most upstream fixture outlet to the inlet of the interceptor does not exceed 60 inches (1524 mm).

184

1002.2 Design of traps. Fixture traps shall be self-scouring. Fixture traps shall not have interior partitions, except where such traps are integral with the fixture or where such traps are constructed of an approved material that is resistant to corrosion and degradation. Slip joints shall be made with an approved elastomeric gasket and shall be installed only on the trap inlet, trap outlet and within the trap seal

185

1002.3 Prohibited traps. The following types of traps are prohibited:
1. Traps that depend on moving parts to maintain the seal.
2. Bell traps.
3. Crown-vented traps.

186

4. Traps not integral with a fixture and that depend on interior partitions for the seal, except those traps constructed of an approved material that is resistant to corrosion and degradation.
5. "S" traps.
6. Drum traps.

Exception: Drum traps used as solids interceptors and drum traps serving chemical waste systems shall not be prohibited

187

1002.4 Trap seals. Each fixture trap shall have a liquid seal of not less than 2 inches (51 mm) and not more than 4 inches (102 mm), or deeper for special designs relating to accessible fixtures. Where a trap seal is subject to loss by evaporation, a trap seal primer valve shall be installed. Trap seal primer valves shall connect to the trap at a point above the level of the trap seal. A trap seal primer valve shall conform to ASSE 1018 or ASSE 1044

188

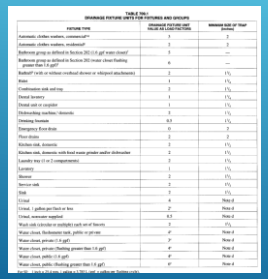
Exception: *Where a fixture trap is supplied with water on a regular basis, a trap seal primer valve shall not be required*

189

ASSE 1072

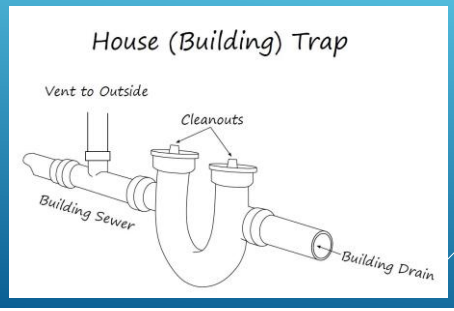
190

1002.5 Size of fixture traps. Fixture trap size shall be sufficient to drain the fixture rapidly and not less than the size indicated in Table 709.1. A trap shall not be larger than the drainage pipe into which the trap discharges



191

1002.6 Building traps. Building (house) traps shall be prohibited, except where local conditions necessitate such traps. Building traps shall be provided with a cleanout and a relief vent or fresh air intake on the inlet side of the trap. The size of the relief vent or fresh air intake shall not be less than one-half the diameter of the drain to which the relief vent or air intake connects. Such relief vent or fresh air intake shall be carried above grade and shall be terminated in a screened outlet located outside the building



192

1002.7 Trap setting and protection. Traps shall be set level with respect to the trap seal and, where necessary, shall be protected from freezing

193

1002.8 Recess for trap connection. A recess provided for connection of the underground trap, such as one serving a bathtub in slab-type construction, shall have sides and a bottom of corrosion-resistant, insect- and vermin proof construction

194

1002.9 Acid-resisting traps. Where a vitrified clay or other brittleware, acid-resisting trap is installed underground, such trap shall be embedded in concrete extending 6 inches (152 mm) beyond the bottom and sides of the trap.

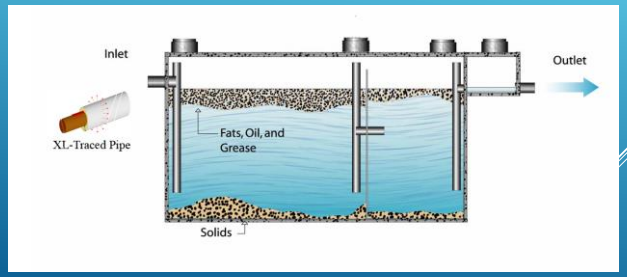
195

1002.10 Plumbing in mental health centers. In mental health centers, pipes and traps shall not be exposed.

196

SECTION 1003
INTERCEPTORS AND SEPARATORS

1003.1 Where required. *Where required by the local sewer purveyor or as otherwise required in this section, interceptors and separators shall be provided to prevent the discharge of oil,* grease, sand and other substances harmful or hazardous to the building drainage system, the public sewer, the private sewage disposal system or the sewage treatment plant or processes



197

1003.1.1 Industrial processes, meat packing and food processing facilities. *Wastes from industrial processes, meat packing and food processing facilities and similar processing plants shall be drained in accordance with the rules of the "Ohio Environ... Agency... ich the wastes... dischar...)*

198

1003.2 Approval. The size, type and location of each interceptor and of each separator shall be designed and installed in accordance with the manufacturer's instructions and the requirements of this section based on the anticipated conditions of use. Wastes that do not require treatment or separation shall not be discharged into any interceptor or separator

199

1003.3 Grease interceptors. Grease interceptors shall comply with the requirements of Sections 1003.3.1 through 1003.3.5.

200

1003.3.1 Grease interceptors and automatic grease removal devices required. A grease interceptor or automatic grease removal device shall be required to receive the drainage from fixtures and equipment with grease-laden waste located in food preparation areas, such as in restaurants, hotel kitchens, hospitals, school kitchens, bars, factory cafeterias and clubs. Fixtures and equipment shall include pot sinks, prerinse sinks; soup kettles or similar devices; wok stations; floor drains or sinks into which kettles are drained; automatic hood wash units and dishwashers without prerinse sinks. Grease interceptors and automatic grease removal devices shall receive waste only from fixtures and equipment that allow fats, oils or grease to be discharged

201

1003.3.2 Food waste grinders. Where food waste grinders connect to grease interceptors, a solids interceptor shall separate the discharge before connecting to the grease interceptor. Solids interceptors and grease interceptors shall be sized and rated for the discharge of the food waste grinder. Emulsifiers, chemicals, enzymes and bacteria shall not discharge into the food waste grinder

202

1003.3.3 Grease interceptors and automatic grease removal devices not required. A grease interceptor or an automatic grease removal device shall not be required for individual dwelling units or any private living quarters

203

1003.3.4 Grease interceptors and automatic grease removal devices. Grease interceptors and automatic grease removal devices shall be sized in accordance with PDI G101, ASME A112.14.3 Appendix A, or ASME A112.14.4. Grease interceptors and automatic grease removal devices shall be designed and tested in accordance with PDI G101, ASME A112.14.3 or ASME A112.14.4. Grease interceptors and automatic grease removal devices shall be installed in accordance with the manufacturer's instructions.
Exception: Interceptors that have a volume of not less than 500 gallons (1893 L) and that are located outdoors shall not be required to meet the requirements of this section

204

1003.3.4.1 Grease interceptor capacity. Grease interceptors shall have the grease retention capacity indicated in Table 1003.3.4.1 for the flow-through rates indicated
1003.3.4.2 Rate of flow controls. Grease interceptors shall be equipped with devices to control the rate of water flow so that the water flow does not exceed the rated flow. The flow-control device shall be vented and terminate not less than 6 inches (152 mm) above the flood rim level or be installed in accordance with the manufacturer's instructions

TABLE 1003.3.4.1
CAPACITY OF GREASE INTERCEPTORS[a]

TOTAL FLOW-THROUGH RATING (gpm)	GREASE RETENTION CAPACITY (pounds)
4	8
6	12
7	14
9	18
10	20
12	24
14	28
15	30
18	36
20	40
25	50
35	70
50	100
75	150
100	200

205

1003.3.5 Automatic grease removal devices. Where automatic grease removal devices are installed, such devices shall be located downstream of each fixture or multiple fixtures in accordance with the manufacturer's instructions. The automatic grease removal device shall be sized to pretreat the measured or calculated flows for all connected fixtures or equipment. **Ready access shall** be provided for inspection and maintenance

206

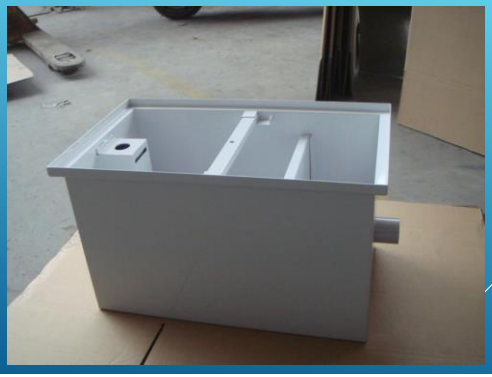
1003.4 Oil separators required. At repair garages, car-washing facilities, and at factories where oily and flammable liquid wastes are produced, separators shall be installed into which all oilbearing, grease-bearing or flammable wastes shall be discharged before emptying into the building drainage system or other point of disposal

207

1003.4.1 Separation of liquids. A mixture of treated or untreated light and heavy liquids with various specific gravities shall be separated in an approved receptacle

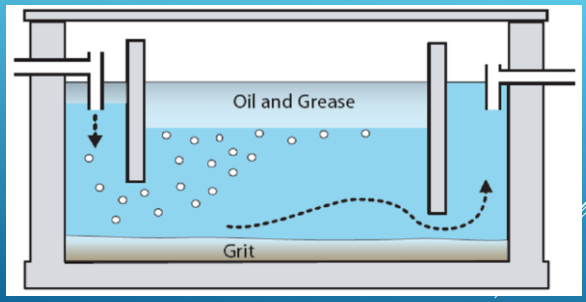
208

1003.4.2 Oil separator design. Oil separators shall be designed in accordance with Sections 1003.4.2.1 and 1003.4.2.2.



209

1003.4.2.1 General design requirements. Oil separators shall have a depth of not less than 2 feet (610 mm) below the invert of the discharge drain. The outlet opening of the separator shall have not less than an 18-inch (457 mm) water seal



210

1003.4.2.2 Garages and service stations. Where automobiles are serviced, greased, repaired or washed or where gasoline is dispensed, oil separators shall have a minimum capacity of 6 cubic feet (0.168 m3) for the first 100 square feet (9.3 m2) of area to be drained, plus 1 cubic foot (0.28 m3) for each additional 100 square feet (9.3 m2) of area to be drained into the separator. Parking garages in which servicing, repairing or washing is not conducted, and in which gasoline is not dispensed, shall not require a separator. Areas of commercial garages utilized only for storage of automobiles are not required to be drained through a separator

211

1003.5 Sand interceptors in commercial establishments. Sand and similar interceptors for heavy solids shall be designed and located so as to be provided with ready access for cleaning, and shall have a water seal of not less than 6 inches (152 mm).

212

1003.6 Laundries. Laundry facilities not installed within an individual dwelling unit or intended for individual family use shall be equipped with an interceptor with a wire basket or similar device, removable for cleaning, that prevents passage into the drainage system of solids 1/**2 inch** (12.7 mm) or larger in size, string, rags, buttons or other materials detrimental to the public sewage system.

213

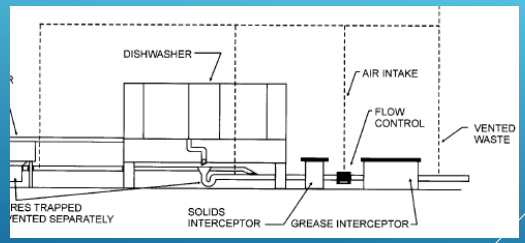
1003.7 Bottling establishments. Bottling plants shall discharge process wastes into an interceptor that will provide for the separation of broken glass or other solids before discharging waste into the drainage system.

214

1003.8 Slaughterhouses. Slaughtering room and dressing room drains shall be equipped with approved separators. The separator shall prevent the discharge into the drainage system of feathers, entrails and other materials that cause clogging

215

1003.9 Venting of interceptors and separators. Interceptors and separators shall be designed so as not to become air bound where tight covers are utilized. Each interceptor or separator shall be vented where subject to a loss of trap seal.



216

409

1003.10 Access and maintenance of interceptors and separators. Access shall be provided to each interceptor and separator for service and maintenance. Interceptors and separators shall be maintained by periodic removal of accumulated grease, scum, oil, or other floating substances and solids deposited in the interceptor or separator

217

SECTION 1004
MATERIALS, JOINTS AND CONNECTIONS

1004.1 General. The materials and methods utilized for the construction and installation of traps, interceptors and separators shall comply with this chapter and the applicable provisions of Chapters 4 and 7. The fittings shall not have ledges, shoulders or reductions capable of retarding or obstructing flow of the piping.

218

File Attachments for Item:

EC-11 Single-Stack Vent Systems (Assn Plumbing & Hydronics Contractors)

All certifications (2 hours)

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:
Name: Tracy Jefferies - Exec Director
Organization: APHC
Address: 3891 Seabell Ct Columbus OH 43230
E-mail: aphc.contractors@gmail.com Telephone: 614-315-6924
Website: aphcofcentralohio.com
Conference Sponsor (if applicable) — Conference Email: —

Check here if Course Renewal: ☐ Prior course number _____ *(i.e. BBS2018-429)*
Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:
Course title: Single Stack Venting Systems
Course instructor: Guy Miller Jr & Darmin Dawson
Course description: See attached doc & outline description

Instructional hours per session: 2 Number of Sessions: TBD
Course Date(s) and Location: Pending Approval for dates
↳ 653 McCorkle Blvd Suite H Westerville OH 43082

Special Content:
Code Administration: ☐
Existing Buildings: ☐
Electrical Instruction: ☐
Plumbing Instruction: ☒

Conference Course: _____
Conference Name: _____
Conference location: _____

Course to be offered online? ☐ **On Demand** ☐ **Webinar** ☐
Course Website: _____
Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:

Course applicable for the following certifications

Residential Certifications Only: ☐ Commercial Certifications: ☐
Administrative Course, All Certifications: ☒

Application materials included:
☒ Course Outline or Course Learning Objectives
☒ Presentation Materials/Slides (not required for roundtable courses)
☐ Assessment Materials (for online courses)
☒ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

APHC

OBJECTIVE: The presentation will cover Single Stack Venting systems. This will cover the installation of the vent system in new and existing buildings. The presentation will also compare and contrast other vent methods of Chapter 9 and how each system interacts with the single stack venting method.

MATERIALS/BOOKS: State of Ohio plumbing code book, PowerPoint

LENGTH OF COURSE: 2 hours

COURSE TITLE: Single Stack Venting Systems

COURSE OUTLINE:

Chapter 9 section 917 will be covered in depth with comparisons and contrasts relating to section 910 (individual vent), section 911 (common vent), sections 912 (wet venting), 913 (waste stack venting), 914 (circuit venting), 915 (combination waste and vent system), and 916 (Island fixture venting)

PHYSICAL FACILITIES DESCRIPTION

Classroom at 653 McCorkle Blvd. Suite H in Westerville:

The room is set up in a classroom style with seating for up to 24 individuals at conference tables. The room is well lit using overhead fluorescent lighting. The room is also provided with audio/visual equipment; overhead projector, screen and eraser board for illustrations as needed for presentation purposes. The room is equipped with its own controls to control heating and cooling for comfort. Of course, restroom facilities are available.

This site is also equipped with a lab area consisting of workstations for the backflow prevention certification and recertification classes held. These stations (8) are equipped with different manufacturers' devices to test and repair. All tools and equipment needed for the lab portion of the class are provided as part of the course.

QUALIFICATIONS:

Darrin Dawson has worked 39 years in the plumbing industry. In May of 1990, he received his Master Plumbing Certification.

He has been a State of Ohio Certified Plumbing Inspector since June of 2003. He became a National Certified Medical Gas Inspector in June of 2007.

In April of 2022 he received a State of Ohio Backflow Certification.

Mr. Dawson has been an instructor for The Association of Plumbers and Hydronics Contractors (APHC) apprenticeship program for 16 years.

He is currently employed at The Delaware Public Health District as a Plumbing and Medical Gas inspector.

Guy Miller Jr.
629 Fenchurch Way
Gahanna, OH 43230
Ph. (614) 940-5700
guymillerjr@gmail.com

Certification: Master Plumber, State of Ohio-Id Number #24380 (exp)
Certified Backflow Preventer - Certificate #1300 (State of Ohio – exp)
Certified plumbing inspector - Certificate #K02033 (State of Ohio), 5523 (BBS)
Certified plumbing plans examiner- Certificate #K02033 (State of Ohio), 5523 (BBS)

Teacher: APHC Apprenticeship Program, Fourth Year Instructor
8/08-present

APHC Association - Continuing Education Classes
2021- Present

Work Experience:

1/85 – 1/95	Guy Miller Plumbing
1/95-8/03	Eric Guy Plumbing
8/03 – 2/10	Foreman: Crawford Mechanical Services
2/10-04/17	Foreman/Project Manager: Gutridge Plumbing
4/17-current	Plumbing Field Supervisor-City of Columbus

SECTION 917

Single stack systems

APHC

1

SECTION 913
WASTE STACK VENTING

913.1 Waste stack vent permitted. *A waste stack shall be considered a vent for all of the fixtures discharging to the stack* where installed in accordance with the requirements of this section.

913.2 Stack installation. The waste stack shall be vertical, and *both horizontal and vertical offsets shall be prohibited* between the lowest fixture drain connection and the highest fixture drain connection. *Fixture drains shall connect separately to the waste stack.* ***The stack shall not receive the discharge of water closets, urinals, clinic or flushing rim sinks.***

913.3 Stack vent. *A stack vent shall be provided for the waste stack. The size of the stack vent shall be not less than the size of the waste stack.* Offsets shall be permitted in the stack vent, shall be located not less than 6 inches (152 mm) above the flood level of the highest fixture and shall be in accordance with Section 905.2. The stack vent shall be permitted to connect with other stack vents and vent stacks in accordance with Section 904.5

2

SECTION 913
WASTE STACK VENTING

913.4 Waste stack size. The waste stack shall be sized based on the total discharge to the stack and the discharge within a branch interval in accordance with Table 913.4. *The waste stack shall be the same size throughout its length.*

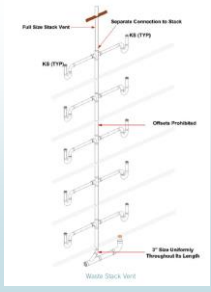
TABLE 913.4
WASTE STACK VENT SIZE

STACK SIZE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Total discharge into one branch interval	Total discharge for stack
1½	1	2
2	2	4
2½	No limit	8
3	No limit	24
4	No limit	50
5	No limit	75
6	No limit	100

For SI: 1 inch = 25.4 mm.]

3

SECTION 913
WASTE STACK VENTING



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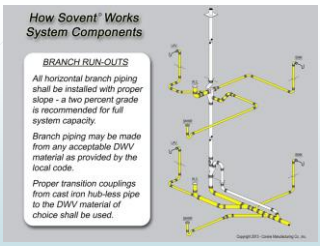
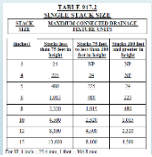


5

SECTION 917
SINGLE STACK VENTING SYSTEM

917.1 Where permitted. A drainage stack shall serve as a single stack vent system where sized and installed in accordance with Sections 917.2 through 917.9. The drainage stack and branch piping shall be the vents for the drainage system. *The drainage stack shall have a stack vent.*

917.2 Stack size. Drainage stacks shall be sized in accordance with Table 917.2. Stacks shall be uniformly sized based on the total connected drainage fixture unit load. *The stack vent shall be the same size as the drainage stack.* A 3inch (76 mm) stack shall serve not more than two water closets.



6

Stack Vent

The extension of a soil or waste stack above the highest horizontal drain connected to the stack.

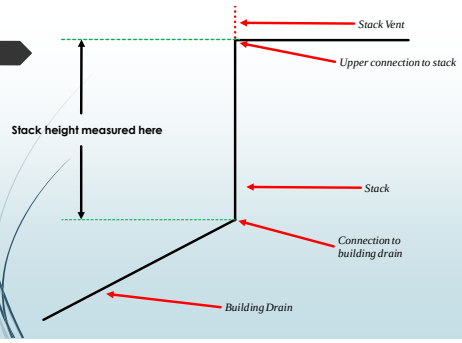
The drainage stack shall have a stack vent. (waste stack vent)

The stack vent shall be the same size as the drainage stack. (*waste stack vent*)

The *COMMENTARY* Clarifies How to Determine the Height of the Stack section 917.2

- The height of the *stack* is from the connection to the *building drain* to the most upper drainage connection to the *stack*. Drainage *stacks* must be the same size from the base to the termination of the *stack vent* to the outdoors.

7



8

Waste stack vent

TABLE 913.4
WASTE STACK VENT SIZE

STACK SIZE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Total discharge into one branch interval	Total discharge for stack
1½	4	4
2	5	8
2½	No limit	8
3	No limit	24
4	No limit	50
5	No limit	72
6	No limit	100

For SI: 1 inch = 25.4 mm.]

Single stack

TABLE 917.2
SINGLE STACK SIZE

STACK SIZE (inches)	MAXIMUM CONNECTED DRAINAGE FIXTURE UNITS		
	Stacks less than 75 feet in height	Stacks 75 feet to less than 160 feet in height	Stacks 160 feet and greater in height
3	24	NP	NP
4	225	24	NP
5	480	225	24
6	1,015	480	225
8	2,320	1,015	480
10	4,500	2,320	1,015
12	8,100	4,500	2,320
15	13,600	8,100	4,500

9

917.3 Branch size. Horizontal branches connecting to a single stack vent system shall be sized in accordance with Table 710.1(2). Not more than one water closet shall discharge into a 3-inch (76 mm) horizontal branch at a point within a developed length of 18 inches (457 mm) measured horizontally from the stack. Where a water closet is within 18 inches (457 mm) measured horizontally from the stack and not more than one fixture with a drain size of not more than 11 /2 inches (38 mm) connects to a 3-inch (76 mm) horizontal branch, the branch drain connection to the stack shall be made with a sanitary tee.

10

SECTION 917
SINGLE STACK VENTING SYSTEM

- **917.3 Branch size.** Horizontal branches connecting to a single stack vent system shall be sized in accordance with Table 710.1(2).
- Not more than one water closet shall discharge into a 3-inch (76 mm) horizontal branch at a point within a developed length of 18 inches (457 mm) measured horizontally from the stack.
- Where a water closet is within 18 inches (457 mm) measured horizontally from the stack and not more than one fixture with a drain size of not more than 11/2 inches (38 mm) connects to a 3-inch (76 mm) horizontal branch, the branch drain connection to the stack shall be made with a sanitary tee.

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

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
		Stacks[b]		
	Total for horizontal branch	Total discharge into one branch interval	Total for stack of three branch intervals or less	Total for stack greater than three branch intervals
1½	3	2	4	8
2	6	6	10	24
2½	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Note c	Note c	Note c

11

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

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
		Stacks[b]		
	Total for horizontal branch	Total discharge into one branch interval	Total for stack of three branch intervals or less	Total for stack greater than three branch intervals
1½	3	2	4	8
2	6	6	10	24
2½	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Note c	Note c	Note c

TABLE 917.2
SINGLE STACK SIZE

STACK SIZE (inches)	MAXIMUM CONNECTED DRAINAGE FIXTURE UNITS		
	Stacks less than 75 feet in height	Stacks 75 feet to less than 160 feet in height	Stacks 160 feet and greater in height
3	24	NP	NP
4	225	24	NP
5	480	225	24
6	1,015	480	225
8	2,320	1,015	480
10	4,500	2,320	1,015
12	8,100	4,500	2,320
15	13,600	8,100	4,500

12

917.3 BREAKDOWN (RESTRICTIONS)

➡IF the horizontal branch is 3", not more than 1 W.C. shall discharge within a developed length of 18" measured horizontally from the stack. (WYE)

➡If the branch size is 3" and the W.C. discharge is with 18" measured horizontally, the branch can receive the discharge of not more than 1 fixture drain not larger than 1-1/2 inches, however, then the connection to the stack MUST be made using a sanitary tee

➡ If the connection to the stack is made with a WYE pattern fitting, then the only fixture that can connect to the stack would be the W.C.

13

917.3 BREAKDOWN

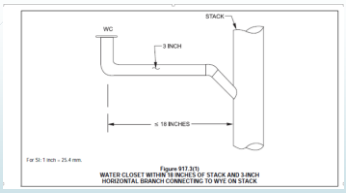


Figure 917.3(1)
WATER CLOSET WITHIN 18 INCHES OF STACK AND 3-INCH HORIZONTAL BRANCH CONNECTING TO WYE ON STACK

Simply, the single fixture connection only applies IF there is a water closet connected AND the connection to the stack isn't made with a sanitary tee.

14

917.3 BREAKDOWN

In other words, the fitting used at the connection to the stack determines what you can or cannot connect to the branch.

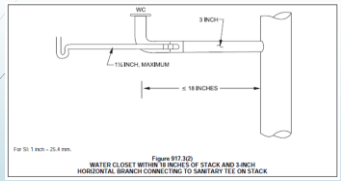


Figure 917.3(2)
WATER CLOSET WITHIN 18 INCHES OF STACK AND 3-INCH HORIZONTAL BRANCH CONNECTING TO SANITARY TEE ON STACK

For a 3" horizontal branch with a water closet connected within 18" horizontally from the stack, you can only have 1 additional 1-1/2" fixture drain connection to the horizontal branch, through a Sanitary Tee Connection.

15

16

17

SECTION 917
SINGLE STACK VENTING SYSTEM

917.4 Length of horizontal branches. The length of horizontal branches shall conform to the requirements of Sections 917.4.1 through 917.4.3.

917.4.1 Water closet connection. Water closet connections shall be not greater than 4 feet (1219 mm) in developed length measured horizontally from the stack.

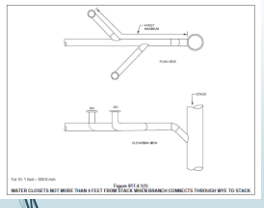
Exception: Where the connection is made with a sanitary tee, the maximum developed length shall be 8 feet (2438 mm).

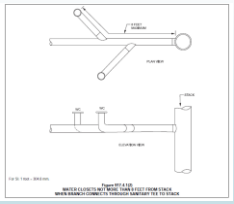
917.4.2 Fixture connections. Fixtures other than water closets shall be located not greater than 12 feet (3657 mm) in developed length, measured horizontally from the stack.

917.4.3 Vertical piping in branch. The length of vertical piping in a fixture drain connecting to a horizontal branch shall not be considered in computing the fixture's distance in developed length measured horizontally from the stack.

18

SECTION 917
SINGLE STACK VENTING SYSTEM





19

917.4.1 BREAKDOWN

Establishes the maximum horizontal developed length from the stack to the water closet.

1. 4 feet if a WYE pattern fitting is used at the stack
2. 8 feet if a sanitary tee is used at the stack(*exception*)

20

SECTION 917
SINGLE STACK VENTING SYSTEM

917.5 Minimum vertical piping size from fixture. The vertical portion of piping in a fixture drain to a horizontal branch shall be 2 inches (51 mm). The minimum size of the vertical portion of piping for a water-supplied urinal or standpipe shall be 3 inches (76 mm). The maximum vertical drop shall be 4 feet (1219 mm). Fixture drains that are not increased in size or have a vertical drop in excess of 4 feet (1219 mm), shall be individually vented.

917.4.3 Vertical piping

The length of vertical piping in a fixture drain connecting to a horizontal *branch* shall not be considered in computing the fixture's distance in *developed length* measured horizontally from the *stack*.

21

2nd sentence;

The minimum size of the vertical portion of piping for a water-supplied urinal or ***standpipe*** shall be 3 inches.

Because of the amount of water discharged in a single use, 3" pipe is required on the vertical pipe of both water-supplied urinal and standpipes. The fixture drain connection to the vertical pipe will be by a reducing 90. Again, since the vertical piping is required to be 3", the horizontal piping is required to be 3" (ref. - 704.2).

22

SECTION 917
SINGLE STACK VENTING SYSTEM

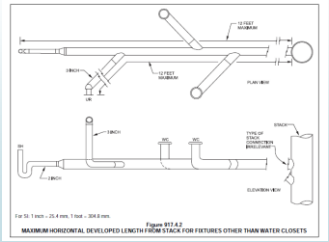
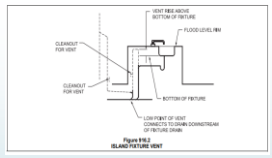


Figure 917.4.2
MAXIMUM HORIZONTAL DEVELOPED LENGTH FROM STACK FOR FIXTURES OTHER THAN WATER CLOSETS

23

24



25

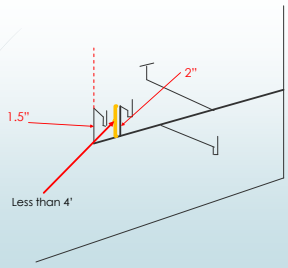
917.5 BREAKDOWN

3rd & 4th sentences;

The maximum vertical drop shall be 4 feet (1219 mm). *Fixture drains* that are not increased in size, or have a vertical drop in excess of 4 feet (1219 mm), shall be individually vented.

Establishes a maximum vertical drop of 4 feet, while also establishing that IF the drop is greater than 4 feet OR if the fixture drain was not increased in size, THEN the fixture(s) SHALL be individually vented.

26



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SECTION 917
SINGLE STACK VENTING SYSTEM

917.6 Additional venting required. Additional venting shall be provided where more than one water closet discharges to a horizontal branch and where the distance from a fixture trap to the stack exceeds the limits in Section 917.4. Where additional venting is required, the fixture(s) shall be vented by individual vents, common vents, wet vents, circuit vents, or a combination waste and vent pipe. The dry vent extensions for the additional venting shall connect to a branch vent, vent stack, stack vent, air admittance valve, or shall terminate outdoors.

917.7 Stack offsets. Where fixture drains are not connected below a horizontal offset in a stack, a horizontal offset shall not be required to be vented. Where horizontal branches or fixture drains are connected below a horizontal offset in a stack, the offset shall be vented in accordance with Section 907. Fixture connections shall not be made to a stack within 2 feet (610 mm) above or below a horizontal offset.

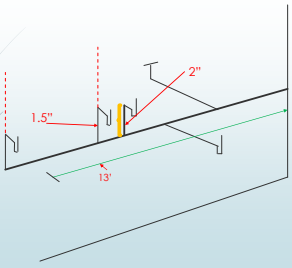
28

917.6 Additional venting required.

Additional venting shall be provided where more than one water closet discharges to a horizontal *branch* and where the distance from a fixture *trap* to the *stack* exceeds the limits in Section 917.4.

Where additional venting is required, the fixture(s) shall be vented by *individual vents*, *common vents*, *wet vents*, *circuit vents*, or a *combination waste and vent pipe*.

29



30

917.7 Stack offsets.

Where fixture drains are not connected below a horizontal offset in a *stack*, a horizontal offset shall not be required to be vented. Where horizontal *branches* or *fixture drains* are connected below a horizontal offset in a *stack*, the offset shall be vented in accordance with Section 907. Fixture connections shall NOT be made to a *stack* within 2 feet (610 mm) above or below a horizontal offset.

31

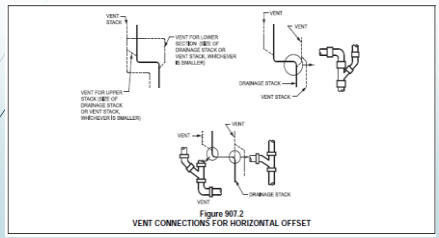


Figure 907.2
VENT CONNECTIONS FOR HORIZONTAL OFFSET

32

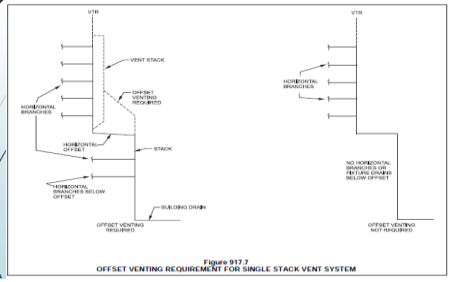


Figure 917.7
OFFSET VENTING REQUIREMENT FOR SINGLE STACK VENT SYSTEM

33

SECTION 917
SINGLE STACK VENTING SYSTEM

917.8 Prohibited lower connections. Stacks greater than 2 branch intervals in height shall not receive the discharge of horizontal branches on the lower two floors. There shall be no connections to the stack between the lower two floors and a distance of not less than 10 pipe diameters downstream from the base of the single stack vented system.

917.9 Sizing building drains and sewers. The building drain and building sewer receiving the discharge of a single stack vent system shall be sized in accordance with Table 710.1(1).

34

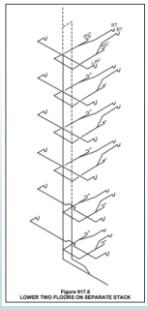


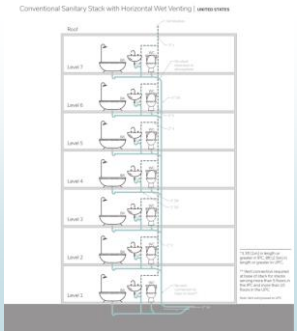
Figure 917.8
LOWER TWO FLOORS ON SEPARATE STACK

35

917.8 Prohibited lower connections.

Stacks greater than 2 *branch intervals* in height shall not receive the discharge of horizontal *branches* on the lower two floors. There shall be no connections to the *stack* between the lower two floors and a distance of not less than 10 pipe diameters downstream from the base of the single stack vented system.

36



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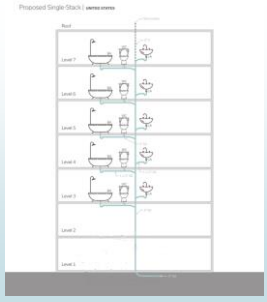

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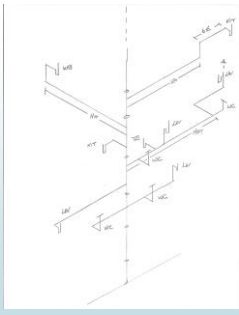
The oversized piping prevents negative pressures from developing in the branches, and the oversized stack prevents excessive positive or negative pressures from developing in the stack. Theoretically, this allows the system to maintain a *"near"* neutral pressure (*equal to atmospheric pressure*).

39



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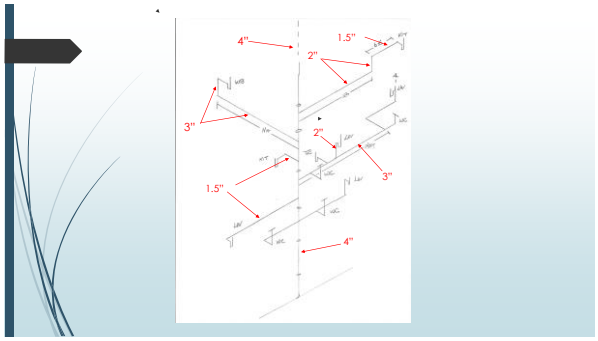

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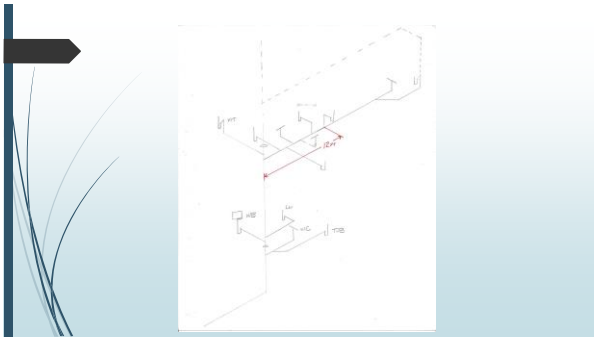

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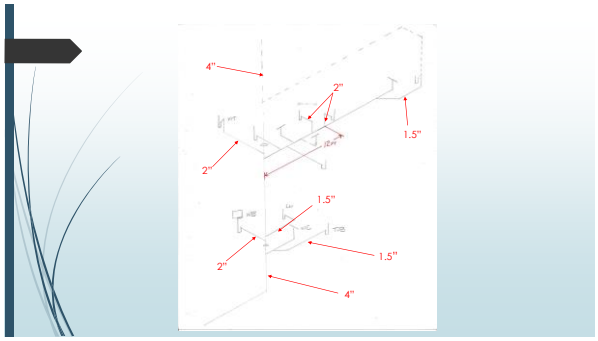

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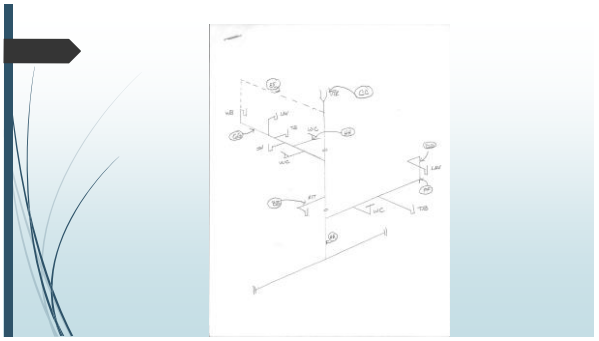

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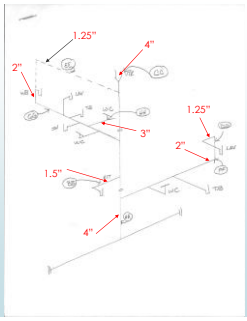

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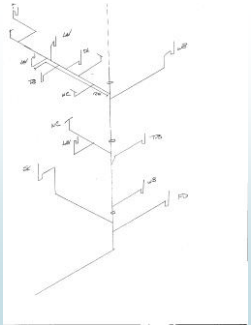

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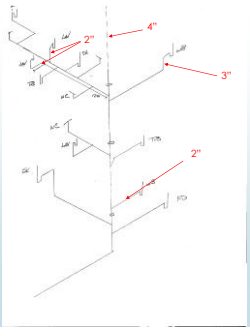

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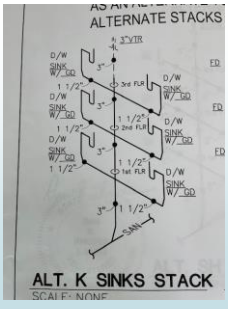


48


917.9
Sizing building drains and sewers. The building drain and building sewer receiving the discharge of a single stack vent system shall be sized in accordance with Table 710.1(1)

49

File Attachments for Item:

EC-12 Understanding the Ohio Plumbing Code (Assn Plumbing & Hydronics Contractors)

All certifications (8 hours)

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Tracy Jefferies - Exec Director

Organization: APHC

Address: 3891 Seabell Ct Columbus OH 43230

E-mail: aphc.contractors@gmail.com Telephone: 614-315-6924

Website: aphcofcentralohio.com

Conference Sponsor (if applicable) — Conference Email: —

Check here if Course Renewal: ☐ Prior course number _____ (*i.e. BBS2018-429*)

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

New Course Information:

Course title: Understanding the Plumbing Code

Course instructor: Greg Miller Jr & Darrin Dawson

Course description:

Instructional hours per session: 8 hrs Number of Sessions: TBD

Course Date(s) and Location: Pending Approval for dates
↳ 653 McCorkle Blvd Suite H Westerville OH 43082

Special Content:

Code Administration: ☐
Existing Buildings: ☐
Electrical Instruction: ☐
Plumbing Instruction: ☒

Conference Course: _____
Conference Name: _____
Conference location: _____

Course to be offered online? ☐ **On Demand** ☐ **Webinar** ☐

Course Website: _____

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

Course applicable for the following certifications

Residential Certifications Only: ☐ Commercial Certifications: ☐
Administrative Course, All Certifications: ☒

Application materials included:

☒ Course Outline or Course Learning Objectives
☒ Presentation Materials/Slides (not required for roundtable courses)
☐ Assessment Materials (for online courses)
☒ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

APHC

OBJECTIVE: A comprehensive review of sections of the state plumbing code, emphasizing code revisions and code clarification.

MATERIALS/BOOKS: State of Ohio plumbing code book, PowerPoint presentation for illustrations.

LENGTH OF COURSE: 8 hours

COURSE TITLE: Understanding the Plumbing Code

COURSE OUTLINE:

Part I — Chapters 1-6 – 2 hrs
General review of these chapters highlighting changes from the 2011 code to the 2017 plumbing code that are of importance

Part II — Chapter 8, 10,11 – 2hrs
Indirect waste, Traps and Interceptors and storm piping

Part III — Chapter 7 - 2hrs
Discussing the fixture unit table
Sizing the building drains, stacks and branches.
Sewage ejector systems

Part IV — Chapter 9 – 2 hrs
Vents, trap vent distance, vent connections.
Overview of venting requirements and vent stacks.
Explanation of the venting methods.

PHYSICAL FACILITIES DESCRIPTION

Classroom at 653 McCorkle Blvd. Suite H in Westerville:

The room is set up in a classroom style with seating for up to 24 individuals at conference tables. The room is well lit using overhead fluorescent lighting. The room is also provided with audio/visual equipment; overhead projector, screen and eraser board for illustrations as needed for presentation purposes. The room is equipped with its own controls to control heating and cooling for comfort. Of course, restroom facilities are available.

This site is also equipped with a lab area consisting of workstations for the backflow prevention certification and recertification classes held. These stations (8) are equipped with different manufacturers' devices to test and repair. All tools and equipment needed for the lab portion of the class are provided as part of the course.

QUALIFICATIONS:

Darrin Dawson has worked 39 years in the plumbing industry. In May of 1990, he received his Master Plumbing Certification.

He has been a State of Ohio Certified Plumbing Inspector since June of 2003. He became a National Certified Medical Gas Inspector in June of 2007.

In April of 2022 he received a State of Ohio Backflow Certification.

Mr. Dawson has been an instructor for The Association of Plumbers and Hydronics Contractors (APHC) apprenticeship program for 16 years.

He is currently employed at The Delaware Public Health District as a Plumbing and Medical Gas inspector.

Guy Miller Jr.
629 Fenchurch Way
Gahanna, OH 43230
Ph. (614) 940-5700
guymillerjr@gmail.com

Certification: Master Plumber, State of Ohio-Id Number #24380 (exp)
Certified Backflow Preventer - Certificate #1300 (State of Ohio – exp)
Certified plumbing inspector - Certificate #K02033 (State of Ohio), 5523 (BBS)
Certified plumbing plans examiner- Certificate #K02033 (State of Ohio), 5523 (BBS)

Teacher: APHC Apprenticeship Program, Fourth Year Instructor
8/08-present

APHC Association - Continuing Education Classes
2021- Present

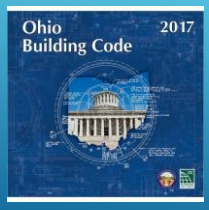
Work Experience:

1/85 – 1/95	Guy Miller Plumbing
1/95-8/03	Eric Guy Plumbing
8/03 – 2/10	Foreman: Crawford Mechanical Services
2/10-04/17	Foreman/Project Manager: Gutridge Plumbing
4/17-current	Plumbing Field Supervisor-City of Columbus

.

Ohio Code General Requirements

or stuff you should know



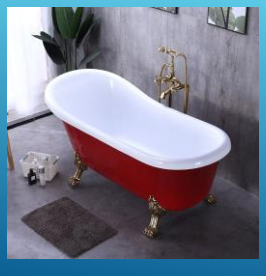
APHC

1

2024 PURPOSED CODE CHANGES

2

407.2 Modified - Bathtub overflow optional



3

610.1 EXCEPTION

(R) Add an exception to section 610.1 that reads as follows: Exception: New plumbing systems in one-, two-, and three-family dwellings are to be purged of deleterious matter and shown by a bacteriological examination, prescribed by the health authority or the water purveyor having jurisdiction and performed by a third-party testing laboratory certified/accepted by the Ohio EPA, that the water in the system meets prescribed water quality standards in accordance with the following procedure:

1. If, after first bacteriological examination, the water in the plumbing system meets prescribed water quality standards, then no disinfection is required.

2. If, after first bacteriological examination, the water in the plumbing system fails to meet prescribed water quality standards, then a second bacteriological examination is to be performed. If, after the second bacteriological examination, the water in the plumbing system meets prescribed water quality standards, then no disinfection is required.

3. If, after the second bacteriological examination, the water in the plumbing system fails to meet prescribed water quality standards, then the system is to be disinfected as described in this section prior to utilization

4

608.17.1.1 Modified Renumbered and reorganized sections to clarify backflow requirements used with carbonated beverage machines from requirements used with coffee and non-carbonated beverage machines

5

608.17.10 Added – Backflow requirements for humidifiers

6

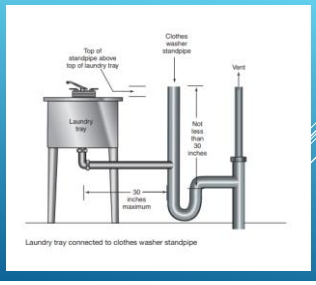
705.2.4 Added – Push fit DWV fittings for ABS and PVC piping

7

705.16.4 Modified-Allow a cement joint between drain and sewer where only one joint is needed between ABS and PVC

8

802.4.3.1 Added –Alternative connection of laundry tub/tray, without a fixture trap, to clothes washer standpipe

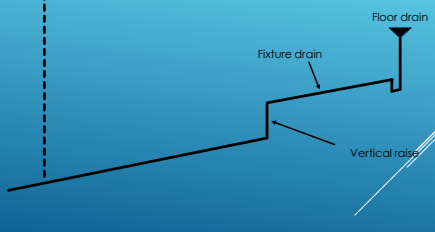


9

915.1 Modified- Food waste disposer may discharge into a combination waste vent

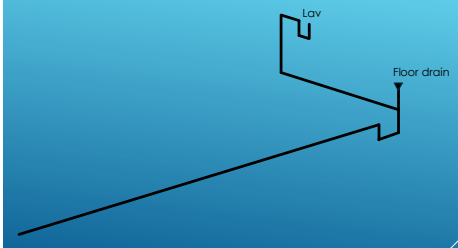
10

915.2 Retained model code for combination waste and vent, allowing vertical pipe between fixture drain of floor drain and horizontal pipe



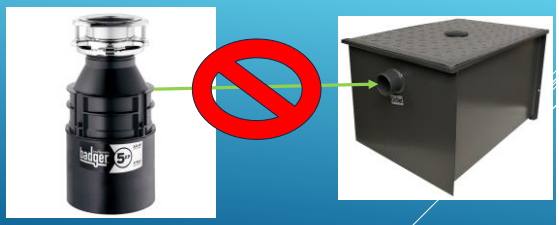
11

1002.4.1.5 Added- use of wastewater from lavs and hand sinks to supply trap primers



12

1003.3.2 modified- prohibits a food waste disposer from discharging to a grease interceptor



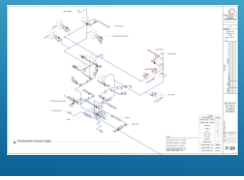
13

Administrative Code

14

106.1.1 Information on construction documents.

Construction documents shall be dimensioned and drawn upon suitable material. Electronic media documents are permitted to be submitted when approved by the building official. Construction documents shall be coordinated and of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code. Construction documents, adequate for the scope of the project, shall include information necessary to determine compliance with the building, mechanical, plumbing, fire, electrical, energy, and fuel gas codes



15

107.7 Approved construction document sets.

One set of approved construction documents shall be kept by the building official. The other set(s)shall be returned to the applicant, kept at the work site, along with manufacturers' installation instructions and product information, and shall be available for use by the inspector.

16

108.1 General.

After construction documents have been approved, construction or work may proceed in ***accordance with the approved documents****. Construction or work for which an approval is required shall be subject to inspection. It shall be the duty of the owner or the owner's duly authorized representative to notify the building department when work is ready for inspection.* ***Access*** *to and means for inspection of such work shall be provided for any inspections that are required by this code. It shall be the duty of the owner or the owner's authorized representative to cause the work to remain accessible and exposed for inspection purposes. Such construction or work shall remain accessible and exposed for inspection purposes until the work has been inspected to verify compliance with the approved construction documents, but failure of the inspectors to inspect the work* ***within four days****, exclusive of Saturdays, Sundays, and legal holidays, after the work is ready for inspection, allows the work to proceed. Subsequent work is allowed to proceed only to the point of the next required inspection.*

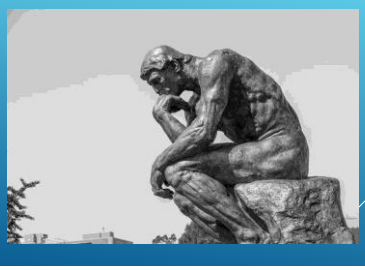
17

108.6 Inspections, observation of violations, unsafe conditions, or serious hazards.

When an inspector from the department having jurisdiction finds that any work in connection with the location, erection, construction, repair, alteration, moving, or equipment of a building is contrary to the approved construction documents for the same, the building inspector shall proceed as required in either section 108.6.1 or 108.7.

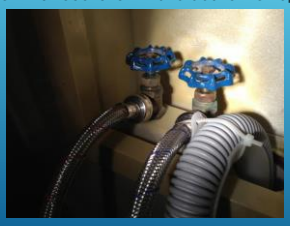
18

ESSENTIAL CODE DEFINITIONS



19

AIR BREAK (Drainage System). A piping arrangement in which a drain from a fixture, appliance or device discharges indirectly into another fixture, receptacle or interceptor at a point below the flood level rim and above the trap seal.



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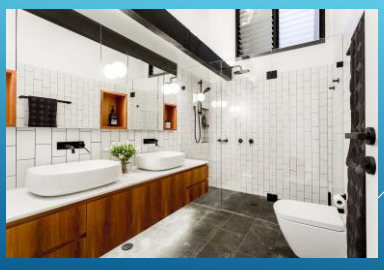
AIR GAP (Drainage System). The unobstructed vertical distance through the free atmosphere between the outlet of the waste pipe and the flood level rim of the receptacle into which the waste pipe is discharging.

21

AIR GAP (Water Distribution System). The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of the receptacle.

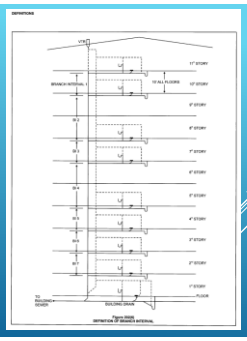
22

BATHROOM GROUP. A group of fixtures consisting of a water closet, lavatory, bathtub or shower, including or excluding a bidet, an emergency floor drain or both. Such fixtures are located together on the same floor level



23

BRANCH INTERVAL. A vertical measurement of distance, 8 feet (2438 mm) or more in developed length, between the connections of horizontal branches to a drainage stack. Measurements are taken down the stack from the highest horizontal branch connection.

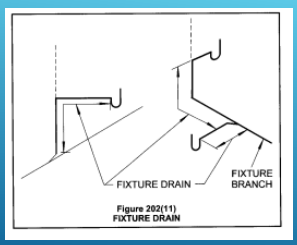


24

CONSTRUCTION DOCUMENTS. All of the written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of the project necessary for obtaining plan approval in accordance with section 106 of rule 4101:1-1-01 of the Administrative code.

25

FIXTURE DRAIN. The drain from the trap of a fixture to a junction with any other drain pipe.



26

FLOOD LEVEL RIM. The edge of the receptacle from which water overflows.

27

HORIZONTAL BRANCH DRAIN. A drainage branch pipe extending laterally from a soil or waste stack or building drain, with or without vertical sections or branches, that receives the discharge from two or more fixture drains or branches and conducts the discharge to the soil or waste stack or to the building drain.

28

INDIRECT WASTE PIPE. A waste pipe that does not connect directly with the drainage system, but that discharges into the drainage system through an air break or air gap into a trap, fixture, receptor or interceptor.

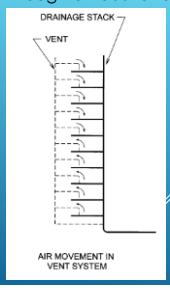
29

DRAINAGE FIXTURE UNIT

A measure of the probable discharge into the drainage system by various types of plumbing fixtures. The drainage fixture-unit value for a particular fixture depends on its volume rate of drainage discharge, on the time duration of a single drainage operation and on the average time between successive operations.

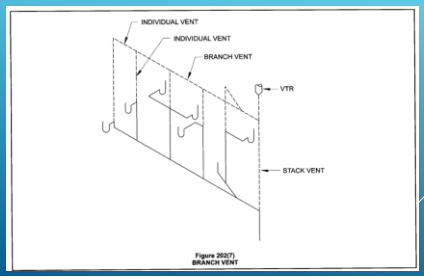
30

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



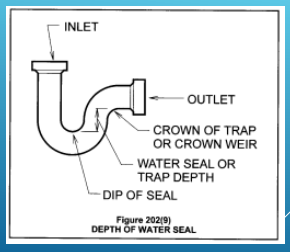
31

STACK VENT. The extension of a soil or waste stack above the highest horizontal drain connected to the stack.



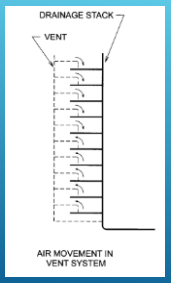
32

TRAP. A fitting or device that provides a liquid seal to prevent the emission of sewer gases without materially affecting the flow of sewage or waste water through the trap.



33

VENT STACK. A vertical vent pipe installed primarily for the purpose of providing circulation of air to and from any part of the drainage system



34

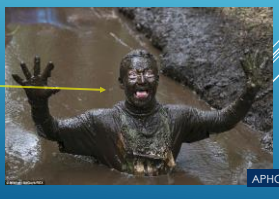
SECTION 306
TRENCHING, EXCAVATION AND BACKFILL

306.1 **Support of piping.** Buried piping shall be supported throughout its entire length.

35

306.2.3 **Soft load-bearing materials.** If soft materials of poor load-bearing quality are found at the bottom of the trench, stabilization shall be achieved by overexcavating not less than two pipe diameters and backfilling to the installation level of the bottom of the pipe with fine gravel, crushed stone or a concrete foundation. The concrete foundation shall be bedded with sand tamped into place so as to provide uniform load-bearing support for the pipe between joints.

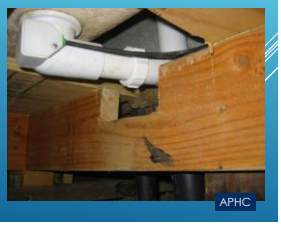
Plumbing Inspector checking underground piping.



36

STRUCTURAL SAFETY

307.2 **Cutting, notching or bored holes.** A framing member shall not be cut, notched or bored in excess of limitations specified in the *building code*

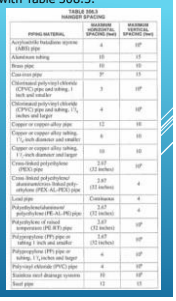


APHC

37

PIPING SUPPORT

308.5 **Interval of support.** Pipe shall be supported in accordance with Table 308.5.



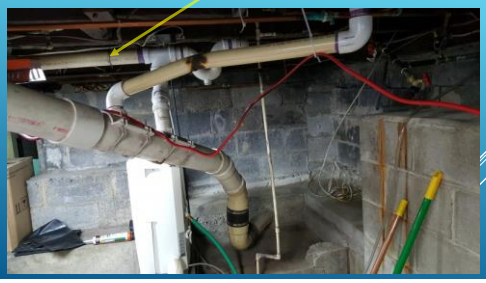
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.

b. For sizes 2 inches and smaller, a guide shall be installed midway between required vertical supports. Such guides shall prevent pipe movement in a direction perpendicular to the axis of the pipe.

38

One Hanger on the drainage system



39

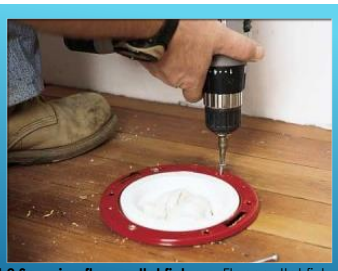
Stuff not to do during final inspection.....

Like pump air to the system to hold a test.

40

Chapter 4

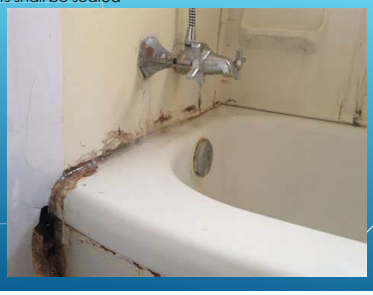
41



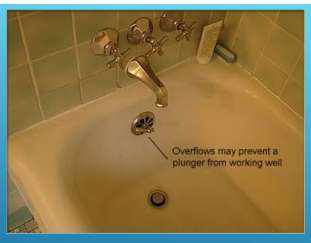
405.4.2 Securing floor outlet fixtures. Floor outlet fixtures shall be secured to the floor or floor flanges by screws or bolts of **corrosion-resistant** material.

42

405.5 Water-tight joints. Joints formed where fixtures come in contact with walls or floors shall be sealed



43



405.7 Design of overflows. Where any fixture is provided with an overflow, the waste shall be designed and installed so that standing water in the fixture will not rise in the overflow when the stopper is closed, and no water will remain in the overflow when the fixture is empty

44

406.2 **Waste connection.** The waste from an automatic clothes washer shall discharge through an air break into a standpipe in accordance with Section 802.4 or into a laundry sink. The trap and fixture drain for an automatic clothes washer standpipe shall be not less than 2 inches (51 mm) in diameter. The fixture drain for the standpipe serving an automatic clothes washer shall connect to a 3-inch (76 mm) or larger diameter fixture branch or stack. Automatic clothes washers that discharge by gravity shall be permitted to drain to a waste receptor or an approved trench drain.

45

408.3 Bidet water temperature. The discharge water temperature from a bidet fitting shall be limited to a maximum temperature of 110°F (43°C) by a water temperature limiting device conforming to ASSE 1070 or CSA B125.3.

46

412.2 **Floor drains.** Floor drains shall have removable strainers. The floor drain shall be constructed so that the drain is capable of being cleaned. Access shall be provided to the drain inlet. Ready access shall be provided to floor drains.

Exception: Floor drains serving refrigerated display cases shall be provided with access.

47

416.5 TEMPERED WATER FOR PUBLIC HAND-WASHING FACILITIES. TEMPERED WATER SHALL BE DELIVERED FROM PUBLIC HAND-WASHING FACILITIES. TEMPERED WATER SHALL BE DELIVERED THROUGH AN APPROVED WATER-TEMPERATURE LIMITING DEVICE THAT CONFORMS TO ASSE 1070 OR CSA B125.3

48

417.5.2 Shower lining. Floors under shower compartments, except where prefabricated receptors have been provided, shall be lined and made water tight utilizing material complying with Sections 417.5.2.1 through 417.5.2.6. Such liners shall turn up on all sides not less than 2 inches (51 mm) above the finished threshold level. Liners shall be recessed and fastened to an approved backing so as not to occupy the space required for wall covering, and shall not be nailed or perforated at any point less than 1 inch (25 mm) above the finished threshold. Liners shall be pitched one-fourth unit vertical in 12 units horizontal (2-percent slope) and shall be sloped toward the fixture drains and be securely fastened to the waste outlet at the seepage entrance, making a water-tight joint between the liner and the outlet. The completed liner shall be tested in accordance with Section 312.9.

49

Exceptions: 1. Floor surfaces under shower heads provided for rinsing laid directly on the ground are not required to comply with this section.

2. Where a sheet-applied, load-bearing, bonded, waterproof membrane is installed as the shower lining, the membrane shall not be required to be recessed.

50

3. The shower liner test is not required for one-, two-, or three-family dwellings unless required by the shower liner manufacturer's installation instructions.

51

423.3 Footbaths, pedicure baths and head shampoo sinks. The water supplied to specialty plumbing fixtures, such as pedicure chairs having an integral foot bathtub, footbaths, and head shampoo sinks, shall be limited to a maximum temperature of 120°F (49°C) by a water temperature limiting device that conforms to ASSE 1070 or CSA B125.3.

Vacuum Breaker

52

Chapter 5

53

502.5 Clearances for maintenance and replacement. Appliances shall be provided with access for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances or any other piping or ducts not connected to the appliance being inspected, serviced, repaired or replaced. A level working space not less than **30 inches in length and 30 inches in width** (762 mm by 762 mm) shall be provided in front of the control side to service an appliance

54

55

504.2 Vacuum relief valve. Bottom fed water heaters and bottom fed tanks connected to water heaters shall have a vacuum relief valve installed. The vacuum relief valve shall comply with ANSI Z21.22.

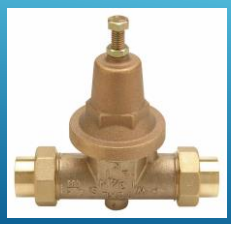
56

Chapter 6

57

604.8 Water pressure-reducing valve or regulator. Where water pressure within a building exceeds 80 psi (552 kPa) static, an approved water pressure reducing valve conforming to ASSE 1003 or CSA B356 with strainer shall be 4101:3-6-01 6 installed to reduce the pressure in the building water distribution piping to not greater than 80 psi (552 kPa) static.

Exception: Service lines to sill cocks and outside hydrants, and main supply risers where pressure from the mains is reduced to 80 psi (552 kPa) or less at individual fixtures



58

608.16.10 Coffee machines and noncarbonated beverage dispensers. The water supply connection to coffee machines and noncarbonated beverage dispensers shall be protected against backflow by a backflow preventer conforming to ASSE 1022 or by an air gap

59

SECTION 610 DISINFECTION OF POTABLE WATER SYSTEM 610.1 General. **New potable water systems** shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the health authority or water purveyor having jurisdiction or, in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652, or as described in this section. This requirement shall apply to "on-site" or "inplant" fabrication of a system or to a modular portion of a system.

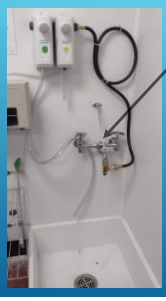
1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
2. The system or part thereof shall be filled with a water/chlorine solution containing not less than 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing not less than 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3 hours.
3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.
4. 4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

60

61

Do not alter faucet

62



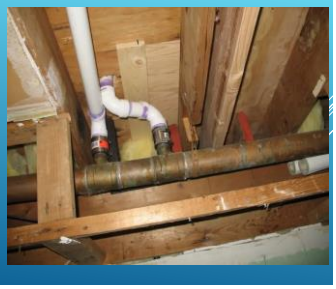
This vacuum breaker is not designed for continuous pressure!

63

Chapter 7

64

705.16 Joints between different materials. Joints between different piping materials shall be made with a mechanical joint of the compression or mechanical-sealing type conforming to ASTM C 1173, ASTM C 1460 or ASTM 4101:3-7-01 12 C 1461. Connectors and adapters shall be approved for the application and such joints shall have an elastomeric seal conforming to ASTM C 425, ASTM C 443, ASTM C 564, ASTM C 1440, ASTM F 477, CSA A257.3M or CSA B602, or as required in Sections 705.16.1 through 705.16.7. Joints between glass pipe and other types of materials shall be made with adapters having a TFE seal. Joints shall be installed in accordance with the manufacturer's instructions.



65

NOPE!

use this

66

706.3 Installation of fittings. Fittings shall be installed to guide sewage and waste in the direction of flow. Change in direction shall be made by fittings installed in accordance with Table 706.3. Change in direction by combination fittings, side inlets or increasers shall be installed in accordance with Table 706.3 based on the pattern of flow created by the fitting. Double sanitary tee patterns shall not receive the discharge of back-to-back water closets and fixtures or appliances with pumping action discharge.

67

No!

and

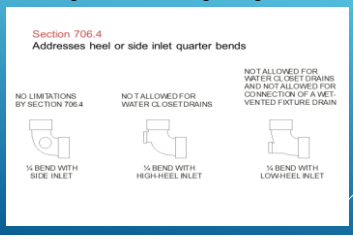
2" Trap

1 1/2 pipe

No!

68

706.4 Heel- or side-inlet quarter bends. Heel-inlet quarter bends shall be an acceptable means of connection, except where the quarter bend serves a water closet. A low-heel inlet shall not be used as a wet-vented connection. Side-inlet quarter bends shall be an acceptable means of connection for drainage, wet venting and stack venting arrangements.



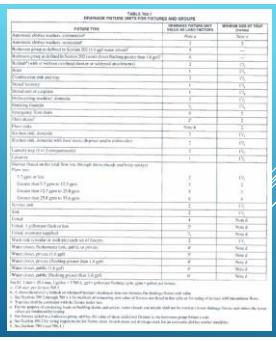
69

SECTION 708
CLEANOUTS
708.1 Cleanouts required. Cleanouts shall be provided for drainage piping in accordance with Sections 708.1.1 through 708.1.11.

Stack Cleanout's no longer required

70

709.1 **Values for fixtures.** Drainage fixture unit values as given in Table 709.1 designate the relative load weight of different kinds of fixtures that shall be employed in estimating the total load carried by a soil or waste pipe, and shall be used in connection with Tables 710.1(1) and 710.1(2) of sizes for soil, waste and vent pipes for which the permissible load is given in terms of fixture units.



71

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

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

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

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

d. Trap size shall be consistent with the fixture outlet size.

e. For the purpose of computing loads on building drains and sewers, water closets and urinals shall not be rated at a lower fixture unit unless the lower values are confirmed by testing.

f. For fixtures added to a dwelling unit bathroom group, add the dfu value of those additional fixtures to the bathroom group count.

g. See Section 406.3 for sizing requirements for fixture drain, branch drain, and drainage stack for an automatic clothes washer standpipe.

h. See Sections 709.4 and 709.4.1.

72

709.2 **Fixtures not listed in Table 709.1.** Fixtures not listed in Table 709.1 shall have a drainage fixture unit load based on the outlet size of the fixture in accordance with Table 709.2. The minimum trap size for unlisted fixtures shall be the size of the drainage outlet but not less than 1¼ inches (32 mm).

TABLE 709.2

DRAINAGE FIXTURE UNITS FOR FIXTURE DRAINS OR TRAPS

FIXTURE DRAIN OR TRAP SIZE (inches)	DRAINAGE FIXTURE UNIT VALUE
1 ¼	1
1 ½	2
2	3
2 ½	4
3	5
4	6

73

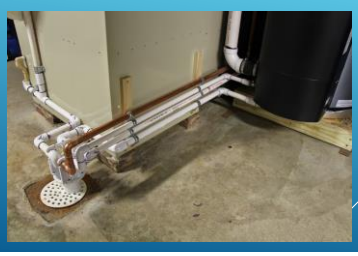
709.3 **Values for continuous and semi-continuous flow.** Drainage fixture unit values for continuous and semi-continuous flow into a drainage system shall be computed on the basis that 1 gpm (0.06 L/s) of flow is equivalent to two fixture units.

74

709.4 Values for indirect waste receptor. The drainage fixture unit load of an indirect waste receptor receiving the discharge of indirectly connected fixtures shall be the sum of the drainage fixture unit values of the fixtures that discharge to the receptor, but not less than the drainage fixture unit value given for the indirect waste receptor in Table 709.1 or 709.2

75

709.4.1 Clear-water waste receptors. Where waste receptors such as floor drains, floor sinks and hub drains receive only clear-water waste from display cases, refrigerated display cases, ice bins, coolers and freezers, such receptors shall have a drainage fixture unit value of one-half.



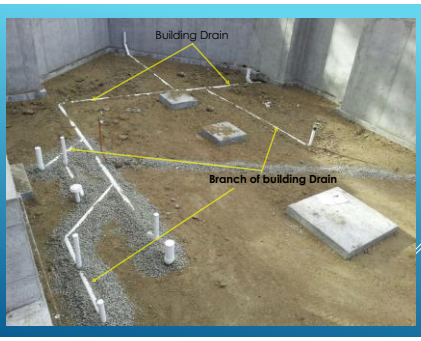
76

TABLE 710.1(1) BUILDING DRAINS AND SEWERS
DIAMETER OF PIPE (inches)
MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS CONNECTED TO ANY PORTION OF THE BUILDING DRAIN OR THE BUILDING SEWER, INCLUDING BRANCHES OF THE BUILDING Drain

	Slope per foot			
	1/16 inch	1/8 inch	1/4 inch	1/2 inch
1 ¼	—	—	1	1
1 ½	—	—	3	3
2	—	—	21	26
2 ½	—	—	24	31
3	—	36	42	50
4	—	180	216	250
5	—	390	480	575
6	—	700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

For SI: 1 inch = 25.4 mm, 1 inch per foot = 83.3 mm/m.
a. The minimum size of any building drain serving a water closet shall be 3 inches.

77



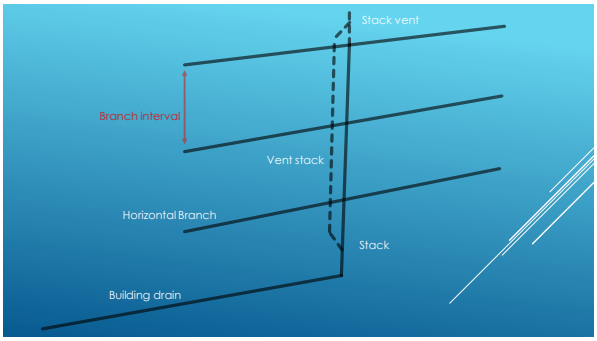
78

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

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
		Stacks[b]		
	Total for horizontal branch	Total discharge into one branch interval	Total for stack of three branch Intervals or less	Total for stack greater than three branch intervals
1 ¼	3	2	4	8
2	6	6	10	24
2 ½	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Note c	Note c	Note c

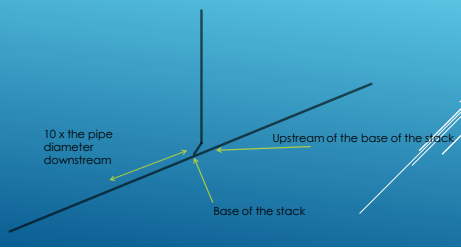
For SI: 1 inch = 25.4 mm.
a. Does not include branches of the building drain. Refer to Table 710.1(1).
b. Stacks shall be sized based on the total accumulated connected load at each story or branch interval. As the total accumulated connected load decreases, stacks are permitted to be reduced in size. Stack diameters shall not be reduced to less than one-half of the diameter of the largest stack size required.
c. Sizing load based on design criteria.

79



80

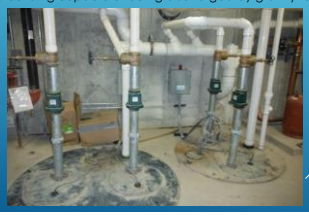
704.3 Connections to offsets and bases of stacks. Horizontal branches shall connect to the bases of stacks at a point located not less than 10 times the diameter of the drainage stack downstream from the stack. Except as prohibited by Section 711.2, horizontal branches shall connect to horizontal stack offsets at a point located not less than 10 times the diameter of the drainage stack downstream from the upper stack



81

SECTION 712
SUMPS AND EJECTORS
712.1 Building subdrains.

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



82

712.2 Valves required. A check valve and a full open valve located on the discharge side of the check valve shall be installed in the pump or ejector discharge piping between the pump or ejector and the gravity drainage system. Access shall be provided to such valves. Such valves shall be located above the sump cover required by Section 712.1 or, where the discharge pipe from the ejector is below grade, the valves shall be accessibly located outside the sump below grade in an access pit with a removable access cover.

83

715.5 Location. Backwater valves shall be installed so that access is provided to the working parts for service and repair.

84

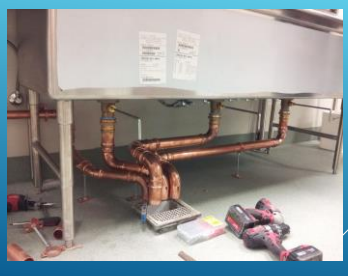
Chapter 8

85

802.1 **Where required.** Food-handling equipment, in other than dwelling units, clear-water waste, dishwashing machines and utensils, pots, pans and dishwashing sinks shall discharge through an indirect waste pipe as specified in Sections 802.1.1 through 802.1.8. Health-care related fixtures, devices and equipment shall discharge to the drainage system through an indirect waste pipe by means of an air gap in accordance with this chapter and Section 713.3. Fixtures not required by this section to be indirectly connected shall be directly connected to the plumbing system in accordance with Chapter 7.

86

802.1.1 **Food handling.** Equipment and fixtures utilized for the storage, preparation and handling of food shall discharge through an indirect waste pipe by means of an air gap. Each well of a multiple-compartment sink shall discharge independently to a waste receptor.



87

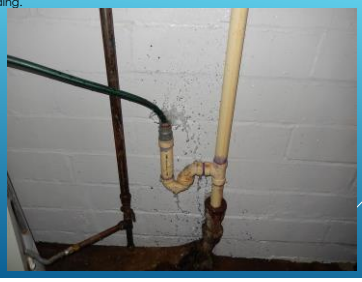
802.2.1 Air gap. The air gap between the indirect waste pipe and the flood level rim of the waste receptor shall be a minimum of twice the effective opening of the indirect waste pipe

88

802.2.2 Air break. An air break shall be provided between the indirect waste pipe and the trap seal of the waste receptor or standpipe

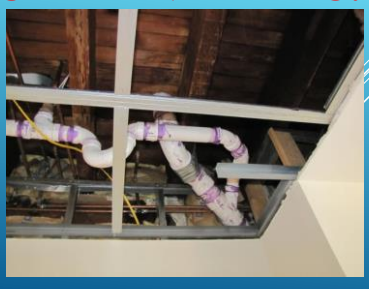
89

802.3.3 **Standpipes.** Standpipes shall be individually trapped. Standpipes shall extend not less than 18 inches (457 mm) but not greater than 42 inches (1066 mm) above the trap weir. Access shall be provided to standpipes and drains for rodding.



90

CHAPTER 9 VENTING!



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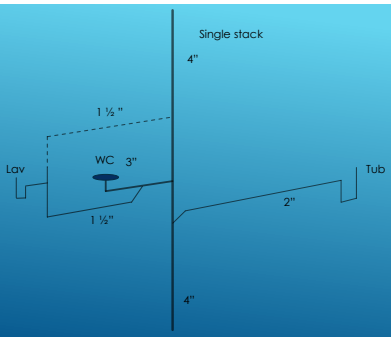

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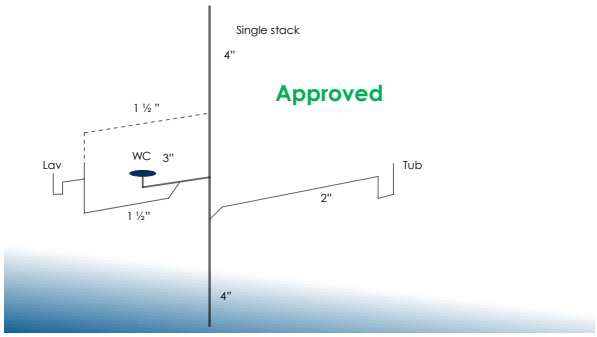
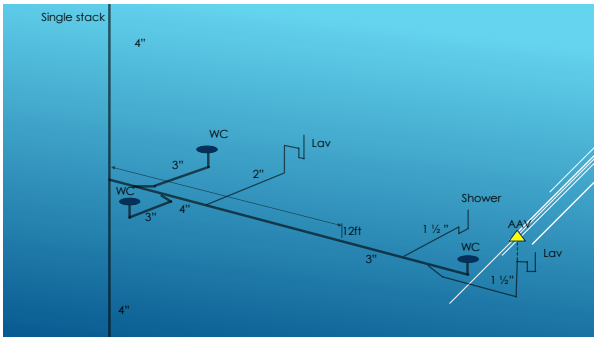
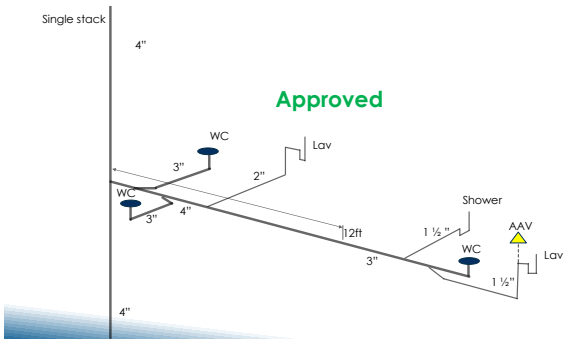

Single stack
4"
Approved
1 ½ "
Lav
WC
3"
Tub
2"
1 ½"
4"

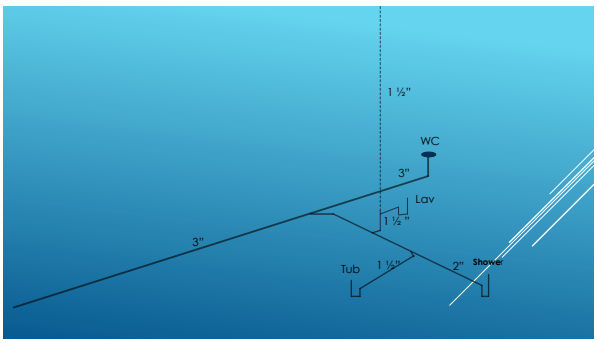
93


Single stack
4"
WC
Lav
3"
2"
WC
3"
4"
12ft
Shower
1 ½ "
AAV
WC
3"
Lav
1 ½"
4"

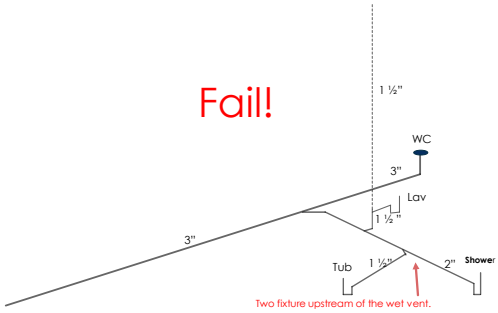
94


Single stack
4"
Approved
WC
Lav
3"
2"
WC
3"
4"
12ft
Shower
1 ½ "
AAV
WC
3"
Lav
1 ½"
4"

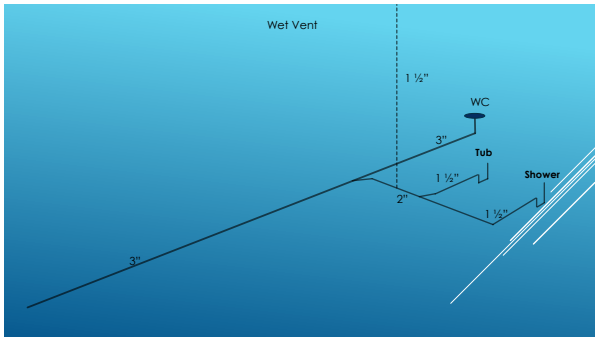
95


1 ½"
WC
3"
Lav
1 ½"
3"
Tub
1 ½"
2"
Shower

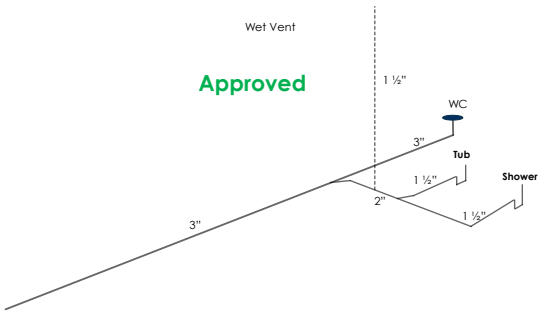
96


Fail!
1 ½"
WC
3"
Lav
1 ½"
3"
Tub
1 ½"
2"
Shower
Two fixture upstream of the wet vent.

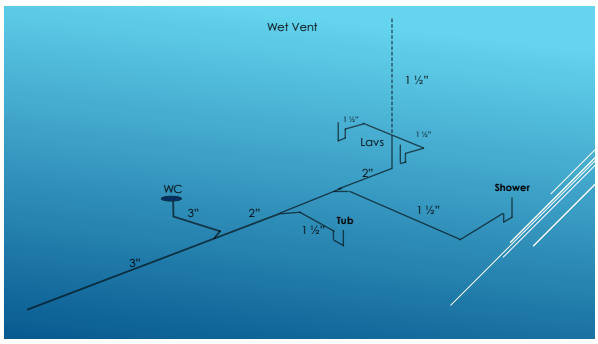
97


Wet Vent
1 ½"
WC
3"
Tub
1 ½"
Shower
2"
1 ½"
3"

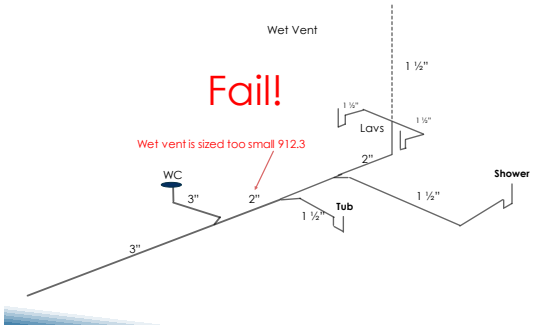
98


Wet Vent
Approved
1 ½"
WC
3"
Tub
1 ½"
Shower
2"
1 ½"
3"

99


Wet Vent
1 ½"
Lavs
2"
WC
3"
2"
Tub
1 ½"
1 ½"
Shower
3"

100



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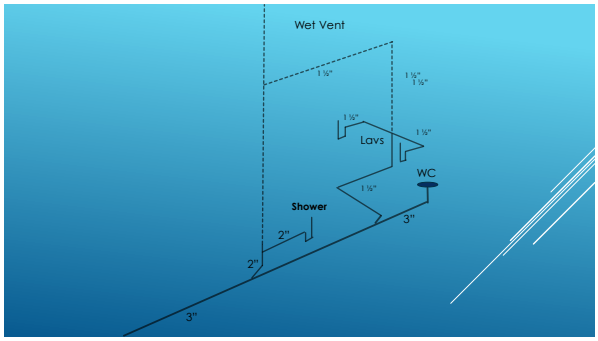

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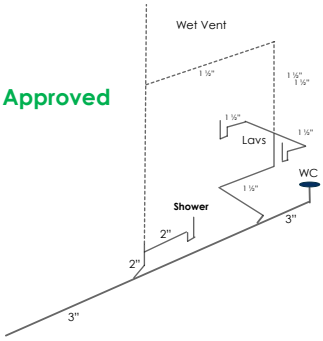

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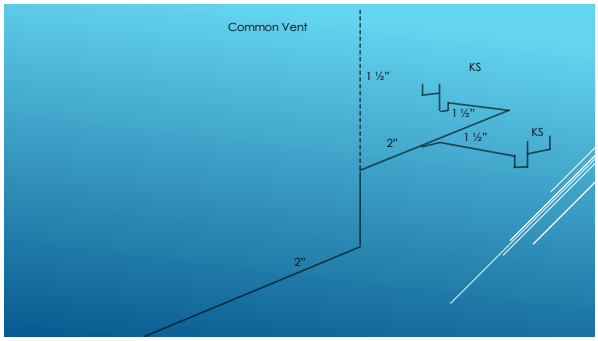

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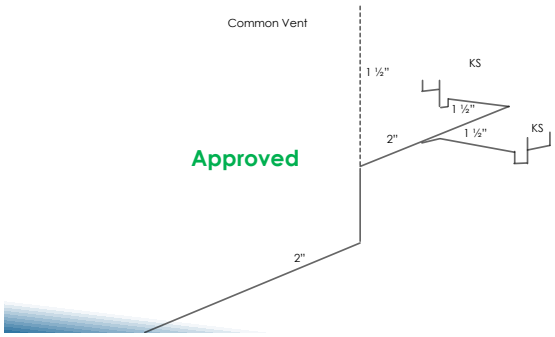

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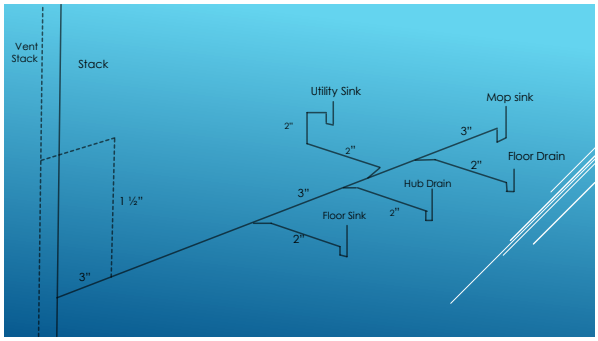

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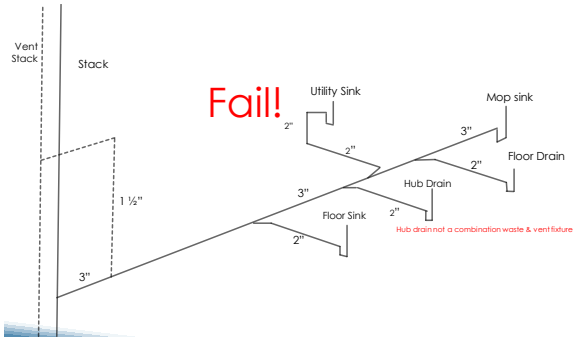

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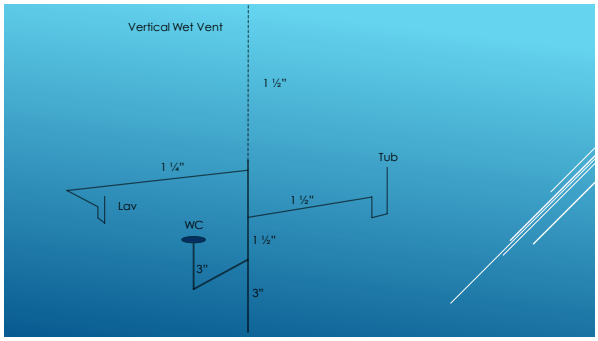

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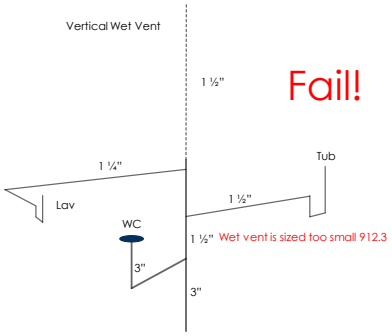

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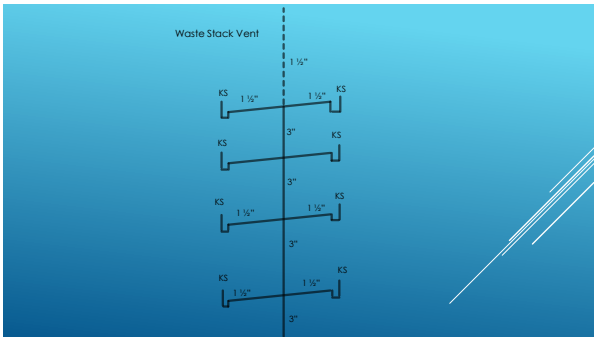

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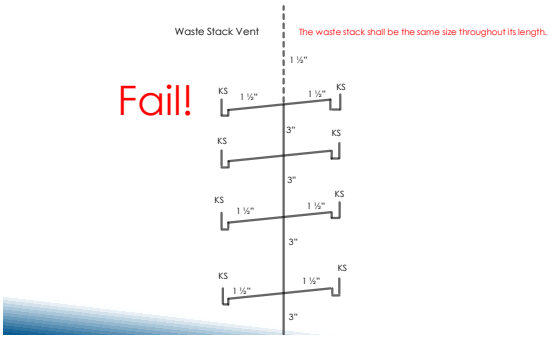

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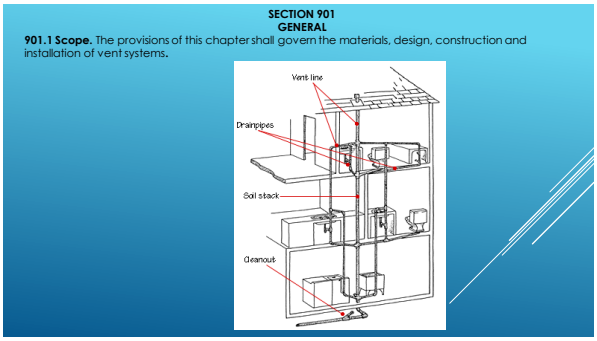
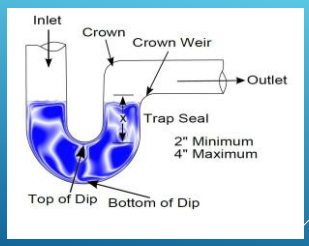


112

901.2 Trap seal protection. The plumbing system shall be provided with a system of vent piping that will permit the admission or emission of air so that the seal of any fixture trap shall not be subjected to a pneumatic pressure differential of more than 1 inch of water column (249 Pa).



113

901.2.1 Venting required. Traps and trapped fixtures shall be vented in accordance with one of the venting methods specified in this chapter

114

901.3 **Chemical waste vent systems.** The vent system for a chemical waste system shall be independent of the sanitary vent system and shall terminate separately through the roof to the outdoors or to an air admittance valve that complies with ASSE 1049. Air admittance valves for chemical waste systems *shall comply with Section 918.8 and* shall be constructed of materials approved in accordance with Section 702.5 and shall be tested for chemical resistance in accordance with ASTM F 1412.

115

901.6 Engineered systems. Engineered venting systems shall conform to the provisions of Section 919

116

903.2 **Frost closure.** Where the 97.5 -percent value for outside design temperature is 0°F (-18°C) or less, vent extensions through a roof or wall shall be not less than 3 inches (76 mm) in diameter. Any increase in the size of the vent shall be made not less than 1 foot (305 mm) inside the thermal envelope of the building.

117

From: debbie.ohler@com.ohio.gov [mailto:debbie.ohler@com.ohio.gov]
Sent: Monday, March 13, 2023 3:49 PM
To: McClurg, Sierra D. <SDMcClurg@columbus.gov>
Subject: [EXTERNAL] RE: plumbing code question

Hello Sierra.
According to the International Plumbing Code (IBC) Appendix D, the 97.5% value for outside design temperature is never less than 0°F in Ohio. The closest city to this would be Toledo which has a +1°F for the Winter 97.5% Design Temperature. Therefore, the 3 inch minimum vent extension requirement is not applicable in Ohio.
Although we don't adopt Appendix D, that is the easiest place to find this information. You can view the IPC Appendix D here: https://codes.iccsafe.org/content/IPC2015P4/appendix-d-degree-day-and-design-temperatures
Hope this helps.
Debbie

118

903.5 **Location of vent terminal.** An open vent terminal from a drainage system shall not be located directly beneath any door, openable window, or other air intake opening of the building or of an adjacent building, and any such vent terminal shall not be within 10 feet (3048 mm) horizontally of such an opening unless it is 3 feet (914 mm) or more above the top of such opening.

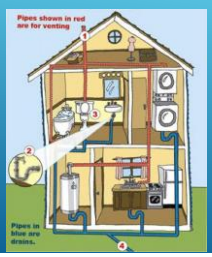
119

903.6 **Extension through the wall.** Vent terminals extending through the wall shall terminate at a point not less than 10 feet (3048 mm) from a lot line and not less than 10 feet (3048 mm) above average ground level. Vent terminals shall not terminate under the overhang of a structure with soffit vents. Side wall vent terminals shall be protected to prevent birds or rodents from entering or blocking the vent opening.

120

SECTION 904
OUTDOOR VENT EXTENSIONS

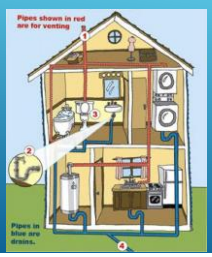
904.1 **Required vent extension.** The vent system serving each building drain shall have not less than one vent pipe that extends to the outdoors



121

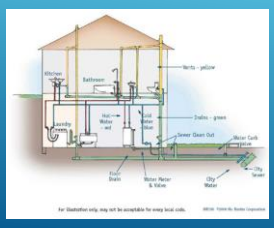
SECTION 904
OUTDOOR VENT EXTENSIONS

904.1 **Required vent extension.** The vent system serving each building drain shall have not less than one vent pipe that extends to the outdoors



122

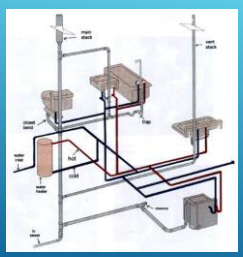
904.1.1 **Installation.** The required vent shall be a dry vent that connects to the building drain or an extension of a drain that connects to the building drain. Such vent shall not be an island fixture vent as allowed by Section 916.



NOT THIS!

123

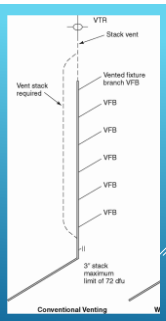
904.1.2 **Size.** The required vent shall be sized in accordance with Section 906.2 based on the required size of the building drain.



124

904.2 **Vent stack required.** A vent stack shall be required for every drainage stack that has five branch intervals or more.

Exception: Drainage stacks installed in accordance with Section 913.



APHC

125

904.3 **Vent termination.** Vent stacks or stack vents shall terminate outdoors to the open air or to a stack-type air admittance valve in accordance with Section 918.

APHC

126

905.2 Grade. All vent and branch vent pipes shall be so graded and connected as to drain back to the drainage pipe by gravity.

APHC

127

905.4 Vertical rise of vent. Every dry vent shall rise vertically to a minimum of 6 inches (152 mm) above the flood level rim of the highest trap or trapped fixture being vented.

Exception: Vents for interceptors located outdoors

APHC

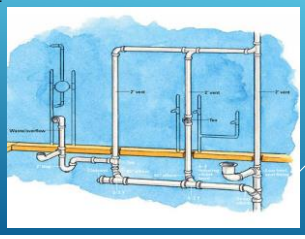
128

905.5 Height above fixtures. A connection between a vent pipe and a vent stack or stack vent shall be made at least 6 inches (152 mm) above the flood level rim of the highest fixture served by the vent. Horizontal vent pipes forming branch vents, relief vents or loop vents shall be at least 6 inches (152 mm) above the flood level rim of the highest fixture served

APHC

129

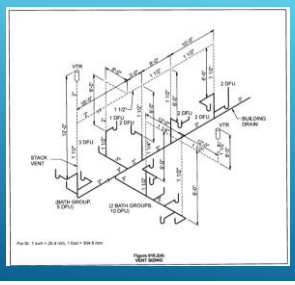
906.2 **Vents other than stack vents or vent stacks.** The diameter of individual vents, branch vents, circuit vents and relief vents shall be not less than one-half the required diameter of the drain served. The required size of the drain shall be determined in accordance with Table 710.1(2). Vent pipes shall not be less than 1¼ inches (32 mm) in diameter. Vents exceeding 40 feet (12 192 mm) in developed length shall be increased by one nominal pipe size for the entire developed length of the vent pipe. Relief vents for soil and waste stacks in buildings having more than 10 branch intervals shall be sized in accordance with Section 908.2.



APHC

130

906.3 **Developed length.** The developed length of individual, branch, circuit and relief vents shall be measured from the farthest point of vent connection to the drainage system to the point of connection to the vent stack, stack vent or termination outside of the building.



APHC

131

906.5.1 **Sewage pumps and sewage ejectors other than pneumatic.** Drainage piping below *the building sewer* level shall be vented in the same manner as that of a gravity system. Building sump vent sizes for sumps with sewage pumps or sewage ejectors, other than pneumatic, shall be determined in accordance with Table 906.5.1.

APHC

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TABLE 906.5.1
SIZE AND LENGTH OF SUMP VENTS

DISCHARGE CAPACITY OF SUMP PUMP (gpm)	MAXIMUM DEVELOPED LENGTH OF VENT (feet)[a]					
	Diameter of vent (inches)					
	1¼	1½	2	2½	3	4
10	No limit[d]	No limit	No limit	No limit	No limit	No limit
20	270	No limit	No limit	No limit	No limit	No limit
40	72	160	No limit	No limit	No limit	No limit
60	31	72	270	No limit	No limit	No limit
80	16	41	150	380	No limit	No limit
100	10[c]	72	97	250	No limit	No limit
150	Not permitted	10[c]	44	110	370	No limit
200	Not permitted	Not permitted	20	60	210	No limit
250	Not permitted	Not permitted	10	36	132	No limit
300	Not permitted	Not permitted	10[c]	22	88	380
400	Not permitted	Not permitted	Not permitted	10[c]	44	210
500	Not permitted	Not permitted	Not permitted	Not permitted	24	130

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

a. Developed length plus an appropriate allowance for entrance losses and friction due to fittings, changes in direction, and diameter. Suggested allowances shall be obtained from NBS Monograph 31 or other approved sources. An allowance of 50 percent of the developed length shall be assumed if a more precise value is not available.

b. Actual values greater than 500 feet.

c. Less than 10 feet.

133

SECTION 909
FIXTURE VENTS

909.1 Distance of trap from vent. Each fixture trap shall have a protecting vent located so that the slope and the developed length in the fixture drain from the trap weir to the vent fitting are within the requirements set forth in Table 909.1.

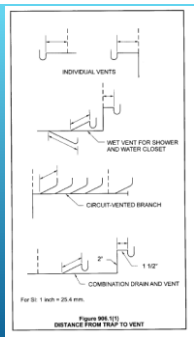
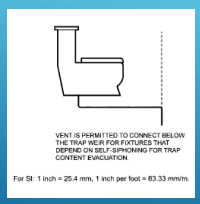


Figure 909.1(1)
DISTANCE FROM TRAP TO VENT

134

909.1 EXCEPTION: The developed length of the fixture drain from the trap weir to the vent fitting for self-siphoning fixtures, such as water closets, shall not be limited.

NEW



OLD

Exception: The developed length of the fixture drain from the trap weir to the vent fitting for self-siphoning fixtures, such as water closets, shall not be limited *in individual vent, common vent, and wet vent systems*

135

909.2 Venting of fixture drains. The total fall in a fixture drain due to pipe slope shall not exceed the diameter of the fixture drain, nor shall the vent connection to a fixture drain, except for water closets, be below the weir of the trap

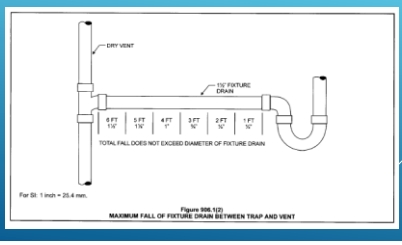


Figure 909.1(2)
MAXIMUM FALL OF FIXTURE DRAIN BETWEEN TRAP AND VENT

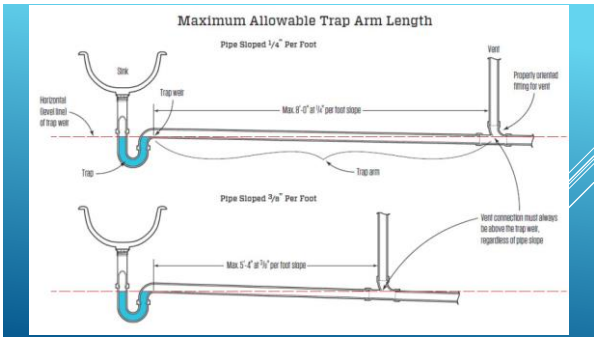
136

TABLE 909.1
MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT

SIZE OF TRAP (inches)	SLOPE (inch per foot)	DISTANCE FROM TRAP (feet)
1 ¼	¼	5
1 ½	¼	6
2	¼	8
3	1/8	12
4	1/8	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m.

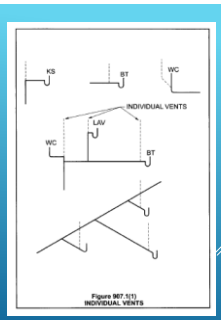
137



138

SECTION 910
INDIVIDUAL VENT

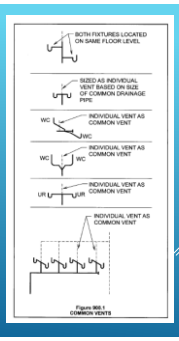
910.1 Individual vent permitted. Each trap and trapped fixture is permitted to be provided with an individual vent. The individual vent shall connect to the fixture drain of the trap or trapped fixture being vented.



139

SECTION 911
COMMON VENT

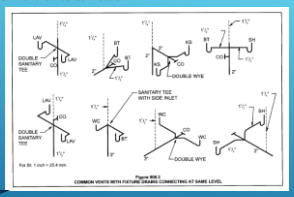
911.1 Individual vent as common vent. An individual vent is permitted to vent two traps or trapped fixtures as a common vent. The traps or trapped fixtures being common vented shall be located on the same floor level.



140

NEW

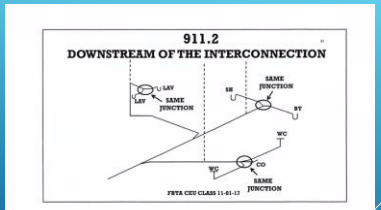
911.2 Connection at the same level. Where the fixture drains being common vented connect at the same level, the vent connection shall be at the interconnection of the fixture drains or downstream of the interconnection.



OLD

911.2 Connection at the same level. Where the fixture drains being common vented connect at the same level, the vent connection shall be at the interconnection of the fixture drains or downstream of the interconnection. *Common vent on the horizontal shall be a double pattern fitting*

141



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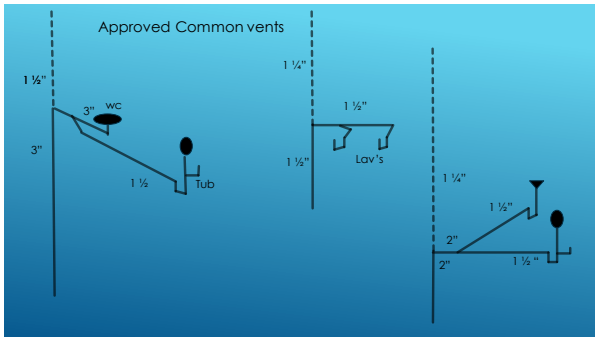
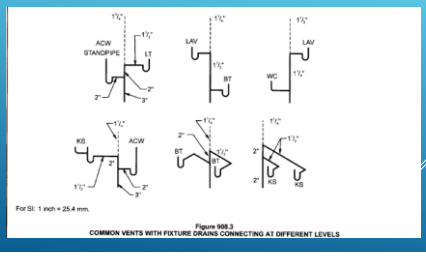


143

911.3 Connection at different levels. Where the fixture drains connect at different levels, the vent shall connect as a vertical extension of the vertical drain. The vertical drain pipe connecting the two fixture drains shall be considered the vent for the lower fixture drain, and shall be sized in accordance with Table 911.3. The upper fixture shall not be a water closet.



144

TABLE 911.3
COMMON VENT SIZES

PIPE SIZE (inches)	MAXIMUM DISCHARGE FROM UPPER FIXTURE DRAIN (dfu)
1¼	1
2	4
2½ to 3	6

For SI: 1 inch = 25.4 mm.

APHC

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WET VENTING

912.1 Horizontal wet vent permitted. Any combination of fixtures within two bathroom groups located on the same floor level is permitted to be vented by a horizontal wet vent. The wet vent shall be considered the vent for the fixtures and shall extend from the of the horizontal wet vent. connection of the dry vent along the direction of the flow in the drain pipe to the most downstream fixture drain connection to the horizontal branch drain. Each wet-vented fixture drain shall connect independently to the horizontal wet vent. Only the fixtures within the bathroom groups shall connect to the wet vented horizontal branch drain. Any additional fixtures shall discharge downstream

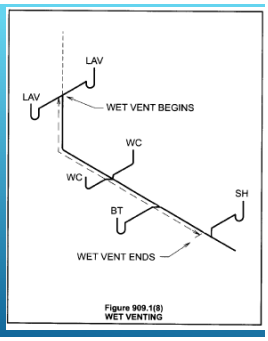
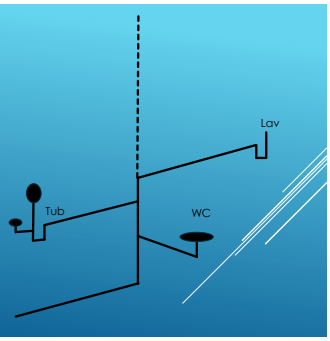


Figure 909.1(8)
WET VENTING

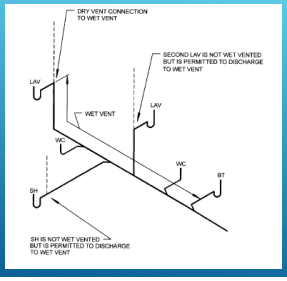
146

912.1.1 Vertical wet vent permitted. Any combination of fixtures within two bathroom groups located on the same floor level is permitted to be vented by a vertical wet vent. The vertical wet vent shall be considered the vent for the fixtures and shall extend from the connection of the dry vent down to the lowest fixture drain connection. Each wet-vented fixture shall connect independently to the vertical wet vent. Water closet drains shall connect at the same elevation. Other fixture drains shall connect above or at the same elevation as the water closet fixture drains. The dry-vent connection to the vertical wet vent shall be an individual or common vent serving one or two fixtures



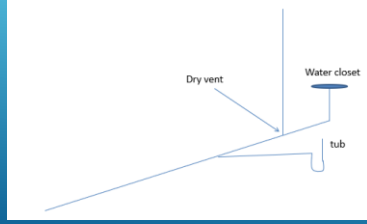
147

912.2 Dry vent connection. The required dry-vent connection for wet-vented systems shall comply with Sections 909.2.1 and 909.2.2



148

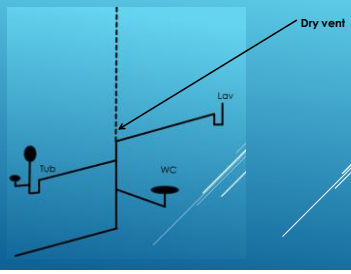
912.2.1 Horizontal wet vent. The dry-vent connection for a horizontal wet-vent system shall be an individual vent or a common vent for any bathroom group fixture, except an emergency floor drain. Where the dry-vent connects to a water closet fixture drain, the drain shall connect horizontally to the horizontal wet-vent system. Not more than one wet-vented fixture drain shall discharge upstream of the dry-vented fixture drain connection.



APHC

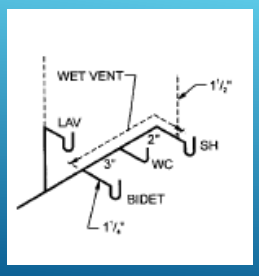
149

912.2.2 Vertical wet vent. The dry-vent connection for a vertical wet-vent system shall be an individual vent or common vent for the most upstream fixture drain



150

912.3 Size. The dry vent serving the wet vent shall be sized based on the largest required diameter of pipe within the wet-vent system served by the dry vent. The wet vent shall be of a minimum size as specified in Table 909.3, based on the fixture unit discharge to the wet vent.



151

TABLE 912.3
WET VENT SIZE

WET VENT PIPE SIZE (inches)	DRAINAGE FIXTURE UNIT LOAD (dfu)
1½	1
2	4
2½	6
3	12

For SI: 1 inch = 25.4 mm.

APHC

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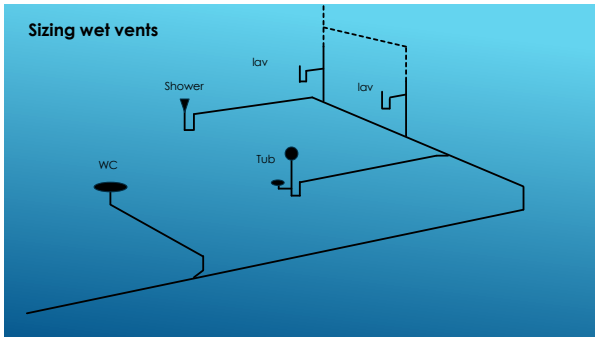

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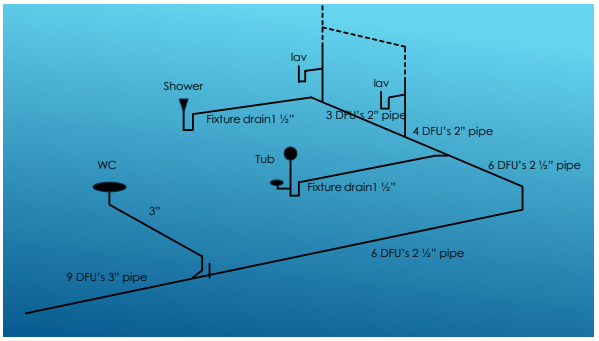

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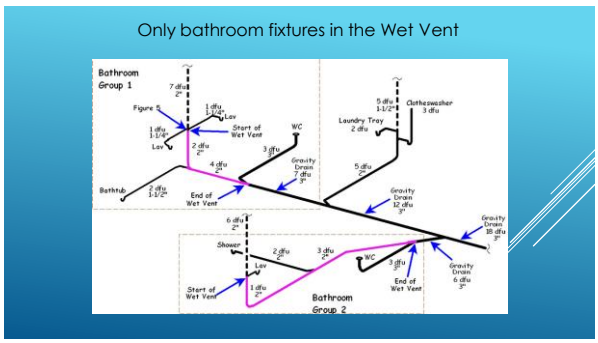

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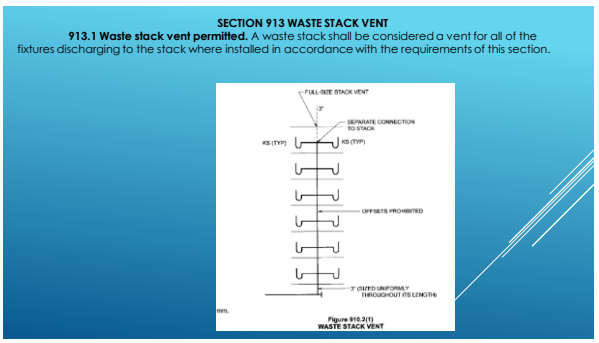
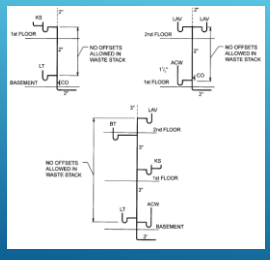


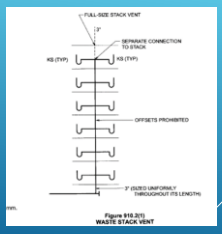
156

913.2 Stack installation. The waste stack shall be vertical, and both horizontal and vertical offsets shall be prohibited between the lowest fixture drain connection and the highest fixture drain connection. Fixture drains shall connect separately to the waste stack. The stack shall not receive the discharge of water closets, **urinals, clinic or flushing rim sinks**.



157

913.3 Stack vent. A stack vent shall be provided for the waste stack. The size of the stack vent shall be not less than the size of the waste stack. Offsets shall be permitted in the stack vent, shall be located not less than 6 inches (152 mm) above the flood level of the highest fixture and shall be in accordance with Section 905.2. The stack vent shall be permitted to connect with other stack vents and vent stacks in accordance with Section 904.5



158

913.4 Waste stack size. The waste stack shall be sized based on the total discharge to the stack and the discharge within a branch interval in accordance with Table 910.4. The waste stack shall be the same size throughout its length.

TABLE 910.4
WASTE STACK VENT SIZE

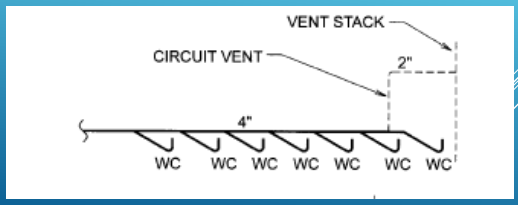
STACK SIZE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Total discharge into one branch interval	Total discharge for stack
1 ½	1	2
2	2	4
2 ½	No limit	8
3	No limit	24
4	No limit	50
5	No limit	75
6	No limit	100

For SI: 1 inch = 25.4 mm.

159

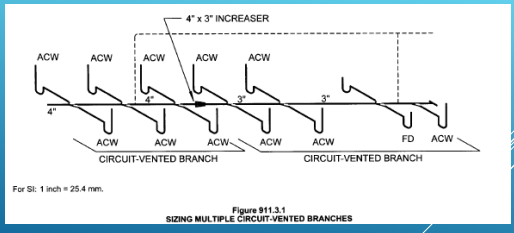
SECTION 911
CIRCUIT VENTING

914.1 Circuit vent permitted. A maximum of eight fixtures connected to a horizontal branch drain shall be permitted to be circuit vented. Each fixture drain shall connect horizontally to the horizontal branch being circuit vented. The horizontal branch drain shall be classified as a vent from the most downstream fixture drain connection to the most upstream fixture drain connection to the horizontal branch.



160

914.1.1 Multiple circuit-vented branches. Circuit-vented horizontal branch drains are permitted to be connected together. Each group of a maximum of eight fixtures shall be considered a separate circuit vent and shall conform to the requirements of this section.

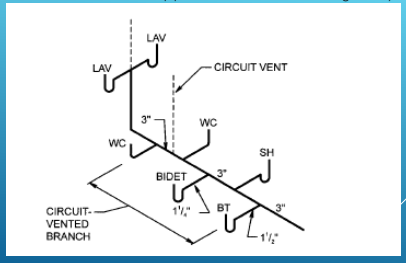


For SI: 1 inch = 25.4 mm.

Figure 911.3.1
SIZING MULTIPLE CIRCUIT-VENTED BRANCHES

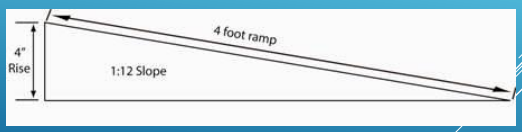
161

914.2 Vent connection. The circuit vent connection shall be located between the two most upstream fixture drains. The vent shall connect to the horizontal branch and shall be installed in accordance with Section 905. The circuit vent pipe shall not receive the discharge of any soil or waste.



162

914.3 Slope and size of horizontal branch. The maximum slope of the vent section of the horizontal branch drain shall be one unit vertical in 12 units horizontal (8-percent slope). The entire length of the vent section of the horizontal branch drain shall be sized for the total drainage discharge to the branch



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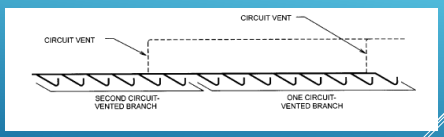
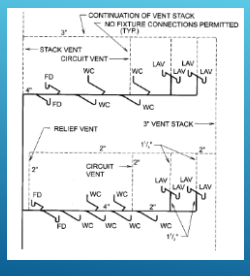
163

914.3.1 Size of multiple circuit vent. Each separate circuit-vented horizontal branch that is interconnected shall be sized independently in accordance with Section 914.3. The downstream circuit-vented horizontal branch shall be sized for the total discharge into the branch, including the upstream branches and the fixtures within the branch.



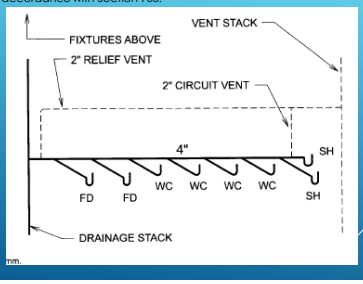
164

914.4 Relief vent. A relief vent shall be provided for circuit-vented horizontal branches receiving the discharge of four or more water closets and connecting to a drainage stack that receives the discharge of soil or waste from upper horizontal branches



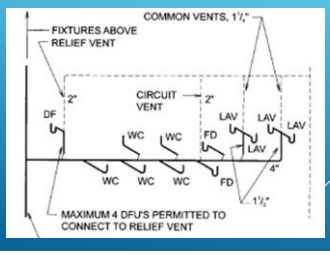
165

914.4.1 Connection and installation. The relief vent shall connect to the horizontal branch drain between the stack and the most downstream fixture drain of the circuit vent. The relief vent shall be installed in accordance with Section 905.



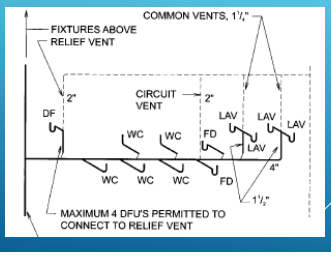
166

914.4.2 Fixture drain or branch. The relief vent is permitted to be a fixture drain or fixture branch for fixtures located within the same branch interval as the circuit-vented horizontal branch. The maximum discharge to a relief vent shall be four fixture units



167

914.5 Additional fixtures. Fixtures, other than the circuit-vented fixtures, are permitted to discharge to the horizontal branch drain. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.



168

SECTION 915
COMBINATION DRAIN AND VENT SYSTEM

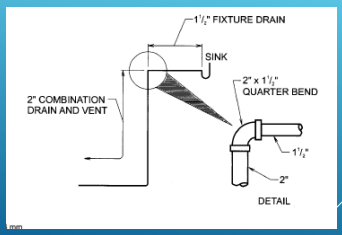
915.1 Type of fixtures. A combination drain and vent system shall not serve fixtures other than floor drains, sinks, lavatories and drinking fountains.




Combination drain and vent systems shall not receive the discharge from a food waste grinder or clinical sink.


169

915.2 Installation. The only vertical pipe of a combination drain and vent system shall be the connection between the fixture drain *of a sink, lavatory or drinking fountain, and the horizontal* combination drain and vent pipe. The maximum vertical distance shall be 8 feet (2438 mm).



170

915.2.1 Slope. The horizontal combination drain and vent pipe shall have a maximum slope of one-half unit vertical in 12 units horizontal (4-percent slope). The minimum slope shall be in accordance with Table 704.1.

¼ inch per foot minim ½ per foot maximum

APHC

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915.2.2 Size and length. The size of a combination waste and vent pipe shall be not less than that indicated in Table 915.2.2. The horizontal length of a combination waste and vent system shall be unlimited.

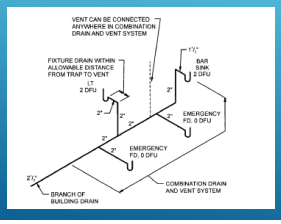
TABLE 915.2.2
SIZE OF COMBINATION WASTE AND VENT PIPE

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Connecting to a horizontal branch or stack	Connecting to a building drain or building subdrain
2	3	4
2½	6	26
3	12	31
4	20	50
5	160	250
6	360	575

For SI: 1 inch = 25.4 mm.

172

915.2.3 Connection. The combination waste and vent system shall be provided with a dry vent connected at any point within the system or the system shall connect to a horizontal drain that serves vented fixtures located on the same floor. Combination waste and vent systems connecting to building drains receiving only the discharge from one or more stacks shall be provided with a dry vent. The vent connection to the combination waste and vent pipe shall extend vertically to a point not less than 6 inches (152 mm) above the flood level rim of the highest fixture being vented before offsetting horizontally.



173

915.2.4 Vent size. The vent shall be sized for the total drainage fixture unit load in accordance with Section 906.2.

Vent pipes shall not be less than 1 1 /4 inches (32 mm) in diameter. Vents exceeding 40 feet (12 192 mm) in developed length shall be increased by one nominal pipe size for the entire developed length of the vent pipe.

174

915.2.5 Fixture branch or drain. The fixture branch or fixture drain shall connect to the combination waste and vent within a distance specified in Table 909.1. The combination waste and vent pipe shall be considered the vent for the fixture.

MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT

SIZE OF TRAP (inches)	SLOPE (inch per foot)	DISTANCE FROM TRAP (feet)
1¼	¼	5
1½	¼	6
2	¼	8
3	⅛	12
4	⅛	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m.

175

SECTION 916
ISLAND FIXTURE VENTING

916.1 Limitation. Island fixture venting shall not be permitted for fixtures other than sinks and lavatories. Residential kitchen sinks with a dishwasher waste connection, a food waste grinder, or both, in combination with the kitchen sink waste, shall be permitted to be vented in accordance with this section.

176

916.2 Vent connection. The island fixture vent shall connect to the fixture drain as required for an individual or common vent. The vent shall rise vertically to above the drainage outlet of the fixture being vented before offsetting horizontally or vertically downward. The vent or branch vent for multiple island fixture vents shall extend to a minimum of 6 inches (152 mm) above the highest island fixture being vented before connecting to the outside vent terminal.

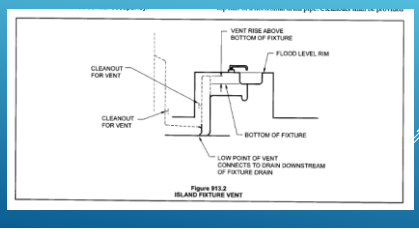


Figure 913.2
ISLAND FIXTURE VENT

177

SECTION 917

Single stack systems

178

SECTION 913
WASTE STACK VENTING

913.1 Waste stack vent permitted. *A waste stack shall be considered a vent for all of the fixtures discharging to the stack* where installed in accordance with the requirements of this section.

913.2 Stack installation. The waste stack shall be vertical, and *both horizontal and vertical offsets shall be prohibited* between the lowest fixture drain connection and the highest fixture drain connection. *Fixture drains shall connect separately to the waste stack.* ***The stack shall not receive the discharge of water closets, urinals, clinic or flushing rim sinks.***

913.3 Stack vent. *A stack vent shall be provided for the waste stack. The size of the stack vent shall be not less than the size of the waste stack.* Offsets shall be permitted in the stack vent, shall be located not less than 6 inches (152 mm) above the flood level of the highest fixture and shall be in accordance with Section 905.2. The stack vent shall be permitted to connect with other stack vents and vent stacks in accordance with Section 904.5

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SECTION 913
WASTE STACK VENTING

913.4 Waste stack size. The waste stack shall be sized based on the total discharge to the stack and the discharge within a branch interval in accordance with Table 913.4. *The waste stack shall be the same size throughout its length.*

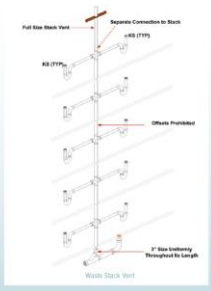
TABLE 913.4
WASTE STACK VENT SIZE

STACK SIZE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Total discharge into one branch interval	Total discharge for stack
1½	1	2
2	2	4
2½	No limit	8
3	No limit	24
4	No limit	50
5	No limit	75
6	No limit	100

For SI: 1 inch = 25.4 mm.

180

SECTION 913
WASTE STACK VENTING



181

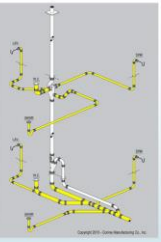
How Sovent® Works
System Components

BRANCH RUN-OUTS

All horizontal branch piping shall be installed with proper slope - a two percent grade is recommended for full system capacity.

Branch piping may be made from any acceptable DWV material as provided by the local code.

Proper transition couplings from cast iron hub-less pipe to the DWV material of choice shall be used.



182

SECTION 917
SINGLE STACK VENTING SYSTEM

917.1 Where permitted. A drainage stack shall serve as a single stack vent system where sized and installed in accordance with Sections 917.2 through 917.9. The drainage stack and branch piping shall be the vents for the drainage system. *The drainage stack shall have a stack vent.*

917.2 Stack size. Drainage stacks shall be sized in accordance with Table 917.2. Stacks shall be uniformly sized based on the total connected drainage fixture unit load. *The stack vent shall be the same size as the drainage stack.* A 3inch (76 mm) stack shall serve not more than two water closets.

TABLE 917.2
SINGLE STACK SIZE

STACK SIZE	MAXIMUM CONNECTED DRAINAGE FIXTURE UNITS		
(inches)	Stacks less than 75 feet in height	Stacks 75 feet to less than 100 feet in height	Stacks 100 feet and greater in height
3	24	NP	NP
4	215	24	NP
5	480	215	24
6	1,011	480	215
8	2,520	1,011	480
10	4,500	2,520	1,011
12	8,100	4,500	2,520
15	13,600	8,100	4,500

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

183

Stack Vent

The extension of a soil or waste stack above the highest horizontal drain connected to the stack.

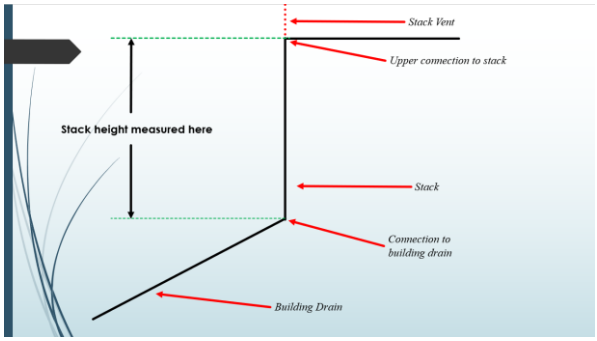
The drainage stack shall have a stack vent. (waste stack vent)

The stack vent shall be the same size as the drainage stack. (waste stack vent)

The *COMMENTARY* Clarifies How to Determine the Height of the Stack section 917.2

- The height of the *stack* is from the connection to the *building drain* to the most upper drainage connection to the *stack*. Drainage *stacks* must be the same size from the base to the termination of the *stack vent* to the outdoors.

184



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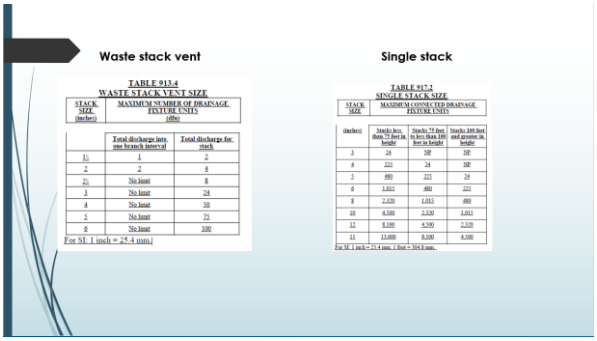

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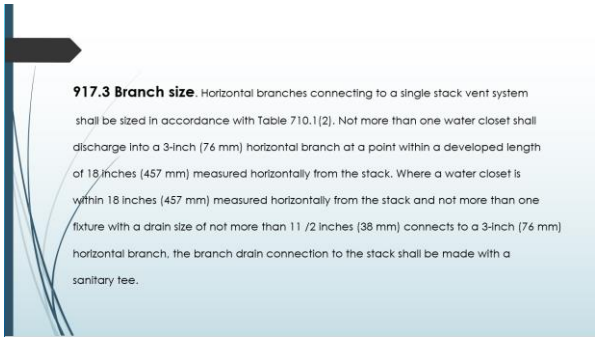

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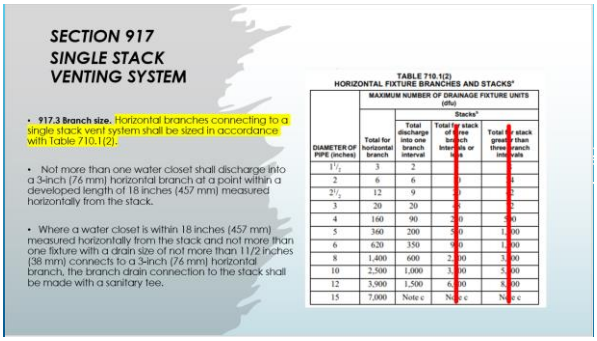


188

SECTION 917
SINGLE STACK
VENTING SYSTEM

- **917.3 Branch size.** Horizontal branches connecting to a single stack vent system shall be sized in accordance with Table 710.1(2).
- Not more than one water closet shall discharge into a 3-inch (76 mm) horizontal branch at a point within a developed length of 18 inches (457 mm) measured horizontally from the stack.
- Where a water closet is within 18 inches (457 mm) measured horizontally from the stack and not more than one fixture with a drain size of not more than 11/2 inches (38 mm) connects to a 3-inch (76 mm) horizontal branch, the branch drain connection to the stack shall be made with a sanitary tee.

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

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
	Total for horizontal branch	Stacks[b]		
		Total discharge into one branch interval	Total for stack of three branch intervals or less	Total for stack greater than three branch intervals
$1^1/_2$	3	2	4	8
2	6	6	10	24
$2^1/_2$	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Note c	Note c	Note c

189

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

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
	Total for horizontal branch	Stacks[b]		
		Total discharge into one branch interval	Total for stack of three branch intervals or less	Total for stack greater than three branch intervals
$1^1/_2$	3	2	4	8
2	6	6	10	24
$2^1/_2$	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Note c	Note c	Note c

TABLE 917.2
SINGLE STACK SIZE

STACK SIZE (inches)	MAXIMUM CONNECTED DRAINAGE FIXTURE UNITS		
	Stacks less than 75 feet in height	Stacks 75 feet to less than 160 feet in height	Stacks 160 feet and greater in height
3	24	NP	NP
4	225	24	NP
5	480	225	24
6	1,015	480	225
8	2,320	1,015	480
10	4,500	2,320	1,015
12	8,100	4,500	2,320
15	13,600	8,100	4,500

190

917.3 BREAKDOWN (RESTRICTIONS)

➨IF the horizontal branch is 3", not more than 1 W.C. shall discharge within a developed length of 18" measured horizontally from the stack. (WYE)

➨If the branch size is 3" and the W.C. discharge is with 18" measured horizontally, the branch can receive the discharge of not more than 1 fixture drain not larger than 1-1/2 inches, however, then the connection to the stack MUST be made using a sanitary tee

➨ If the connection to the stack is made with a WYE pattern fitting, then the only fixture that can connect to the stack would be the W.C.

191

917.3 BREAKDOWN

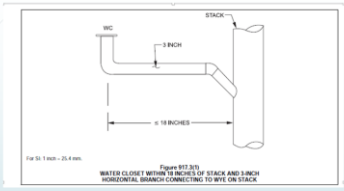


Figure 917.3(1)
WATER CLOSET WITHIN 18 INCHES OF STACK AND 3-INCH HORIZONTAL BRANCH CONNECTING TO WYE OR STACK

Simply, the single fixture connection only applies IF there is a water closet connected AND the connection to the stack isn't made with a sanitary tee.

192

917.3 BREAKDOWN

In other words, the fitting used at the connection to the stack determines what you can or cannot connect to the branch.

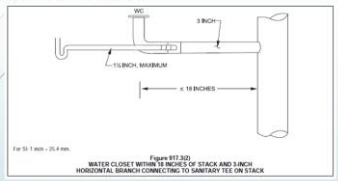


Figure 917.3(2)
WATER CLOSET WITHIN 18 INCHES OF STACK AND 3-INCH HORIZONTAL BRANCH CONNECTING TO SANITARY TEE ON STACK

For a 3" horizontal branch with a water closet connected within 18" horizontally from the stack, you can only have 1 additional 1-1/2" fixture drain connection to the horizontal branch, through a Sanitary Tee Connection.

193

917.3 BREAKDOWN

In other words, the fitting used at the connection to the stack determines what you can or cannot connect to the branch.

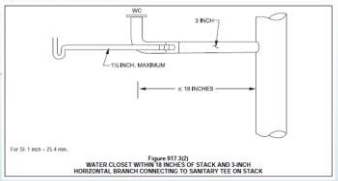


Figure 917.3(2)
WATER CLOSET WITHIN 18 INCHES OF STACK AND 3-INCH HORIZONTAL BRANCH CONNECTING TO SANITARY TEE ON STACK

For a 3" horizontal branch with a water closet connected within 18" horizontally from the stack, you can only have 1 additional 1-1/2" fixture drain connection to the horizontal branch, through a Sanitary Tee Connection.

194

195

196

SECTION 917
SINGLE STACK VENTING SYSTEM

917.4 Length of horizontal branches. The length of horizontal branches shall conform to the requirements of Sections 917.4.1 through 917.4.3.

917.4.1 Water closet connection. Water closet connections shall be not greater than 4 feet (1219 mm) in developed length measured horizontally from the stack.

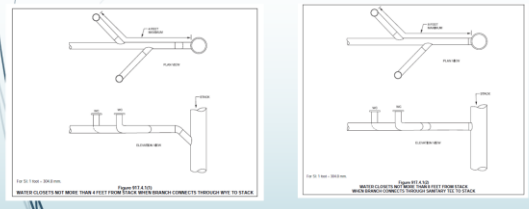
Exception: Where the connection is made with a sanitary tee, the maximum developed length shall be 8 feet (2438 mm).

917.4.2 Fixture connections. Fixtures other than water closets shall be located not greater than 12 feet (3657 mm) in developed length, measured horizontally from the stack.

917.4.3 Vertical piping in branch. The length of vertical piping in a fixture drain connecting to a horizontal branch shall not be considered in computing the fixture's distance in developed length measured horizontally from the stack.

197

SECTION 917
SINGLE STACK VENTING SYSTEM



198

917.4.1 BREAKDOWN

Establishes the maximum horizontal developed length from the stack to the water closet.

1. 4 feet if a WYE pattern fitting is used at the stack
2. 8 feet if a sanitary tee is used at the stack(*exception*)

199

SECTION 917
SINGLE STACK VENTING SYSTEM

917.5 Minimum vertical piping size from fixture. The vertical portion of piping in a fixture drain to a horizontal branch shall be 2 inches (51 mm). The minimum size of the vertical portion of piping for a water-supplied urinal or standpipe shall be 3 inches (76 mm). The maximum vertical drop shall be 4 feet (1219 mm). Fixture drains that are not increased in size or have a vertical drop in excess of 4 feet (1219 mm), shall be individually vented.

917.4.3 Vertical piping

The length of vertical piping in a fixture drain connecting to a horizontal *branch* shall not be considered in computing the fixture's distance in *developed length* measured horizontally from the *stack*.

200

2nd sentence;

The minimum size of the vertical portion of piping for a water-supplied urinal or *standpipe* shall be 3 inches.

Because of the amount of water discharged in a single use, 3" pipe is required on the vertical pipe of both water-supplied urinal and standpipes. The fixture drain connection to the vertical pipe will be by a reducing 90. Again, since the vertical piping is required to be 3", the horizontal piping is required to be 3" (ref. - 704.2).

201

SECTION 917
SINGLE STACK VENTING SYSTEM

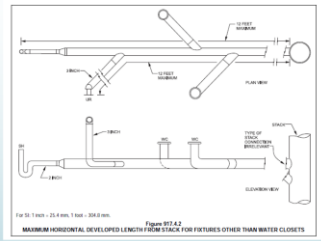


Figure 917.4.2
MAXIMUM HORIZONTAL DEVELOPED LENGTH FROM STACK FOR FIXTURES OTHER THAN WATER CLOSETS

202

203

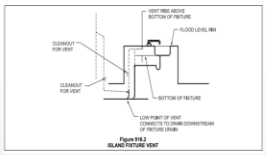


Figure 916.2
ISLAND FIXTURE VENT

204

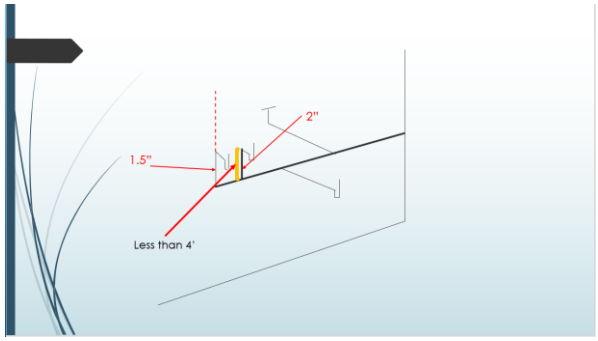
917.5 BREAKDOWN

3rd & 4th sentences;

The maximum vertical drop shall be 4 feet (1219 mm). *Fixture drains* that are not increased in size, or have a vertical drop in excess of 4 feet (1219 mm), shall be individually vented.

Establishes a maximum vertical drop of 4 feet, while also establishing that IF the drop is greater than 4 feet OR if the fixture drain was not increased in size, THEN the fixture(s) SHALL be individually vented.

205



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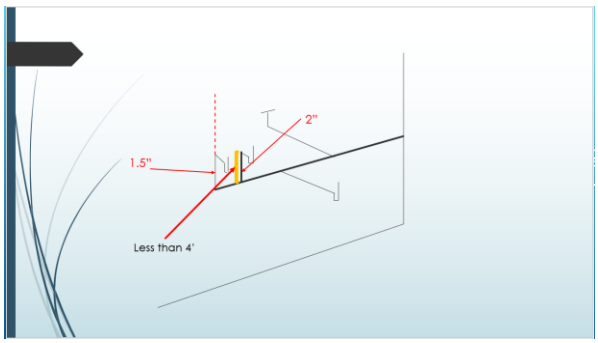


207

SECTION 917
SINGLE STACK VENTING SYSTEM

917.6 Additional venting required. Additional venting shall be provided where more than one water closet discharges to a horizontal branch and where the distance from a fixture trap to the stack exceeds the limits in Section 917.4. Where additional venting is required, the fixture(s) shall be vented by individual vents, common vents, wet vents, circuit vents, or a combination waste and vent pipe. The dry vent extensions for the additional venting shall connect to a branch vent, vent stack, stack vent, air admittance valve, or shall terminate outdoors.

917.7 Stack offsets. Where fixture drains are not connected below a horizontal offset in a stack, a horizontal offset shall not be required to be vented. Where horizontal branches or fixture drains are connected below a horizontal offset in a stack, the offset shall be vented in accordance with Section 907. Fixture connections shall not be made to a stack within 2 feet (610 mm) above or below a horizontal offset.

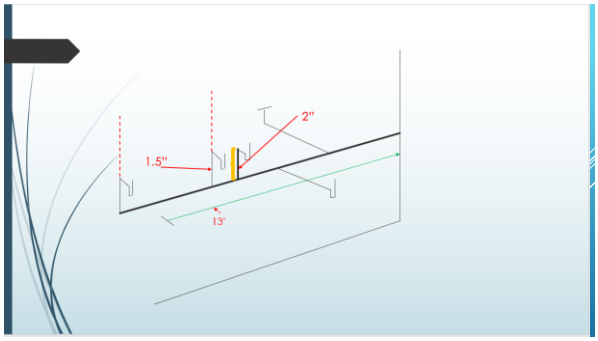
208

917.6 Additional venting required.

Additional venting shall be provided where more than one water closet discharges to a horizontal *branch* and where the distance from a fixture *trap* to the *stack* exceeds the limits in Section 917.4.

Where additional venting is required, the fixture(s) shall be vented by *individual vents*, *common vents*, *wet vents*, *circuit vents*, or a *combination waste and vent pipe*.

209



210

917.7 Stack offsets.

Where fixture drains are not connected below a horizontal offset in a *stack*, a horizontal offset shall not be required to be vented. Where horizontal *branches* or *fixture drains* are connected below a horizontal offset in a *stack*, the offset shall be vented in accordance with Section 907. Fixture connections shall NOT be made to a *stack* within 2 feet (610 mm) above or below a horizontal offset.

211

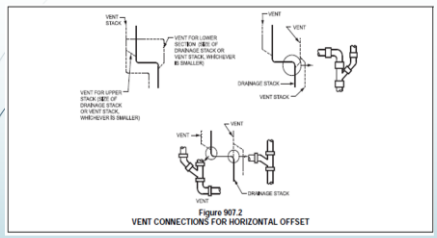
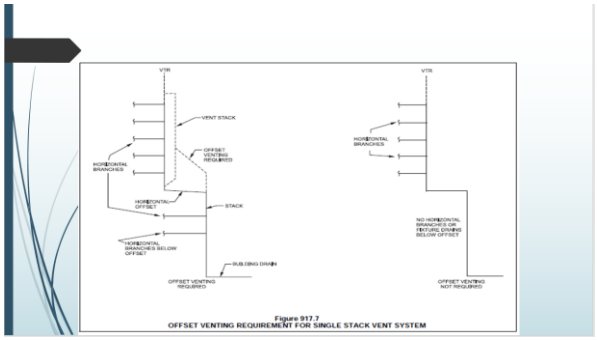


Figure 907.2
VENT CONNECTIONS FOR HORIZONTAL OFFSET

212



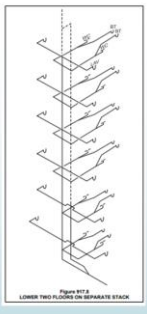
213

SECTION 917
SINGLE STACK VENTING SYSTEM

917.8 Prohibited lower connections. Stacks greater than 2 branch intervals in height shall not receive the discharge of horizontal branches on the lower two floors. There shall be no connections to the stack between the lower two floors and a distance of not less than 10 pipe diameters downstream from the base of the single stack vented system.

917.9 Sizing building drains and sewers. The building drain and building sewer receiving the discharge of a single stack vent system shall be sized in accordance with Table 710.1(1).

214

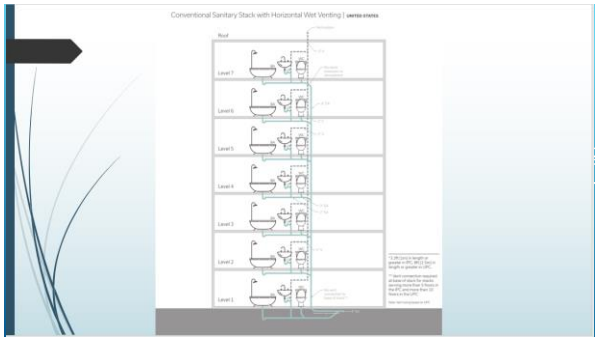


215

917.8 Prohibited lower connections.

Stacks greater than 2 *branch intervals* in height shall not receive the discharge of horizontal *branches* on the lower two floors. There shall be no connections to the *stack* between the lower two floors and a distance of not less than 10 pipe diameters downstream from the base of the single stack vented system.

216



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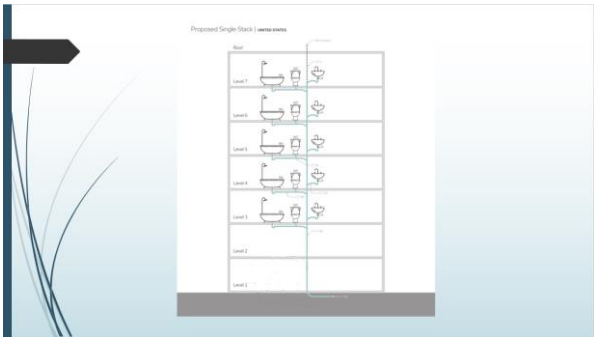
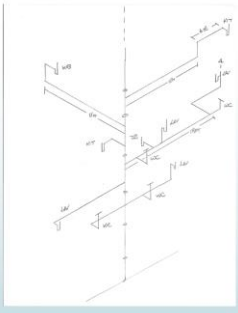


218

The oversized piping prevents negative pressures from developing in the branches, and the oversized stack prevents excessive positive or negative pressures from developing in the stack. Theoretically, this allows the system to maintain a *"near"* neutral pressure (*equal to atmospheric pressure*).

219



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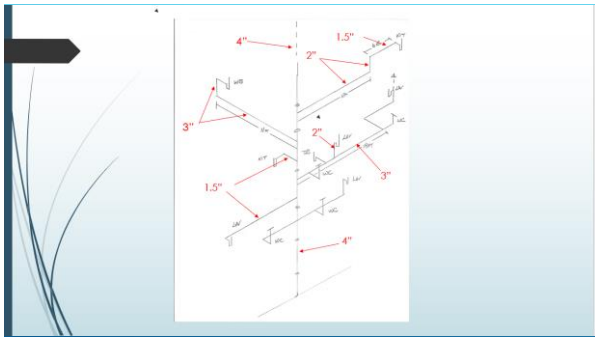

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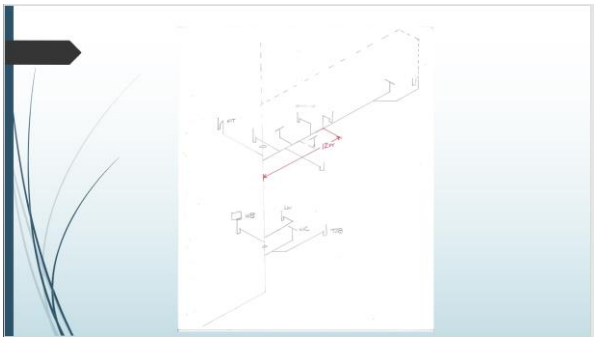

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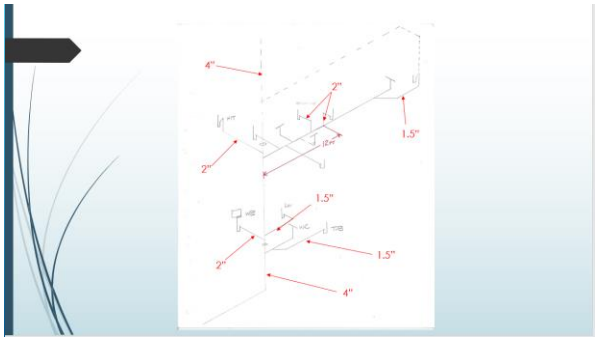

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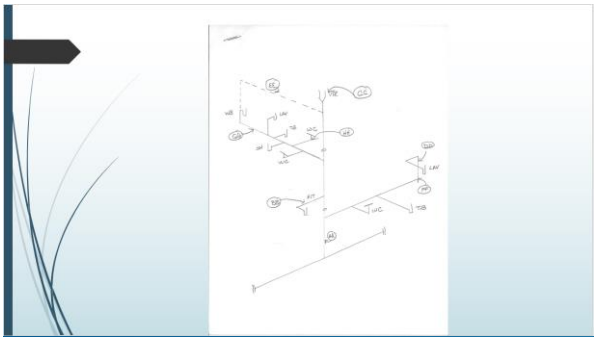

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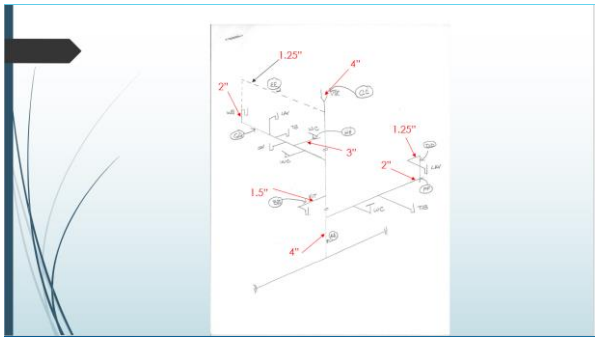

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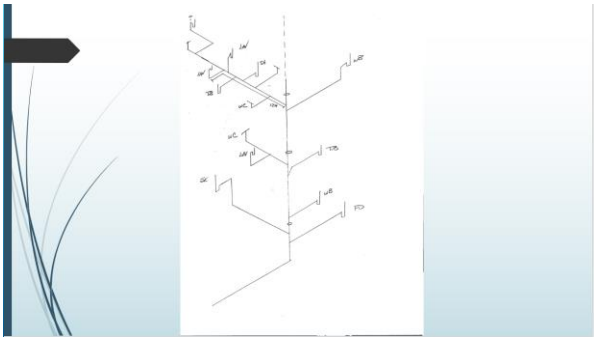

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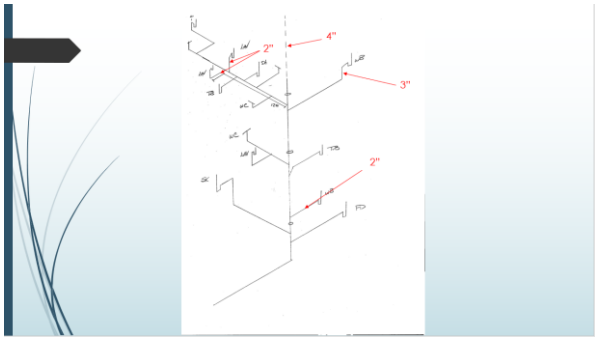

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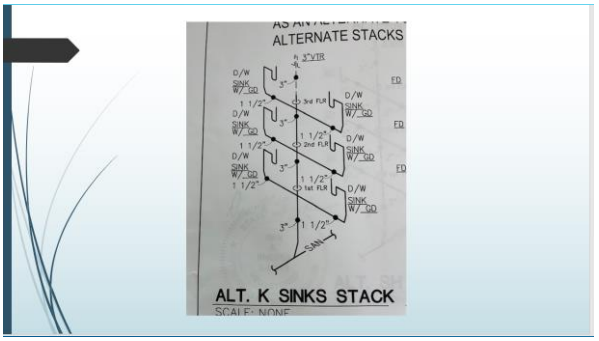

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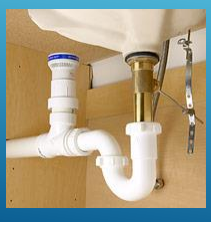
917.9

- **Sizing building drains and sewers.** The building drain and building sewer receiving the discharge of a single stack vent system shall be sized in accordance with Table 710.1(1)

229

SECTION 918
AIR ADMITTANCE VALVES

918.1 **General.** Vent systems utilizing air admittance valves shall comply with this section. Stack-type air admittance valves shall conform to ASSE 1050. Individual and branch type air admittance valves shall conform to ASSE 1051.



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918.2 **Installation.** The valves shall be installed in accordance with the requirements of this section and the manufacturer's instructions. Air admittance valves shall be installed after the DWV testing required by Section 312.2 or 312.3 has been performed.

231

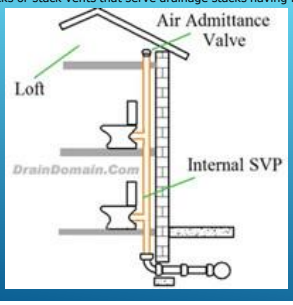
918.3 **Where permitted.** Individual, branch and circuit vents shall be permitted to terminate with a connection to an individual or branch-type air admittance valve in accordance with Section 918.3.1. Stack vents and vent stacks shall be permitted to terminate to stack-type air admittance valves in accordance with Section 918.3.2

232

918.3.1 **Horizontal branches.** Individual and branch-type air admittance valves shall vent only fixtures that are on the same floor level and connect to a **horizontal branch drain**. Where the horizontal branch is located more than four branch intervals from the top of the stack, the horizontal branch shall be provided with a relief vent that shall connect to a vent stack or stack vent, or extend outdoors to the open air. The relief vent shall connect to the horizontal branch drain between the stack and the most downstream fixture drain connected to the horizontal branch drain. The relief vent shall be sized in accordance with Section 906.2 and installed in accordance with Section 905. The relief vent shall be permitted to serve as the vent for other fixtures.

233

918.3.2 **Stack.** Stack-type air admittance valves shall be prohibited from serving as the vent terminal for vent stacks or stack vents that serve drainage stacks having more than six branch intervals



234

918.4 **Location.** Individual and branch-type air admittance valves shall be located a minimum of 4 inches (102 mm) above the horizontal branch drain or fixture drain being vented. Stack-type air admittance valves shall be located not less than 6 inches (152 mm) above the flood level rim of the highest fixture being vented. The air admittance valve shall be located within the maximum developed length permitted for the vent. The air admittance valve shall be installed not less than 6 inches (152 mm) above insulation materials.

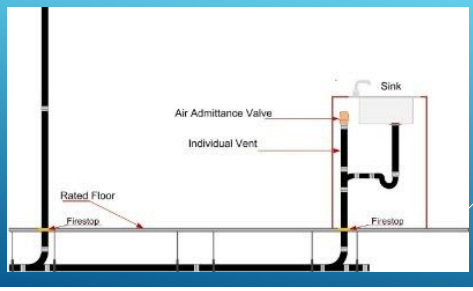
235

918.5 **Access and ventilation.** Access shall be provided to all air admittance valves. Such valves shall be installed in a location that allows air to enter the valve.

918.6 **Size.** The air admittance valve shall be rated in accordance with the standard for the size of the vent to which the valve is connected.

236

918.7 **Vent required.** Within each plumbing system, not less than one stack vent or vent stack shall extend outdoors to the open air.

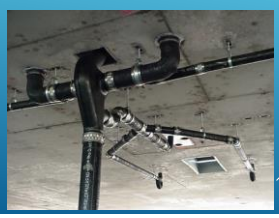


237

918.8 **Prohibited installations.** Air admittance valves shall not be installed in non-neutralized special waste systems as described in Chapter 8 except where such valves are in compliance with ASSE 1049, are constructed of materials approved in accordance with Section 702.5 and are tested for chemical resistance in accordance with ASTM F 1412. Air admittance valves shall not be located in spaces utilized as supply or return air plenums *or where limited by the manufacturer's installation instructions*. Air admittance valves without an engineered design shall not be utilized to vent sumps or tanks of any type.

238

SECTION 919
ENGINEERED VENT SYSTEMS
919.1 **General.** Engineered vent systems shall comply with this section and the design, submittal, approval, inspection and testing requirements of Section *106.5 of the building code*.
919.2 **Individual branch fixture and individual fixture header vents.** The maximum developed length of individual fixture vents to vent branches and vent headers shall be determined in accordance with Table 919.2 for the minimum pipe diameters at the indicated vent airflow rates. The individual vent airflow rate shall be determined in accordance with the following:



239

Chapter 10

240

SECTION 1001
GENERAL

1001.1 Scope. This chapter shall govern the material and installation of traps, interceptors and separators *when installed inside a building and not on the building sewer. The rules of the "Ohio Environmental Protection Agency" may also govern the design and installation of pretreatment devices such as traps, interceptors, and separators*

241

SECTION 1002
TRAP REQUIREMENTS

1002.1 Fixture traps. Each plumbing fixture shall be separately trapped by a liquid-seal trap, except as otherwise permitted by this code. The vertical distance from the fixture outlet to the trap weir shall not exceed 24 inches (610 mm), and the horizontal distance shall not exceed 30 inches (610 mm) measured from the centerline of the fixture outlet to the centerline of the inlet of the trap. The height of a clothes washer standpipe above a trap shall conform to Section 802.4. A fixture shall not be double trapped.

242

Exceptions:

1. This section shall not apply to fixtures with integral traps.

2. A combination plumbing fixture is permitted to be installed on one trap, provided that one compartment is not more than 6 inches (152 mm) deeper than the other compartment and the waste outlets are not more than 30 inches (762 mm) apart.

3. A grease interceptor intended to serve as a fixture trap in accordance with the manufacturer's installation instructions shall be permitted to serve as the trap for a single fixture or a combination sink of not more than three compartments where the vertical distance from the fixture outlet to the inlet of the interceptor does not exceed 30 inches (762 mm) and the developed length of the waste pipe from the most upstream fixture outlet to the inlet of the interceptor does not exceed 60 inches (1524 mm).

243

1002.2 Design of traps. Fixture traps shall be self-scouring. Fixture traps shall not have interior partitions, except where such traps are integral with the fixture or where such traps are constructed of an approved material that is resistant to corrosion and degradation. Slip joints shall be made with an approved elastomeric gasket and shall be installed only on the trap inlet, trap outlet and within the trap seal

244

1002.3 Prohibited traps. The following types of traps are prohibited:
1. Traps that depend on moving parts to maintain the seal.
2. Bell traps.
3. Crown-vented traps.

245

4. Traps not integral with a fixture and that depend on interior partitions for the seal, except those traps constructed of an approved material that is resistant to corrosion and degradation.
5. "S" traps.
6. Drum traps.

Exception: Drum traps used as solids interceptors and drum traps serving chemical waste systems shall not be prohibited

246

1002.4 Trap seals. Each fixture trap shall have a liquid seal of not less than 2 inches (51 mm) and not more than 4 inches (102 mm), or deeper for special designs relating to accessible fixtures. Where a trap seal is subject to loss by evaporation, a trap seal primer valve shall be installed. Trap seal primer valves shall connect to the trap at a point above the level of the trap seal. A trap seal primer valve shall conform to ASSE 1018 or ASSE 1044

247

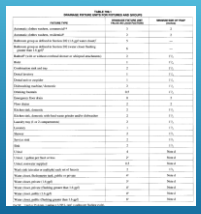
Exception: *Where a fixture trap is supplied with water on a regular basis, a trap seal primer valve shall not be required*

248

ASSE 1072

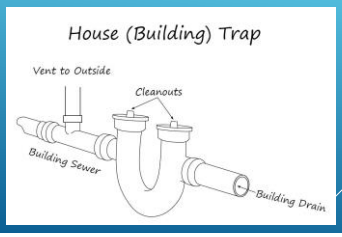
249

1002.5 Size of fixture traps. Fixture trap size shall be sufficient to drain the fixture rapidly and not less than the size indicated in Table 709.1. A trap shall not be larger than the drainage pipe into which the trap discharges



250

1002.6 Building traps. Building (house) traps shall be prohibited, except where local conditions necessitate such traps. Building traps shall be provided with a cleanout and a relief vent or fresh air intake on the inlet side of the trap. The size of the relief vent or fresh air intake shall not be less than one-half the diameter of the drain to which the relief vent or air intake connects. Such relief vent or fresh air intake shall be carried above grade and shall be terminated in a screened outlet located outside the building



251

1002.7 Trap setting and protection. Traps shall be set level with respect to the trap seal and, where necessary, shall be protected from freezing

252

1002.8 Recess for trap connection. A recess provided for connection of the underground trap, such as one serving a bathtub in slab-type construction, shall have sides and a bottom of corrosion-resistant, insect- and vermin proof construction

253

1002.9 Acid-resisting traps. Where a vitrified clay or other brittleware, acid-resisting trap is installed underground, such trap shall be embedded in concrete extending 6 inches (152 mm) beyond the bottom and sides of the trap.

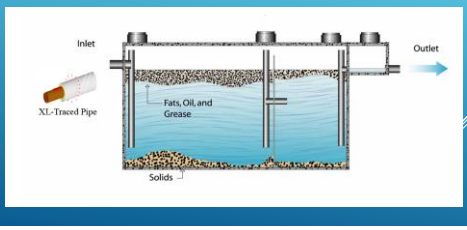
254

1002.10 Plumbing in mental health centers. In mental health centers, pipes and traps shall not be exposed.

255

SECTION 1003
INTERCEPTORS AND SEPARATORS

1003.1 Where required. *Where required by the local sewer purveyor or as otherwise required in this section, interceptors and separators shall be provided to prevent the discharge of oil,* grease, sand and other substances harmful or hazardous to the building drainage system, the public sewer, the private sewage disposal system or the sewage treatment plant or processes



256

1003.1.1 Industrial processes, meat packing and food processing facilities. *Wastes from industrial processes, meat packing and food processing facilities and similar processing plants shall be drained in accordance with the rules of the "Ohio Environmental Protection Agency", or the authority in charge of the sewerage system into which the wastes are to be discharged. (See sections 6111.44 and 6111.45 of the Revised Code.)*

257

1003.2 Approval. The size, type and location of each interceptor and of each separator shall be designed and installed in accordance with the manufacturer's instructions and the requirements of this section based on the anticipated conditions of use. Wastes that do not require treatment or separation shall not be discharged into any interceptor or separator

258

1003.3 Grease interceptors. Grease interceptors shall comply with the requirements of Sections 1003.3.1 through 1003.3.5.

259

1003.3.1 Grease interceptors and automatic grease removal devices required. A grease interceptor or automatic grease removal device shall be required to receive the drainage from fixtures and equipment with grease-laden waste located in food preparation areas, such as in restaurants, hotel kitchens, hospitals, school kitchens, bars, factory cafeterias and clubs. Fixtures and equipment shall include pot sinks, prerinse sinks; soup kettles or similar devices; wok stations; floor drains or sinks into which kettles are drained; automatic hood wash units and dishwashers without prerinse sinks. Grease interceptors and automatic grease removal devices shall receive waste only from fixtures and equipment that allow fats, oils or grease to be discharged

260

1003.3.2 Food waste grinders. Where food waste grinders connect to grease interceptors, a solids interceptor shall separate the discharge before connecting to the grease interceptor. Solids interceptors and grease interceptors shall be sized and rated for the discharge of the food waste grinder. Emulsifiers, chemicals, enzymes and bacteria shall not discharge into the food waste grinder

261

1003.3.3 Grease interceptors and automatic grease removal devices not required. A grease interceptor or an automatic grease removal device shall not be required for individual dwelling units or any private living quarters

262

1003.3.4 Grease interceptors and automatic grease removal devices. Grease interceptors and automatic grease removal devices shall be sized in accordance with PDI G101, ASME A112.14.3 Appendix A, or ASME A112.14.4. Grease interceptors and automatic grease removal devices shall be designed and tested in accordance with PDI G101, ASME A112.14.3 or ASME A112.14.4. Grease interceptors and automatic grease removal devices shall be installed in accordance with the manufacturer's instructions.
Exception: Interceptors that have a volume of not less than 500 gallons (1893 L) and that are located outdoors shall not be required to meet the requirements of this section

263

1003.3.4.1 Grease interceptor capacity. Grease interceptors shall have the grease retention capacity indicated in Table 1003.3.4.1 for the flow-through rates indicated
1003.3.4.2 Rate of flow controls. Grease interceptors shall be equipped with devices to control the rate of water flow so that the water flow does not exceed the rated flow. The flow-control device shall be vented and terminate not less than 6 inches (152 mm) above the flood rim level or be installed in accordance with the manufacturer's instructions

TABLE 1003.3.4.1
CAPACITY OF GREASE INTERCEPTORS[a]

TOTAL FLOW THROUGH RATING (gpm)	GREASE RETENTION CAPACITY (pounds)
4	8
6	12
9	18
15	30
20	40
25	50
30	60
35	70
40	80
50	100
75	150
100	200

264

1003.3.5 Automatic grease removal devices. Where automatic grease removal devices are installed, such devices shall be located downstream of each fixture or multiple fixtures in accordance with the manufacturer's instructions. The automatic grease removal device shall be sized to pretreat the measured or calculated flows for all connected fixtures or equipment. **Ready access shall** be provided for inspection and maintenance

265

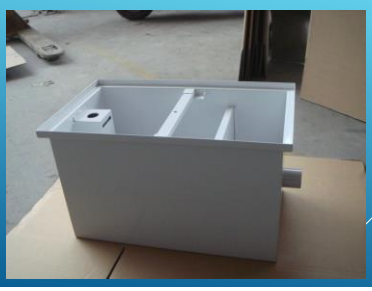
1003.4 Oil separators required. At repair garages, car-washing facilities, and at factories where oily and flammable liquid wastes are produced, separators shall be installed into which all oilbearing, grease-bearing or flammable wastes shall be discharged before emptying into the building drainage system or other point of disposal

266

1003.4.1 Separation of liquids. A mixture of treated or untreated light and heavy liquids with various specific gravities shall be separated in an approved receptacle

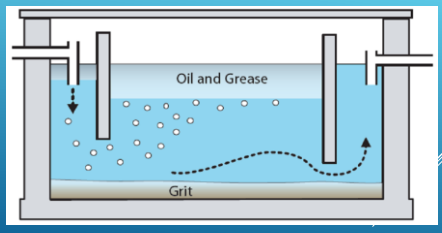
267

1003.4.2 Oil separator design. Oil separators shall be designed in accordance with Sections 1003.4.2.1 and 1003.4.2.2.



268

1003.4.2.1 General design requirements. Oil separators shall have a depth of not less than 2 feet (610 mm) below the invert of the discharge drain. The outlet opening of the separator shall have not less than an 18-inch (457 mm) water seal



269

1003.4.2.2 Garages and service stations. Where automobiles are serviced, greased, repaired or washed or where gasoline is dispensed, oil separators shall have a minimum capacity of 6 cubic feet (0.168 m3) for the first 100 square feet (9.3 m2) of area to be drained, plus 1 cubic foot (0.28 m3) for each additional 100 square feet (9.3 m2) of area to be drained into the separator. Parking garages in which servicing, repairing or washing is not conducted, and in which gasoline is not dispensed, shall not require a separator. Areas of commercial garages utilized only for storage of automobiles are not required to be drained through a separator

270

1003.5 Sand interceptors in commercial establishments. Sand and similar interceptors for heavy solids shall be designed and located so as to be provided with ready access for cleaning, and shall have a water seal of not less than 6 inches (152 mm).

271

1003.6 Laundries. Laundry facilities not installed within an individual dwelling unit or intended for individual family use shall be equipped with an interceptor with a wire basket or similar device, removable for cleaning, that prevents passage into the drainage system of solids 1/**2 inch** (12.7 mm) or larger in size, string, rags, buttons or other materials detrimental to the public sewage system.

272

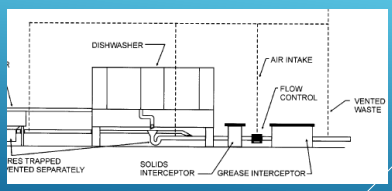
1003.7 Bottling establishments. Bottling plants shall discharge process wastes into an interceptor that will provide for the separation of broken glass or other solids before discharging waste into the drainage system.

273

1003.8 Slaughterhouses. Slaughtering room and dressing room drains shall be equipped with approved separators. The separator shall prevent the discharge into the drainage system of feathers, entrails and other materials that cause clogging

274

1003.9 Venting of interceptors and separators. Interceptors and separators shall be designed so as not to become air bound where tight covers are utilized. Each interceptor or separator shall be vented where subject to a loss of trap seal.



275

1003.10 Access and maintenance of interceptors and separators. Access shall be provided to each interceptor and separator for service and maintenance. Interceptors and separators shall be maintained by periodic removal of accumulated grease, scum, oil, or other floating substances and solids deposited in the interceptor or separator

276

SECTION 1004
MATERIALS, JOINTS AND CONNECTIONS

1004.1 General. The materials and methods utilized for the construction and installation of traps, interceptors and separators shall comply with this chapter and the applicable provisions of Chapters 4 and 7. The fittings shall not have ledges, shoulders or reductions capable of retarding or obstructing flow of the piping.

277

File Attachments for Item:

EC-13 Using Isometric Drawings for Code Understanding (Assn Plumbing & Hydronics Contractors)

All certifications (2 hours)

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:
Name: Tracy Jefferies - Exec Director
Organization: APHC.
Address: 3891 Seabull Ct Columbus OH 43230
E-mail: aphc.contractors@gmail.com Telephone: 614-315-6924
Website: aphcofcentralohio.com
Conference Sponsor (if applicable) — Conference Email: —

Check here if Course Renewal: ☐ Prior course number _____ *(i.e. BBS2018-429)*
Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:
Course title: Using Isometric Drawings for Code Understanding
Course instructor: Guy Miller Jr & Darrin Dawson - bios attached
Course description: See attached doc with description & outline

Instructional hours per session: 2hrs Number of Sessions: TBD
Course Date(s) and Location: Pending Approval for dates
653 McCorkle Blvd Suite H Westerville OH 43082

Special Content:
Code Administration: ☐
Existing Buildings: ☐
Electrical Instruction: ☐
Plumbing Instruction: ☒

Conference Course: _____
Conference Name: _____
Conference location: _____

Course to be offered online? ☐ **On Demand** ☐ **Webinar** ☐
Course Website: _____
Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:

Course applicable for the following certifications

Residential Certifications Only: ☐
Administrative Course, All Certifications: ☒
Commercial Certifications: ☐

Application materials included:
☒ Course Outline or Course Learning Objectives
☒ Presentation Materials/Slides (not required for roundtable courses)
☐ Assessment Materials (for online courses)
☒ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

APHC

OBJECTIVE: A review of sections of the state plumbing code, emphasizing proper code interpretation and understanding.

MATERIALS/BOOKS: State of Ohio plumbing code book, overheads for illustrations, worksheets that students will answer provide answers to.

LENGTH OF COURSE: 2 hours

COURSE TITLE: Using Isometric Drawings for Code Understanding

COURSE OUTLINE:

Part I — Have students review an isometric drawing answering specific questions as to sizing, system type, identify various components, etc. Review answers to part I above explaining each as to its proper use and application with reference to the applicable code section.

Part II — Have students review various isometric drawings as to code compliance and discuss the answers and explain each as to sizing and code correctness.

Part III — Have students' size various isometric drawings review the answers and explain each as to sizing per code.

PHYSICAL FACILITIES DESCRIPTION

Classroom at 653 McCorkle Blvd. Suite H in Westerville:

The room is set up in a classroom style with seating for up to 24 individuals at conference tables. The room is well lit using overhead fluorescent lighting. The room is also provided with audio/visual equipment; overhead projector, screen and eraser board for illustrations as needed for presentation purposes. The room is equipped with its own controls to control heating and cooling for comfort. Of course, restroom facilities are available.

This site is also equipped with a lab area consisting of workstations for the backflow prevention certification and recertification classes held. These stations (8) are equipped with different manufacturers' devices to test and repair. All tools and equipment needed for the lab portion of the class are provided as part of the course.

Guy Miller Jr.
629 Fenchurch Way
Gahanna, OH 43230
Ph. (614) 940-5700
guymillerjr@gmail.com

Certification: Master Plumber, State of Ohio-Id Number #24380 (exp)
Certified Backflow Preventer - Certificate #1300 (State of Ohio – exp)
Certified plumbing inspector - Certificate #K02033 (State of Ohio), 5523 (BBS)
Certified plumbing plans examiner- Certificate #K02033 (State of Ohio), 5523 (BBS)

Teacher: APHC Apprenticeship Program, Fourth Year Instructor
8/08-present

APHC Association - Continuing Education Classes
2021- Present

Work Experience:

1/85 – 1/95	Guy Miller Plumbing
1/95-8/03	Eric Guy Plumbing
8/03 – 2/10	Foreman: Crawford Mechanical Services
2/10-04/17	Foreman/Project Manager: Gutridge Plumbing
4/17-current	Plumbing Field Supervisor-City of Columbus

QUALIFICATIONS:

Darrin Dawson has worked 39 years in the plumbing industry. In May of 1990, he received his Master Plumbing Certification.

He has been a State of Ohio Certified Plumbing Inspector since June of 2003. He became a National Certified Medical Gas Inspector in June of 2007.

In April of 2022 he received a State of Ohio Backflow Certification.

Mr. Dawson has been an instructor for The Association of Plumbers and Hydronics Contractors (APHC) apprenticeship program for 16 years.

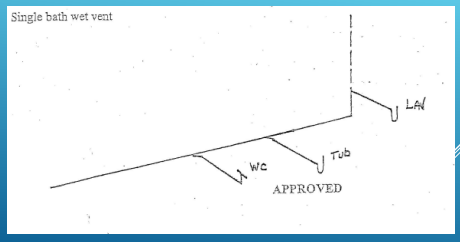
He is currently employed at The Delaware Public Health District as a Plumbing and Medical Gas inspector.

Isometric Drawings

With Guy & Darin

1

Isometric Drawings from the Past



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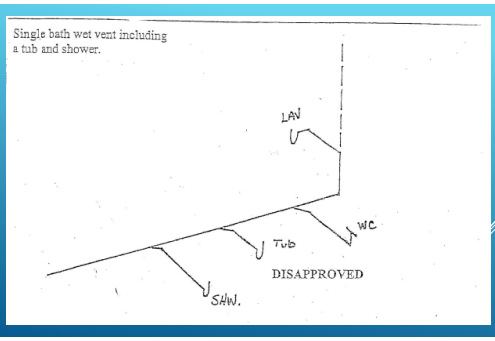

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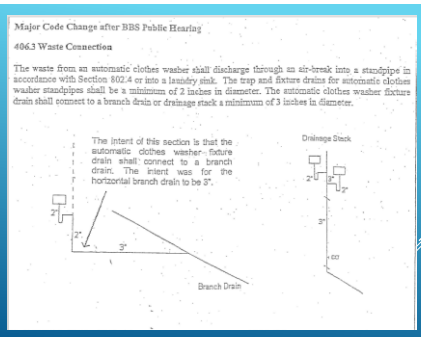

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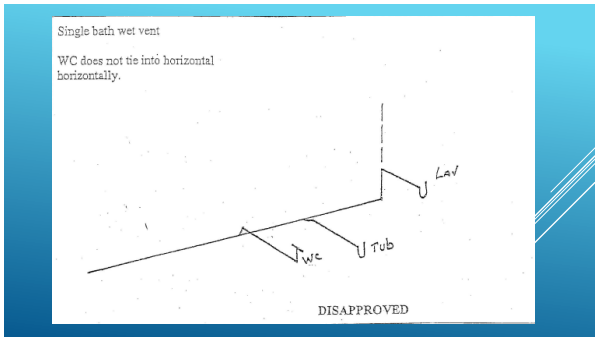
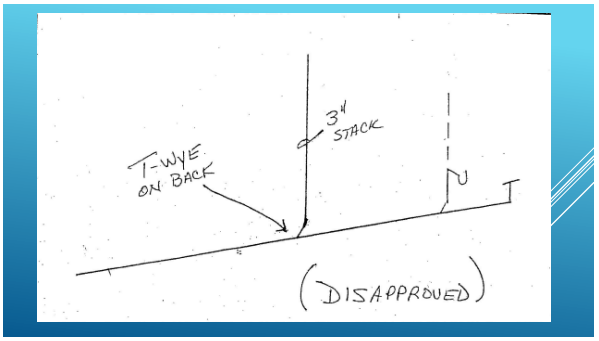
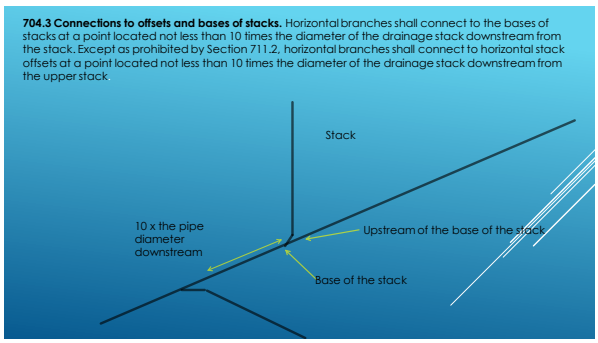

Single bath wet vent
WC does not tie into horizontal horizontally.
Lav
Wc
Tub
DISAPPROVED

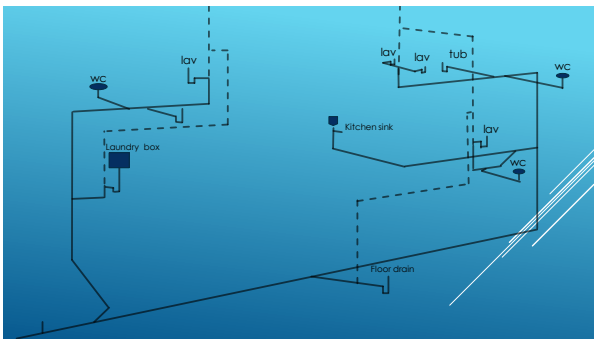
5


3" STACK
T-WYE ON BACK
DISAPPROVED

6


704.3 Connections to offsets and bases of stacks. Horizontal branches shall connect to the bases of stacks at a point located not less than 10 times the diameter of the drainage stack downstream from the stack. Except as prohibited by Section 711.2, horizontal branches shall connect to horizontal stack offsets at a point located not less than 10 times the diameter of the drainage stack downstream from the upper stack
Stack
10 x the pipe diameter downstream
Upstream of the base of the stack
Base of the stack

7


wc
lav
lav
lav
tub
wc
Kitchen sink
lav
Laundry box
wc
Floor drain

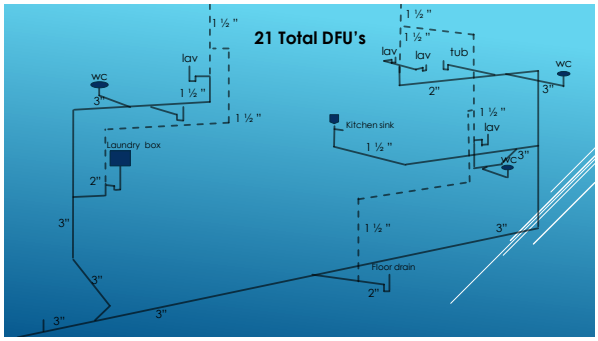
8

TABLE 710.1(1) BUILDING DRAINS AND SEWERS
DIAMETER OF PIPE (inches)
MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS CONNECTED TO ANY PORTION OF THE BUILDING DRAIN OR THE BUILDING SEWER, INCLUDING BRANCHES OF THE BUILDING Drain

	Slope per foot			
	1/16 inch	1/8 inch	1/4 inch	1/2 inch
1 ½	—	—	1	1
1 ½	—	—	3	3
2	—	—	21	26
2 ½	—	—	24	31
3	—	36	42	50
4	—	180	216	250
5	—	390	480	575
6	—	700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

For SI: 1 inch = 25.4 mm, 1 inch per foot = 83.3 mm/m.
a. The minimum size of any building drain serving a water closet shall be 3 inches.

9



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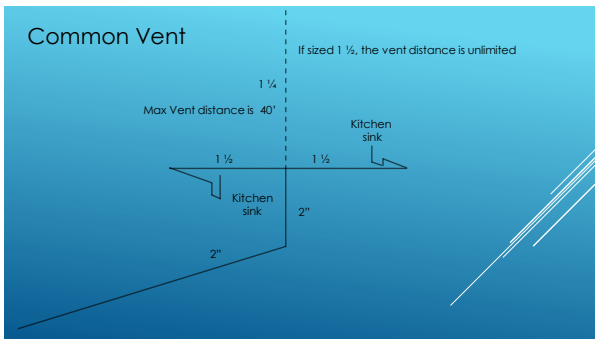
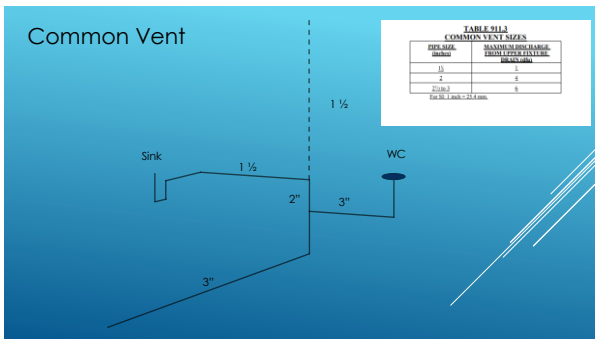


11



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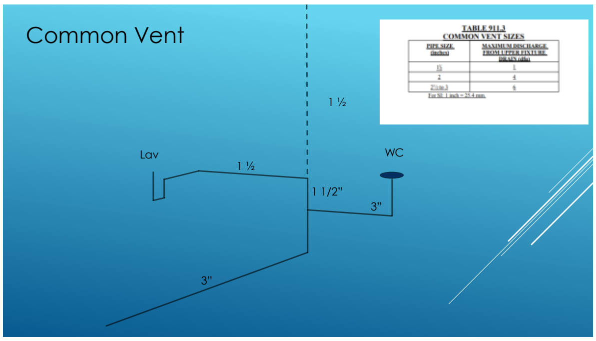
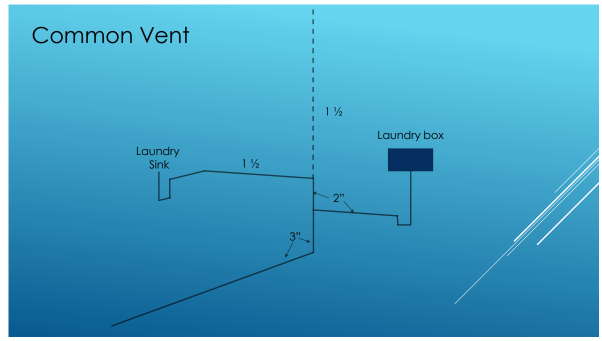


TABLE 911.3
COMMON VENT SIZES

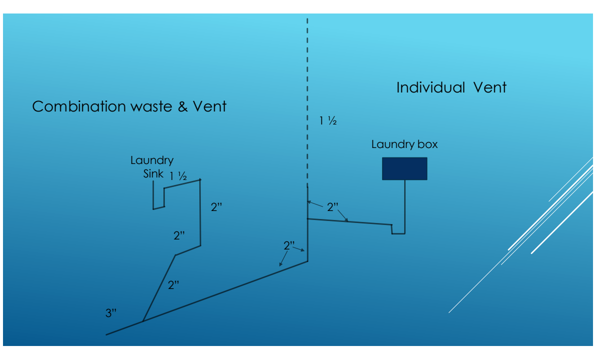
PIPE SIZE (inches)	MAXIMUM DISCHARGE FROM UPPER FIXTURE DRAIN (dfu)
1½	1
2	4
2½ to 3	6

For SI: 1 inch = 25.4 mm.

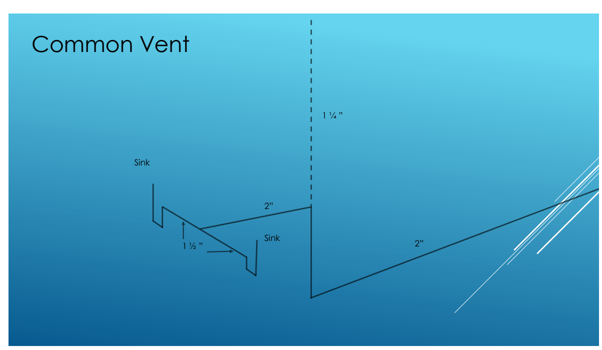
13



14



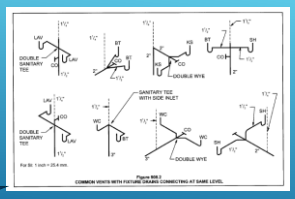
15



16

NEW

911.2 Connection at the same level. Where the fixture drains being common vented connect at the same level, the vent connection shall be at the interconnection of the fixture drains or downstream of the interconnection.

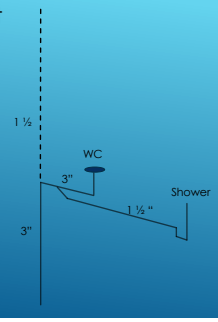


OLD

911.2 Connection at the same level. Where the fixture drains being common vented connect at the same level, the vent connection shall be at the interconnection of the fixture drains or downstream of the interconnection. *Common vent on the horizontal shall be a double pattern fitting.*

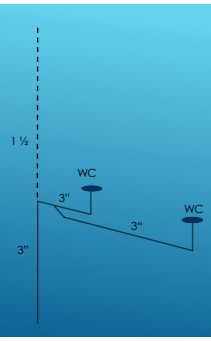
17

Common Vent



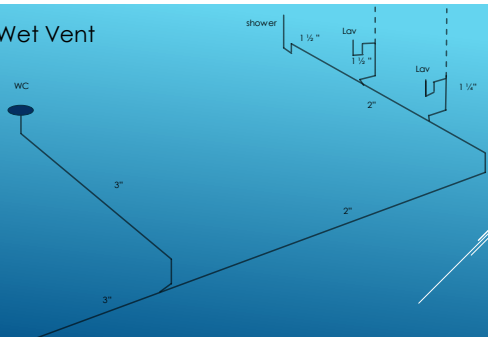
18

Common Vent



19

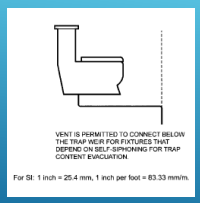
Wet Vent



20

EXCEPTION: The developed length of the fixture drain from the trap weir to the vent fitting for self-siphoning fixtures, such as water closets, shall not be limited.

NEW

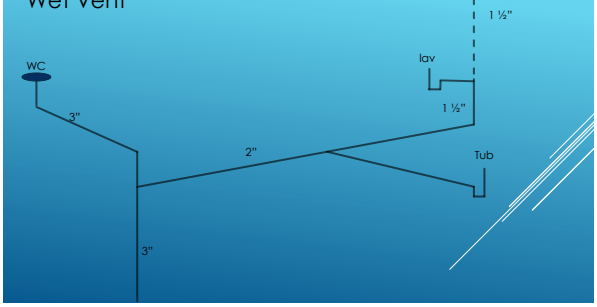


OLD

Exception: The developed length of the fixture drain from the trap weir to the vent fitting for self-siphoning fixtures, such as water closets, shall not be limited *in individual vent, common vent, and wet vent systems.*

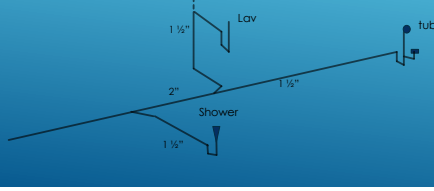
21

Wet Vent



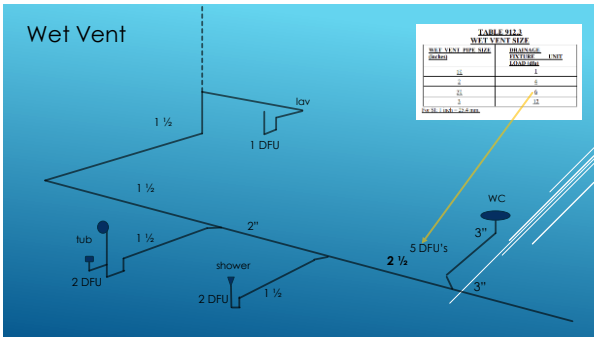
22

912.1 Horizontal wet vent permitted. **Any combination of fixtures within two bathroom** groups located on the same floor level is permitted to be vented by a horizontal wet vent. The wet vent shall be considered the vent for the fixtures and shall extend from the connection of the dry vent along the direction of the flow in the drain pipe to the most downstream fixture drain connection to the horizontal branch drain. Each wet-vented fixture drain shall connect independently to the horizontal wet vent. Only the fixtures within the bathroom groups shall connect to the wet-vented horizontal branch drain. Any additional fixtures shall discharge downstream of the horizontal wet vent.



23

Wet Vent



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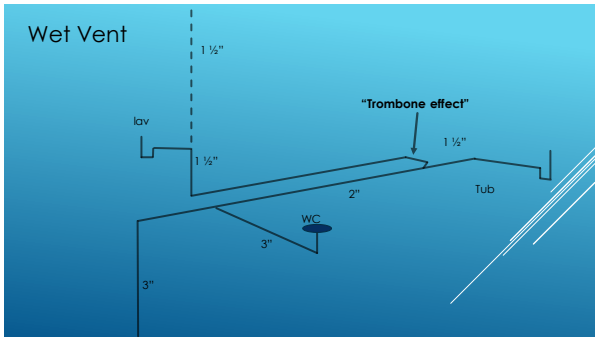

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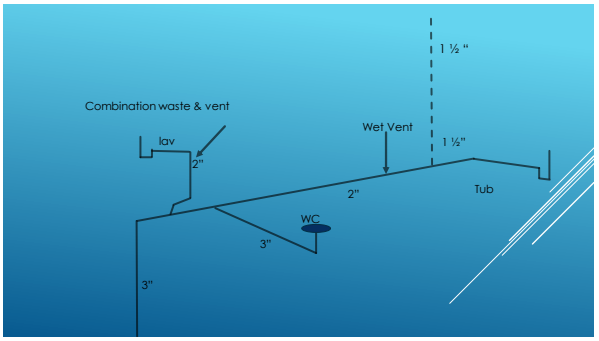

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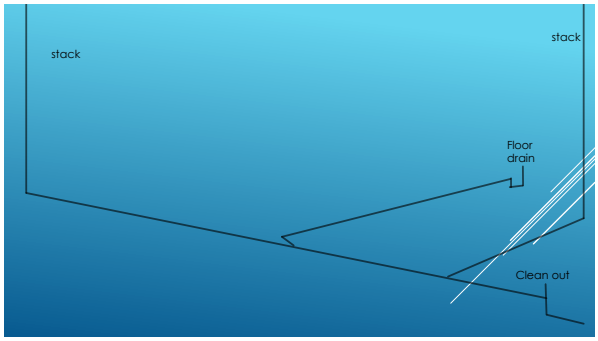
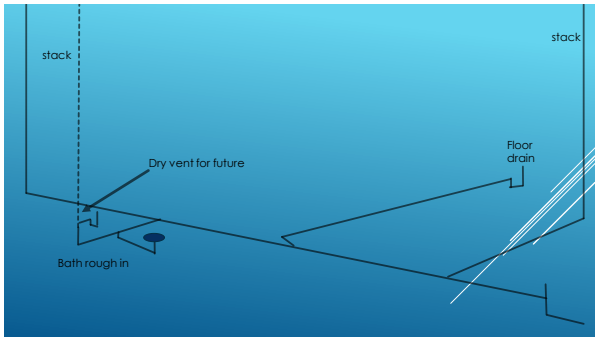


27

915.2.3 Connection. The combination waste and vent system shall be provided with a dry vent connected at any point within the system or the system shall connect to a horizontal drain that serves vented fixtures located on the same floor. **Combination waste and vent systems connecting to building drains receiving only the discharge from one or more stacks shall be provided with a dry vent.** The vent connection to the combination waste and vent pipe shall extend vertically to a point not less than 6 inches (152 mm) above the flood level rim of the highest fixture being vented before offsetting horizontally.

28



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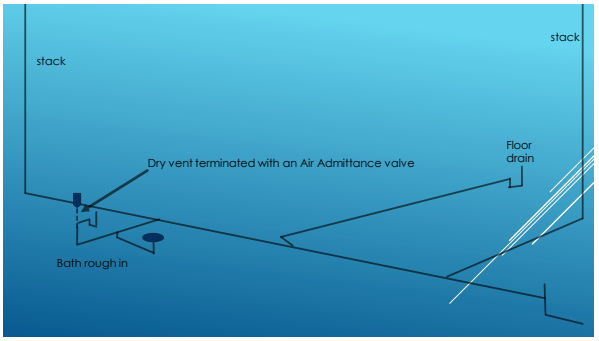

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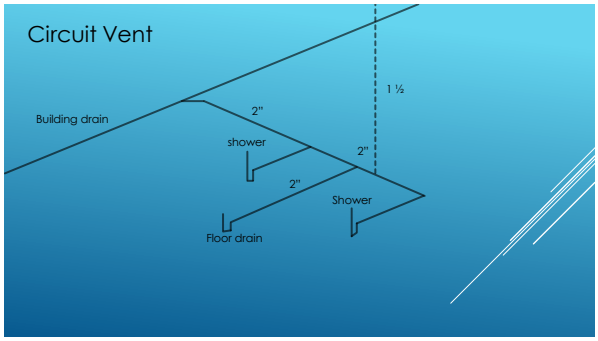


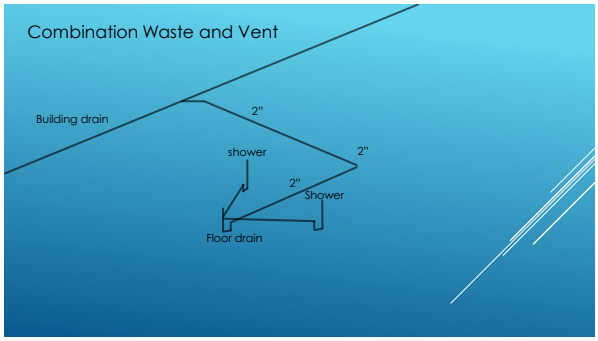
31

301.3 Connections to drainage system.

Plumbing fixtures, drains, appurtenances and appliances used to receive or discharge liquid waste or sewage shall be **directly connected** to the sanitary drainage system of the building or premises, in accordance with the requirements of this code and the requirements of the department of the city engineer, in cities having such departments, the boards of health of health districts, or the sewer purveyor, as appropriate (see division (D) of section 3781.03 of the Revised Code). This section shall not be construed to prevent indirect waste systems required by Chapter 8.

Exceptions: 1. Bathtubs, showers, lavatories, clothes washers and laundry trays shall not be required to discharge to the sanitary drainage system where such fixtures discharge to a recycled water system approved by the "Ohio Environmental Protection Agency" in accordance with Chapter 3745-42 of the Administrative Code or approved by the "Ohio Department of Health" in accordance with Chapter 3701-28 of the Administrative Code.
2. Wastes from dental or cuspidor fountains, drinking fountains, bar sinks, soda fountains, floor drains or **shower drains** may be indirectly connected by means of an air break to the sanitary drainage system. Each indirectly connected item listed above shall individually discharge to a directly connected floor drain, waste receptor or standpipe.

32



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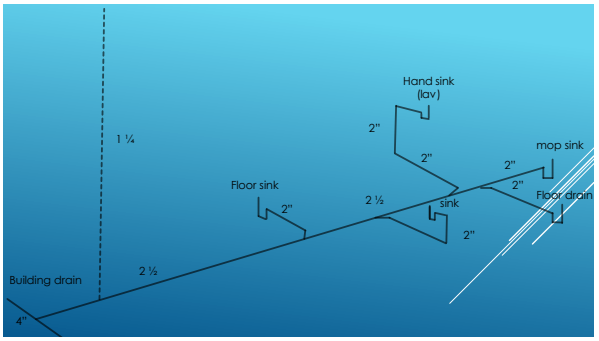


34

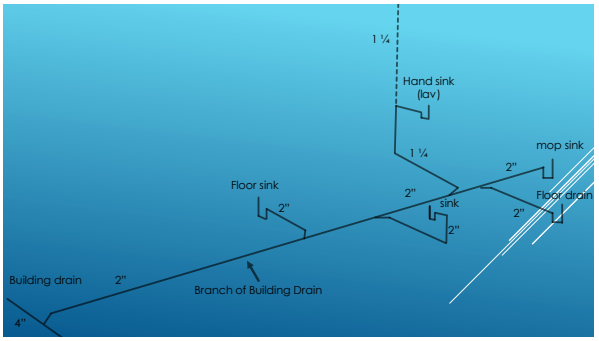
915.2.3 Connection. **The combination waste and vent system shall be provided with a dry vent connected at any point within the system or the system shall connect to a horizontal drain that serves vented fixtures located on the same floor**. Combination waste and vent systems connecting to building drains receiving only the discharge from one or more stacks shall be provided with a dry vent. The vent connection to the combination waste and vent pipe shall extend vertically to a point not less than 6 inches (152 mm) above the flood level rim of the highest fixture being vented before offsetting horizontally.

TABLE 915.2.2
SIZE OF COMBINATION WASTE AND VENT PIPE

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Connecting to a horizontal branch or stack	Connecting to a building drain or building subdrain
1	2	4
1¼	8	26
1½	12	31
2	20	50
3	160	350
4	360	575

For SI: 1 inch = 25.4 mm.

35



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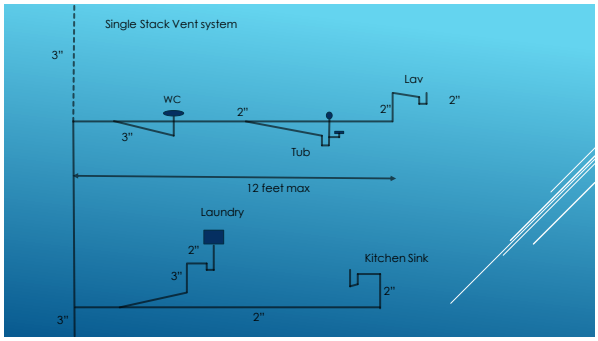
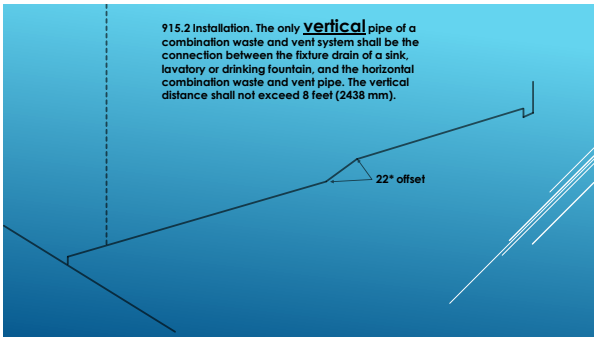
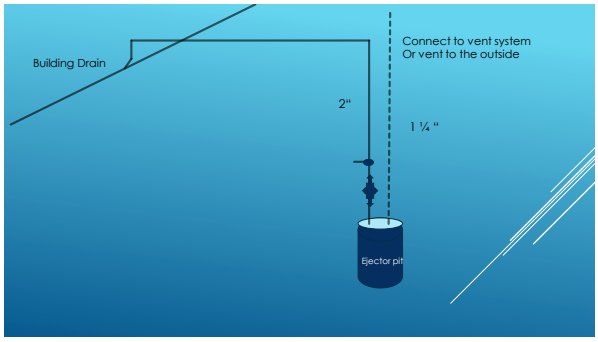

Single Stack Vent system
3"
WC
2"
2"
Lav
2"
3"
Tub
12 feet max
Laundry
2"
3"
Kitchen Sink
2"
3"
2"

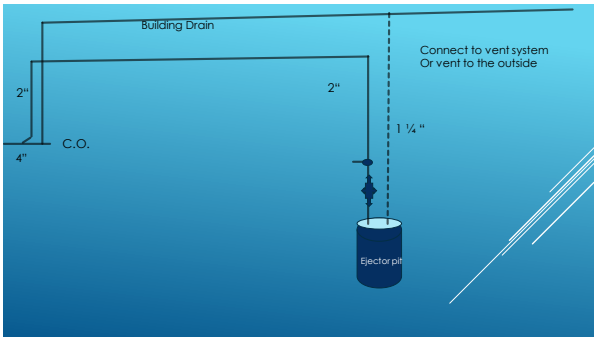
37


915.2 Installation. The only vertical pipe of a combination waste and vent system shall be the connection between the fixture drain of a sink, lavatory or drinking fountain, and the horizontal combination waste and vent pipe. The vertical distance shall not exceed 8 feet (2438 mm).
22° offset

38


Building Drain
Connect to vent system
Or vent to the outside
2"
1 ¼ "
Ejector pit

39


Building Drain
Connect to vent system
Or vent to the outside
2"
2"
1 ¼ "
C.O.
4"
Ejector pit

40

File Attachments for Item:

EC-14 The Evolution of Structural Masonry Systems (International Masonry Institute)

All certifications (1 hour)

BIO:

Tom is a journey-level craftworker who joined the masonry industry in 1985 as an apprentice bricklayer for BAC Local 5 in Cleveland, Ohio. Throughout his time in the industry, he has worked as a journey-level bricklayer, project foreman, and field superintendent on larger masonry projects in Ohio and surrounding states. He also served as a project manager for a restoration contractor and oversaw the restoration of several historic structures.

Previously, he managed his own mason contracting business and helped to negotiate local labor contracts as a board member of the Northeast Ohio Contractors Association.

Tom is a member of the Construction Specifications Institute (CSI) and is a CSI-Certified Construction Document Technologist. He is a voting member on several TMS subcommittees and is actively involved in the ACE Mentoring program. He is also a lecturer at both the Ohio State University and Kent State University and the Chairman of his local Architectural Board of Review and Planning Commission Board.

For the International Masonry Institute, he coordinates activities in Ohio, Michigan, and Northern Kentucky, promoting masonry to a wide variety of audiences including owners, contractors, architects, engineers, and craftworkers.

APPLICATION FOR CONTINUING EDUCATION APPROVAL
COURSE CONDITIONS AND GUIDELINES

The Ohio Board of Building Standards is committed to the ongoing education and professional development of board-certified personnel through the delivery of high-quality, accurate and engaging professional continuing education content. To this end, the Board reviews and approves Continuing Education Courses for building department personnel.

Board approval is granted for course instruction on current codes and standards, including the OBC, OMC, OPC, and RCO, and any other content areas directly related to the responsibilities of the certification for which credit is being requested.

Promotion: Any person or organization promoting an approved course is required to make full and accurate disclosure regarding course title, course approval number, number of credit hours, categories for which the BBS has approved the class, and fees in promotion materials and advertising. ***The Board does not grant retroactive approval. It is recommended that courses be submitted for approval well in advance of any scheduling of classes and advertising***. Advertising may not falsely state BBS approval before approval is granted. Course providers may state that BBS approval is pending.

Application Submission: All Applications and associated materials shall be submitted by email in .pdf format. Instructions for completing the application are attached.

Certificate of Completion: Course providers shall provide participants a certificate of completion containing the following information:

- Name of participant
- Title of approved courses
- BBS approval #
- BBS approved certifications
- Date of the continuing education program
- Number of approved credit hours awarded, and
- Signature of authorized sponsor or instructor.

Any person or organization administering an approved course shall return a completed BBS Course Attendance form by email.

Participants: Participants must attend the complete course as presented by the instructor to receive credit hours approved by the Board. The organization or instructor of online courses shall plan and execute methods to verify the individual's attendance and completion of the course. No partial credit will be given to any participant who failed to complete the entire course as approved.

Board approval: All courses are approved for the calendar year in which application is made. Courses may be renewed so long as the referenced code is in effect, and the CEUs, certification and content remain unchanged. When the referenced code is updated, courses must be updated, and new approvals obtained.

Facility/training area: BBS Course may be delivered in person or online, or both, at the sponsor's option.
Course facilities shall include the following:

In Person Classes:
Sufficient seating capacity
ADA accessible facilities
Appropriate Audio/Visual devices for delivery
Writing surfaces for participants

Online Classes:
Web-accessible
ADA accessible delivery
Tech support available
Live and recorded courses permitted

In-person facilities shall comfortably and safely seat at least the number of attendees present in the room and shall be climate controlled, non-smoking, and sound controlled so that outside noise will not interfere with the training.

Ohio Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Tom Ellitt

Organization: International Masonry Institute

Address: 8499 Leavitt Road Amherst OH 44092

E-mail: telliott@imiweb.org Telephone: 440.986.2260

Website: www.imiweb.org

Conference Sponsor (if applicable)_____ Conference Email:_____

Check here if Course Renewal:_____ Prior course number _____ (*i.e. BBS2018-429*)

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

New Course Information:

Course title: Evolution of Structural Masonry Systems

Course instructor: Tom Elliott

Course description: Masonry has been an important component in structural systems since the beginning of time. This presentation will review the construction of structural masonry buildings from the late 1800's to today with an empahis on how masonry materials combined with the most recent building codes, create safe, healthya and sustainable structures

Instructional hours per session: 1 Number of Sessions: 1

Course Date(s) and Location:_____

Special Content:

Code Administration: ☑ Conference Course: _____

Existing Buildings: ☑ Conference Name: _____

Electrical Instruction: ☐ Conference location: _____

Plumbing Instruction: ☐

Course to be offered online? ☐ **On Demand** ☐ **Webinar** ☐

Course Website: _____

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

_____

Course applicable for the following certifications

Residential Certifications Only: ☐ Commercial Certifications: ☑

Administrative Course, All Certifications: ☑

Application materials included:

☑ Course Outline or Course Learning Objectives

☐ Presentation Materials/Slides (not required for roundtable courses)

☐ Assessment Materials (for online courses)

☐ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

Instructions for new Continuing Education Approval form

Provider Information

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

Course Renewal

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

New Course Information

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

Special Content

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

Course applicable for the following certifications

This section represents a major change from previous BBS course approval forms.

1. If the course is only for residential certifications, check 'Residential Certifications Only'. The course, if approved, will be approved for all residential certifications.
2. If the course is appropriate for any commercial certifications, check Commercial Certifications. The course, if approved, will be approved for all commercial certification **AND** all residential certifications.
3. If the course is intended to meet required instruction in Code Administration (Chapter 1) or Existing Buildings (commercial or residential) check 'Administrative Course, All Certifications'.

Application Materials Included

This is a checklist for the course submitter's use, to be sure all materials necessary for review are included with the application. All materials should be submitted in .pdf format, along with the application, via email to Michael.Lane@com.ohio.gov or BBS@com.ohio.gov

COURSE TITLE: “The Evolution of Structural Masonry”

COURSE DESCRIPTION: Masonry has been an important component in structural systems since the beginning of time. This presentation will review the construction of structural masonry buildings from the late 1800’s to today with an emphasis on how current masonry materials when combined with recent code changes and trained craftworkers - can lead to more efficient structural masonry designs.

LEARNING OBJECTIVE1: Discover how masonry materials and systems can provide long resilient safe structures for multiple generations of occupants

LEARNING OBJECTIVE 2: Understand the history of structural masonry codes and standards

LEARNING OBJECTIVE 3: Learn how structural masonry systems have evolved with the changing codes

LEARNING OBJECTIVE 4: Review structural masonry options allowing for more economical and efficient designs

INTERNATIONAL MASONRY INSTITUTE

THE EVOLUTION OF STRUCTURAL MASONRY SYSTEMS

SEPTEMBER 11, 2023

Tom Elliott, CSI, CDT

telliott@imiweb.org

440.749.0661

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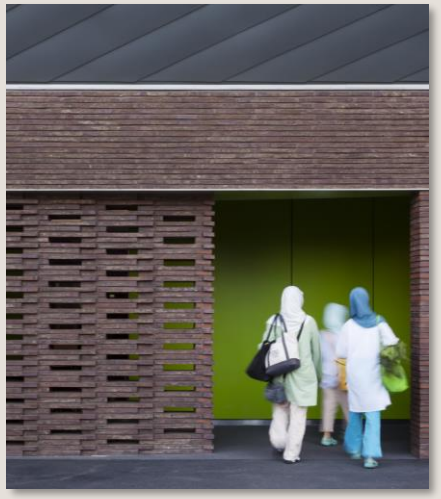
- Stone
- Restoration
- Tile
- Marble
- Terrazzo
- Rainscreen
- Refractory
- Concrete
- Plaster



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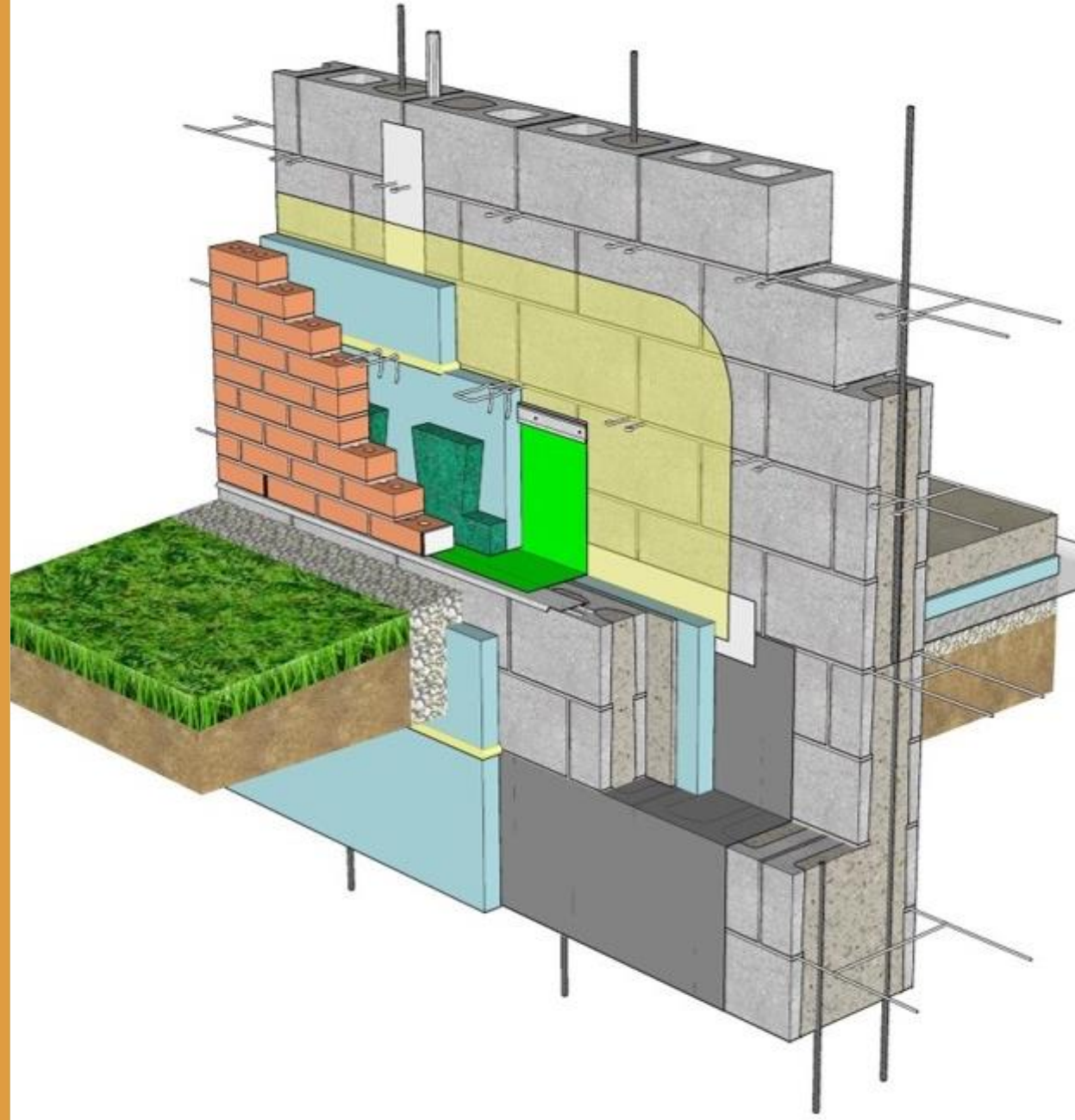

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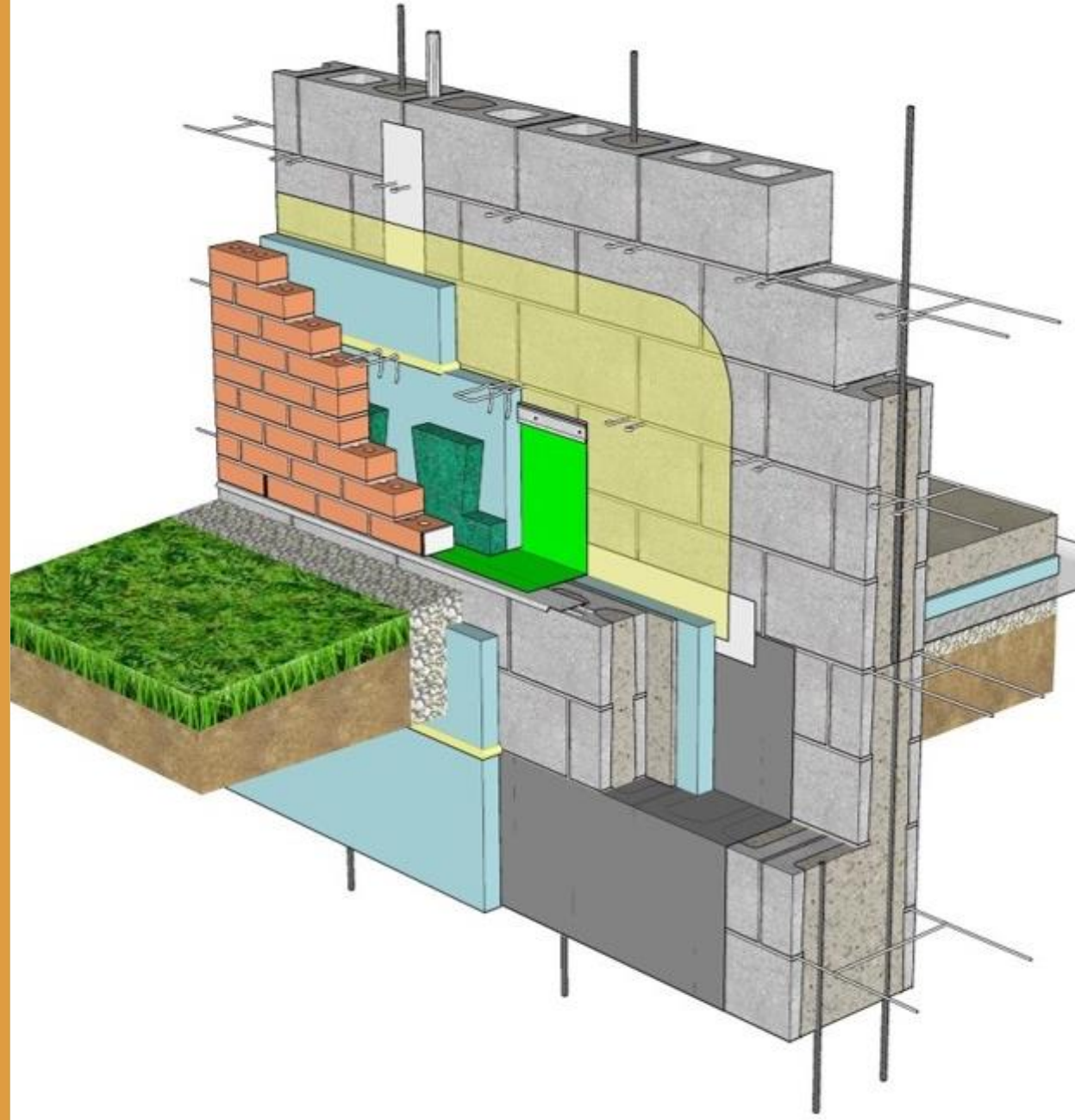


Masonry has been an important component in structural systems since the beginning of time. This presentation will review the construction of structural masonry buildings from the late 1800's to today with an emphasis on how current masonry material when combined with recent code changes and trained craftworkers can lead to more efficient structural masonry designs.

LEARNING OBJECTIVES

AT THE END OF THIS COURSE, PARTICIPANTS WILL BE ABLE TO:

1. Discover how masonry materials and systems can provide resilient safe structures for multiple generations of occupants
2. Understand the history of structural masonry codes and standards
3. Learn how structural masonry systems have evolved with changing codes
4. Review structural masonry options for more economical and efficient designs

SEMINAR OUTLINE

Historic structural masonry examples

Transition of structural masonry

Look at the history of masonry codes

Update on current masonry codes

Modern structural masonry components

Examples of efficient structural designs

SEMINAR OUTLINE

Historic structural masonry examples

Transition of structural masonry

Look at the history of masonry codes

Update on current masonry codes

Modern structural masonry components

Examples of efficient structural designs

GREAT PYRAMID OF EGYPT

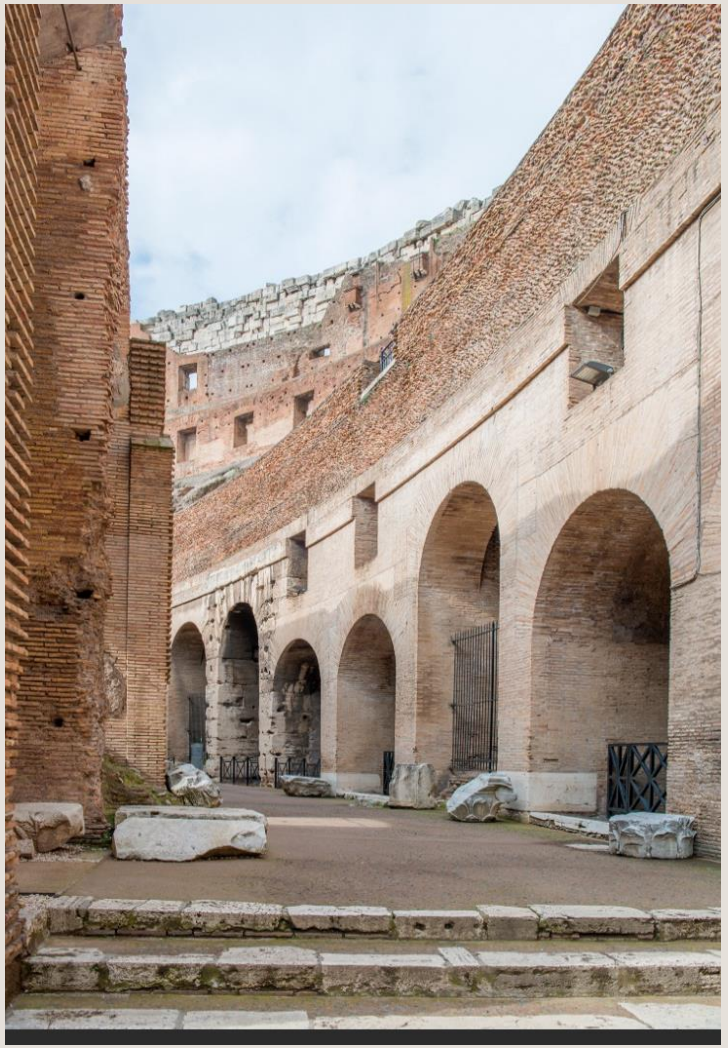
Finished around 2560 B.C.

4581 years old

Estimated to have been 480 ft. high when built

750 ft. at the base

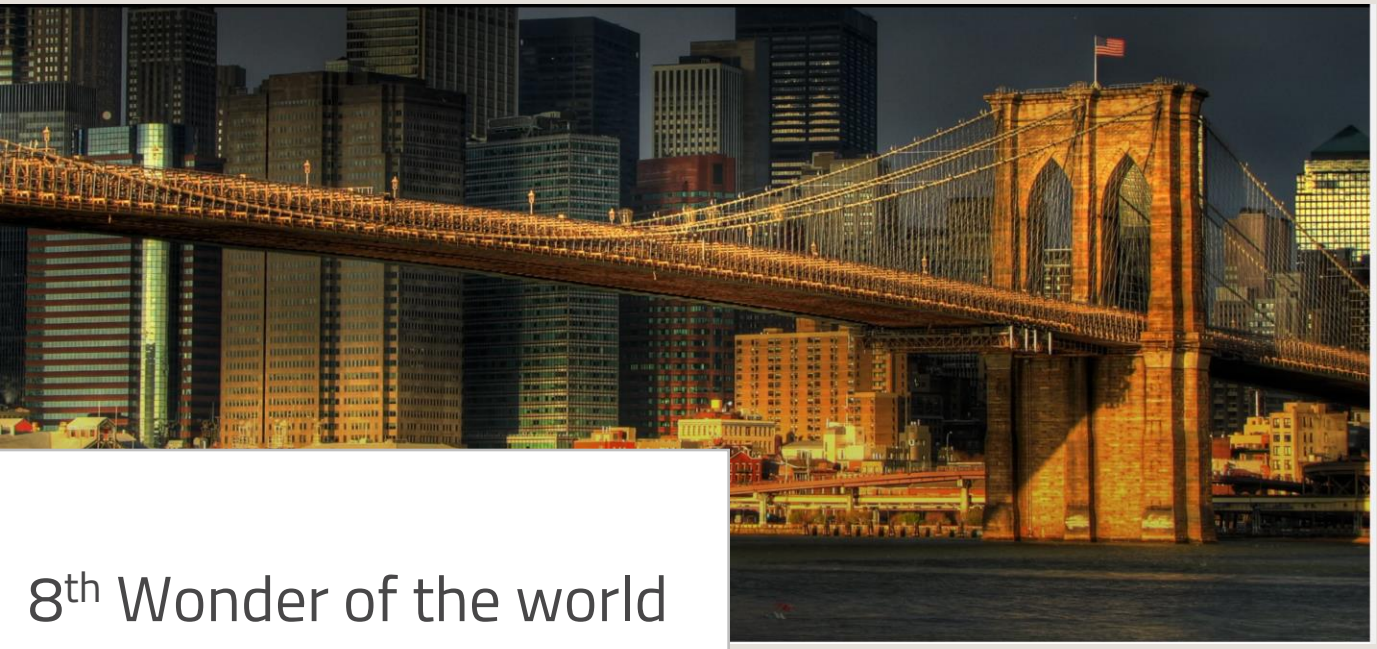
ROMAN COLOSSEUM



Started around 70-72 AD semi-completed in 80 AD

BROOKLYN BRIDGE

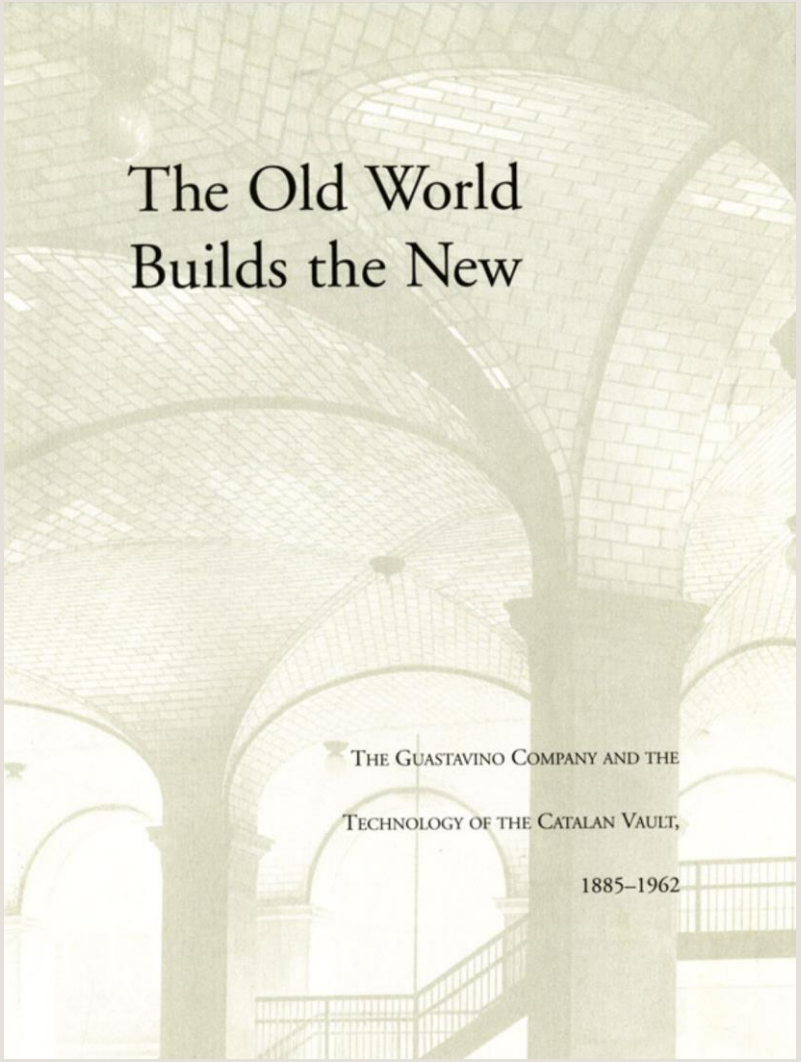
BROOKLYN BRIDGE



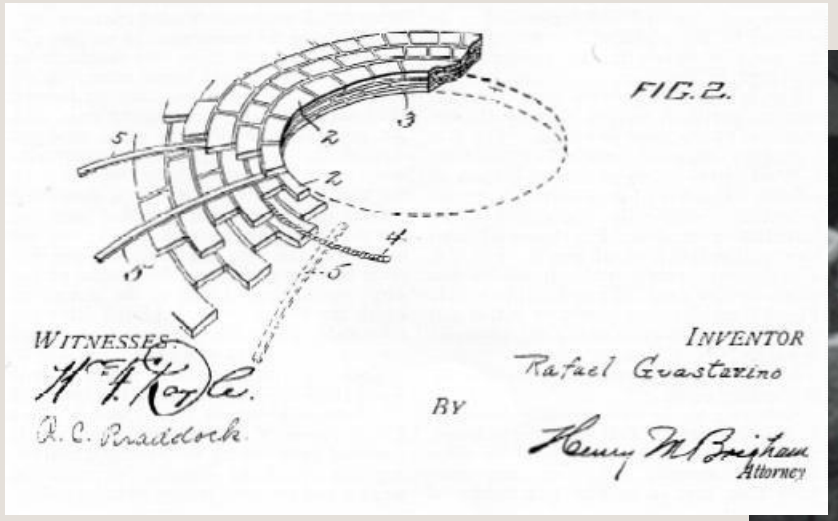
8th Wonder of the world

- Two suspension towers are 278 ft. tall
- Limestone, granite & Rosendale Cement
- Manhattan tower contains 46,945 cubic yards of masonry
- Brooklyn tower has 38,214 cubic yards of masonry

GUASTAVINO TILE (STRUCTURAL)



GUASTAVINO TILE (STRUCTURAL)



INTERNATIONAL MASONRY INSTITUTE

CEILINGS


International Masonry Institute
Metro Detroit
BAC Local 1 Trowel Trades
Training Center
BELDEN

WESTSIDE MARKET-CLEVELAND OH

TOWER OF PISA

- Started to lean during construction in the 12th century, due to soft ground
- 183.27’ (55.86 meters) above ground on the low side
- 185.93’ (56.67 meters) on the high side.

TOWER OF PISA

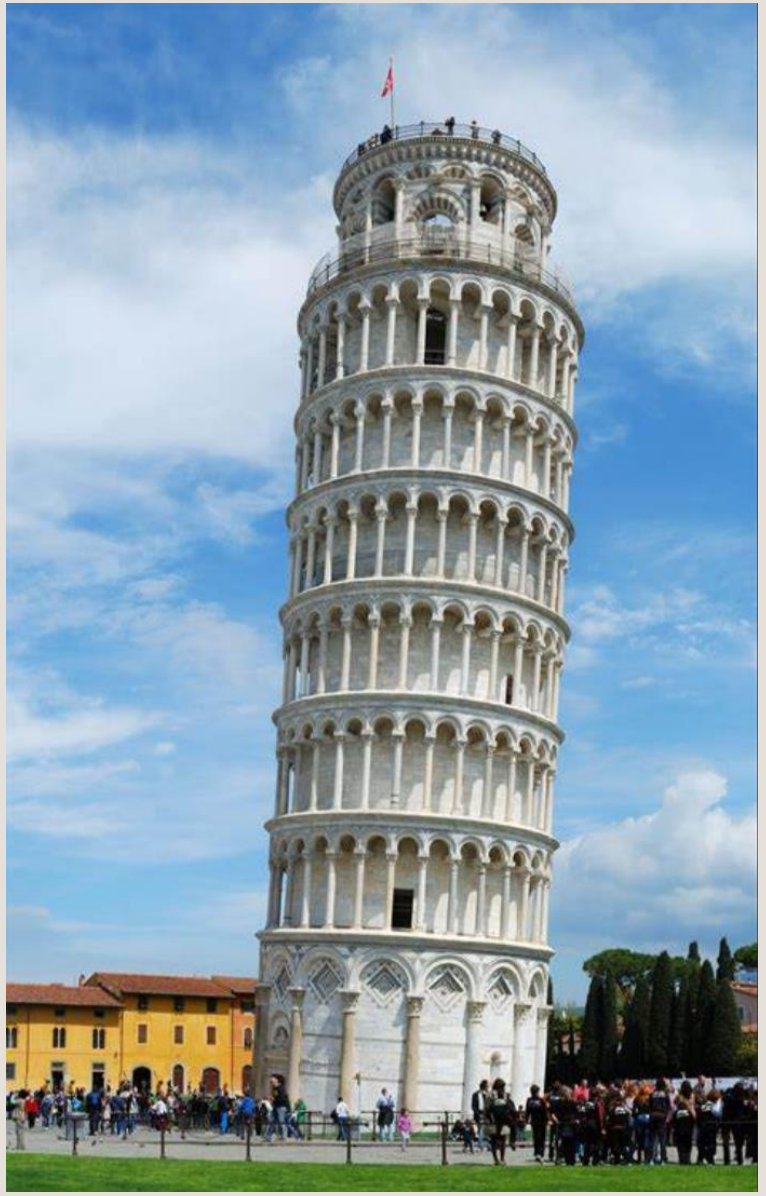
Construction of the tower occurred in three stages over 199 years

On 9 August 1173, the foundations of the tower were laid.

1990-the tilt had reached 5.5 degrees

1993-2001 stabilized by remedial work

Tilt reduced to 3.97 degrees



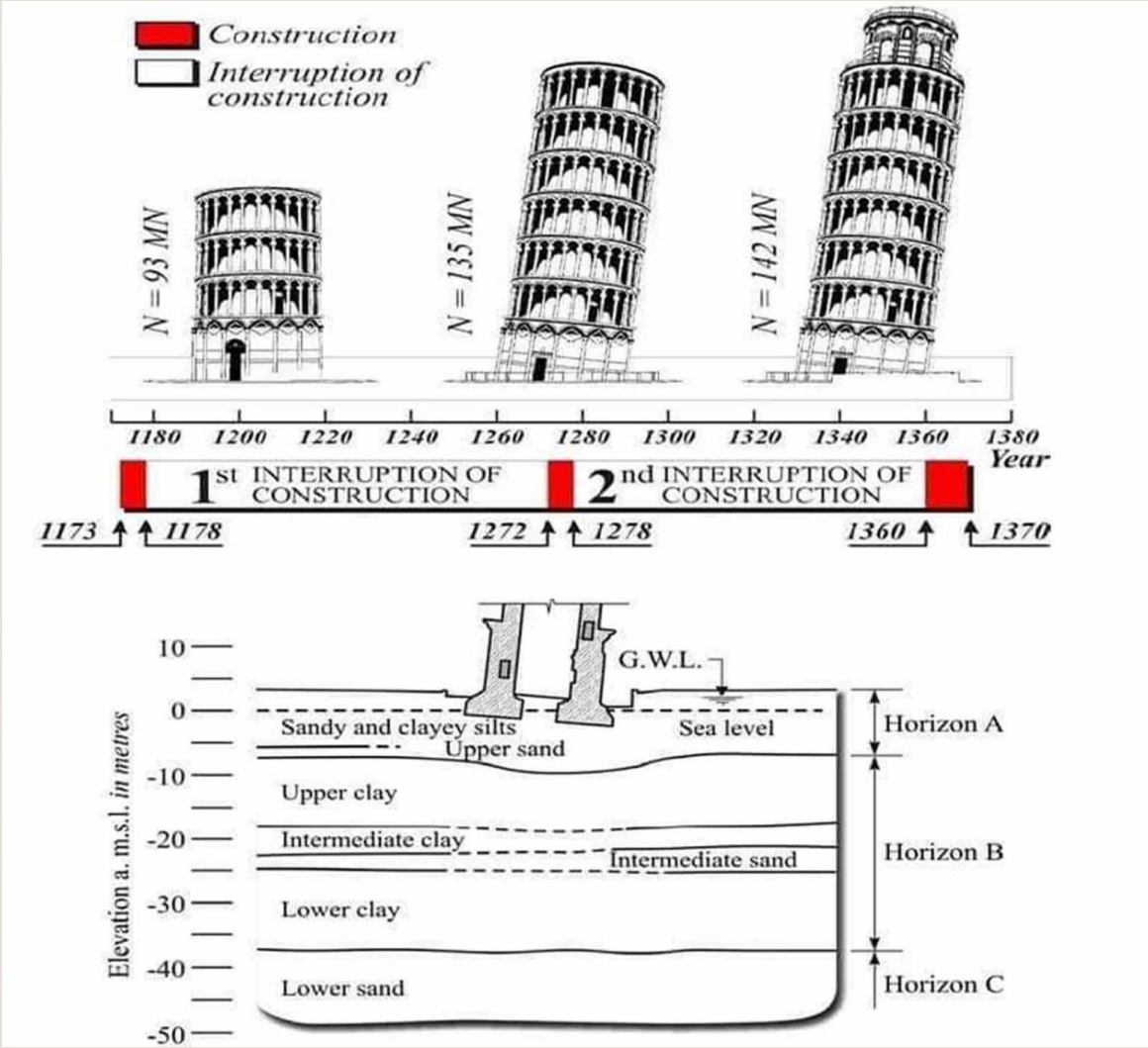
TOWER OF PISA

The foundation for the Tower of Pisa was laid in 1173

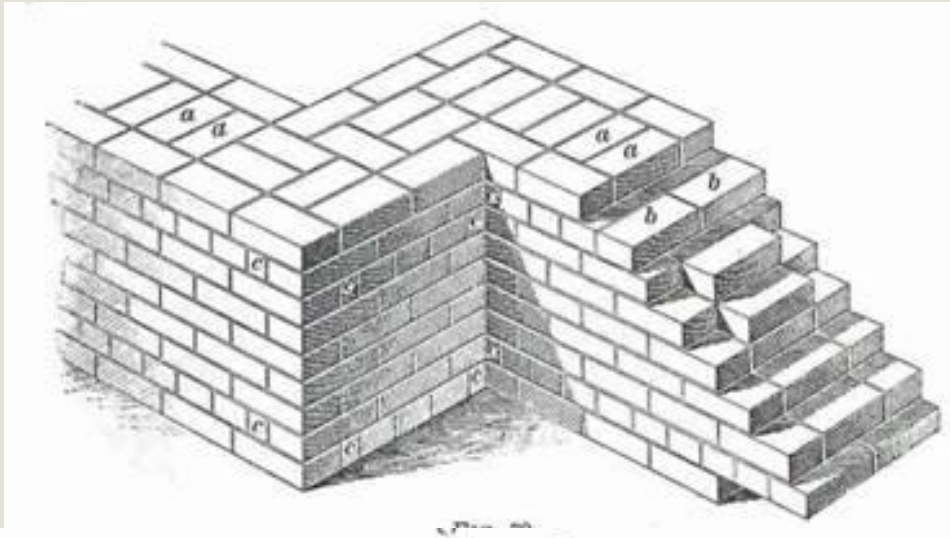
Constructed mainly of marble and limestone

The tower was built in a circular ditch, about five feet deep

Ground consisting of clay, fine sand, and shells



HISTORIC MASONRY BARRIER (MASS) WALLS



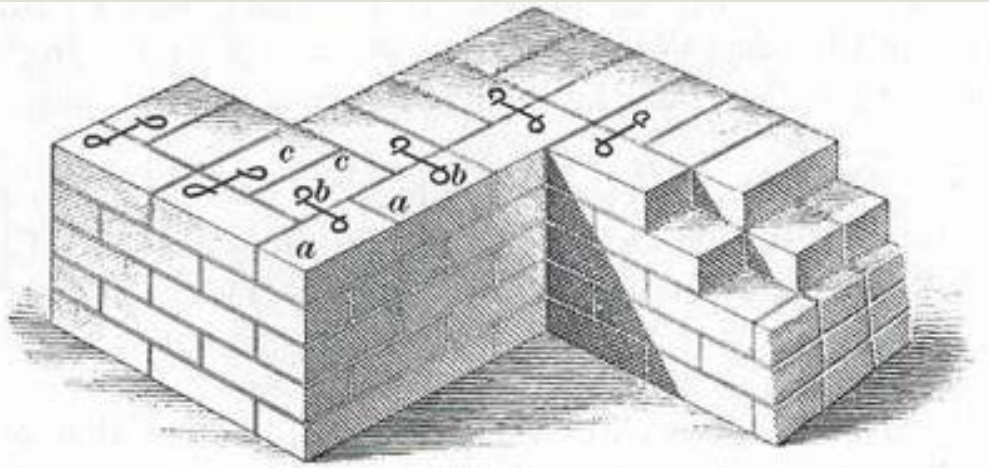


FIG. 82.

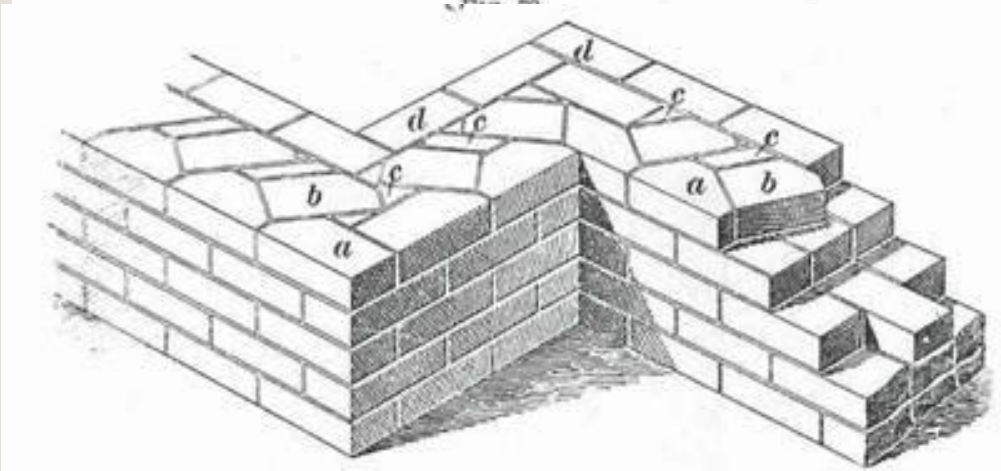


FIG. 80.

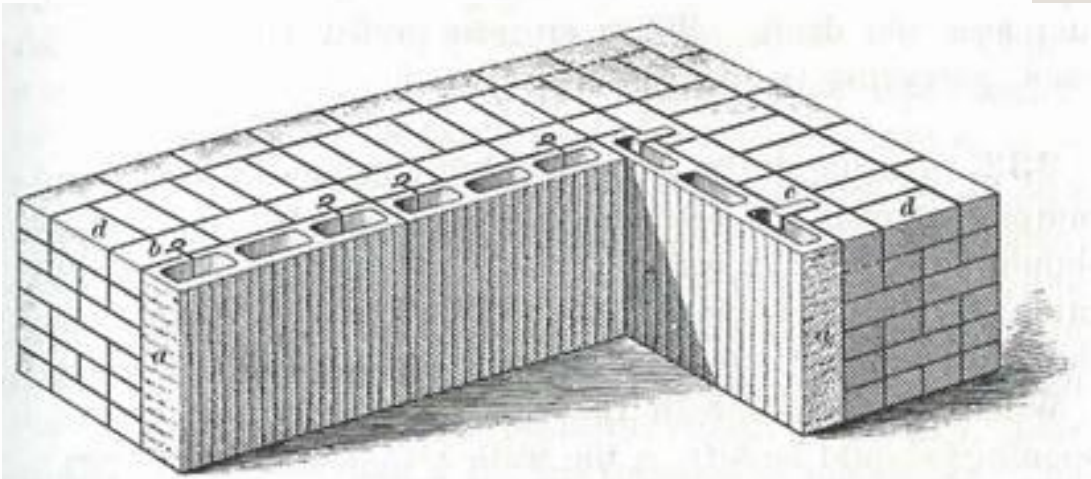
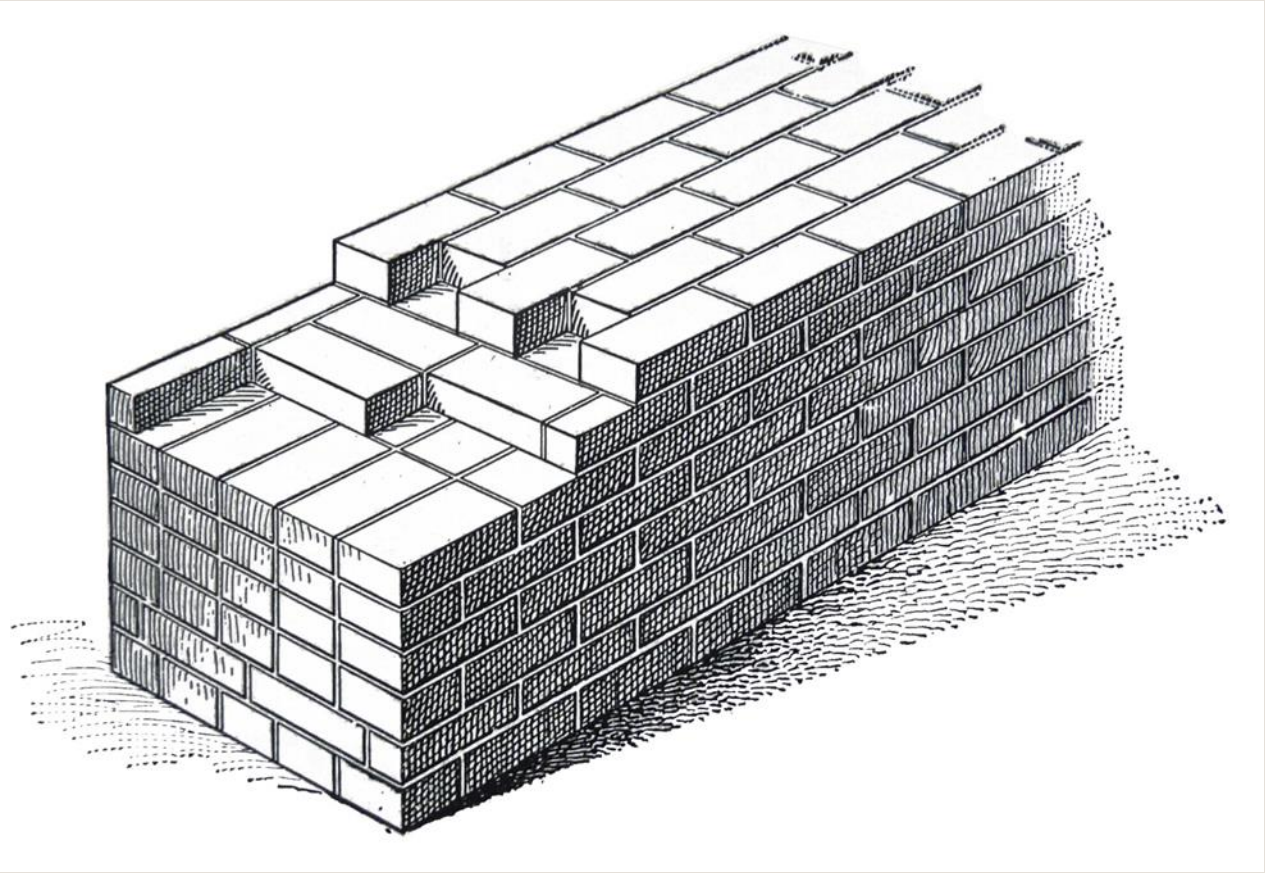


FIG. 92.

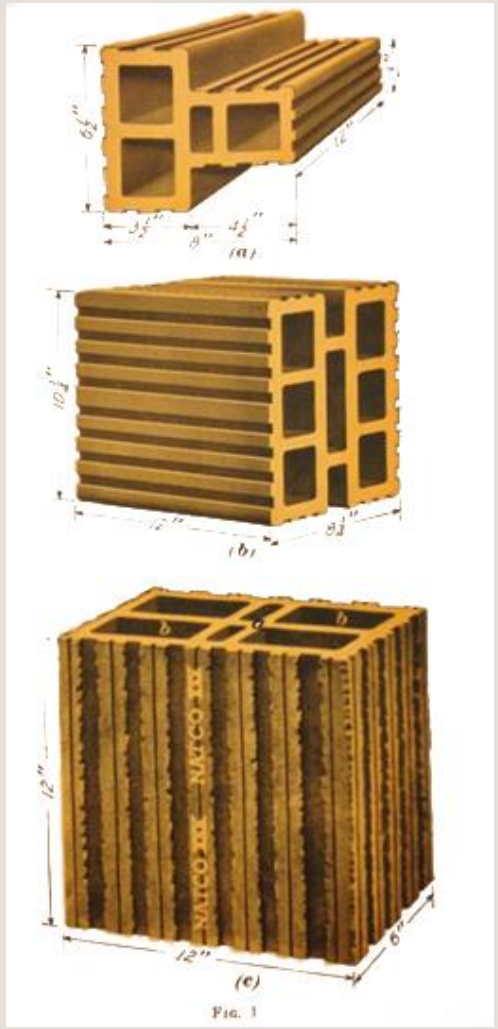
MASS MASONRY-BRICK BONDS

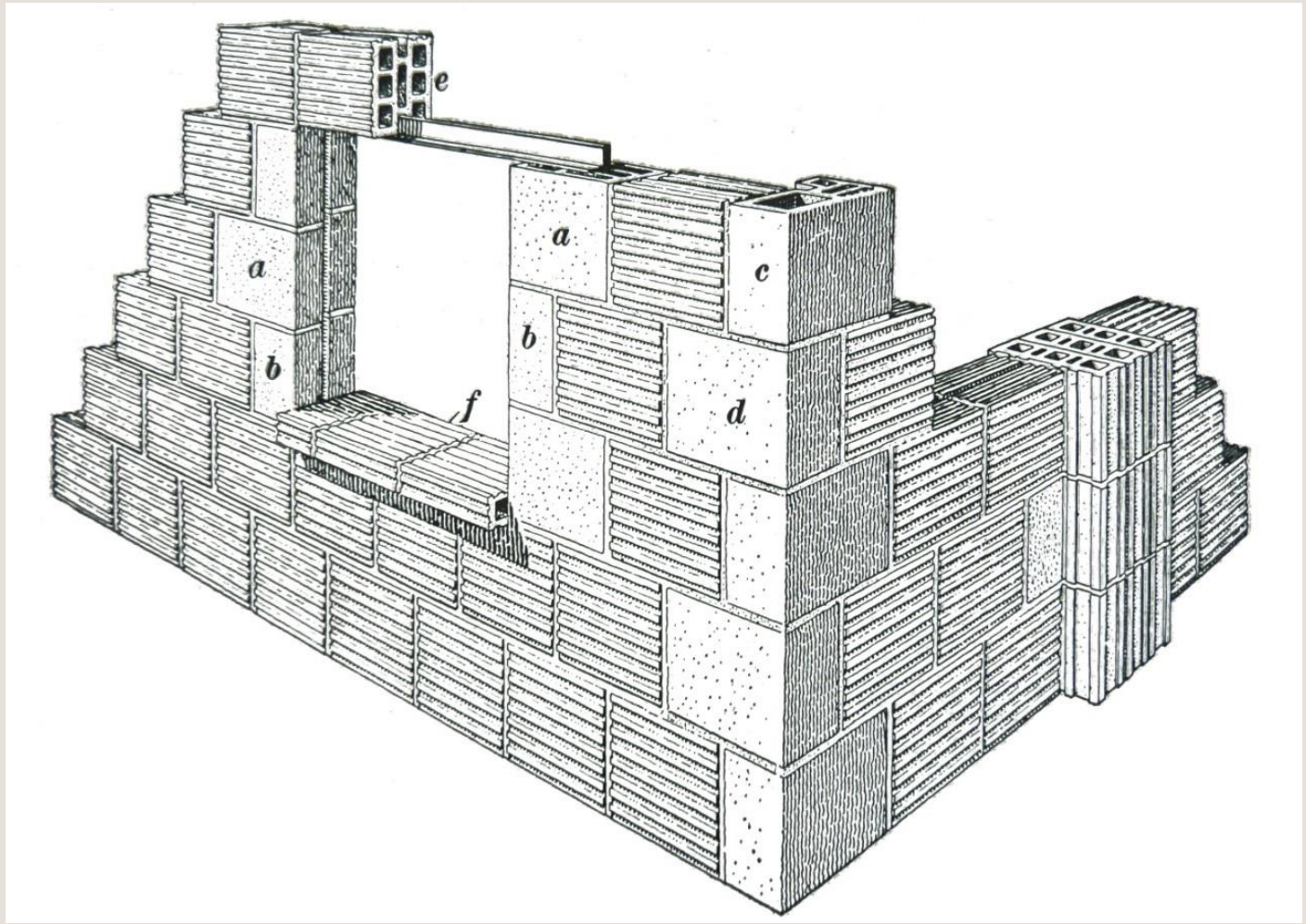
"To build a strong, substantial, and solid wall with bricks requires carful arrangement so that they shall be tied together and form a cohesive mass of masonry"

- Common Bond
- English Bond
- Flemish bond
- Etc.

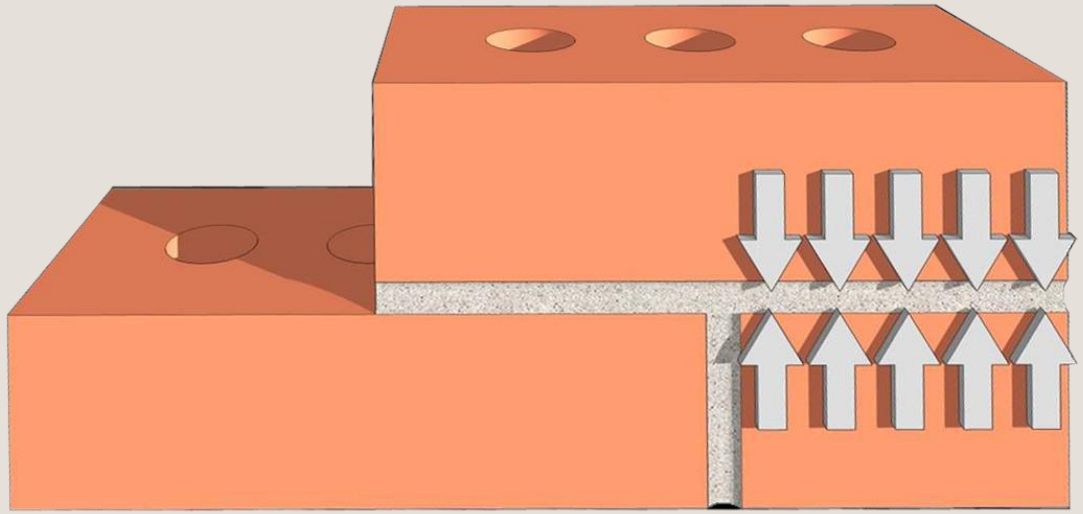


Hollow Clay Tile

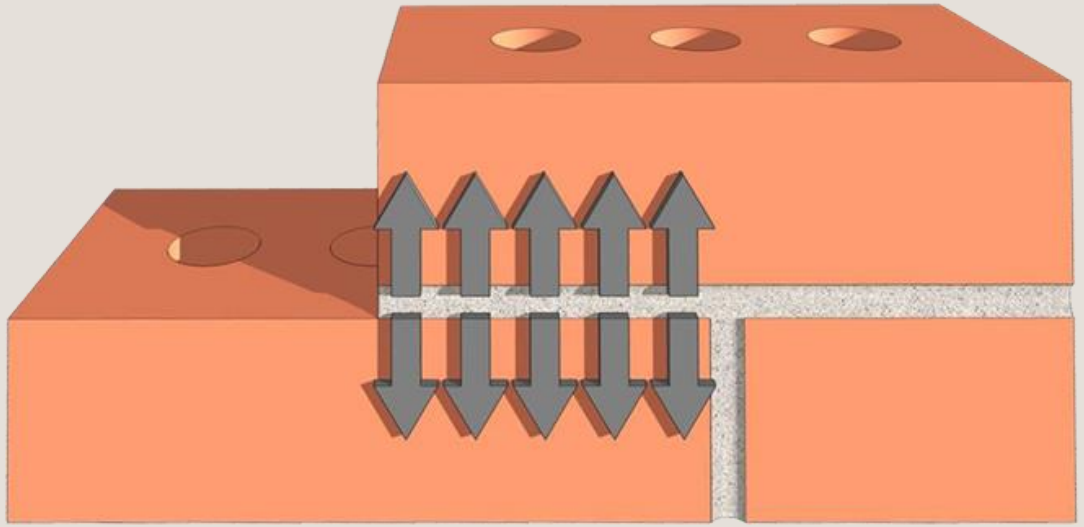




PERFORMANCE OF LOAD BEARING CONSTRUCTION



Holds Units Together

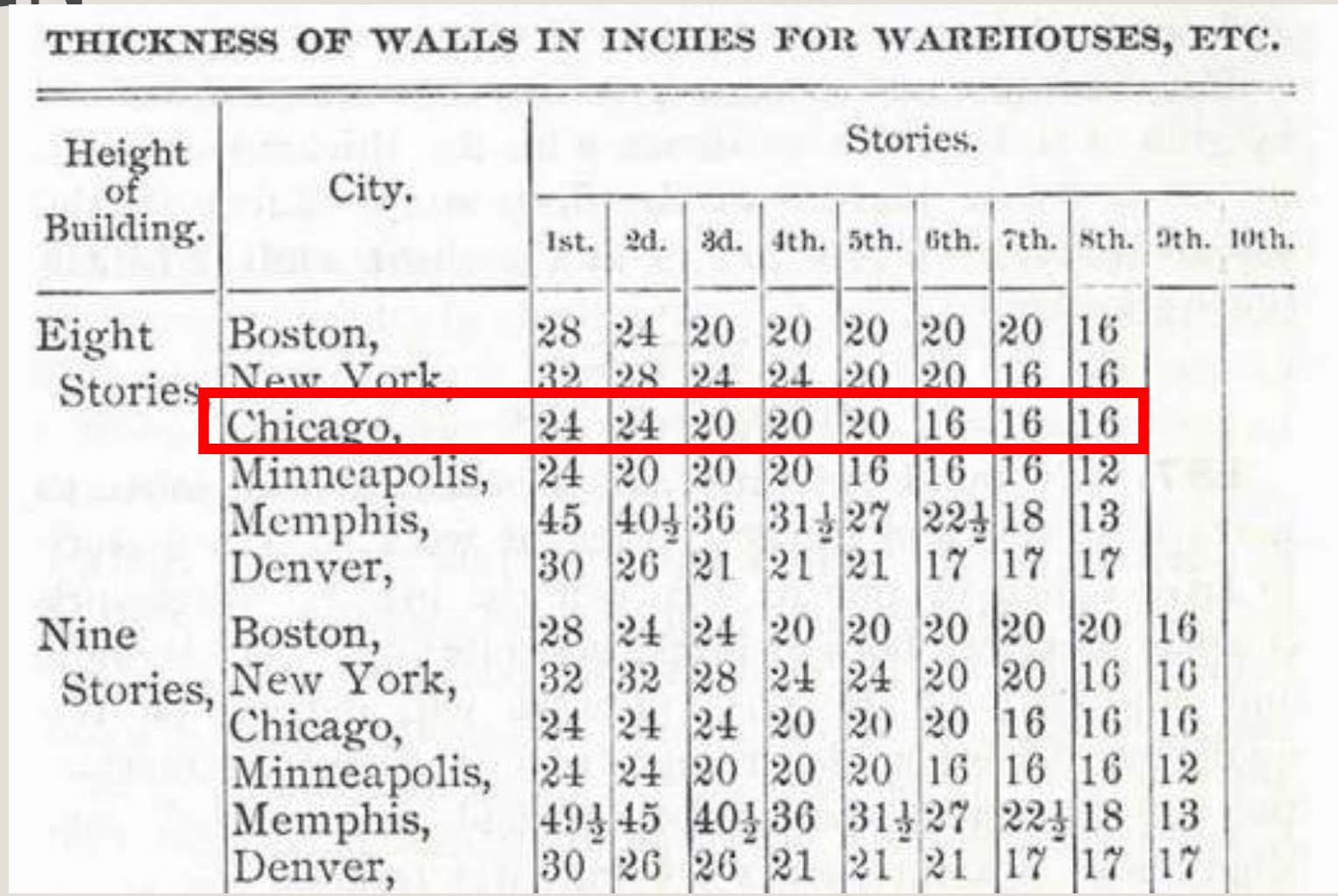


Keeps Units Apart

MONADNOCK BUILDING, CHICAGO (1891)

Tallest load-bearing brick skyscraper ever built when completed in 1893

EMPIRICAL DESIGN



THICKNESS OF WALLS IN INCHES FOR WAREHOUSES, ETC.

Height of Building.	City.	Stories.									
		1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.
Eight Stories	Boston,	28	24	20	20	20	20	20	16		
	New York,	32	28	24	24	20	20	16	16		
	Chicago,	24	24	20	20	20	16	16	16		
	Minneapolis,	24	20	20	20	16	16	16	12		
	Memphis,	45	40½	36	31½	27	22½	18	13		
	Denver,	30	26	21	21	21	17	17	17		
Nine Stories,	Boston,	28	24	24	20	20	20	20	20	16	
	New York,	32	32	28	24	24	20	20	16	16	
	Chicago,	24	24	24	20	20	20	16	16	16	
	Minneapolis,	24	24	20	20	20	16	16	16	12	
	Memphis,	49½	45	40½	36	31½	27	22½	18	13	
	Denver,	30	26	26	21	21	21	17	17	17	

THE CRITTENDEN

Cleveland Ohio

195 ft -7 Story

One of the tallest inhabited masonry loadbearing structures in the world

Entire superstructure made of brick

Opened in 1996

SEMINAR OUTLINE

Historic structural masonry examples

Transition of structural masonry

Look at the history of masonry codes

Update on current masonry codes

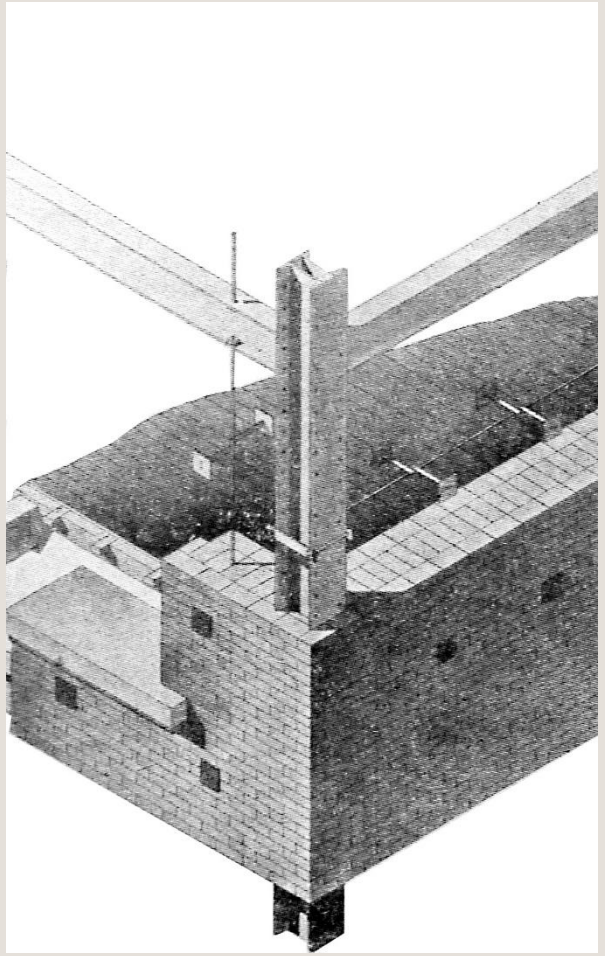
Modern structural masonry components

Examples of efficient structural designs

TRANSITIONAL MASONRY (HYBRID MASONRY)

"Early generation high rise buildings built between 1890 and World War II, represent a technical transition between traditional load bearing masonry construction and modern curtain wall systems".

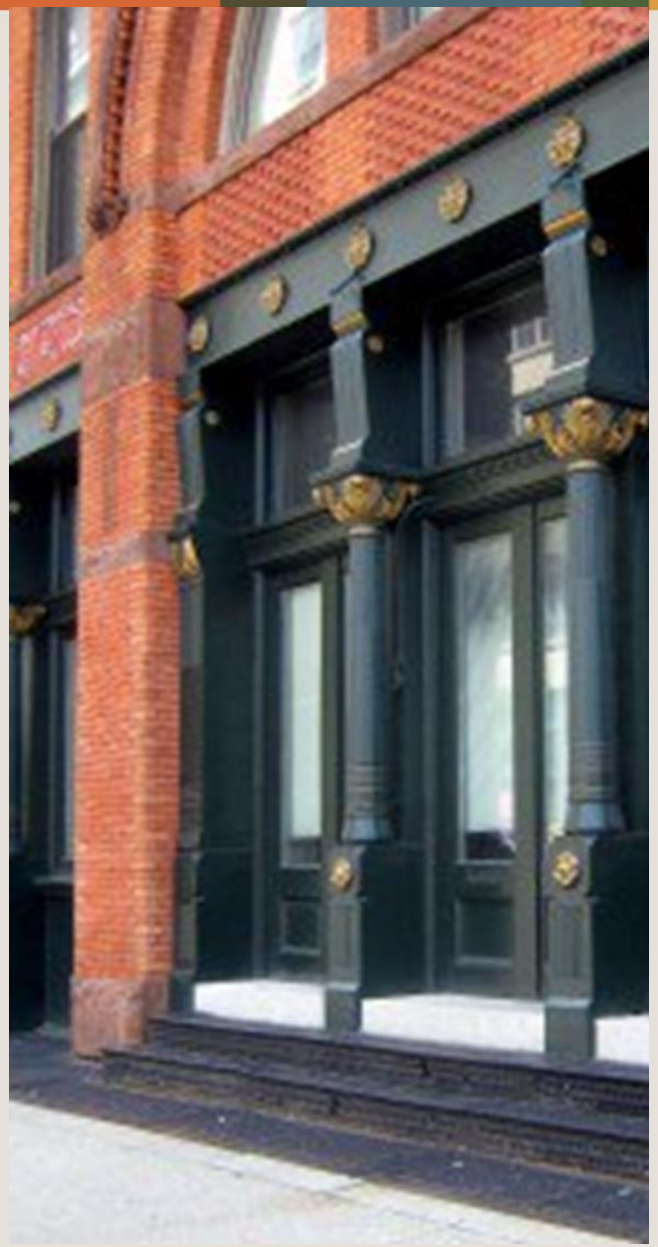
(Buntrock, Rebecca 2010)



LATE 19TH/EARLY 20TH CENTURY IRON ALLOYS

- ***Wrought Iron*** – tough and stringy; has the elasticity and tensile strength needed for bolts, beams, and girders. Began to be used as a structural material around 1850. 8-inch "I" beams first rolled 1855. Produces very little corrosion product

- ***Cast Iron*** - Very hard and brittle. First used as a column in 1820.



LATE 19TH/EARLY 20TH CENTURY-IRON ALLOYS

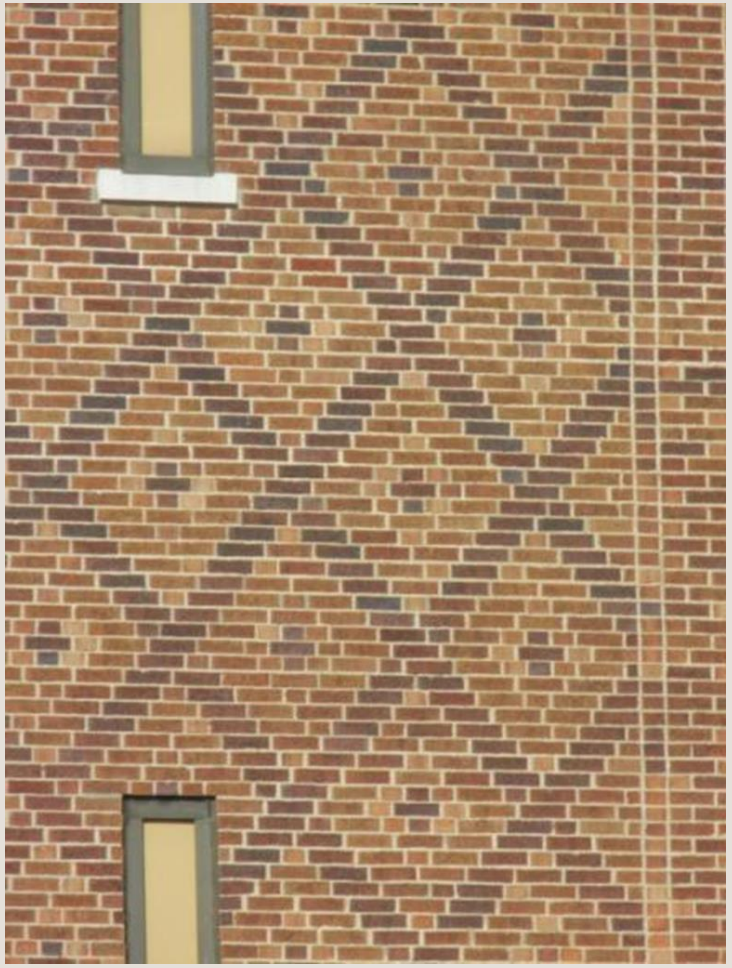
- ***Carbon Steel*** - Stronger than cast iron in compression and wrought iron in tension. Produced cheaply and in quantity, England 1856. Manufacturing in America began in 1865. Corrosion product results in volume gain.

- ***Stainless Steel –*** High in compressive strength and tension. First developed in 1902 and specified in a building project in 1928. Not used extensively because of cost. No corrosion product

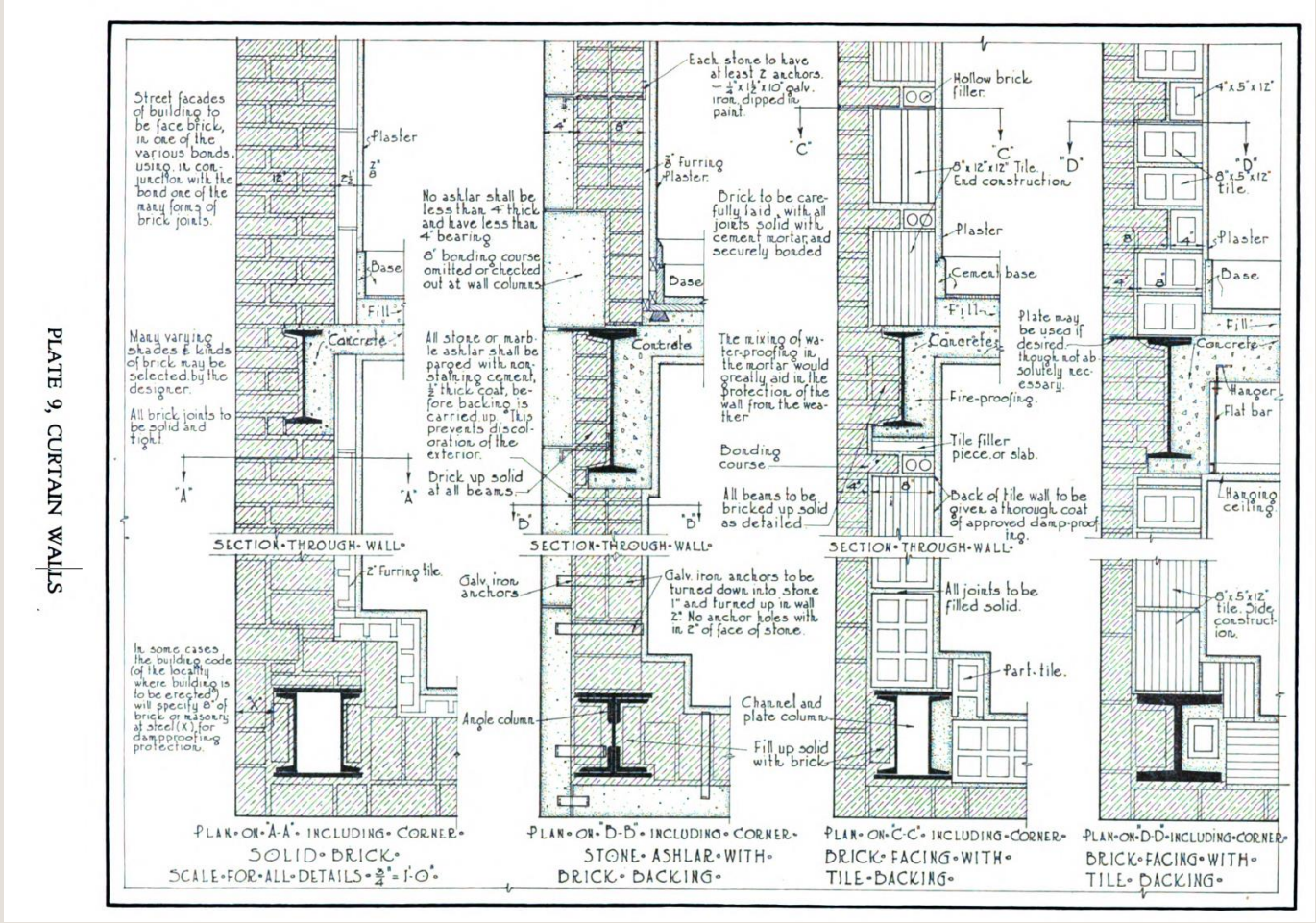
ARCHITECTURAL ENGINEERING

"Less is now required of the brick or masonry wall as a support member…much more is now demanded of it as to quality and perfection of workmanship in order that it afford to the vital steel frame within"

-Joseph Kendall Frietag-1909



20TH CENTURY "TRANSITIONAL HYBRID FACADES" (1)



(1) common from the 1890's until mid-20th century

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

"If ironwork is free from any corrosion when placed in position and is properly cleaned before it is coated (with paint) and is fixed in air-tight, damp proof and watertight brickwork or masonry it is unlikely to corrode appreciably"

Charles L. Norton
Massachusetts Institute of Technology, 1910

CORROSION INHIBITORS

- Lead Red
- Iron Oxide Paint
- Zinc Chromate
- Black Asphaltum
  – Tung Oil
- Bitumen Mastic

THE

CORROSION of METAL STRUCTURES

CAN BE PREVENTED BY THE USE OF

"FERRODOR" PAINT,

known in Germany, &c., as

"SCHUPPENPANZERFARBE."

Manufactured from NATURAL METALLIC STEEL GREY RUSTLESS PEROXIDE OF IRON and PURE LINSEED OIL.

"FERRODOR" PAINT

possesses all the requirements of a Scientifically Perfect Protective Coating FOR METAL Structures.

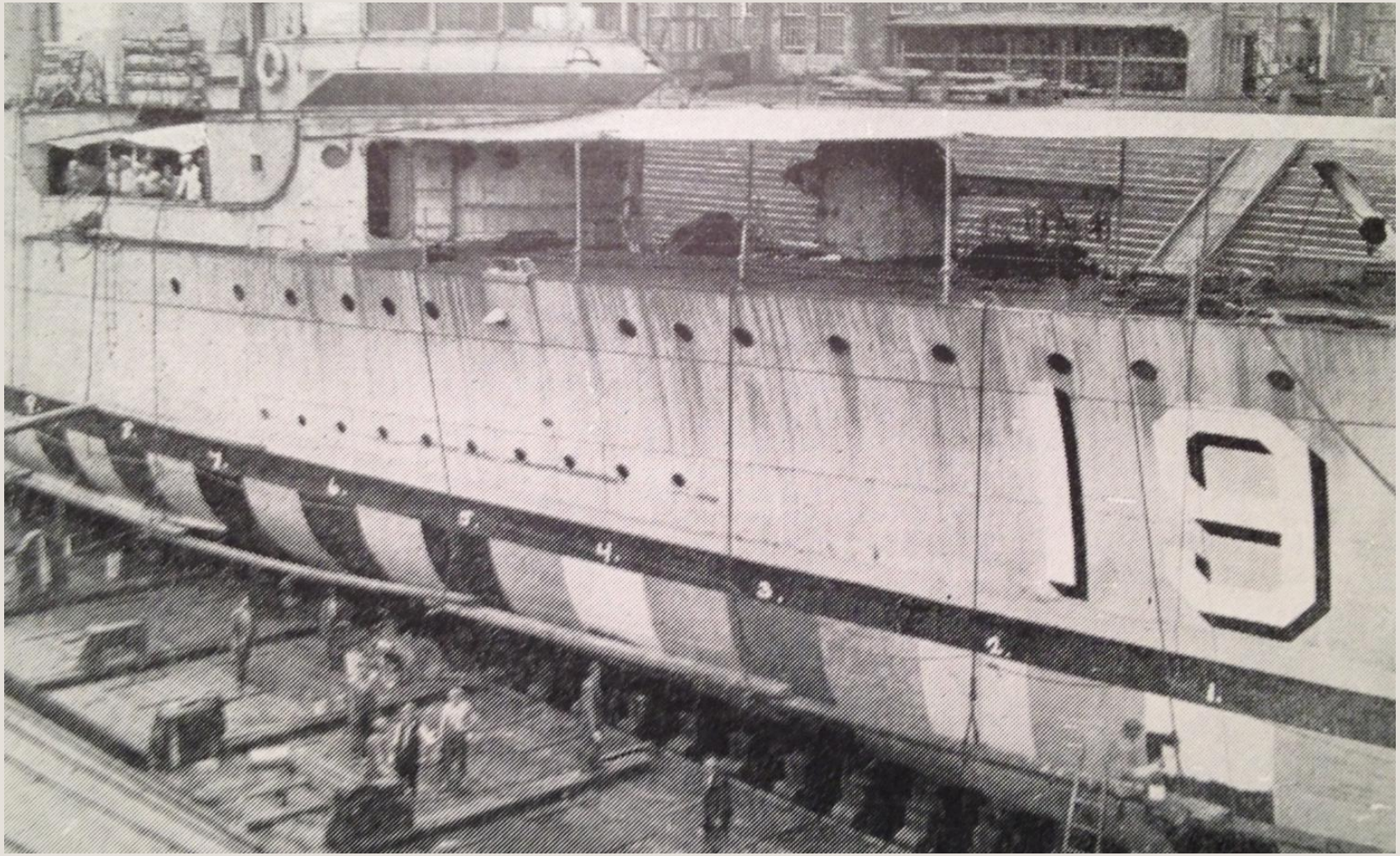
"FERRODOR" PAINT for interior and exterior **Iron and Steel Ship Work**, and all Metal Structures, surpasses Oxides of Iron, &c., and is

SUPERIOR TO RED LEAD.

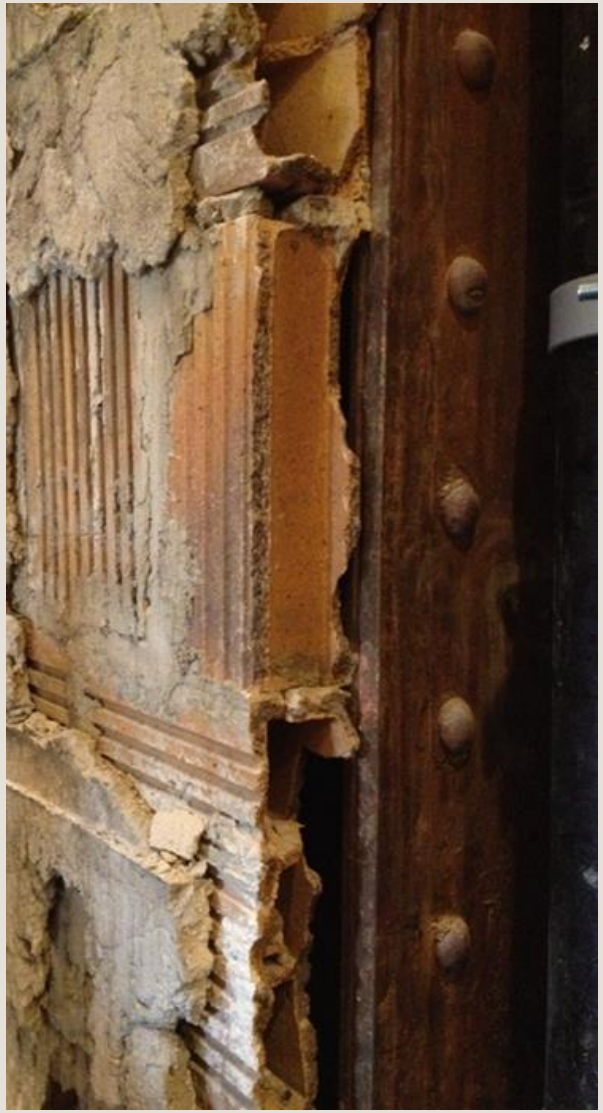
SOLE MANUFACTURERS—

GRIFFITHS BROS. & CO.

CORROSION INHIBITORS



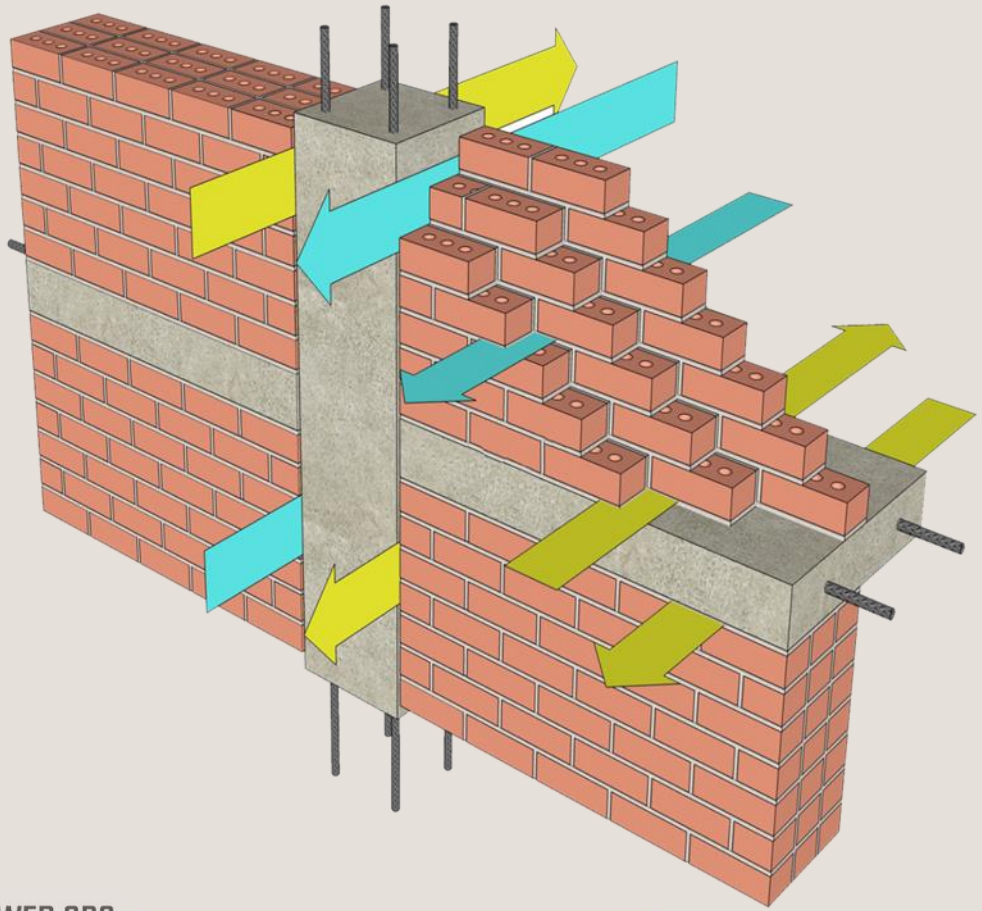
EMBEDDED STEEL



PERFORMANCE OF LOAD BEARING CONSTRUCTION

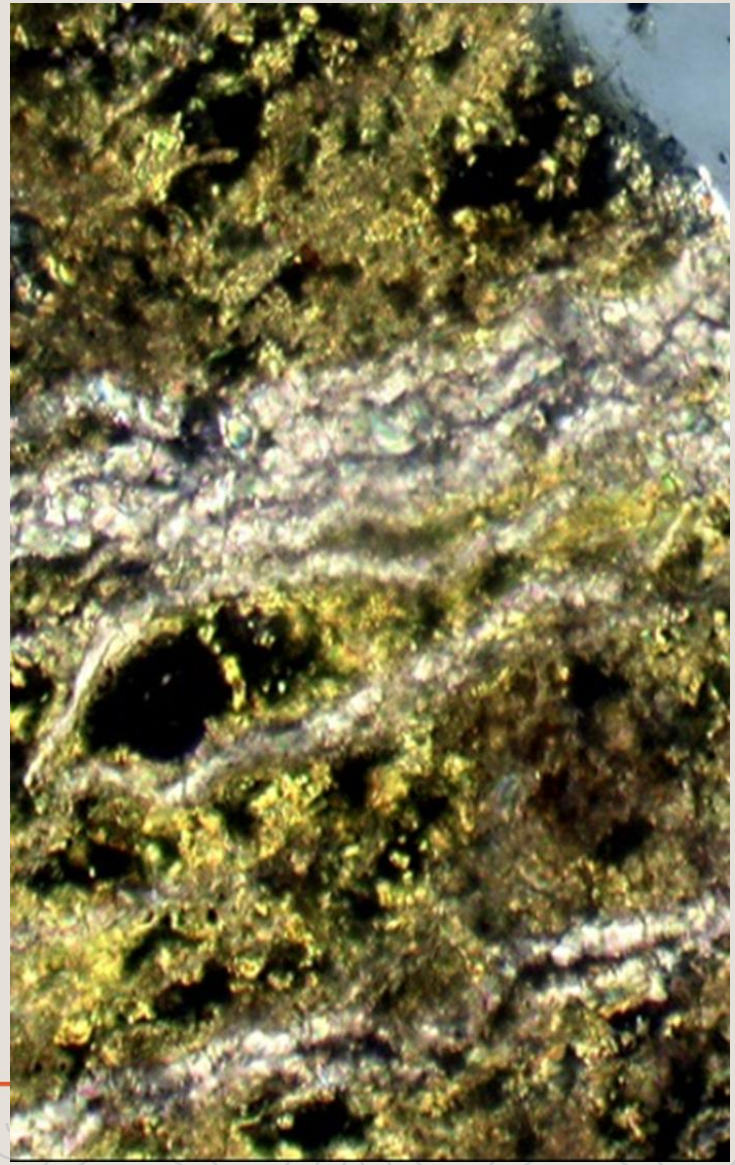
Water Vapor Transmission

Depending on the design and function of the wall, mortar joints can function to allow moisture, in the form of water vapor, to escape from the wall & allow the wall to dry out.



LIME MORTAR AUTOGENOUS HEALING

Lime-rich mortars are referred to as Autogenous or “self-healing”. This means that if small cracks occur in the mortar due to shrinkage during the initial cure or settlement of the structure, they have the capacity to be filled with new calcium material.



RUST JACKING

TRANSITIONAL MASONRY TYPES

- Brick/Stone with Imbedded Steel

SEMINAR OUTLINE

Historic structural masonry examples

Transition of structural masonry

Look at the history of masonry codes

Update on current masonry codes

Modern structural masonry components

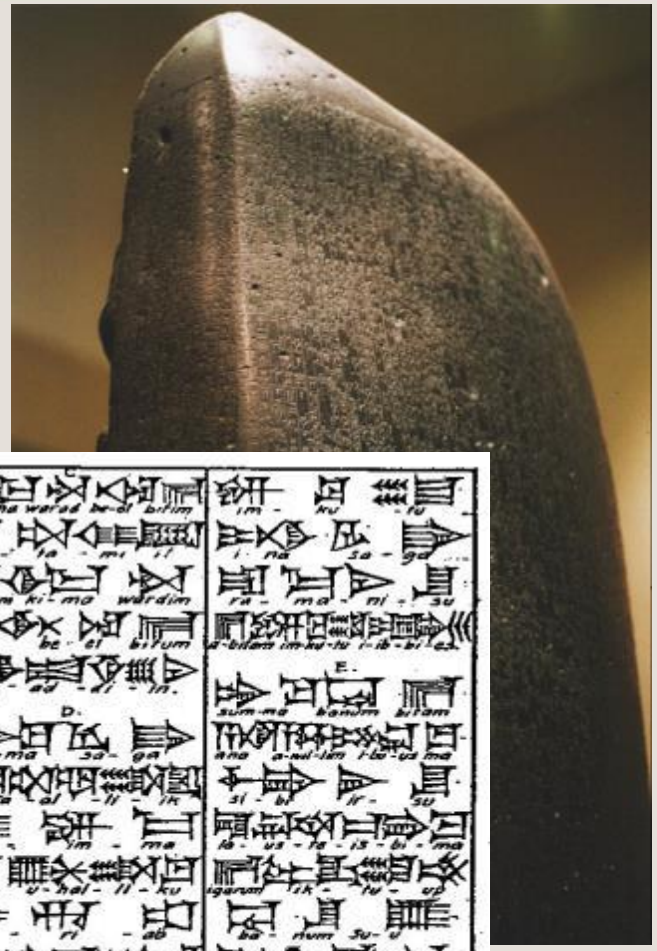
Examples of efficient structural designs

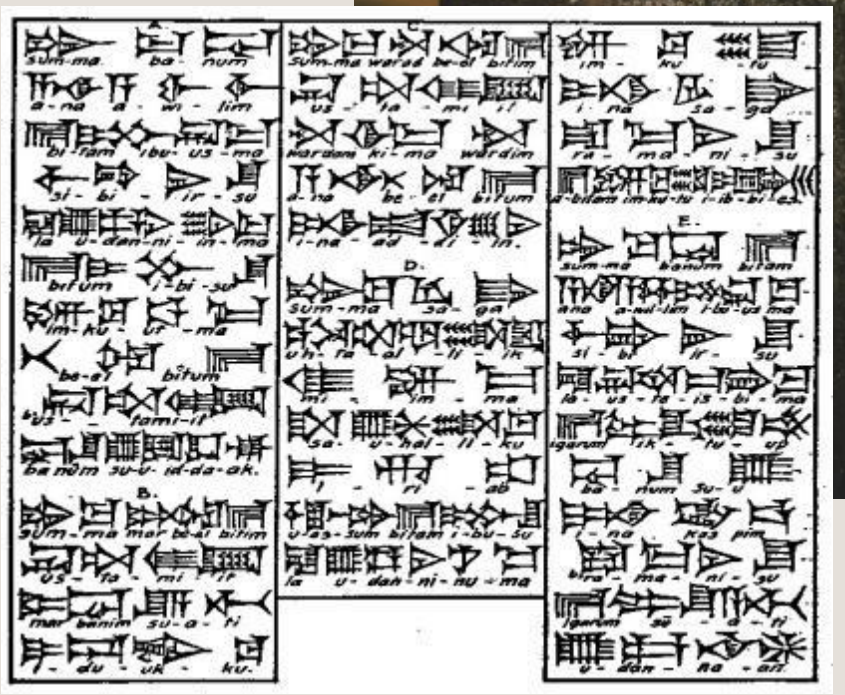
CODE OF HAMMURABI

First set of codified laws written in 1754 BC

“If a builder build a house for someone, and does not construct it properly, and the house which he built fall in and kill its owner, then that builder shall be put to death.”

“If it kill the son of the owner the son of that builder shall be put to death.”

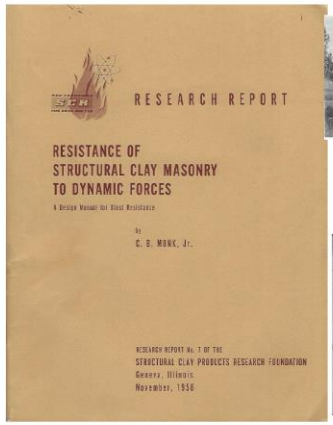




CONTEMPORARY MASONRY TIMELINE

- 1774 1st reinforced concrete building
- 1824 Portland cement invented
- 1850 industrial revolution (steel & concrete combined)
- 1890 cavity walls
- 1920's research on masonry structural behavior
- 1940's serious masonry study began
- 1950's recommended practices developed
- **1966 1st Engineered Masonry Code**
- 1974 1st movement joint code (Wisconsin)
- 1980's rain screen walls (Canada, Norway, Wisconsin)
- 2001 1st US air barrier code
- 2009 new masonry whole building analysis software

MASONRY TECHNOLOGY ADVANCING *1



Octagonal Test Fixture

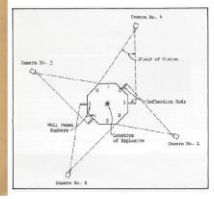
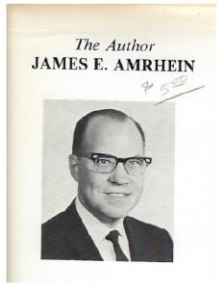
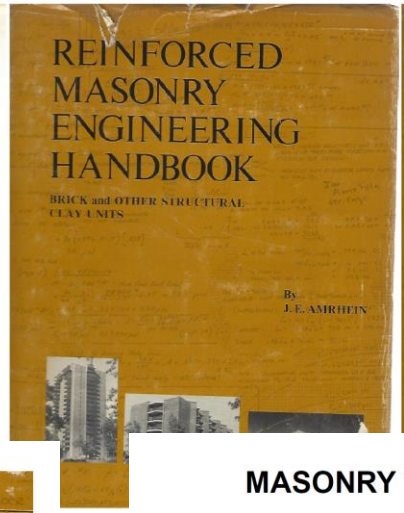
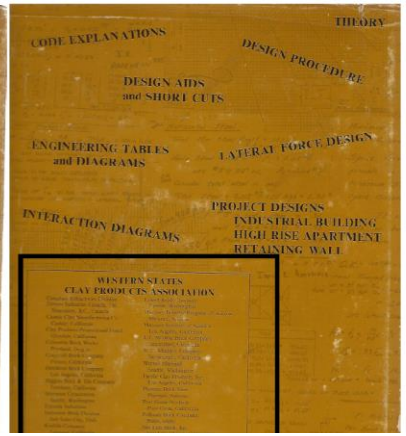


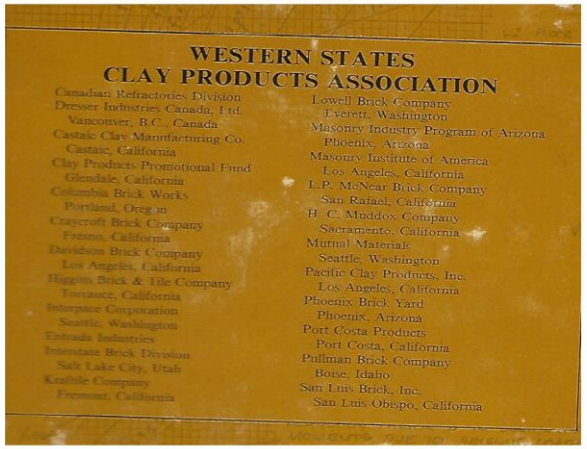
TABLE 2-2*
CONDITIONS OF FAILURE OF PEAK OVERPRESSURE – SENSITIVE ELEMENTS

Structural Element	Failure	Approximate Incident Blast Overpressure (psi)
Glass windows, large and small.	Shattering usually, occasional frame failure.	0.5–1.0
Corrugated asbestos siding	Shattering.	1.0–2.0
Corrugated steel or aluminum paneling.	Connection failure followed by buckling.	1.0–2.0
Wood siding panels, standard house construction.	Usually failure occurs at the main connections allowing a whole panel to be blown in.	1.0–2.0
Concrete or cinder-block wall panels 8 in. or 12 in. thick (not reinforced).	Shattering of the wall.	2.0–3.0
Brick Wall panel, 8 in. or 12 in. thick (not reinforced).	Shearing and flexure failures.	7.0–8.0



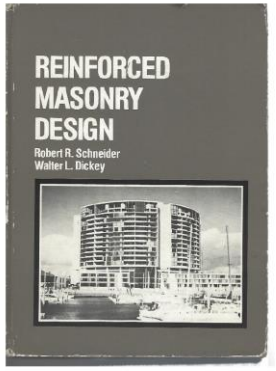






James E. Amrhein
1972

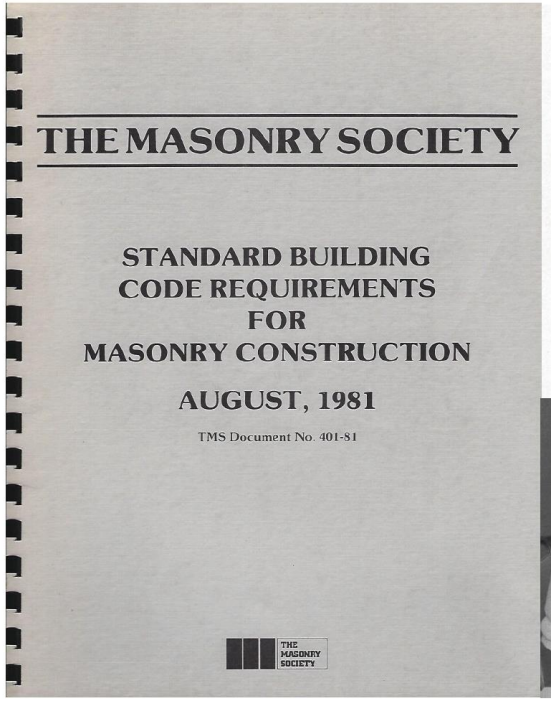
MASONRY TECHNOLOGY ADVANCING



Walt L. Dickey
1980

THE FIRST MASONRY STANDARD-(TMS) AUGUST 1981

THE FIRST STANDARD



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TMS Document No. 401-81

16

MASONRY STANDARDS JOINT COMMITTEE-MSJC

First published by the Masonry Standards Joint Committee in 1988

Developed by the Masonry Standards Joint Committee (MSJC)

THE MASONRY SOCIETY

Advancing the knowledge of masonry

The Masonry Society
105 South Sunset Street, Suite Q
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www.masonrysociety.org

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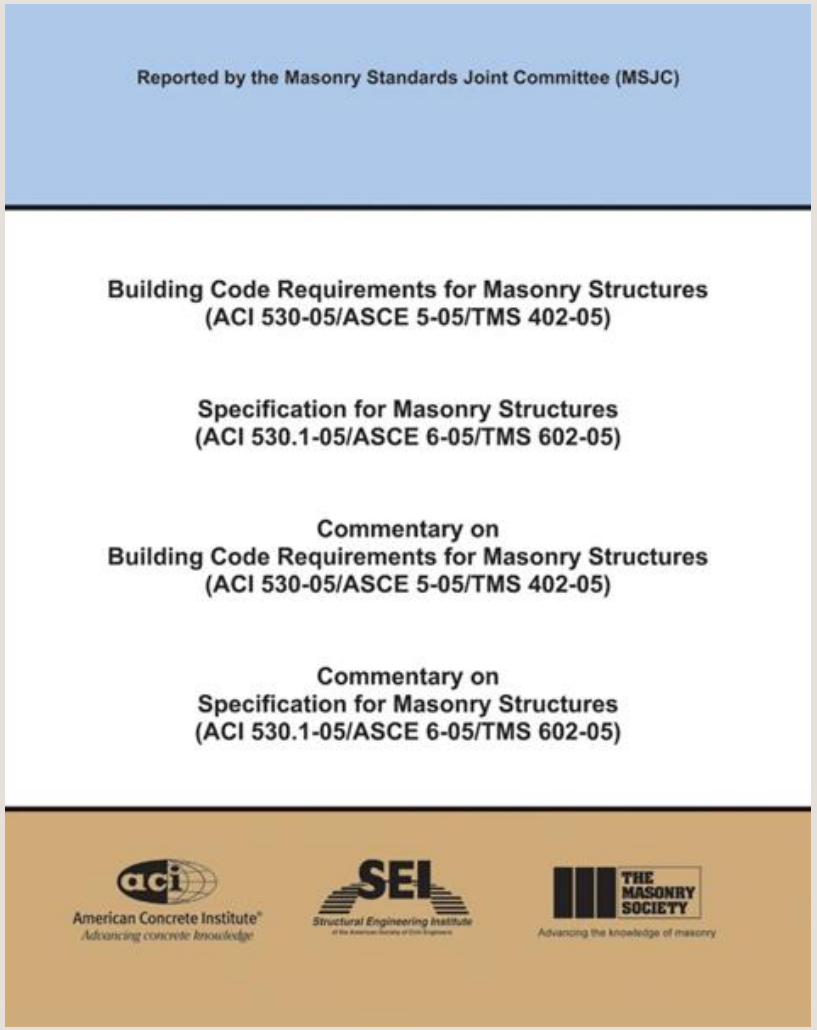
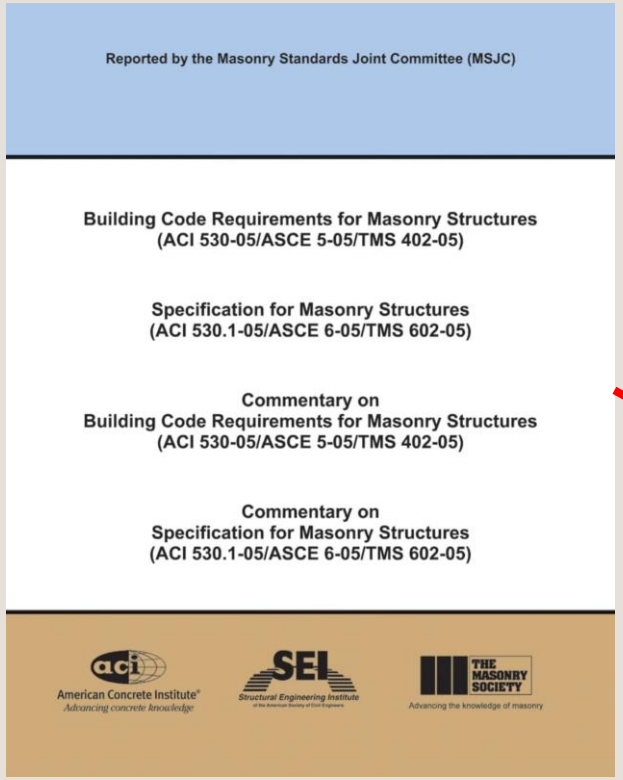
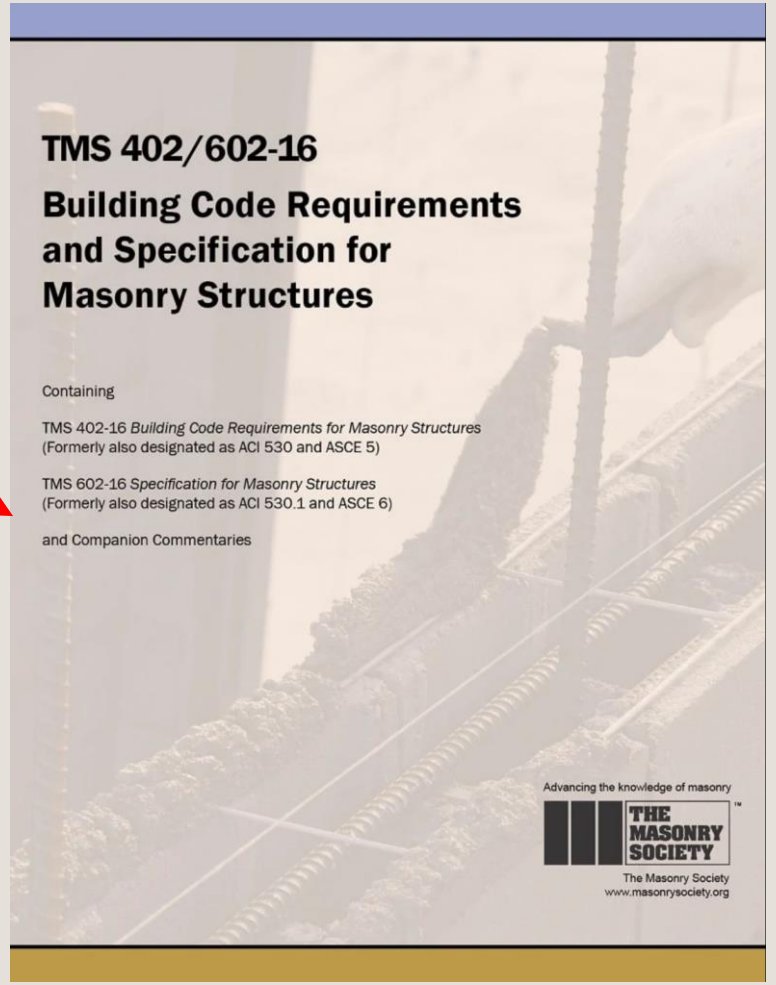


MSJC → TMS 402/602

- TMS-The Masonry Society 2013 publication





MSJC (Masonry Standards Joint Committee) Building Code Requirements and Specification for Masonry Structures

SEMINAR OUTLINE

Historic structural masonry examples

Transition of structural masonry

Look at the history of masonry codes

Update on current masonry codes

Modern structural masonry components

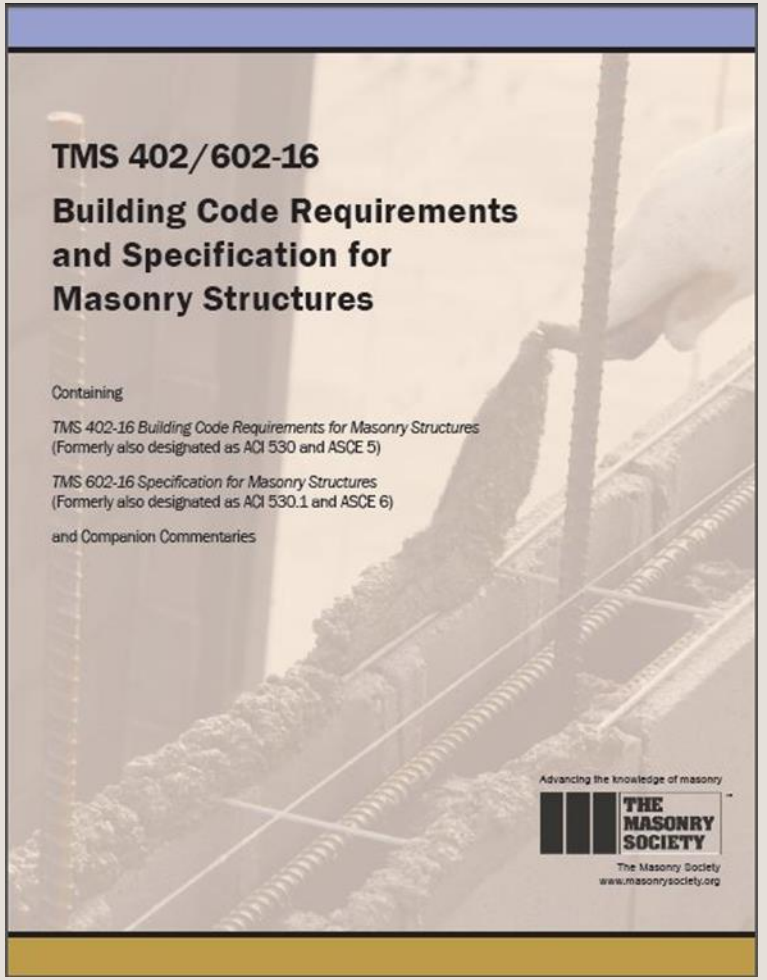
Examples of efficient structural designs

THE MASONRY SOCIETY – TMS 402/602

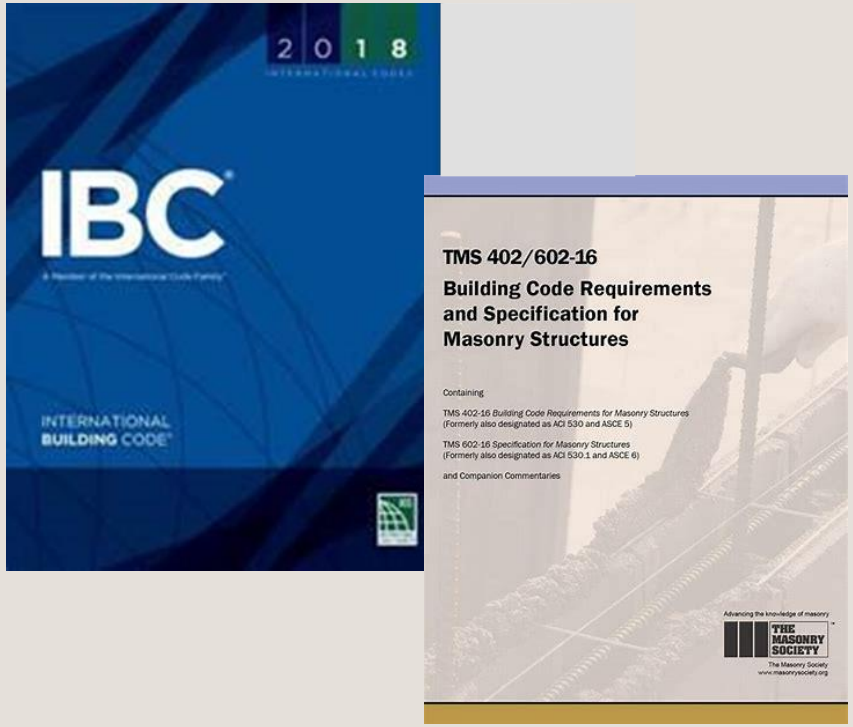
TMS 402/602 “Building Code Requirements and Specification for Masonry Structures” is a consensus document

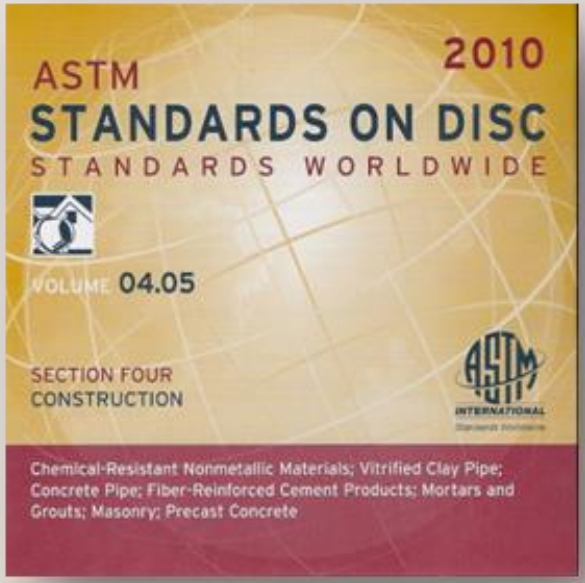
Mainly used for design of masonry structures, but has many installation requirements

Structural engineers should have a copy in their offices



MASONRY CODES, SPECIFICATIONS & STANDARDS

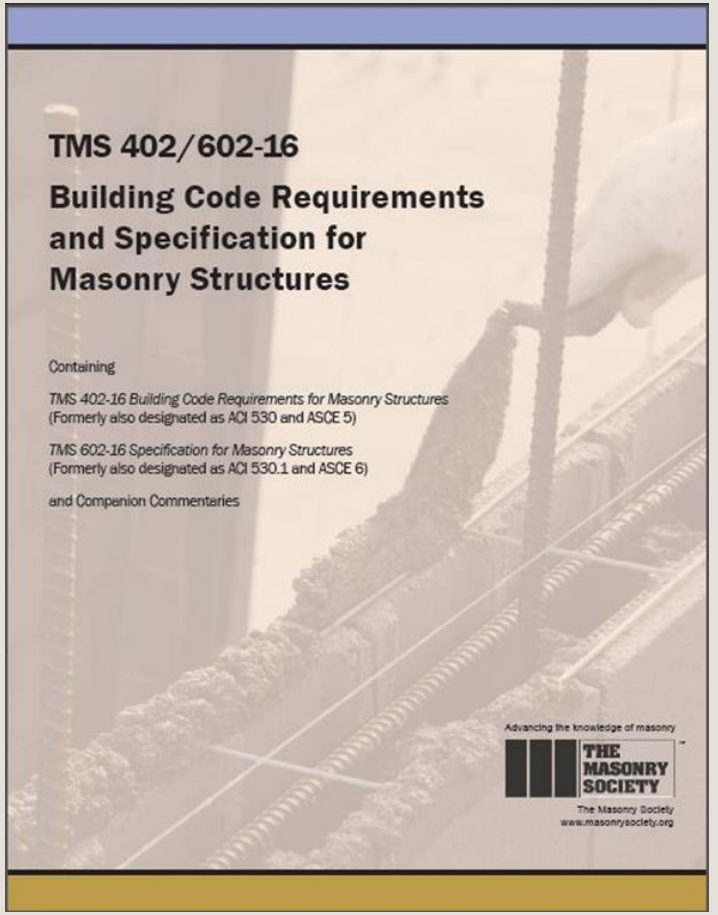




TMS 402/602 BUILDING CODE REQUIREMENTS AND SPECIFICATION FOR MASONRY

Referenced by IBC and IRC

Covers the design and construction of masonry

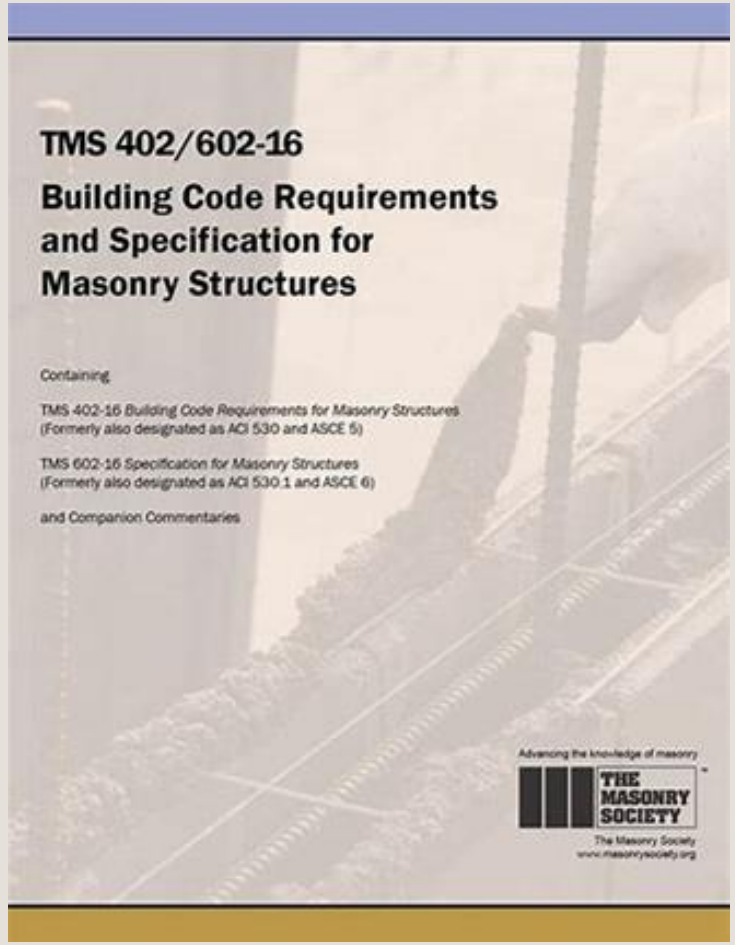


LET'S GET STARTED RIGHT

TMS 402/602 (Masonry Joint Standards Committee-MSJC Documents)

Building Code Requirements for Masonry Structures – TMS 402/ACI 530/ASCE 5

Specification for Masonry Structures – TMS 602/ACI 530.1/ASCE 6
Commentaries for each



International Building Code
Adopted by local jurisdictions
With or without amendments

ASTM Masonry Standards
More than 75 under the masonry committee's jurisdiction
Another 15 new ones under development

COMPANION DOCUMENTS

- Check the dates
- TMS date will be prior to the companion IBC
- ‘18 IBC goes with ‘16 MSJC, etc.
- Also check for local amendments

IBC CHAPTERS RELATED TO MASONRY

7 – Fire Resistant Materials and Construction

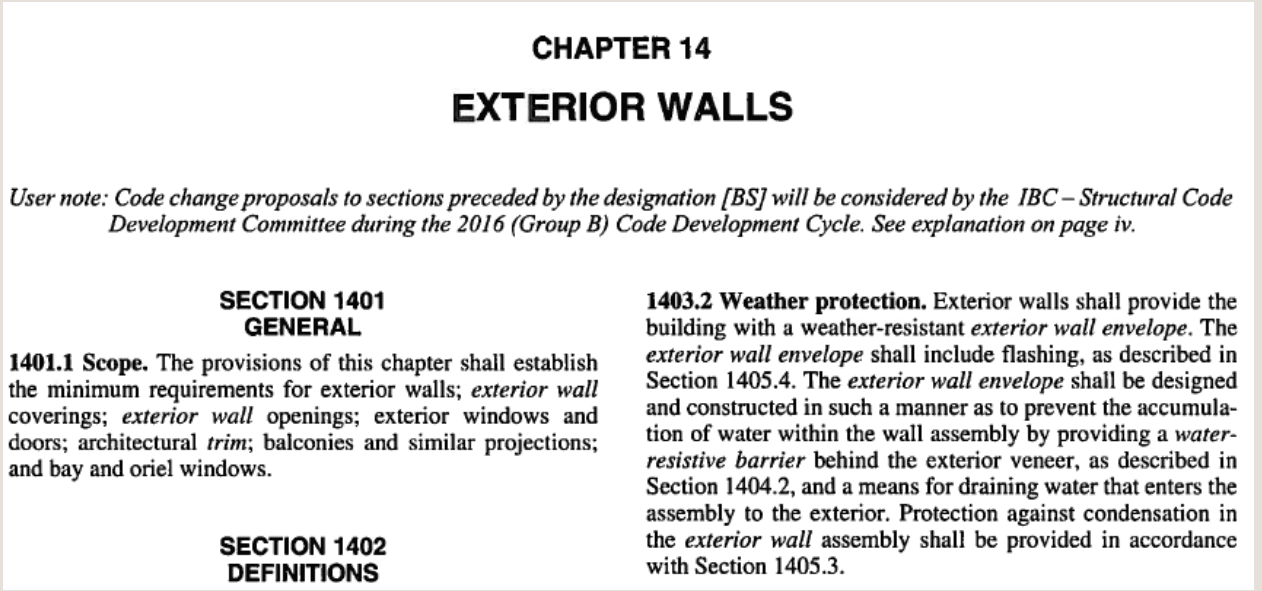
14 – Exterior Walls

16 – Structural Design Requirements (Loads)

17 – Structural Tests and Inspections

18 – Soils and Foundations

21 – Masonry



CHAPTER 14

EXTERIOR WALLS

User note: Code change proposals to sections preceded by the designation [BS] will be considered by the IBC – Structural Code Development Committee during the 2016 (Group B) Code Development Cycle. See explanation on page iv.

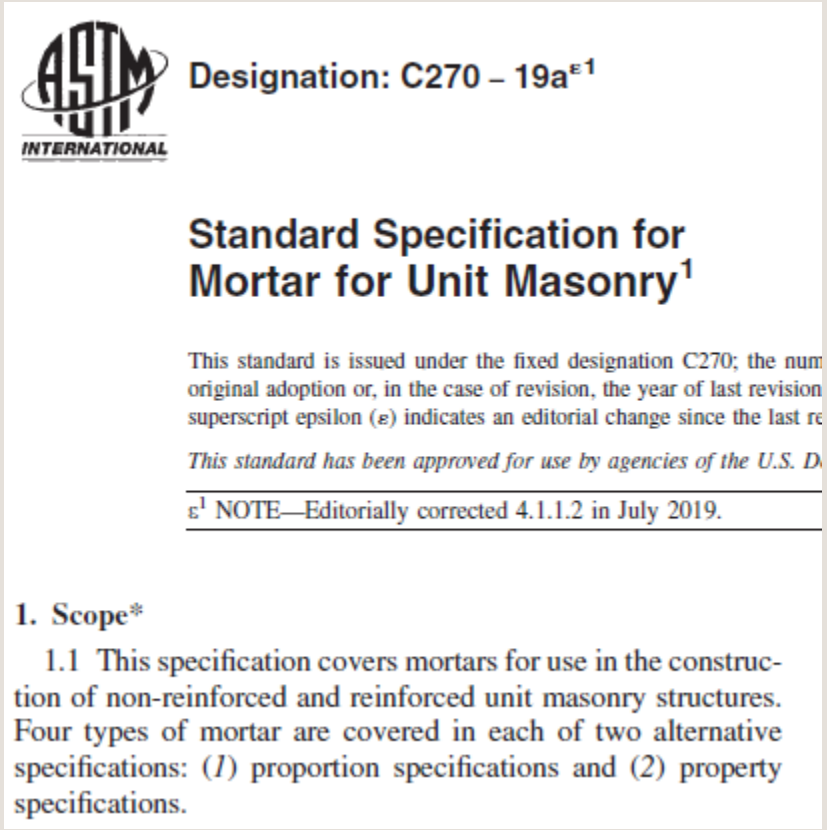
SECTION 1401
GENERAL

1401.1 Scope. The provisions of this chapter shall establish the minimum requirements for exterior walls; *exterior wall* coverings; *exterior wall* openings; exterior windows and doors; architectural *trim*; balconies and similar projections; and bay and oriel windows.

SECTION 1402
DEFINITIONS

1403.2 Weather protection. Exterior walls shall provide the building with a weather-resistant *exterior wall envelope*. The *exterior wall envelope* shall include flashing, as described in Section 1405.4. The *exterior wall envelope* shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a *water-resistive barrier* behind the exterior veneer, as described in Section 1404.2, and a means for draining water that enters the assembly to the exterior. Protection against condensation in the *exterior wall* assembly shall be provided in accordance with Section 1405.3.

MORTAR SPECIFICATIONS



Designation: C270 – 19a$^{\varepsilon 1}$

Standard Specification for Mortar for Unit Masonry[1]

This standard is issued under the fixed designation C270; the num
original adoption or, in the case of revision, the year of last revision
superscript epsilon (ε) indicates an editorial change since the last re

This standard has been approved for use by agencies of the U.S. D

ε[1] NOTE—Editorially corrected 4.1.1.2 in July 2019.

1. Scope*

1.1 This specification covers mortars for use in the construction of non-reinforced and reinforced unit masonry structures. Four types of mortar are covered in each of two alternative specifications: (*1*) proportion specifications and (*2*) property specifications.

ASTM C270, specify by….

Proportion Specification

--OR --

Property Specification

Do not specify (use) both

C270 – PROPORTION METHOD

Directs contractor to mix certain amounts of materials, based on Type of mortar selected

Specifier controls amounts of materials and may control type of material used

C270 – PROPERTY METHOD

Directs contractor to establish mortar mix with certain laboratory properties, based on Type of mortar selected

- Compressive strength
- Water retention
- Air content

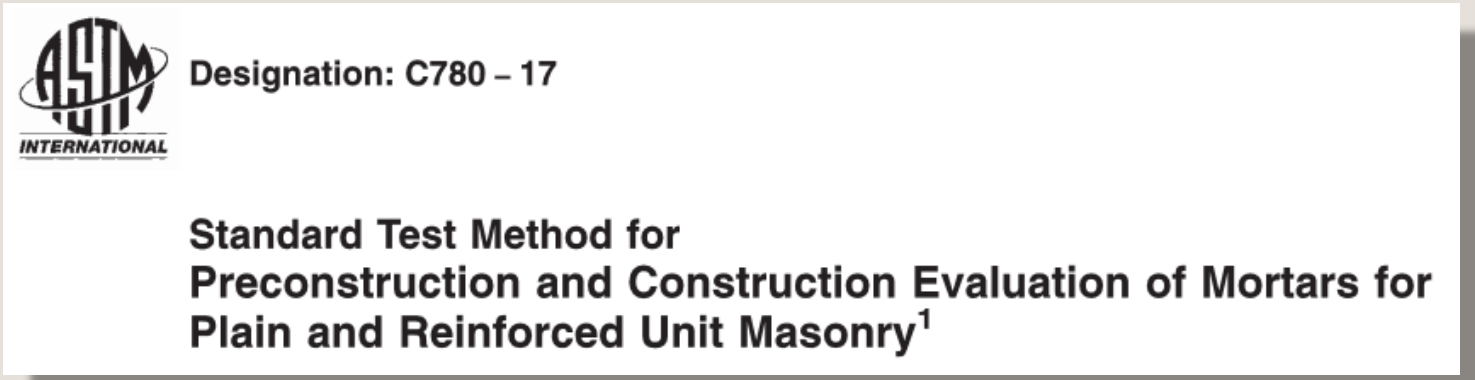
Contractor controls amounts of materials and may control type of material used

This method is not common

MORTAR SPECIFICATION AND QUALITY ASSURANCE


Designation: C270 – 14a

Standard Specification for
Mortar for Unit Masonry[1]


Designation: C780 – 17

Standard Test Method for
Preconstruction and Construction Evaluation of Mortars for
Plain and Reinforced Unit Masonry[1]

ASTM C270 - Think "Laboratory" (no values for field mortar testing)

ASTM C780 - *Think "Field" (sampling standard)*

C 780 does *not* validate C 270 values

SEMINAR OUTLINE

Historic structural masonry examples

Transition of structural masonry

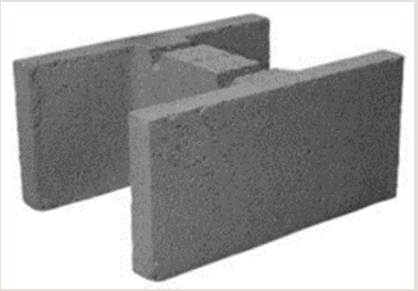
Look at the history of masonry codes

Update on current masonry codes

Modern structural masonry components

Examples of efficient structural designs

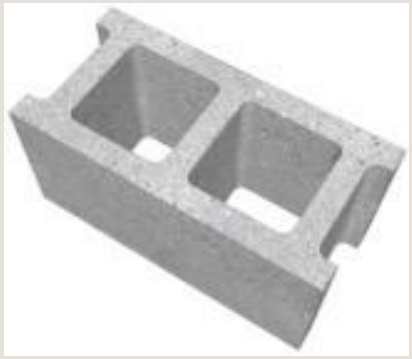
GOODBYE TO F'M = 1500 PSI & FEWER REBAR (maybe)



- This determines the thickness of masonry walls and how much rebar
- Moving from 1500 psi to 2000 psi in masonry codes
- What has changed?
  - Unit types and configurations have changed due to energy code requirements
  - Recalibration of compressive strengths in code
  - Manufacturers consistently exceed minimum block strengths

WHAT IS **F'M** ???

NEW VALUES IN TMS 2013



+

= f'm

individual CMU NET AREA psi		mortar type (Type S, N)		design strength of masonry
~~2,000 psi~~ (1)	+	Type S	=	~~2,000 psi~~
3,250 psi (2)	+	Type S	=	**2,500 psi**
4,500psi (3)	+	Type S	=	**3,000 psi**

STRUCTURAL IMPACTS

Stronger Assemblies… better constructability

18 ft tall wall 8 in. CMU 40 psf wind pressure, 3,000 lb/ft axial load

Table 2 – Design Impact of TMS 402/602 Revisions		
Code Edition[1]	Reinforcement Size	Reinforcement Spacing
2009 IBC[2]	No. 5	40 inches
2012 IBC[2]	No. 5	48 inches
2015 IBC[3]	No. 5	96 inches[4]

[1]The 2009, 2012, and 2015 editions of the IBC adopt the 2008, 2011, and 2013 editions of TMS 402/602, respectively.

[2]f'_m = 1,500 psi

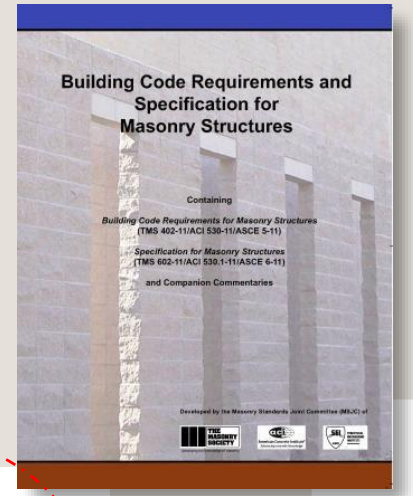
[3]f'_m = 2,000 psi

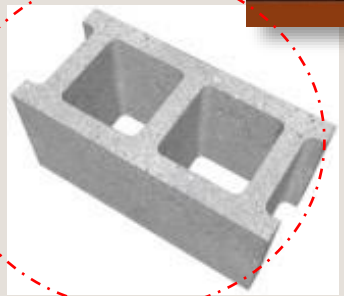
[4]Incorporating 9 gage bed joint reinforcement at 16 inches.

STRUCTURAL MASONRY DESIGN FACTORS IMPACTING EFFICIENT DESIGN

Cost

f'm - masonry design strength





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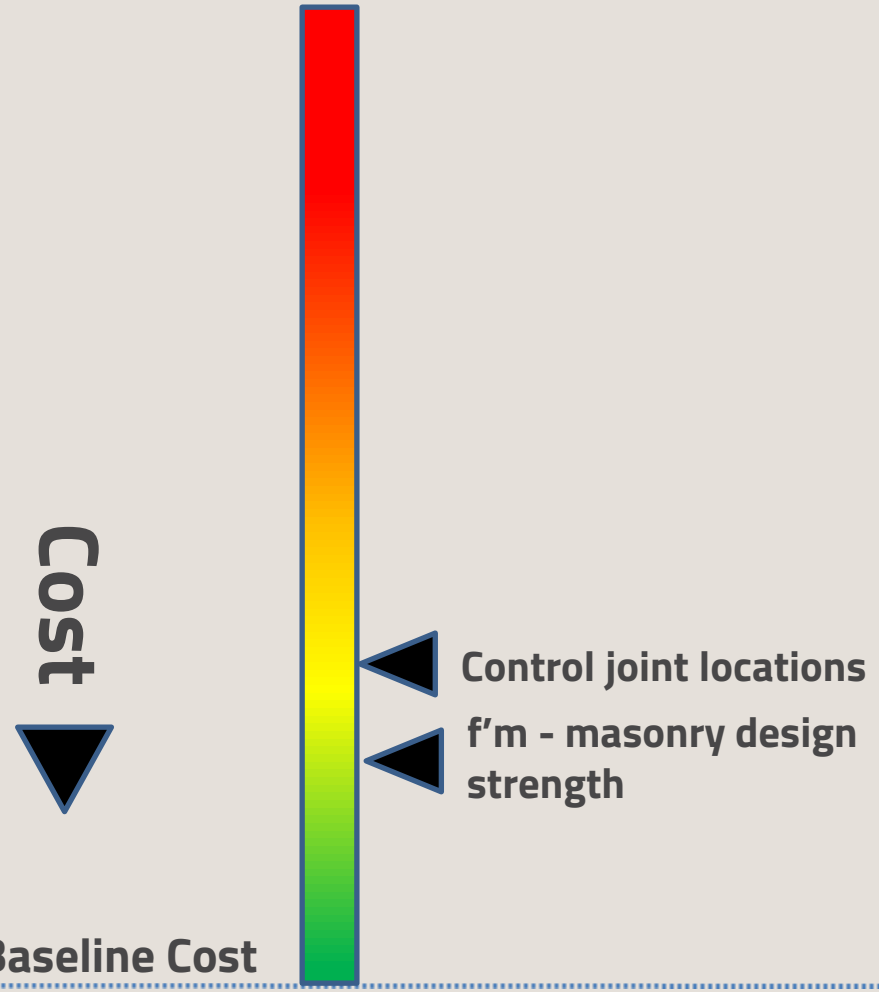
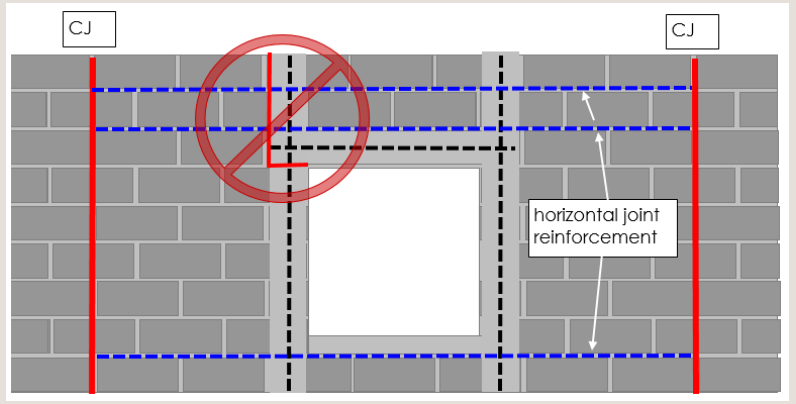
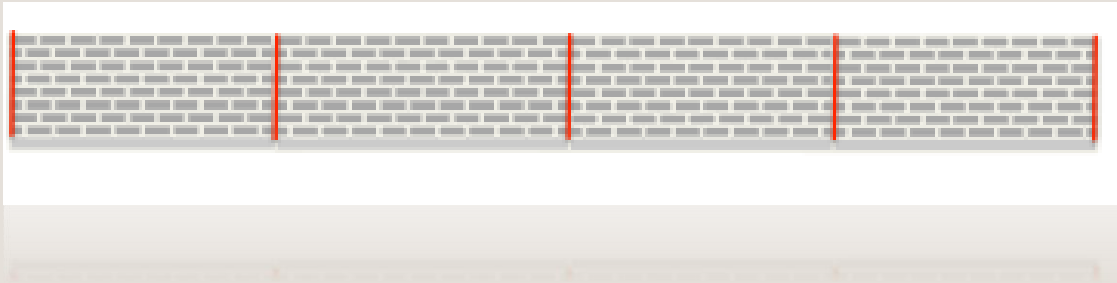
Baseline Cost Efficient Design

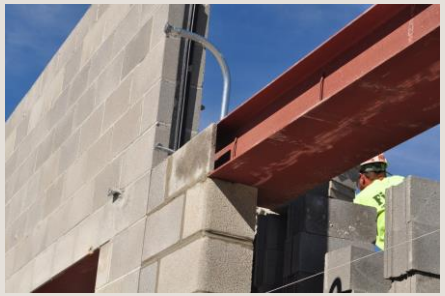
Structural Masonry Design factors impacting efficient design

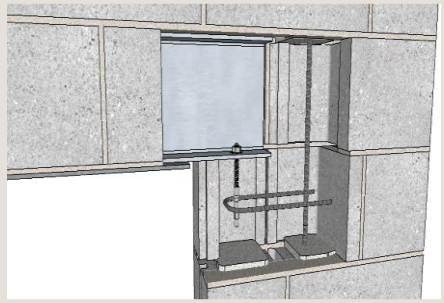




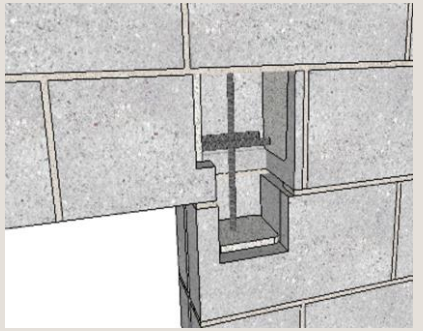


Structural Masonry Design factors impacting efficient design





--Versus--



Structural Masonry Design factors impacting efficient design

Cost

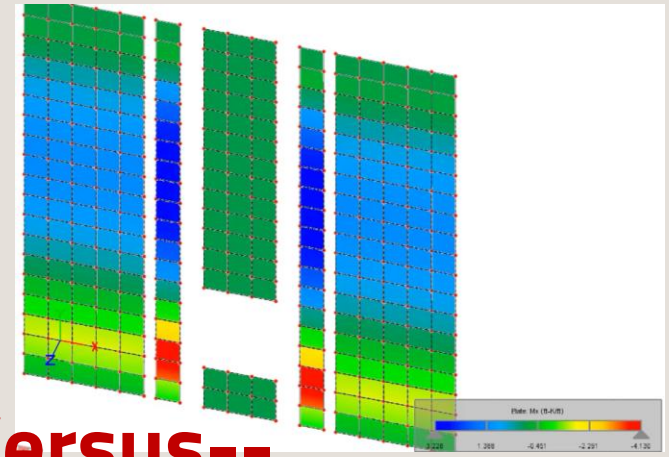
Software

Steel vs masonry lintels

Control joint locations

f'm - masonry design strength

Baseline Cost
Efficient Design



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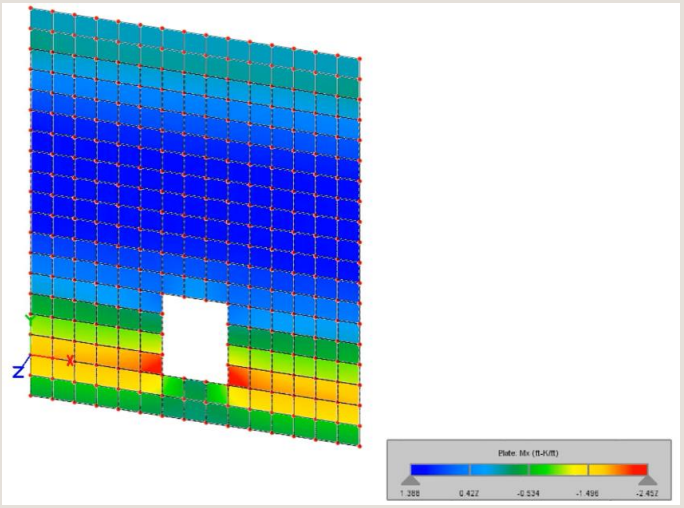
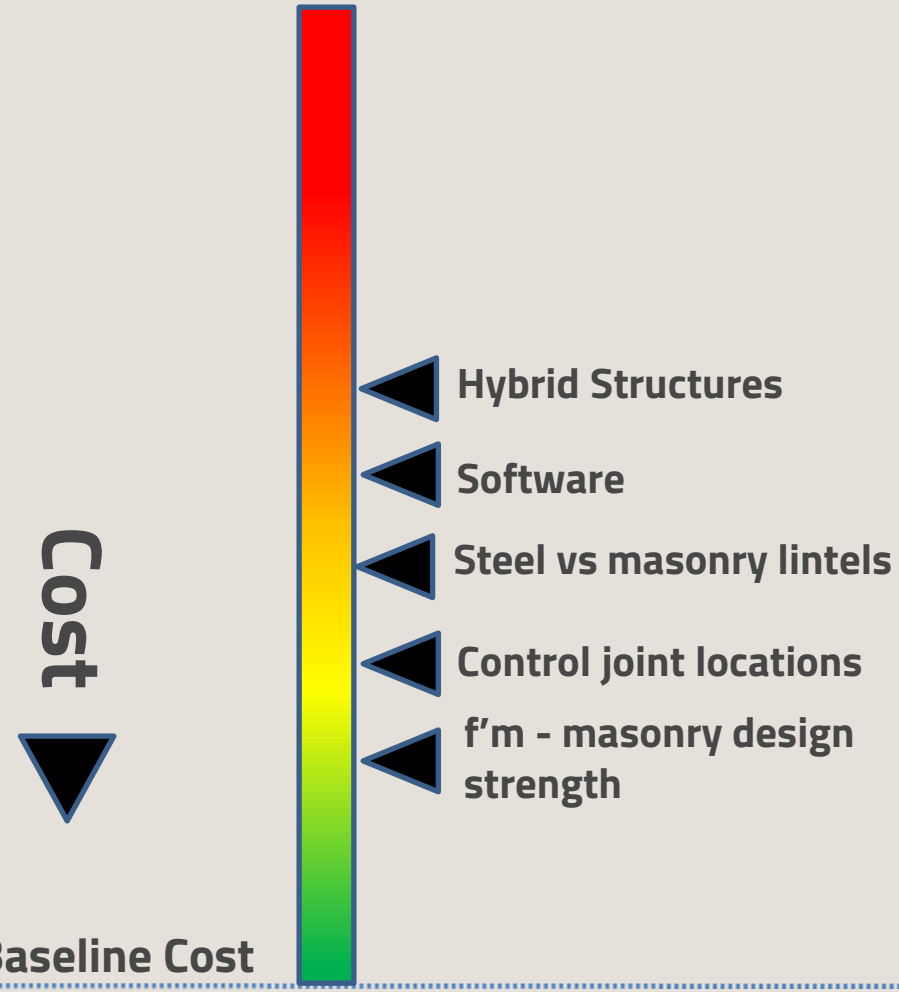
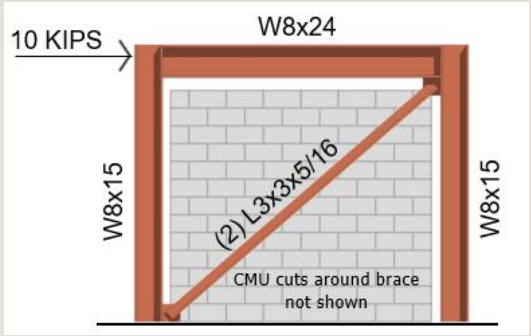
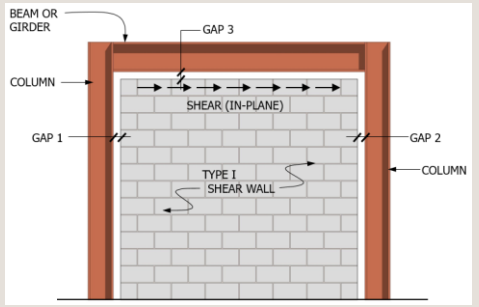


Structural Masonry Design factors impacting efficient design

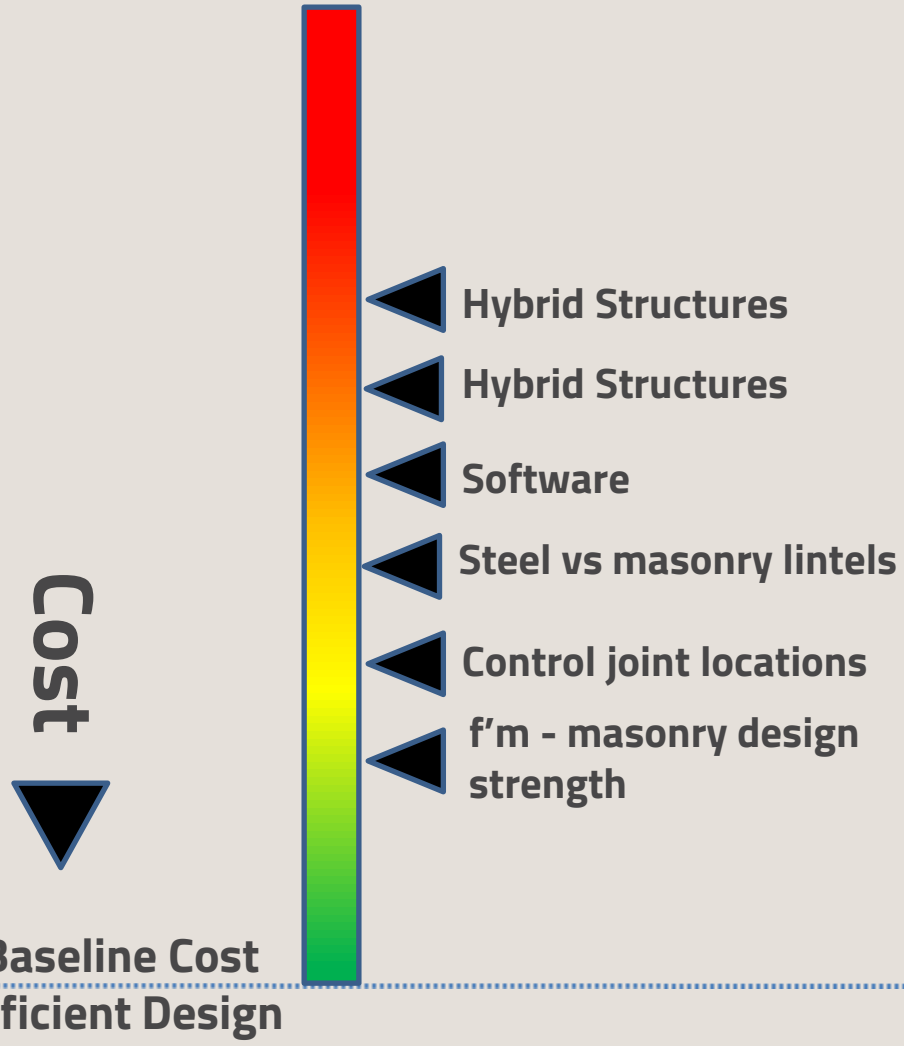




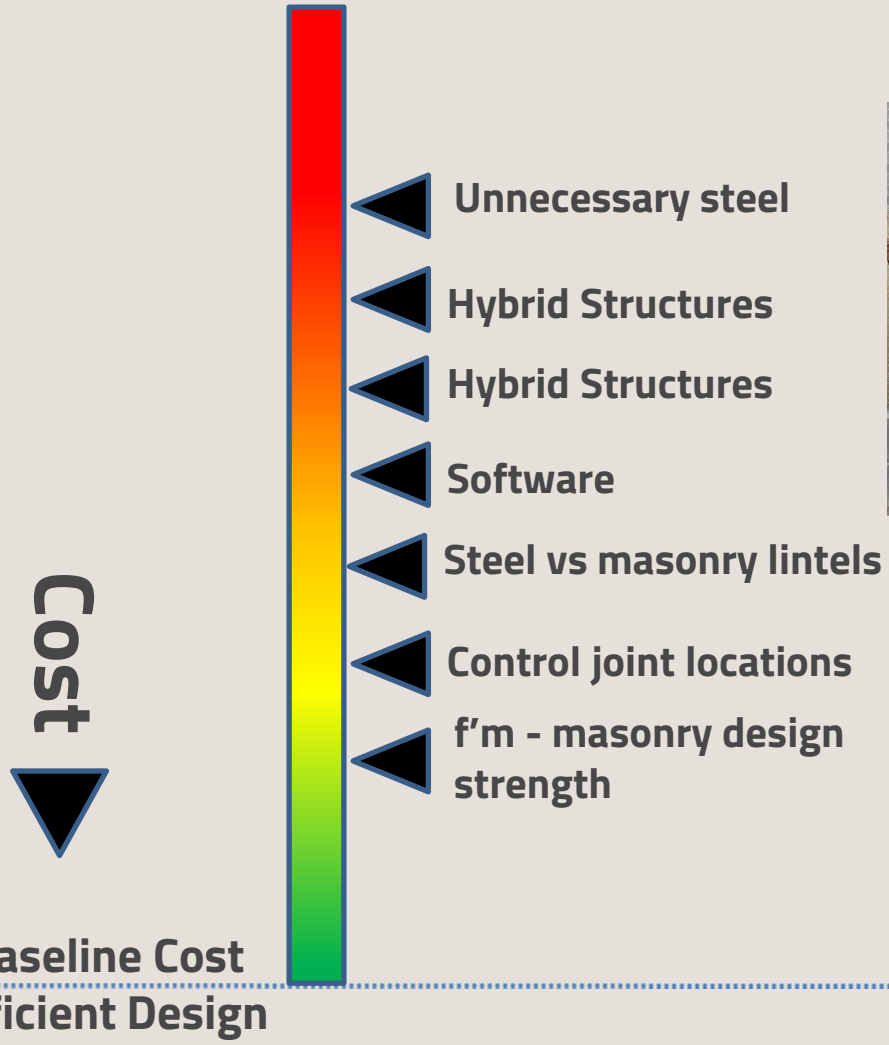
--Versus--



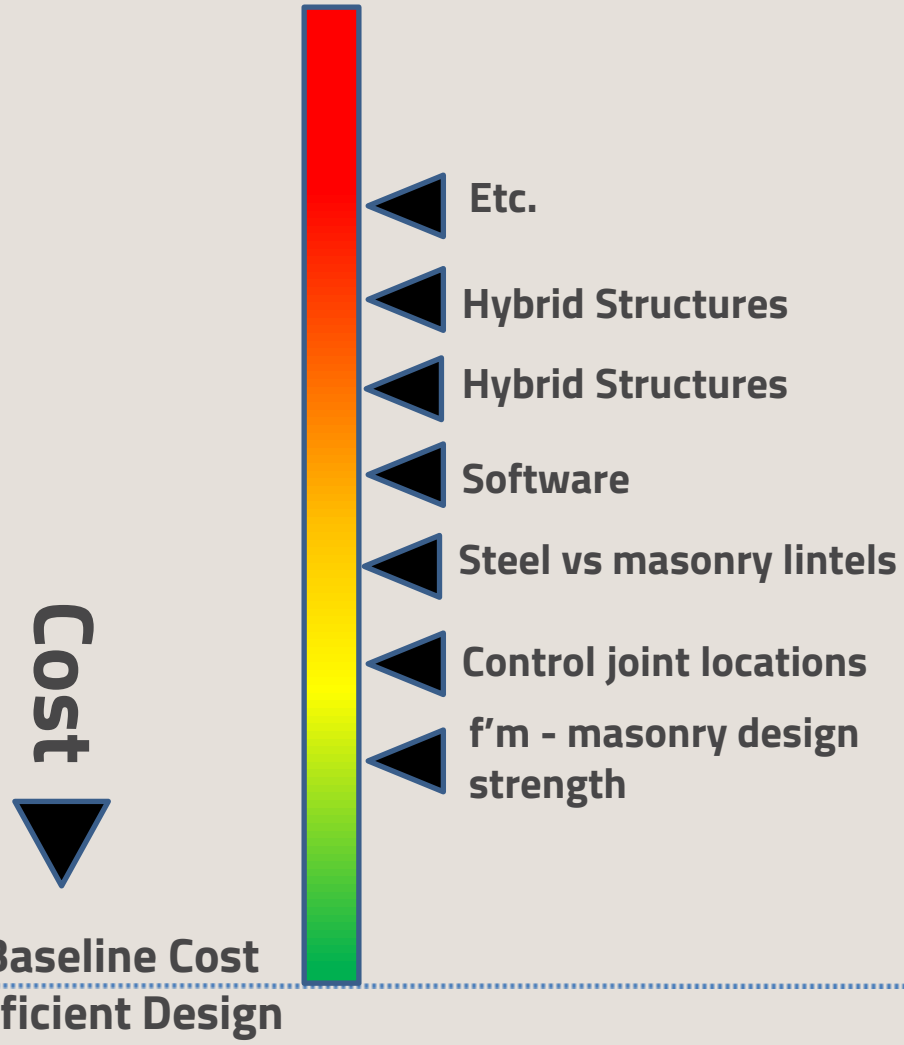
Structural Masonry Design factors impacting efficient design



Structural Masonry Design factors impacting efficient design



Structural Masonry Design factors impacting efficient design



High-strength structural loadbearing masonry in tall buildings

An economical and proven building system, high-strength masonry is gaining popularity in high-rise buildings

By John A. Koski

A hundred years ago, if you wanted to build a 16-story, loadbearing masonry building you needed to specify 6-foot-thick ground-floor walls. Today, you can put up that same building with only 8- or 12-inch-thick walls.

The dramatic reduction in required loadbearing wall thickness was made possible by using high-strength masonry units and steel reinforcement. Though reinforcing steel had long been used in tall poured-concrete structures, it was not until the 1950s that the technology was adapted to loadbearing masonry construction.

In 1966, loadbearing structural masonry in tall buildings reached a significant milepost when it was used in seismic zone 4 to construct San Diego's eight-story Hanalei Hotel. Since then, loadbearing masonry buildings have been erected in numerous cities in Seismic Zones 3 and 4.

Because of this, many architects and engineers view reinforced loadbearing masonry as a specialized type of construction used primarily in seismic areas and hurricane-force wind zones. However, its many advantages make it suitable for loadbearing walls in high-rise buildings in any locale. Prior to the Hanalei, for example, 17-story Park Mayfair Apartments in Denver—was in Seismic Zone 1—was constructed in 1960 of reinforced loadbearing masonry.

Because it is both wall and structure, reinforced loadbearing masonry is an all-in-one system that not only reduces construction time and lowers costs but also provides excellent weather protection, subdivides interior space, provides superior fire resistance, forms acoustic barriers, and has thermal mass.

How it came about

Several key developments helped make high-rise structural masonry possible. These include changes in building code requirements, the use of prism testing, the development of high-strength concrete block and hollow structural brick, and building design concepts.

Code requirements. Until the 1960s, loadbearing masonry used empirical codes based on experience and observation. These codes often had very high safety factors built in because little testing was done to determine accurate and safe minimum requirements.

This changed when building codes began to use rational analysis. This new method allowed needed wall thicknesses and masonry strengths to be determined by testing, not by experience. In addition to testing, rational analysis made use of design formulas and other engineering principles.

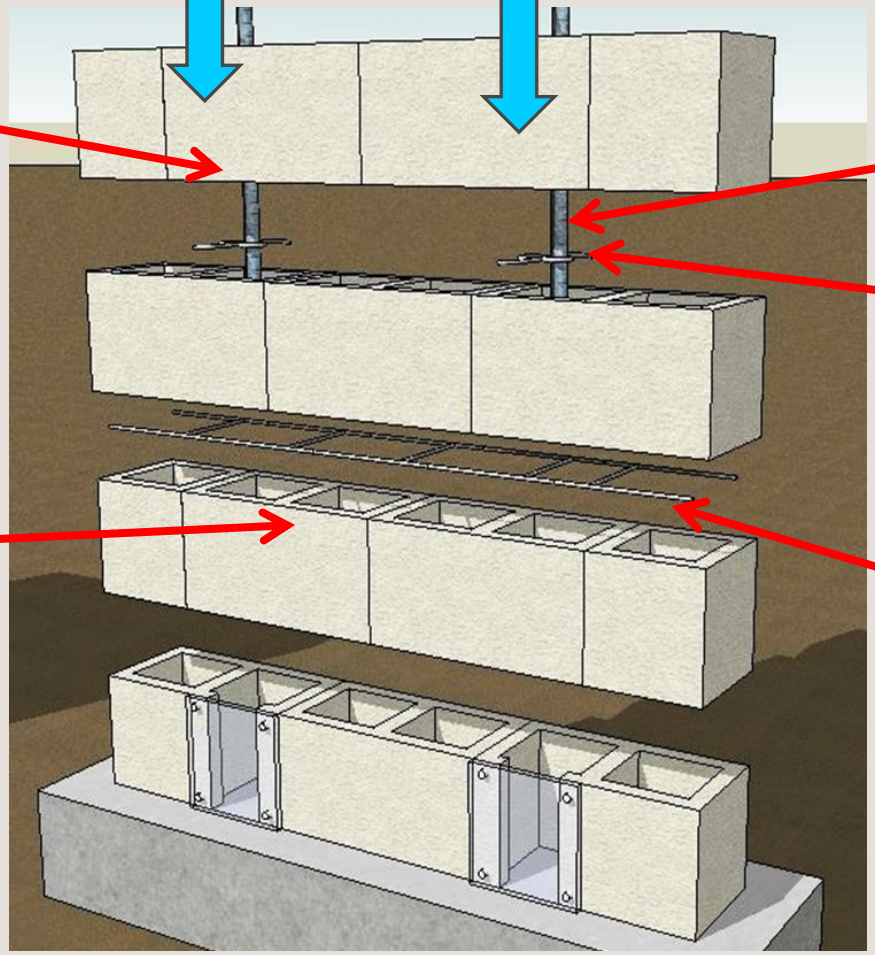
According to the Hanalei's architect, John Mock, the use of 8-inch, high-strength block in the Hanalei was possible due to major building code changes based on rational analysis (Ref.1). Specifically, he notes the 1964 *Uniform Building Code (UBC)*, which increased allowable loadbearing block strength to 3000 psi from 1500 psi.

Prism testing. A masonry prism test determines the compressive strength of masonry materials in combination by loading them to failure, rather than by estimating the strength they will develop. The compressive strength of a masonry prism is sometimes defined as $f'm$ and is given in pounds per square inch.

Masonry prisms generally consist of two or more stacked masonry units made of the same materials and under the same conditions as those of the actual wall. Three principal factors affect the compressive strength of a prism: the compressive strength of individual masonry units, the strength of mortar and grout, and the quality of workmanship. Prisms are a test of masonry strength only; reinforcing steel is not placed in them.

Though prism testing may gen-

MASONRY LOADBEARING **SYSTEM**



concrete masonry unit (CMU)

rebar

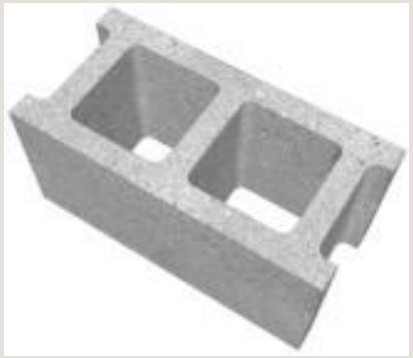
rebar positioners

mortar

horizontal joint reinforcement

WHAT IS **F'M** ???

NEW VALUES IN TMS 2013



+

= f'm

individual CMU NET AREA psi		mortar type (Type S, N)		design strength of masonry
~~2,000 psi~~ (1)	+	Type S	=	~~2,000 psi~~
3,250 psi (2)	+	Type S	=	**2,500 psi**
4,500psi (3)	+	Type S	=	**3,000 psi**

CMU TEST REPORTS

Designation: C90 – 16a

Standard Specification for
Loadbearing Concrete Masonry Units[1]

1. Scope[2]

1.1 This specification covers hollow and solid (see 5.3 and 5.4) concrete masonry units made from hydraulic cement, water, and mineral aggregates with or without the inclusion of other materials. There are three classes of concrete masonry units: Normal Weight, Medium Weight, and Lightweight. These units are suitable for both loadbearing and nonloadbearing applications.

1.2 Concrete masonry units covered by this specification are made from lightweight or normal weight aggregates, or both.

Note 1—The requirements of this specification have been researched, evaluated, and established for over a century, resulting in the physical properties and attributes defined here. These requirements are uniquely and entirely applicable to concrete masonry units manufactured on equipment using low or zero slump concrete and the constituent materials defined herein. Many performance attributes of concrete masonry units are inherently accounted for, or inherently reflected within, the requirements of this specification without direct measurement, assessment, or evaluation. Applying the requirements of this specification to products that may be similar in appearance, use, or nature to those covered by this specification may not address all pertinent physical properties necessary to ensure performance or serviceability of the resulting construction in end-use applications under typical exposure environments. Products manufactured using alternative materials, manufacturing methods, or curing processes not covered by this specification should not be evaluated solely using the requirements in this specification; however, development of new products can consider the property requirements of this specification as a beginning benchmark for unit performance. It is reasonable to use new products for system performance as well as unit performance.

1.3 The text of this specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

Note 2—When particular features are desired such as surface texture, for appearance or load, birds, cores, or particular properties such as density classification, higher compressive strength, fire resistance, thermal performance or acoustical performance, these features should be specified separately by the purchaser. Suppliers should be consulted as to the availability of units having the desired features.

2. Referenced Documents

2.1 *ASTM Standards*[3]

C33/C33M Specification for Concrete Aggregates

C140/C140M Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

C150/C150M Specification for Portland Cement

C331/C331M Specification for Lightweight Aggregates for Concrete Masonry Units

C426 Test Method for Linear Drying Shrinkage of Concrete Masonry Units

C595/C595M Specification for Blended Hydraulic Cements

C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C979/C979M Specification for Pigments for Integrally Colored Concrete

C989/C989M Specification for Slag Cement for Use in Concrete and Mortars

C1157/C1157M Performance Specification for Hydraulic Cement

C1232 Terminology of Masonry

C1240 Specification for Silica Fume Used in Cementitious Mixtures

C1314 Test Method for Compressive Strength of Masonry Prisms

E519/E519M Test Method for Diagonal Tension (Shear) in Masonry Assemblages

E72 Test Methods of Conducting Strength Tests of Panels for Building Construction

3. Terminology

3.1 Terminology defined in Terminology C1232 shall apply for this specification.

[1] This specification is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.03 on Concrete Masonry Units and Related Units.

[2] Current edition approved Dec. 15, 2016. Published January 2017. Originally approved in 1931. Last previous edition approved in 2016 as C90 – 16. DOI: 10.1520/C0090-16A.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

8. Sampling and Testing

8.1 The purchaser or authorized representative shall be accorded proper facilities to inspect and sample the units at the place of manufacture from the lots ready for delivery.

8.2 Compressive strength, absorption, density, and dimensional tolerances shall be based on tests of concrete masonry units of any configuration or dimension made with the same materials, concrete mix design, manufacturing process, and curing method, conducted in accordance with Test Methods C140/C140M and not more than 12 months prior to delivery.

8.3 Total linear drying shrinkage shall be based on tests of concrete masonry units of any configuration or dimension made with the same materials, concrete mix design, manufacturing process, and curing method, conducted in accordance with Test Method C426 and not more than 24 months prior to delivery.

CMU BLOCK STRENGTH RESULTS
39

MINIMUM STRENGTH
3020

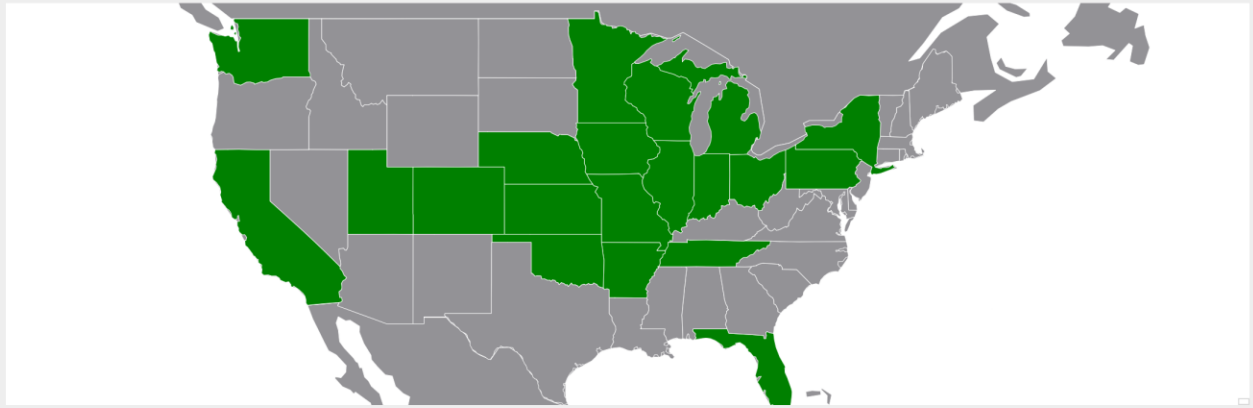
AVERAGE STRENGTH
4294

MAXIMUM STRENGTH
7870

CHANGE STATES, BLOCK TYPE, AND YEAR RANGE TO UPDATE CMU STATISTICS

States

AR × CA × CO ×
FL × IA × IL × IN ×
KS × MI × MN ×
MO × NE × NY ×
OH × OK × PA ×
TN × UT × WA ×
WI ×



YEARS

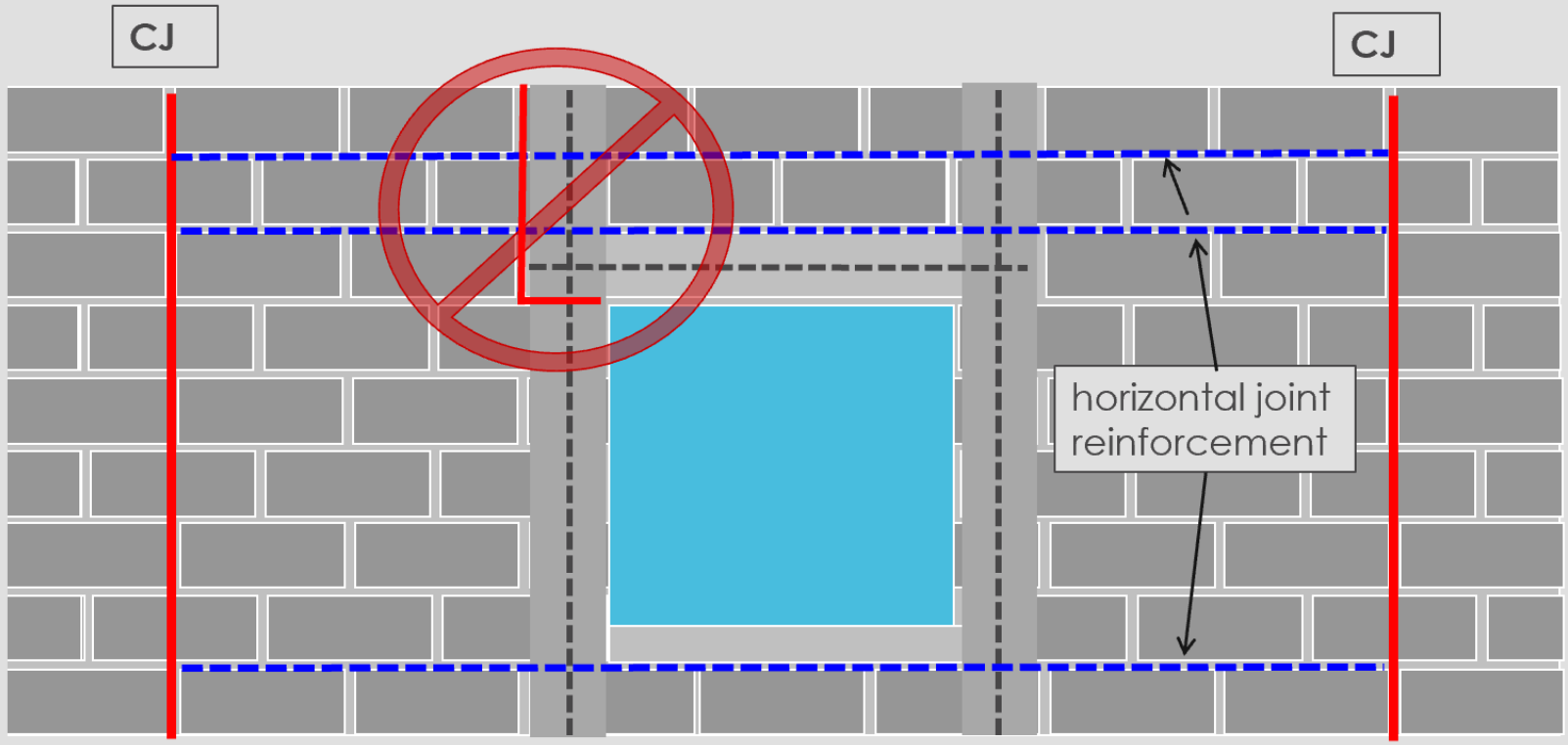
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017

BLOCK TYPE

NORMAL WEIGHT

4 6 8 10 12 14 16

CJ PLACEMENT IS CHANGING DUE TO REBAR PLACEI

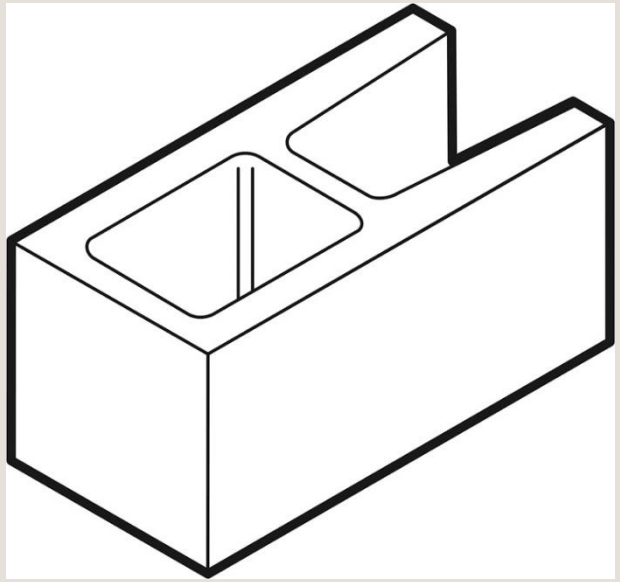


the horizontal portion of the control joint is **pinned** by the vertical reinforcement and will not allow movement

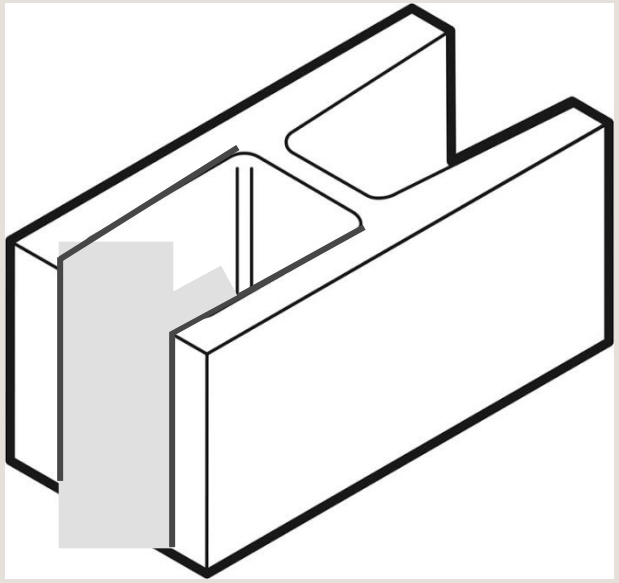
source: National Concrete Masonry Association (NCMA), TEK 10-2C (2010) & 10-3 (2003)

(1) unless spacing exceeds recommended distance. If this applies, locate either side of openings

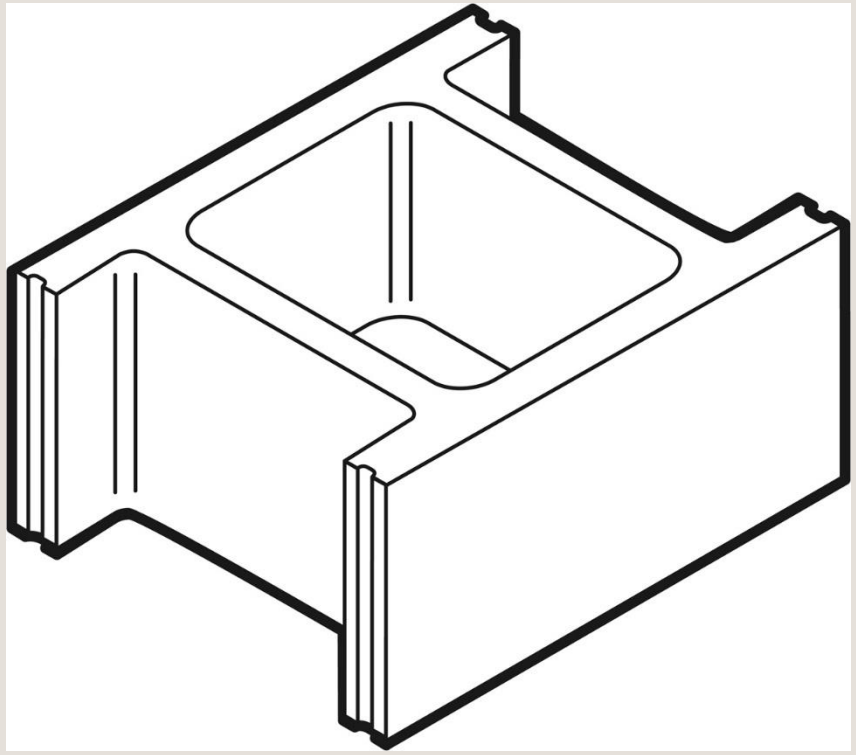
NEWER CMU SHAPES



A-Block



H-Block

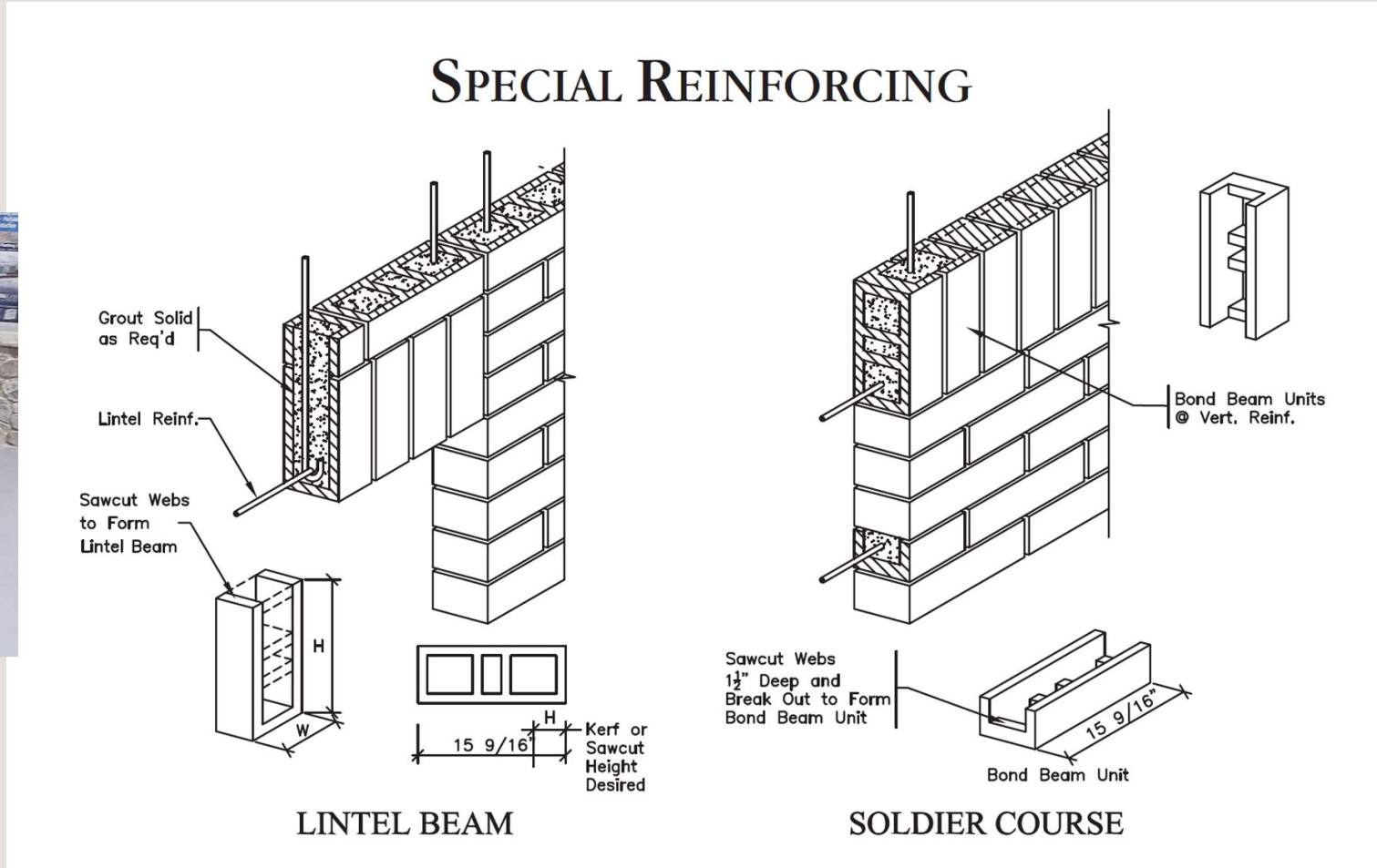


Open-Cell

H-BLOCK

STRUCTURAL BRICK

STRUCTURAL BRICK LINTELS



SEMINAR OUTLINE

Historic structural masonry examples

Transition of structural masonry

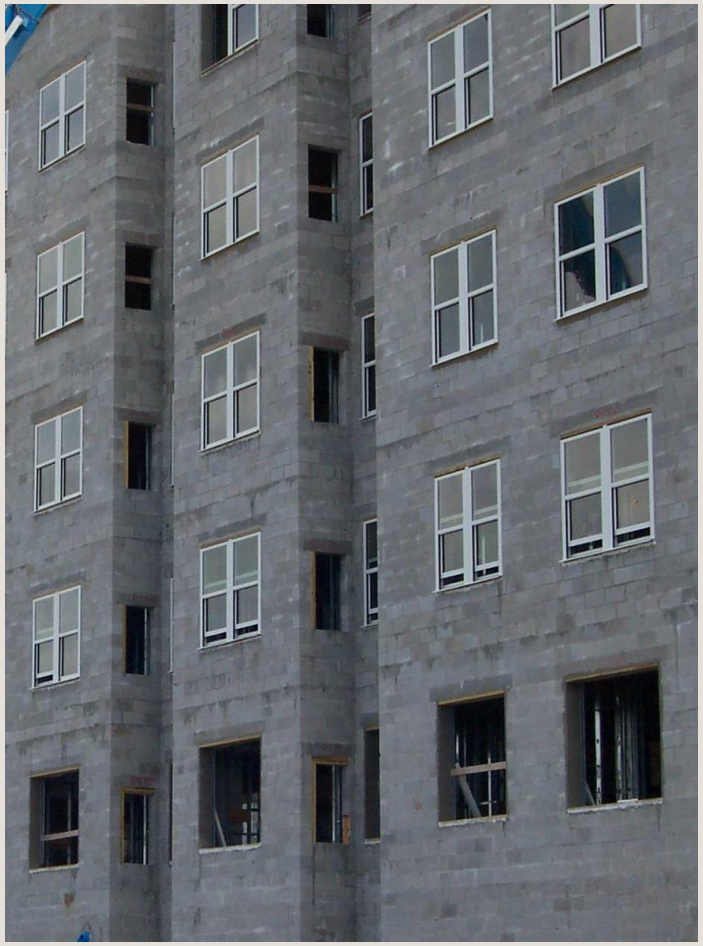
Look at the history of masonry codes

Update on current masonry codes

Modern structural masonry components

Examples of efficient structural designs

CMU WALLS

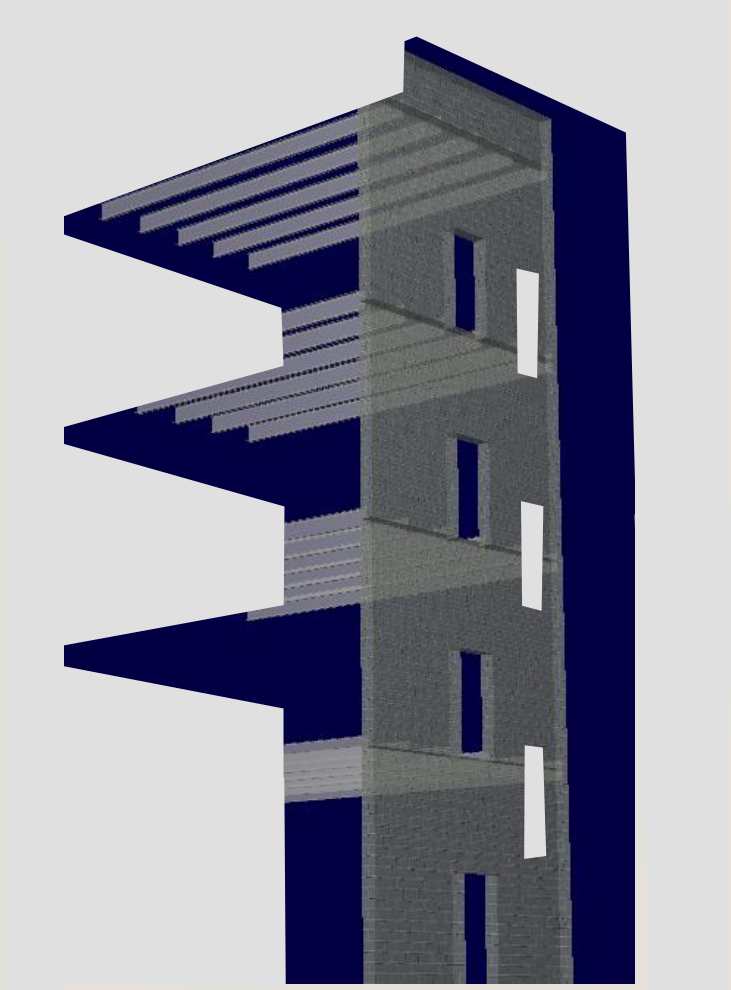


- loadbearing, non-loadbearing, or infill
- **simplified** footings/foundation

  withstands elements during construction
- **safe, quiet, secure**
- cladding can connect anywhere on wall
- **adds** thermal mass to building
  - lower energy bills
  - increased occupant comfort
- **less** continuous insulation needed, per prescriptive energy codes (1)
- opportunities to accelerate construction schedule with quick start & efficient design

(1) compared to "frame" construction

F'M COST ANALYSIS STUDY (1)



4-story tall wall

12' floor-to-floor

f'm 1,500 = 12" CMU

f'm 2,250 = 8" or 10" CMU

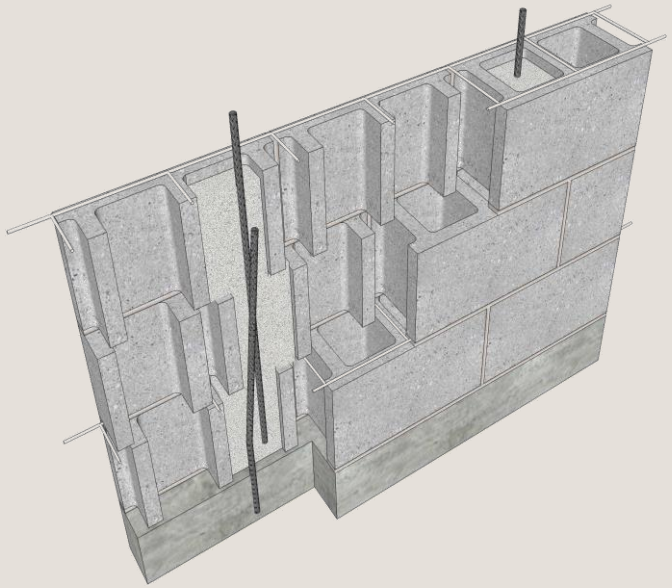
f'm 2,250 = **18%** savings on installed masonry cost

example:

for a $2,000,000 masonry contract = $360,000 savings !

(1) study by ForSE Consulting

WHY IS F'M SO IMPORTANT?



more efficient design w/ higher f'm

wall
- bearing wall
- non-bearing wall
- shear wall

lintel

column/pilaster

lap lengths
- much shorter

connections to masonry
- will be much more efficient
- embed plates
- post-installed anchors

3-STORY - STRUCTURAL CMU

77 Total openings

5 total I-beams

Prefabricated masonry lintels

INTERNATIONAL MASONRY INSTITUTE

Wipfli Office Building (summer 2017)
Eau Claire, WI

PREFABRICATED MASONRY LINTELS (77)

PREFABRICATED STRUCTURAL LINTELS

Cost efficient structural masonry

Efficient structural masonry

LINTEL OPTIONS FOR MASONRY WALLS

- arch
- **masonry lintel**
- precast U-lintel
- precast concrete
- poured-in-place concrete

- Steel
  - angles
  - channels
  - tube
  - wide flange

MASONRY LINTEL ATTRIBUTES

fast

economical

matches look of wall

moves at same rate of wall

built-in-place or prefabricated

common **6 - 12** feet

longer spans possible

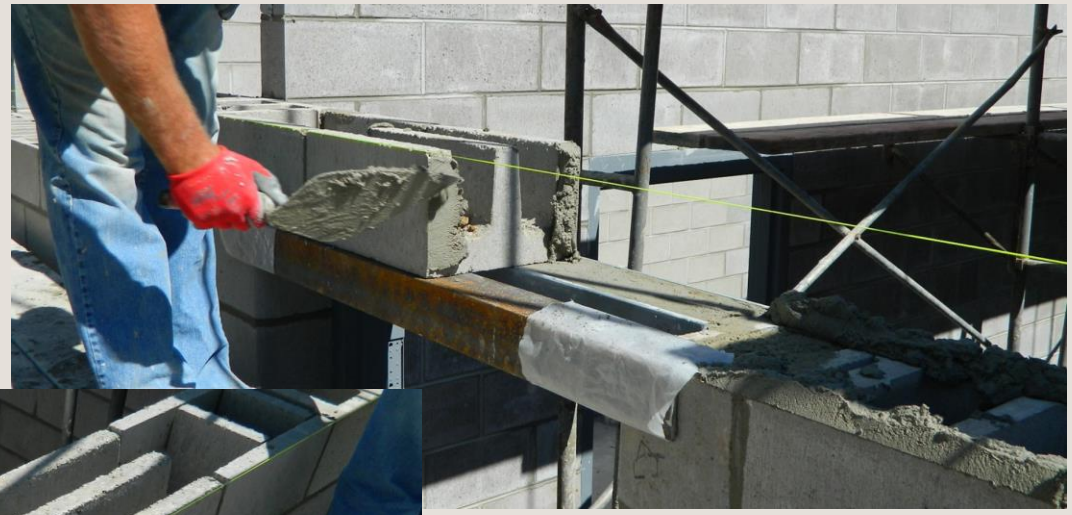
12'-0" recent Detroit school prototype

recent example in Michigan: 27'-0" long @ 7 courses high

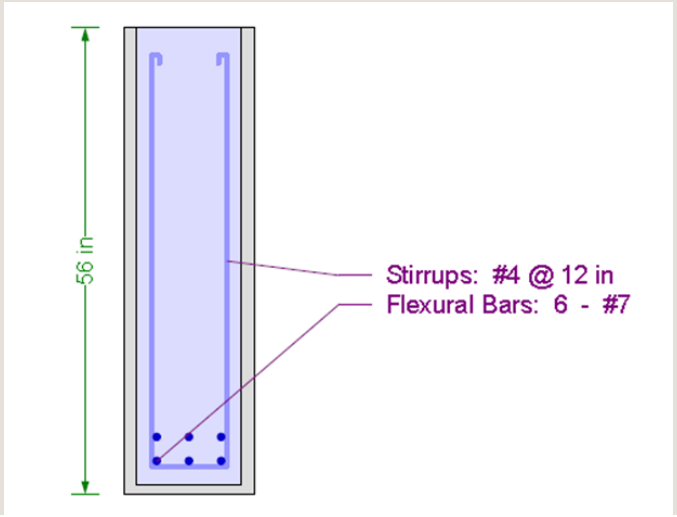
STEEL LINTELS: COMPLICATED/COSTLY/LONG-LEAD ITEM/DIFFERENTIALLY MOVING

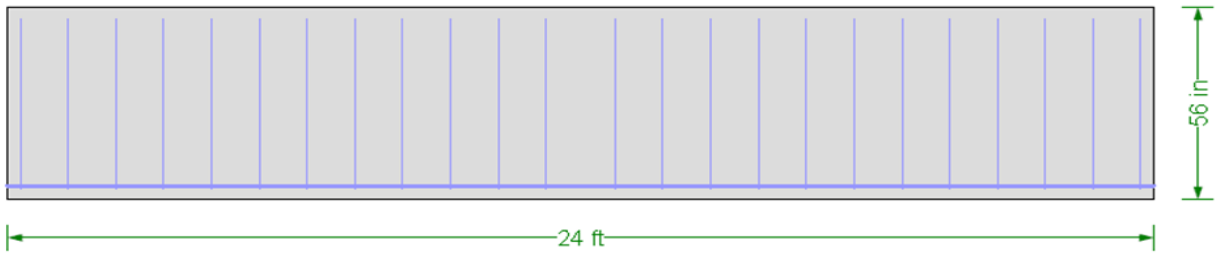
- Multiple cuts
- Inefficient design
- Sequencing concerns
- Differential movement considerations

FAST, EFFICIENT, ROBUST MASONRY LINTEL CONSTRUCTION



24’-0” **LONG** MASONRY LINTEL

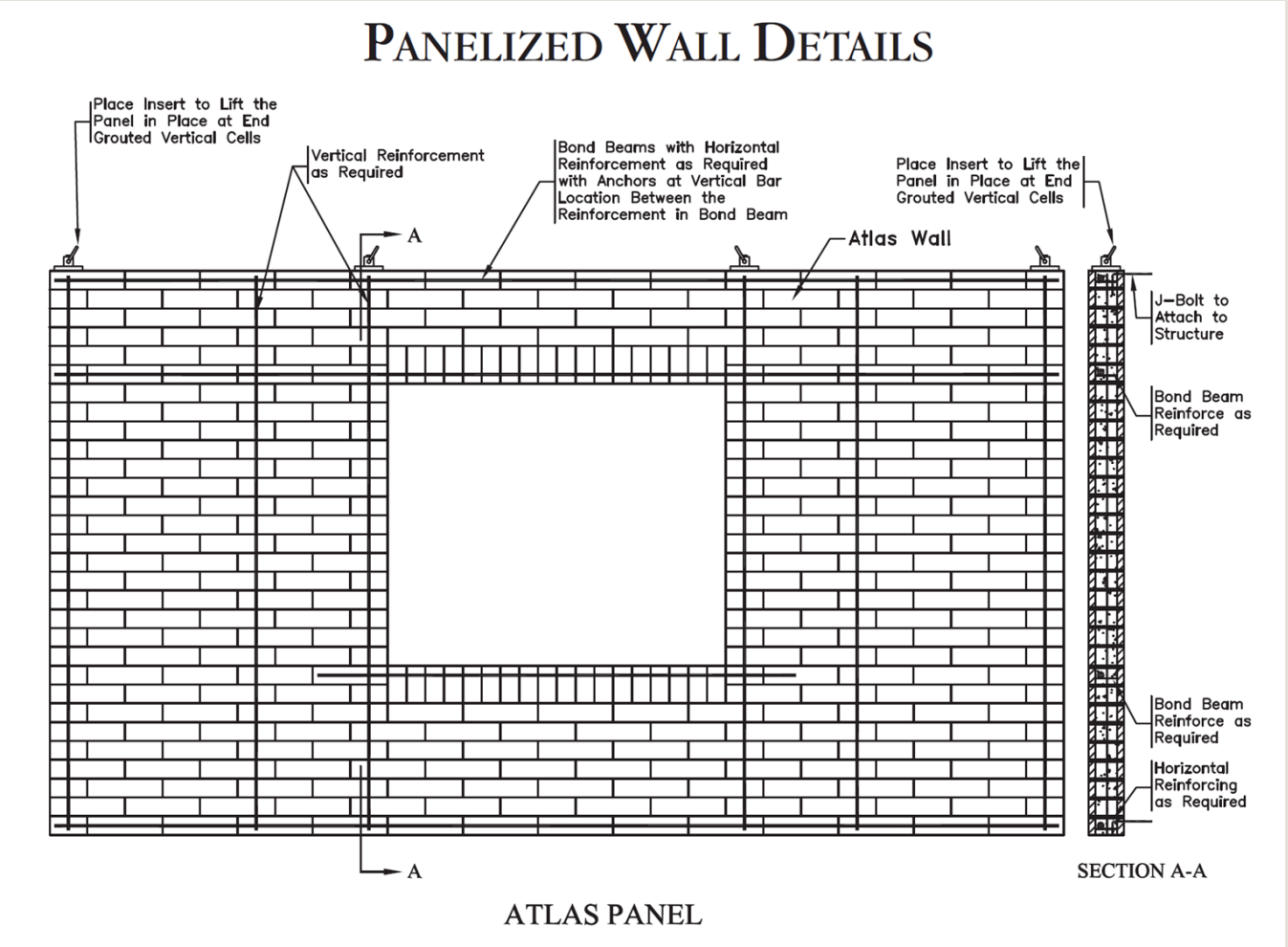




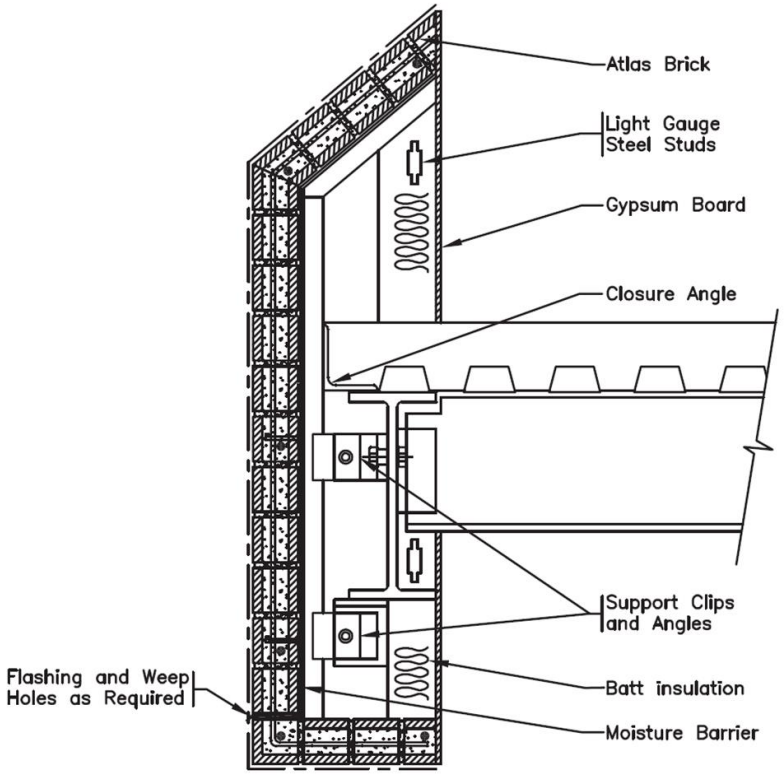
COMPLICATED, SLOW, EXPENSIVE & LESS ROBUST STEEL LINTEL CONSTRUCTION

STEEL LINTELS CAN COMPLICATE MASONRY

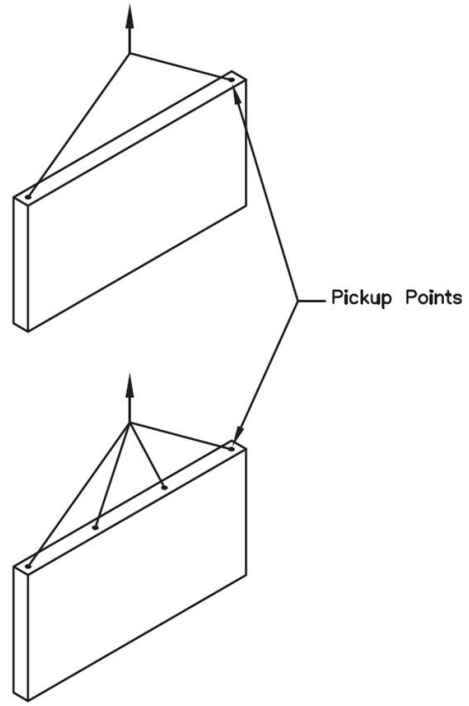
PREFABRICATE WITH STRUCTURAL BRICK



PREFABRICATE WITH STRUCTURAL BRICK

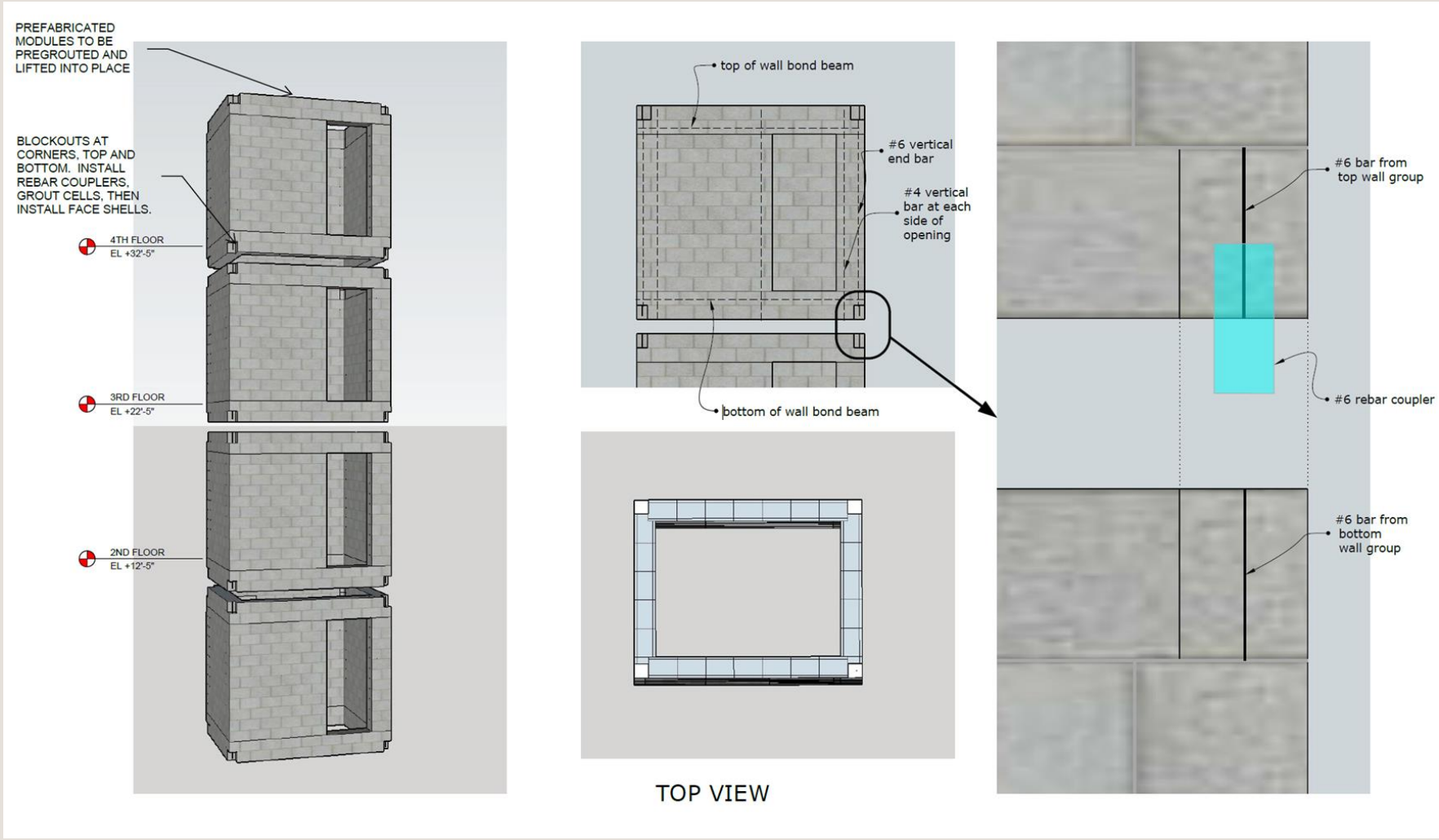


PREFABRICATED SPANDREL BEAM



PANEL PICKUP OPTIONS

PREFABRICATED 10-STORY ELEVATOR SHAFT



CREATIVE STRUCTURAL MASONRY

prefabricated masonry

stair towers

elevator shafts

wall panels


NES Rentals
ILG LIFT
1-800-NES-RENT

WALL PANELS-CORRECTIONAL FACILITY

prefabricated 8” thick fully grouted w/ steel embeds for bunks, bench & shelf

IN CONCLUSION:

- Masonry materials and systems can provide resilient safe structures for multiple generations of occupants
- Structural masonry systems have evolved with changing codes
- Masonry options exist for more economical and efficient designs
- The IMI can help you with structural masonry

QUESTIONS?

www.imiweb.org

Tom Elliott, CSI, CDT
telliott@imiweb.org

File Attachments for Item:

EC-15 Third Parties and Residential Energy Code Compliance (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

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

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

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

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

New Course Information

Course title: Working Title: Third Parties and Residential Energy Code Compliar

Course instructor: Jerica Stacey

Course description

This course explores the effective use of residential third-party professionals in the design, construction and enforcement processes to achieve compliance with the 2021 International Energy Conservation Code (IECC). Attendees will explore the roles of third parties and the benefits of using these professionals in the code compliance process; discuss the concerns, challenges and successes of third parties from the Code Official's perspective; and explore how HERS Raters are used to verify code compliance while also meeting the needs the jurisdictions they serve. This course will offer best practices and lessons learned with the goal of enhancing the relationship and communication between third parties and Code Officials.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

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

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☐ On Demand
- ☐ Webinar

Course Website:

638

☑ No

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

Course applicable for the following certifications *

- ☐ Residential Certifications Only
- ☑ Administrative Course, All Certifications
- ☐ Commercial and Residential Certifications

Application materials included *

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

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

File Name	Size
Outline_PPT_BIO.pdf	704.37 kB

Applicant Full Name *

Laura Morris

Date of Submission

09/01/2023

Instructions for new Continuing Education Approval form

Provider Information

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

Course Renewal

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

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

New Course Information

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

Special Content

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

Working Title: Third Parties and Residential Energy Code Compliance

Length: 90-minute course

Description

This course explores the effective use of residential third-party professionals in the design, construction and enforcement processes to achieve compliance with the 2021 International Energy Conservation Code (IECC). Attendees will explore the roles of third parties and the benefits of using these professionals in the code compliance process; discuss the concerns, challenges and successes of third parties from the Code Official's perspective; and explore how HERS Raters are used to verify code compliance while also meeting the needs the jurisdictions they serve. This course will offer best practices and lessons learned with the goal of enhancing the relationship and communication between third parties and Code Officials.

Course Objectives

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

- Explain the roles various third parties play in energy code compliance
- Identify the residential code provisions within the International Energy Conservation Code that require or allow the use of third parties
- Explore common questions, concerns, and lessons learned that Code Officials have when using third parties for energy code compliance
- Explain the role of HERS Raters and how their qualifications and quality assurance processes meet the needs of jurisdictions
- Identify best practices and improved processes to enhance the relationship between third parties and Code Officials

Timed Outline

Length	Topic
5 minutes	Course and Instructor Introductions
15 minutes	Roles of Third Parties in the IECC
15 minutes	Code Official's Perspective on the Use of Third Parties
15 minutes	Role of HERS Raters in Energy Code Compliance
15 minutes	Best Practices for the Use of Third Parties: Communication, Expectations and Relationships
15 minutes	Best Practices for the Use of Third Parties: Documentation
10 minutes	Final questions and closing

Jerica Stacey

Jerica Stacey is an Energy Code Specialist with the International Code Council's Business and Product Development Group. Within this position, she supports the Code Council's energy code initiatives and energy codes and standards technical content development as well as advances the Code Council's business interests related to energy codes and standards for both the national and international markets. Jerica has over 10 years of experience in the development, adoption and implementation of building energy codes.

Third Parties and Residential Energy Code Compliance

Based on the 2021 *International Energy Conservation Code*® (IECC®)

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2

3

SIGN IN/OUT

Use this QR Code or URL to Sign In & Sign Out

(Automates CEU/CPE Credits in "myICC" Account)

iccsafe.org/attend

4

INSTRUCTORS

Jerica Stacey	Rich Truitt	Chris McTaggart
		
▪ Energy Code Specialist, Product Development ▪ International Code Council ▪ jstacey@iccsafe.org	▪ Director (Building Official) ▪ Harford County Department of Inspections ▪ rctruitt@harfordcountymd.gov	▪ Owner ▪ Dream DET & Building Efficiency Resources ▪ cmctaggart@theber.com

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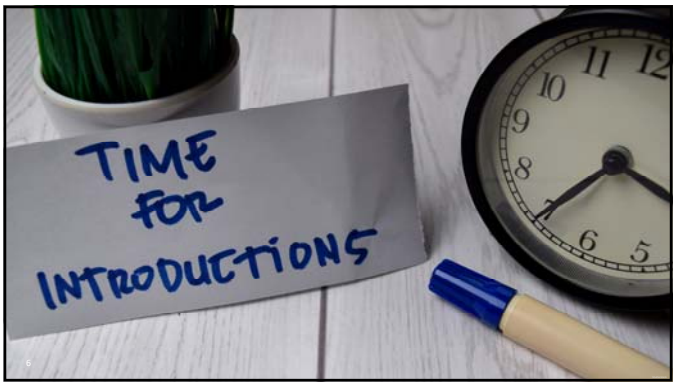

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GOAL & OBJECTIVES

This course explores the effective use of residential third-party professionals in the design, construction and enforcement processes to achieve compliance with the 2021 IECC.

1) Explain the roles various third parties play in energy code compliance
2) Identify the residential code provisions within the IECC that require or allow the use of third parties
3) Explore common questions, concerns, and lessons learned that Code Officials have when using third parties for energy code compliance
4) Explain the role of HERS Raters and how their qualifications and quality assurance processes meet the needs of jurisdictions
5) Identify best practices and improved processes to enhance the relationship between third parties and Code Officials

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REALITY CHECK

Why Does This Matter?

- Energy code compliance is increasingly complex
- Jurisdictions may lack resources for energy code compliance
  - Staff
  - Time
  - Equipment
- Third parties are available to verify energy code compliance and continue to be an effective resource for jurisdictions

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COURSE OUTLINE

- Roles of third parties in the IECC
- Code Official's perspective on the use of third parties
- Role of HERS Raters in energy code compliance
- Best practices for the use of third parties

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Third Parties

Overview of the roles third parties serve within the IECC

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About the IECC

- The IECC regulates the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.
- This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective.
- This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

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What is a third party?

An individual or company without a vested interest in the project

- Plan Review
- Inspection
- Analysis
- Performance Testing
- Compliance Verification

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Definitions to consider

Approved Acceptable to the *code official.*

Approved Agency An established and recognized agency that is regularly engaged in conducting tests furnishing inspection services, or furnishing product certification, where such agency has been *approved* by the *code official*.

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Who are these professionals?

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Third Parties in the IECC – Administration and Enforcement

- Plan Review
  - **R103.3 Examination of documents**
  - *Approved* entity not affiliated with the building design or construction may review plans and specifications for compliance
- Potential third parties
  - Registered design professional
  - Private provider
  - Others?

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Third Parties in the IECC – Administration and Enforcement

- Inspection
  - **R105.4 Approved inspection agencies**
  - Third-party inspection agencies not affiliated with the building design or construction
    - Qualified and relevant to the building components and systems inspected
  - IBC Section 1703
- Potential third parties
  - Building performance specialist
  - Private provider
  - Others?

Looking ahead to 2024 IECC
- Approved third party inspection agencies
- Authorization of approved third party inspection agency
  - Independence
  - Equipment
  - Personnel
  - Delegated authority
- Approved third party inspection agency reporting

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Third Parties in the IECC – Building Thermal Envelope

- Air Leakage
  - **R402.4.1.1 Installation**
  - *Approved* third party may inspect all components and verify compliance
- Potential third parties
  - Building performance specialist
  - Energy rater
  - Others?

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION*

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop-down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	—

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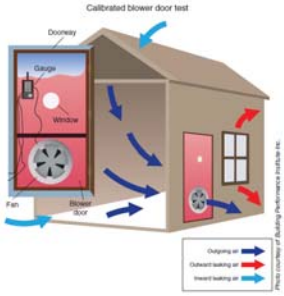
Third Parties in the IECC – Building Thermal Envelope

- Air Leakage
  - **R402.4.1.2 Testing**
  - *Approved* third party may conduct air leakage test
  - Requires written report
- Potential third parties
  - Building performance specialist
  - DET verifier
  - Energy rater
  - Others?



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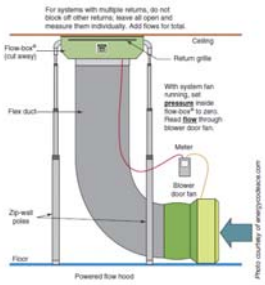
Third Parties in the IECC – Building Systems



- Mechanical ventilation testing
  - **R403.6.3 Testing**
  - *Approved* third party may conduct testing of mechanical ventilation systems
    - Whole-house ventilation and spot (local) ventilation
  - Requires written report
- Potential third parties
  - Building performance specialist
  - DET verifier
  - Energy rater
  - Mechanical contractor
  - Others?

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Third Parties in the IECC – Total Building Performance

- Compliance documentation
  - **R405.3 Documentation**
  - Analysis
    - Two compliance reports required
      - Initial with permit application
      - Final for Certificate of Occupancy
  - Performance testing required in Table R405.2
- Potential third parties
  - Registered design professional
  - Private provider
  - Building performance specialist
  - Others?

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Third Parties in the IECC – Energy Rating Index

- Compliance documentation
  - **R406.6 Verification by approved agency**
  - Compliance with ERI path requires third party verification
    - Documentation and analysis
  - Approved third party may be used to verify compliance with R406.2
    - Table of mandatory requirements
    - Maximum ERI score
- Potential third parties
  - Building performance specialist
  - Energy rater
  - Others?

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Third Parties in the IECC – Other Services

- Manual J, D and S preparation
- Specifying code compliant products
- Documentation
- Others?

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Using Third Parties

A Code Official's perspective on the use of third parties

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Discussion

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HERS Raters

The role of HERS Raters in energy code compliance

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What is a HERS Rater?

An individual who is certified by an accredited Rating Provider to inspect and test a home in order to evaluate each of the minimum rated features and complete a Home Energy Rating according to the RESNET Standards.

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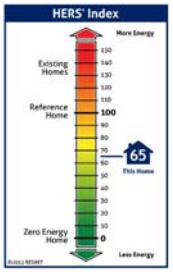
What is a HERS Rater?

Determines the efficiency of a home based on type and efficiency of components and appliances

- Exterior walls
- Floors over unconditioned spaces
- Ceilings and roofs
- Attics, foundations and crawlspaces
- Windows and doors, vents and ductwork
- HVAC and water heating systems
- Air leakage of the home
- Leakage in the heating and cooling distribution system



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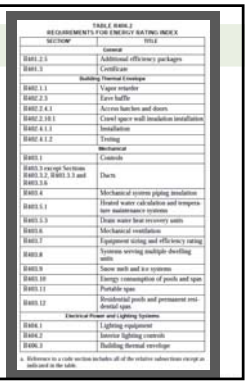
Energy Rating Index

- ERI Compliance Alternative
- HERS rating permitted as ERI score
- Home must meet ERI score AND Table R406.2



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IECC/HERS Compliance Specialist

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Discussion

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Best Practices for the Use of Third Parties

Communication, expectations, and documentation

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Best Practices

- Understand qualifications of third parties
- Know where to find qualified third parties
- Outline roles and expectations of third parties in relation to building department
- Require standardized documentation from third parties
- Facilitate clear and effective communication with third parties

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Understand Qualifications of Third Parties

- Third parties have qualifications specific to the services they provide

Qualifications Example: Building performance specialists

One or more of the following:
- RESNET HERS certification
- RESNET Quality Assurance Designee
- BPI Building Analyst certification
- ENERGY STAR Home Performance Contractor
- LEED for Homes certification
- DET Verification or similar certification

- Experienced in modeling, load calculations, code-related software
- Building science and compliance expertise

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Know Where to Find Qualified Third Parties

Registry Example: Online Databases

Find a HERS Rater on the RESNET website: https://www.hersindex.com/find-a-hers-rater/

Find a Building Performance Specialist on the BPI website: https://www.bpi.org/locator-tool

Verify architect and engineer licenses and registrations on state websites

- Certified professionals are typically listed in a registry, or their professional credentials are available online
- Ask for referrals from others
- Ask for references

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Outline Roles and Expectations

Determine who is ultimately responsible
- Required documentation
- Supporting calculations
- Inspections
- Correction notices
- Compliance verification
- Others?

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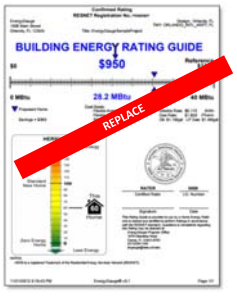
Require Standardized Documentation

- Detail documentation expectations of the building department
- Provide checklists and examples of acceptable software reports
  - EnergyGauge® USA
  - Ekotrope
  - REM/Rate



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Facilitate Clear and Effective Communication

- Be clear about timelines, expectations, responsibilities
- Establish preferred mode of communication
- Share successes and challenges

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KEY POINTS

1) Training goes far beyond simply conveying information.
2) ICC has an intentional strategy for design and delivery.
3) Each training should have a curriculum foundation.
4) PowerPoint® slides are tools, not the curriculum.
5) Simpler is usually better in slide designs and graphics.
6) ICC's presentation template allows tremendous flexibility.
7) ICC respects the intellectual property of others and its own.

39

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EVALUATON & SIGN OUT

Thanks for Allowing Us to Serve You!

Please Complete Your Evaluation & Sign Out

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2 iccsafe.org/attend

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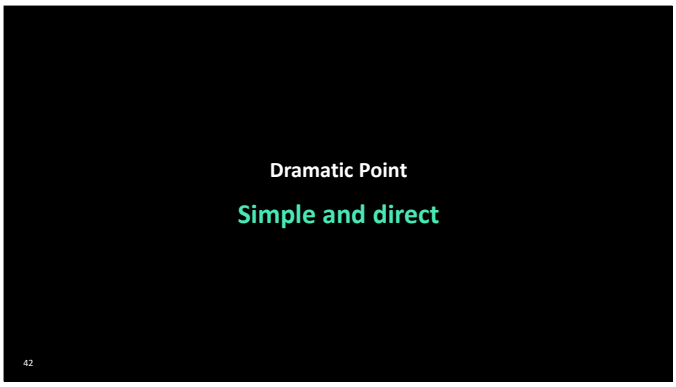
Dramatic Point
Simple and direct
42

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