




Residential Building Inspections





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Instructor



Gil Rossmiller  
 In the construction industry for  
 over 40 years  
 ICC – IRC Plumbing &  
 Mechanical Code Development  
 Committee  
 ICC – Commercial Energy Code  
 Development Committee  
 2003-2016 Building Official  
 Parker, Colorado


2

- Discuss the inspection of residential projects
- Based on 2021 International Residential Code



3

Personal Preparation



- Personal Appearance
  - Professional
  - Look like an inspector
- Proper equipment and tools
- Proper attitude

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## Professionalism



- Professional manner
- Courteous
- Prompt
- Good frame of mind
- Refrain from criticism
- Work to limit complaints



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## Develop a Reputation

- Tough
- Knowledgeable
- Fair
- Reasonable
- Understands construction



- A jerk
- Hard to work with
- Unreasonable
- Arrogant
- Doesn't know the code
- #&\*@\$@&#%



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## Paperwork



- Keep good records
- Keep work up to date
- Be consistent with paperwork
- Streamline forms



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## Records

- Follow basic criteria for developing reports, letters, field cards, notes
  - Keep legal action in mind
- Set up efficient file system
- Destroy old files when permitted



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## Time Management

- Inspections
  - Number per day
  - Difficult projects
  - Unskilled persons
- Phone calls, messages
  - Set time of day
  - Cell phone?
- Report writing
  - In field or office
- Meetings
  - Staff, contractors, designers

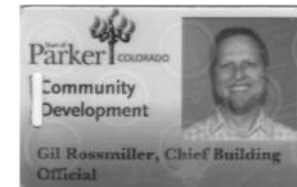


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## Field Relations

- Identify yourself
  - Name
  - Building Inspector
  - Jurisdiction
- Deal with person in authority
  - Superintendent
  - Foreman



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## Field Relations

- Arrive Promptly
  - If appointment was set
  - Phone if delayed
- Be courteous
- Be helpful
- Be professional



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## Field Relations

- Corrections
  - Write all corrections
    - Correction notice
    - Inspection report
    - Include code section
    - Bear legal action in mind
  - Explain corrections
    - Reason for requirement
    - Not "because the code requires it"



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## Field Relations

- Corrections
  - Be consistent
    - Same interpretation for all
    - Enforce the code, no more and no less
  - Offer alternatives if appropriate
- Follow up promptly
  - Time is money



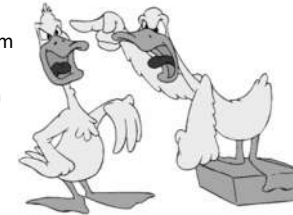
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## Field Relations

- Resolve differences without argument
  - Maintain professionalism
  - Don't raise your voice
  - Leave if your safety is in question
  - Notify your superior



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## Field Relations

- Unskilled people
  - Be patient
  - Expect to spend more time doing inspection
  - Use opportunity to educate person about codes



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## Stop Work Orders

- Issue when necessary
  - Local policy
- Be professional
  - Identify yourself
  - Explain reason for issuing order
- Be Right!
- Follow up promptly



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## Favors



• **DO NOT ACCEPT FAVORS!**

- Illegal
- Compromises all inspector's reputation
- Almost always backfires



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## Tools/Equipment

- Code Book!
- Code References



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202  
Definitions



• **FUEL CELL POWER SYSTEM, STATIONARY**

- A stationary energy generation system that converts the chemical energy of a fuel and oxidant to electric energy (DC or AC electricity) by an electrochemical process.



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202  
Definitions

- **Field-fabricated fuel cell power system**
- A stationary fuel cell power system that is assembled at the job site and is not a pre-engineered or prepackaged factory-assembled fuel cell power system.



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## 202 Definitions



- **Pre-engineered fuel cell power system**
- A stationary fuel cell power system consisting of components and modules that are produced in a factory and shipped to the job site for assembly.



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## 202 Definitions



- **Prepackaged fuel cell power system**
- A stationary fuel cell power system that is factory assembled as a single, complete unit and shipped as a complete unit for installation at the job site.



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## 202 Definitions



- **SLEEPING UNIT**
- A single unit that provides rooms or spaces for one or more persons, includes permanent provisions for sleeping and can include provisions for living, eating and either sanitation or kitchen facilities but not both.
- Such rooms and spaces that are also part of a dwelling unit are not sleeping units.



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## 202 Definition

- **TOWNHOUSE**
- A building that contains three or more attached townhouse units.



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## 202 Definitions



### • TOWNHOUSE UNIT

- A single-family dwelling unit in a townhouse that extends from foundation to roof and that has a yard or public way on not less than two sides.



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## Inspection Procedures

- Develop a routine
  - Top to Bottom
  - Bottom to Top
  - Clockwise
  - Counter clockwise
- Follow checklist until comfortable



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## When Does Inspection Begin?

- As soon as you drive up to the job site
- When you walk in the front door



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## Address/Permit

- Street Address
  - Is there one?
  - Can it be seen from the street?
- Permit
  - Is there one?
  - Correct for work being inspected and done?
  - Posted so it can be seen



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## Site Condition

- Site grade
  - Sloped away from building
  - Safe to access
- Job Cleanliness
  - Trash contained
  - Safe to access



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## Project Plans



- Correct Set
- Changes approved?
- Deferred submittals
- Manufacturer's installation instructions



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## Design Criteria - Table R301.2 2021

GROUND SNOW LOAD <sup>a</sup>	WIND DESIGN	SEISMIC DESIGN CATEGORY <sup>f</sup>	SUBJECT TO DAMAGE FROM	ICE BARRIER UNDERLAYMENT REQUIRED <sup>h</sup>	FLOOD HAZARDS <sup>g</sup>	AIR FREEZING INDEX <sup>i</sup>
Speed <sup>d</sup> (mph)	Topographic effects <sup>k</sup>	Special wind region <sup>l</sup>	Windborne debris zone <sup>m</sup>	Weathering <sup>a</sup>	Frost line depth <sup>h</sup>	Termite <sup>c</sup>
—	—	—	—	—	—	—

MANUAL J DESIGN CRITERIA <sup>a</sup>						
Elevation	Altitude correction factor <sup>a</sup>	Coincident wet bulb	Indoor winter design relative humidity	Indoor winter design dry-bulb temperature	Outdoor winter design dry-bulb temperature	Heating temperature difference
—	—	—	—	—	—	—
Latitude	Daily range	Summer design gains	Indoor summer design relative humidity	Indoor summer design dry-bulb temperature	Outdoor summer design dry-bulb temperature	Cooling temperature difference
—	—	—	—	—	—	—



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## R301.1.4 Intermodal shipping containers

- Intermodal shipping containers that are repurposed for use as buildings or structures shall be designed in accordance with the structural provisions in Section 3115 of the International Building Code.

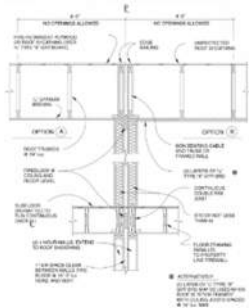


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### R302.2.1 Double walls (2015)



- Each **townhouse unit** shall be separated from other townhouse units by two 1-hour fire-resistance-rated wall assemblies tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the International Building Code.



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### R302.2.2 Common walls



- Common walls separating **townhouse units** shall be assigned a fire-resistance rating in accordance with Item 1 or 2 and shall be rated for fire exposure from both sides.
- Common walls shall extend to and be tight against the exterior sheathing of the exterior walls, or the inside face of exterior walls without stud cavities, and the underside of the roof sheathing.
- The common wall shared by two townhouse units shall be constructed without plumbing or mechanical equipment, ducts or vents, other than water-filled fire sprinkler piping in the cavity of the common wall.

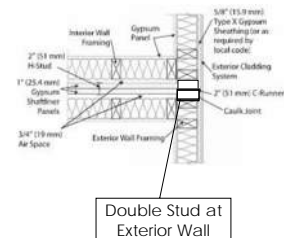


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### R302.2.2 Common walls



- Exception: Common walls are permitted to extend to and be tight against the inside of the exterior walls if the cavity between the end of the common wall and the exterior sheathing is filled with a minimum of two 2-inch nominal thickness wood studs.



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### SECTION R303 LIGHT, VENTILATION AND HEATING

#### R303.1 Mechanical

Exceptions:



1. For habitable rooms other than kitchens, the glazed areas need not be openable where the opening is not required by Section R310 and a whole-house mechanical ventilation system or a mechanical ventilation system capable of producing 0.35 air changes per hour in the habitable rooms is installed in accordance with Section M1505.

2. For kitchens, the glazed areas need not be openable where the opening is not required by Section R310 and a local exhaust system is installed in accordance with Section M1505



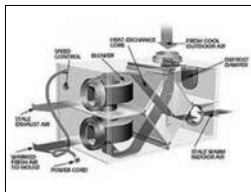
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### R303.4 Mechanical Ventilation

Buildings and dwelling units complying with Section N1102.4.1 shall be provided with mechanical ventilation in accordance with Section M1505, or with other approved means of ventilation.



Where the air infiltration rate of a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2 inch w.c. (50 Pa), buildings complying in accordance with Section N1102.4.1.2, the dwelling unit shall be provided with whole-house mechanical ventilation in accordance with Section M1507.3.



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### R310.1 - Emergency escape and rescue opening required

- New Exception:
- 3. A yard shall not be required to open directly into a public way where the yard opens to an unobstructed path from the yard to the public way.
- Such path shall have a width of not less than 36 inches



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### R310.1.1 Operational constraints and opening control devices

Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys, tools or special knowledge. Window opening control devices and fall prevention devices complying with ASTM F2090 shall be permitted for use on windows serving as a required emergency escape and rescue opening and shall be not more than 70 inches above the finished floor



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### R310.2.3 Maximum height from floor

Emergency escape and rescue openings shall have the bottom of the clear opening not greater than 44 inches above the floor.



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### R310.4.2.1 Ladders

Ladders and rungs shall have an inside width of not less than 12 inches shall project not less than 3 inches from the wall and shall be spaced not more than 18 inches on center vertically for the full height of the area well.



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### R310.2.1 Ladder and steps

Steps shall have an inside width of not less than 12 inches, a minimum tread depth of 5 inches and a maximum riser height of 18 inches for the full height of the area well.



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### R311.7 Stairways



Where required by this code or provided, stairways shall comply with this section.

Exceptions:

1. Stairways not within or serving a building, porch or deck.
2. Stairways leading to non-habitable attics.
3. Stairways leading to crawl spaces.



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### R311.7.7 Stairway walking surface

- The walking surface of treads and landings of stairways shall be sloped not steeper than 1 unit vertical in 48 units horizontal



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## R311.7.7

## Stairway walking surface



Exception: Where the surface of a landing is required elsewhere in the code to drain surface water, the walking surface of the landing shall be sloped not steeper than 1 unit vertical in 20 units horizontal in the direction of travel.



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## R311.8 Ramps

- Where required by this code or provided, ramps shall comply with this section.
  - Exception: Ramps not within or serving a building, porch or deck.



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## R314.3

## Smoke alarm location



Smoke alarms shall be installed in the following locations:

5. In the hallway and in the room open to the hallway in dwelling units where the ceiling height of a room open to a hallway serving bedrooms exceeds that of the hallway by 24 inches or more.



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## R314.3.1 - Installation near cooking appliances

- Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.
- 4. Smoke alarms listed and marked "helps reduce cooking nuisance alarms" shall not be installed less than 6 feet horizontally from a permanently installed cooking appliance.



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## R326 Habitable attics



Habitable attics shall comply with Sections R326.2 and R326.3.

A habitable attic shall have a floor area in accordance with Section R304 and a ceiling height in accordance with Section R305.



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## R326.3 Story above grade plane

A habitable attic shall be considered a story above grade plane.

Exceptions: A habitable attic shall not be considered to be a story above grade plane provided that the habitable attic meets **all** the following:

1. The aggregate area of the habitable attic is either of the following:

1.1. Not greater than one-third of the floor area of the story below.

1.2. Not greater than one-half of the floor area of the story below where the habitable attic is located within a dwelling unit equipped with a fire sprinkler system in accordance with Section P2904.



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## R326.3 Story above grade plane



2. The occupiable space is enclosed by the roof assembly above, knee walls, if applicable, on the sides and the floor-ceiling assembly below.

3. The floor of the habitable attic does not extend beyond the exterior walls of the story below.

4. Where a habitable attic is located above a third story, the dwelling unit or townhouse unit shall be equipped with a fire sprinkler system in accordance with Section P2904.



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## R326.4 Means of egress

The means of egress for habitable attics shall comply with the applicable provisions of Section R311.



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## R328 Energy storage systems



### Previously Stationary storage battery systems

Energy storage systems (ESS) shall comply with the provisions of this section.

#### Exceptions:

1. ESS listed and labeled in accordance with UL 9540 and marked "For use in residential dwelling units" where installed in accordance with the manufacturer's instructions and NFPA 70.
2. ESS less than 1 kWh.



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## R328.2 Equipment listings

- Energy storage systems (ESS) shall be listed and labeled in accordance with UL 9540.
- Exception: Where approved, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached sheds located not less than 5 feet from exterior walls, property lines and public ways.



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## R328.3 Installation



ESS shall be installed in accordance with the manufacturer's instructions and their listing.

R328.3.1 Spacing. Individual units shall be separated from each other by not less than 3 feet (914 mm) except where smaller separation distances are documented to be

adequate based on large-scale fire testing complying with

Section 1207.1.5 of the International Fire Code.



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## R328.4 Locations

ESS shall be installed only in the following locations:

1. Detached garages and detached accessory structures.
2. Attached garages separated from the dwelling unit living space in accordance with Section R302.6.
3. Outdoors or on the exterior side of exterior walls located not less than 3 feet from doors and windows directly entering the dwelling unit.



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### R403.1.6 Foundation anchorage

- New language:
- Anchor bolts shall be permitted to be located while concrete is still plastic and before it has set.
- Where anchor bolts resist placement or the consolidation of concrete around anchor bolts is impeded, the concrete shall be vibrated to ensure full contact between the anchor bolts and concrete.



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### R408.8 Under-floor vapor retarder



- In Climate Zones 1A, 2A and 3A below the warm-humid line, a continuous Class I or II vapor retarder shall be provided on the exposed face of air-permeable insulation installed between the floor joists and exposed to the grade in the under-floor space.
- The vapor retarder shall have a maximum water vapor permeance of 1.5 perms when tested in accordance with Procedure B of ASTM E96.
  - Exception: The vapor retarder shall not be required in unvented crawl spaces constructed in accordance with Section R408.3.



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### Load Bearing Lumber Grading R502.1



- Preservative treated lumber
  - Utility Grade Lumber
- End-jointed lumber
  - Grade Mark
- Prefabricated wood I-joists
  - ASTM D 5055.
- Structural Glued Laminated Timber
  - AITC A190.1 and ASTM D3737



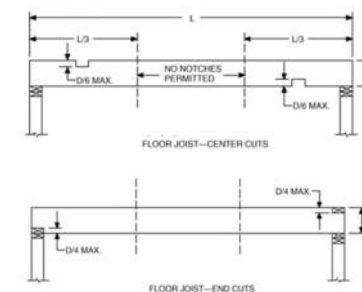
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### Drilling & Notching R502.8

- Sawn Lumber - Notches
  - Top & bottom
    - <1/6 depth of joist
    - No longer than 1/3 depth
  - Ends
    - <1/4 joist depth
  - Cannot be located in middle third of span

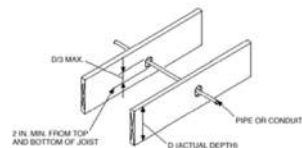


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## Drilling & Notching R502.8



- Holes
  - Diameter must be  $< 1/3$  the depth of the joist
  - Cannot be located within 2" of top or bottom of joist or to any other hole or notch



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## Drilling & Notching R502.8



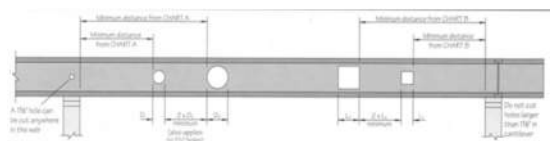
- Engineered wood products
  - not permitted unless specifically considered in design of member



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## Drilling & Notching R502.8 Engineered Wood



**CHART A - ROUND HOLES**  
MINIMUM DISTANCE FROM INSIDE FACE OF ANY SUPPORT TO NEAREST EDGE OF HOLE

DEPTH	Dir. Pres.	SOUND HOLE SIZE											
		2"	3"	4"	5"	6"	8"	9"	10"	10 1/2"	12"	12 1/2"	
11 1/2"	150	1-0"	1-6"	3-0"	4-6"	7-0"	7-6"	-	-	-	-	-	
	200	1-0"	1-6"	4-0"	5-6"	7-0"	7-6"	-	-	-	-	-	
	250	1-0"	1-6"	4-0"	5-6"	7-0"	7-6"	-	-	-	-	-	
	300	1-0"	1-6"	4-0"	5-6"	7-0"	7-6"	-	-	-	-	-	
	350	1-0"	1-6"	4-0"	5-6"	7-0"	7-6"	-	-	-	-	-	
14"	150	1-0"	1-6"	3-0"	4-6"	7-0"	7-6"	8-0"	8-6"	9-0"	-	-	
	200	1-0"	1-6"	3-0"	4-6"	7-0"	7-6"	8-0"	8-6"	9-0"	-	-	
	250	1-0"	1-6"	3-0"	4-6"	7-0"	7-6"	8-0"	8-6"	9-0"	-	-	
	300	1-0"	1-6"	3-0"	4-6"	7-0"	7-6"	8-0"	8-6"	9-0"	-	-	
	350	1-0"	1-6"	3-0"	4-6"	7-0"	7-6"	8-0"	8-6"	9-0"	-	-	
16"	150	1-0"	1-6"	3-0"	4-6"	7-0"	7-6"	8-0"	8-6"	9-0"	10-0"	-	
	200	1-0"	1-6"	3-0"	4-6"	7-0"	7-6"	8-0"	8-6"	9-0"	10-0"	-	
	250	1-0"	1-6"	3-0"	4-6"	7-0"	7-6"	8-0"	8-6"	9-0"	10-0"	-	
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Wood Trusses  
R502.11

- Designed using ANSI/TPI 1
- Truss drawings required
- Lateral bracing required
- Alterations require engineer review

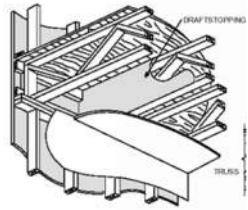


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## Draftstopping Required R502.12 – 302.12

- Usable space above & below
- Suspended ceiling, open-web trusses
- No concealed area exceeds 1,000 s.f., divided equally



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## R302.13 – Fire Protection of Floors

- Non FR floor assemblies:
- ...shall be provided with
  - ½" Gypsum Board
  - 5/8" Wood Structural Panel
  - Or equivalent...
- ...on the underside of the floor framing member



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## R302.13 – Fire Protection of Floors

- Exception 1
- Floor assemblies located directly over a space protected by fire sprinklers
  - P2904
  - NFPA 13d



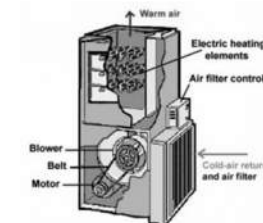
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## R302.13 – Fire Protection of Floors (2018)

- Exception 2
- Floor assemblies located directly over a crawl space not intended for storage or fuel-fired equipment or electric-powered heating appliances



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## R302.13 – Fire Protection of Floors



- Exception 3
- Permits unprotected floor assemblies when:
  - 80sf area or less per story in aggregate
  - Fire blocking is provided in the cavity between the protected and unprotected portions
- Intended to address mechanical areas with piping, ducts or other penetration issues.



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## R302.13 – Fire Protection of Floors



- Exception 4
- Wood floor assemblies using 2x10 or greater dimension solid or composite lumber.
- Also permits testing for equivalency to these materials.



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R506.2.3  
Vapor retarder

- A minimum 10-mil (was 6 mil) vapor retarder conforming to ASTM E1745 Class A requirements with joints lapped not less than 6 inches shall be placed between the concrete floor slab and the base course or the prepared subgrade where a base course does not exist.



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R507.1  
Exterior decks

- Wood-framed decks shall be in accordance with this section.
- Decks shall be designed for the live load required in Section R301.5 or the ground snow load indicated in Table R301.2, whichever is greater.
- For decks using materials and conditions not prescribed in this section, refer to Section R301.



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### R507.3 Footings



- Exceptions:
- 2. Footings shall not be required for free-standing decks that meet all of the following criteria:
  - 2.1. The joists bear directly on precast concrete pier blocks at grade without support by beams or posts.
  - 2.2. The area of the deck does not exceed 200 square feet.
  - 2.3. The walking surface is not more than 20 inches above grade at any point within 36 inches measured horizontally from the edge.



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### R507.3.2 Minimum depth

- Deck footings shall be placed not less than 12 inches below the undisturbed ground surface.



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### R507.10.1 Exterior Guards - Support of guards

- Where guards are supported on deck framing, guard loads shall be transferred to the deck framing with a continuous load path to the deck joists.

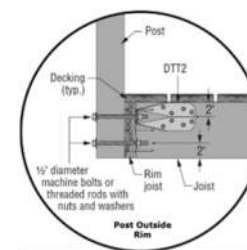


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### R507.10.1.1 - Guards supported by side of deck framing



- Where guards are connected to the interior or exterior side of a deck joist or beam, the joist or beam shall be connected to the adjacent joists to prevent rotation of the joist or beam.
- Connections relying only on fasteners in end grain withdrawal are not permitted.



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### R507.10.1.2 - Guards supported on top of deck framing

- Where guards are mounted on top of the decking, the guards shall be connected to the deck framing or blocking and installed in accordance with manufacturer's instructions to transfer the guard loads to the adjacent joists.



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### R507.10.2 - Wood posts at deck guards

- Where 4-inch by 4-inch wood posts support guard loads applied to the top of the guard, such posts shall not be notched at the connection to the supporting structure.



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### R507.10.3 Plastic composite guards

- Plastic composite guards shall comply with the provisions of Section R507.2.2.



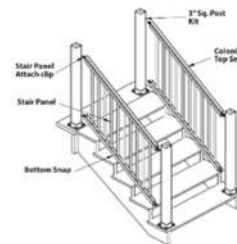
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### R507.10.4 Other guards

- Other guards shall be in accordance with either manufacturer's instructions or accepted engineering principles.



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## Exterior Walls R602.3

- Double Top Plate Required
  - Overlapped at corners and intersections of bearing walls
  - End joints of plates offset 24"
- Single top plate
  - Permitted if tied at joints with 3"x6" steel plate each side
- Bottom plate
  - Nominal 2" thick with width same as stud



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## Notching R602.6

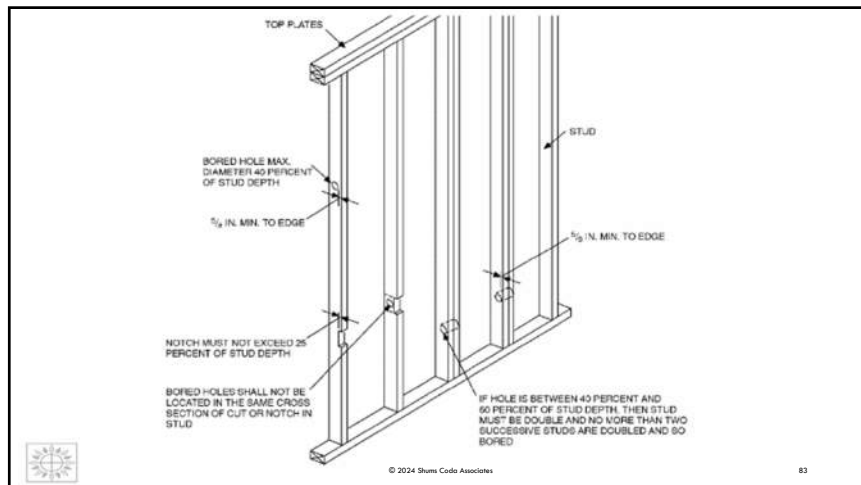
- Notching
  - Exterior & bearing
    - cannot exceed 25% of stud width
  - Non-bearing
    - up to 40% of stud width
- Drilling
  - Max. 40% of stud
  - Min. 5/8" from edge



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## Drilling/Notching of Top Plate R602.6.1

- Top plate cut by more than 50 %
  - Galvanized metal tie
    - Minimum 0.054 inch thick (16 gage)
    - 1 1/2 inches wide
    - Fastened to each plate with not less than eight 10d nails at each side or equivalent



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## Nonbearing Walls R602.7.4



- Load bearing headers not required
  - single flat 2X4 up to 8 feet in width
  - less than 24 inches vertical distance from header to plate
  - cripples/blocking not required



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## R302.11 Fireblocking

- Code previously placed requirement in “wood wall framing”
- Now preface is “in combustible construction”



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## Fire Blocking R602.8 – R302.11

- In concealed spaces of stud walls and partitions, including furred spaces and parallel rows of studs or staggered studs; as follows:
  - 1.1. Vertically at the ceiling and floor levels.
  - 1.2. Horizontally at intervals not exceeding 10 feet



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## Fire Blocking R602.8 – R302.11

- At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings.



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### Fire Block Material R602.8.1 – R302.11

- 2" nominal lumber or two 1"
- 23/32" structural panel backed
- 3/4" particle board backed
- 1/2" gypsum board
- 1/4" cement based millboard
- Loose fill insulation not approved - except-



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### Fire Block Material R602.8.1 – R302.11

- Cellulose insulation installed as tested in accordance
- with ASTM E 119 or UL 263, for the specific application.
- mineral or glass fiber batts
  - installed in such a manner as to be securely retained in place shall be permitted as an acceptable fire block.
- Mineral or glass fiber batts or other approved non-rigid materials permitted for horizontal blocking in staggered or parallel stud walls



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### Unfaced Fiberglass R602.8.1.1 – R302.11



- Unfaced fiberglass batt insulation shall fill the entire cross section of the wall cavity to a minimum height of 16 inches measured vertically.
- Insulation shall be packed tightly around piping or conduits

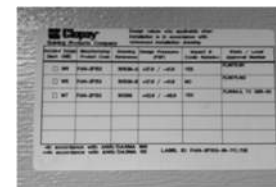


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### R609.4.1 Garage door labeling



- Garage doors shall be labeled with a permanent label provided by the garage door manufacturer.
- The label shall identify the garage door manufacturer, the garage door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.



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## R702.7 Vapor retarders

- Vapor retarder materials shall be classified in accordance with Table R702.7(1).
- A vapor retarder shall be provided on the interior side of frame walls of the class indicated in Table R702.7(2), including compliance with Table R702.7(3) or R702.7(4) where applicable.
- An approved design using accepted engineering practice for hygrothermal analysis shall be permitted as an alternative.
- The climate zone shall be determined in accordance with Section N1101.7.



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## R702.7 Vapor retarders

- Exceptions:
- 1. Basement walls.
- 2. Below-grade portion of any wall.
- 3. Construction where accumulation, condensation or freezing of moisture will not damage the materials.
- 4. A vapor retarder shall not be required in Climate Zones 1, 2 and 3.



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TABLE R702.7(1)  
VAPOR RETARDER MATERIALS AND CLASSES

CLASS	ACCEPTABLE MATERIALS
I	Sheet polyethylene, nonperforated aluminum foil or other approved materials with a perm rating less than or equal to 0.1.
II	Kraft-faced fiberglass batts, vapor retarder paint or other approved materials applied in accordance with the manufacturer's installation instructions for a perm rating greater than 0.1 and less than or equal to 1.0.
III	Latex paint, enamel paint or other approved materials applied in accordance with the manufacturer's installation instructions for a perm rating greater than 1.0 and less than or equal to 10.0.

TABLE R702.7(2)  
VAPOR RETARDER OPTIONS

CLIMATE ZONE	VAPOR RETARDER CLASS		
	CLASS I <sup>a</sup>	CLASS II <sup>b</sup>	CLASS III
1, 2	Not Permitted	Not Permitted	Permitted
3, 4 (except Marine 4)	Not Permitted	Permitted <sup>c</sup>	Permitted
Marine 4, 5, 6, 7, 8	Permitted <sup>d</sup>	Permitted <sup>d</sup>	See Table R702.7(3)

- a. Class I and II vapor retarders with vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B) shall be allowed on the interior side of any frame wall in all climate zones.
- b. Use of a Class I interior vapor retarder in frame walls with a Class I vapor retarder on the exterior side shall require an approved design.
- c. Where a Class II vapor retarder is used in combination with foam plastic insulating sheathing installed as continuous insulation on the exterior side of frame walls, the continuous insulation shall comply with Table R702.7(4) and the Class II vapor retarder shall have a vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B).



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## R702.7.1 Spray foam plastic insulation for moisture control with Class II and III vapor retarders

- For purposes of compliance with Tables R702.7(3) and R702.7(4), spray foam with a maximum permeance of 1.5 perms at the installed thickness applied to the interior side of wood structural panels, fiberboard, insulating sheathing or gypsum shall be deemed to meet the continuous insulation moisture control requirement in accordance with one of the following conditions:
- 1. The spray foam R-value is equal to or greater than the specified continuous insulation R-value.
- 2. The combined R-value of the spray foam and continuous insulation is equal to or greater than the specified continuous insulation R-value.



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TABLE R702.7(3) CLASS II VAPOR RETARDERS	
CLIMATE ZONE	CLASS II VAPOR RETARDERS PERMITTED FOR: <sup>a</sup>
Marine 4	Vented cladding over wood structural panels.
	Vented cladding over fiberboard.
	Vented cladding over gypsum.
	Continuous insulation with $R$ -value $\geq 2.5$ over $2 \times 4$ wall.
5	Continuous insulation with $R$ -value $\geq 3.75$ over $2 \times 6$ wall.
	Vented cladding over wood structural panels.
	Vented cladding over fiberboard.
	Vented cladding over gypsum.
6	Continuous insulation with $R$ -value $\geq 5$ over $2 \times 4$ wall.
	Continuous insulation with $R$ -value $\geq 7.5$ over $2 \times 6$ wall.
	Vented cladding over fiberboard.
	Vented cladding over gypsum.
7	Continuous insulation with $R$ -value $\geq 7.5$ over $2 \times 4$ wall.
	Continuous insulation with $R$ -value $\geq 11.25$ over $2 \times 6$ wall.
	Continuous insulation with $R$ -value $\geq 10$ over $2 \times 4$ wall.
	Continuous insulation with $R$ -value $\geq 15$ over $2 \times 6$ wall.
8	Continuous insulation with $R$ -value $\geq 12.5$ over $2 \times 4$ wall.
	Continuous insulation with $R$ -value $\geq 20$ over $2 \times 6$ wall.

a. Vented cladding shall include vinyl, polypropylene, or horizontal aluminum siding, brick veneer with a clear airspace as specified in Table R703.8.4(1), and other approved vented claddings.  
b. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class II vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of Chapter 11.



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TABLE R702.7(4) CONTINUOUS INSULATION WITH CLASS II VAPOR RETARDER	
CLIMATE ZONE	CLASS II VAPOR RETARDERS PERMITTED FOR: <sup>a</sup>
3	Continuous insulation with $R$ -value $\geq 2$ .
4, 5 and 6	Continuous insulation with $R$ -value $\geq 3$ over $2 \times 4$ wall.
	Continuous insulation with $R$ -value $\geq 5$ over $2 \times 6$ wall.
7	Continuous insulation with $R$ -value $\geq 5$ over $2 \times 4$ wall.
8	Continuous insulation with $R$ -value $\geq 7.5$ over $2 \times 6$ wall.
	Continuous insulation with $R$ -value $\geq 7.5$ over $2 \times 4$ wall.
	Continuous insulation with $R$ -value $\geq 10$ over $2 \times 6$ wall.

a. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class II vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of Chapter 11.



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### M1305.1.3.2 Pit locations (2018)

Appliances installed in pits or excavations shall not come in direct contact with the surrounding soil and shall be installed not less than 3 inches above the pit floor. The sides of the pit or excavation shall be held back not less than 12 inches from the appliance. Where the depth exceeds 12 inches below adjoining grade, the walls of the pit or excavation shall be lined with concrete or masonry. Such concrete or masonry shall extend not less than 4 inches above adjoining grade and shall have sufficient lateral load-bearing capacity to resist collapse. Excavation on the control side of the appliance shall extend horizontally not less than 30 inches. The appliance shall be protected from flooding in an approved manner.



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### M1411.3.1.2 Appliance, equipment and insulation in pans 2021

- Where appliances, equipment or insulation are subject to water damage when auxiliary drain pans fill, that portion of the appliance, equipment and insulation shall be installed above the rim of the pan. Supports located inside of the pan to support the appliance or equipment shall be water resistant and approved.



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### M1411.6 Insulation of refrigerant piping

Piping and fittings for refrigerant vapor (suction) lines shall be insulated with insulation having a thermal resistivity of not less than R-3 and having external surface permeance not exceeding 0.05 perm  $[2.87 \text{ ng}/(\text{s} \times \text{m}^2 \times \text{Pa})]$  when tested in accordance with ASTM E96. (2021)



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### M1411.8 Support of refrigerant piping (2021)

Refrigerant piping and tubing shall be securely fastened to a permanent support within 6 feet of the condensing unit.



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### Clothes dryer exhaust

New section 2018

M1502.3.1 Exhaust termination outlet and passageway size.

The passageway of dryer exhaust duct terminals shall be undiminished in size and shall provide an open area of not less than 12.5 square inches



Area minimum 12.5 sq. in.  
(4" duct)  
5" duct = 19.6 sq. in.  
6" duct = 28. sq. in.

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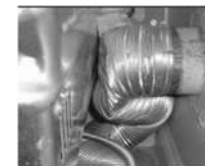


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### M1502.4.2 Duct installation

Exhaust ducts shall be supported at intervals not to exceed 12 feet and shall be secured in place. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow. Exhaust duct joints shall be sealed in accordance with Section M1601.4.1 and shall be mechanically fastened. Ducts shall not be joined with screws or similar fasteners that protrude more than 1/8 inch into the inside of the duct. Where dryer exhaust ducts are enclosed in wall or ceiling cavities, such cavities shall allow the installation of the duct without deformation.



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## SECTION M1503 DOMESTIC COOKING EXHAUST EQUIPMENT (2018)

### M1503.2 Domestic cooking exhaust.

Where domestic cooking exhaust equipment is provided, it shall comply with one of the following:

1. The fan for overhead range hoods and downdraft exhaust equipment not integral with the cooking appliance shall be listed and labeled in accordance with UL 507.
2. Overhead range hoods and downdraft exhaust equipment with integral fans shall comply with UL 507.
3. Domestic cooking appliances with integral downdraft exhaust equipment shall be listed and labeled in accordance with ANSI Z21.1 or UL 858.
4. Microwave ovens with integral exhaust for installation over the cooking surface shall be listed and labeled in accordance with UL 923.



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## M1503.2.1 Open-top broiler exhaust (2018)

Domestic open-top broiler units shall be provided with a metal exhaust hood having a thickness of not less than 0.0157 inch (No. 28 gage). Such hoods shall be installed with a clearance of not less than 1/4 inch between the hood and the underside of combustible material and cabinets. A clearance of not less than 24 inches shall be maintained between the cooking surface and combustible material and cabinets. The hood width shall be not less than the width of the broiler unit and shall extend over the entire unit.

Exception: Broiler units that incorporate an integral exhaust system, and that are listed and labeled for use without an exhaust hood, shall not be required to have an exhaust hood.



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## M1503.4 Duct material (2018)

Ducts serving domestic cooking exhaust equipment shall be constructed of galvanized steel, stainless steel or copper.



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## M1503.4 Makeup air required M1503.6 in 2018

### M1503.6 Makeup air required.

Where one or more gas, liquid or solid fuel-burning appliance that is neither direct-vent nor uses a mechanical draft venting system is located within a dwelling unit's air barrier, each exhaust system capable of exhausting in excess of 400 cubic feet per minute shall be mechanically or passively provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with not fewer than one damper complying with Section M1503.6.2.



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## M1802.4 Blocked vent switch (2021)

Oil-fired appliances shall be equipped with a device that will stop burner operation in the event that the venting system is obstructed. Such device shall have a manual reset and shall be installed in accordance with the manufacturer's instructions.



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## Definitions (2021)

**BALANCED VENTILATION**

Any combination of concurrently operating mechanical exhaust and mechanical supply whereby the total mechanical exhaust airflow rate is within 10 percent of the total mechanical supply airflow rate.

**BALANCED VENTILATION SYSTEM**

A ventilation system where the total supply airflow and total exhaust airflow are simultaneously within 10 percent of their averages. The balanced ventilation system airflow is the average of the supply and exhaust airflows.



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Table M1505.4.3(1) Continuous whole-house mechanical ventilation system airflow rate requirements

DWELLING UNIT FLOOR AREA (square feet)	NUMBER OF BEDROOMS				
	0-1	2-3	4-5	6-7	> 7
Airflow in CFM					
< 1,500	30	45	60	75	90
1,501-3,000	45	60	75	90	105
3,001-4,500	60	75	90	105	120
4,501-6,000	75	90	105	120	135
6,001-7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

$$\text{CFM} = (.01 \times \text{conditioned floor area}) + [7.5 \times (\text{number of bedrooms} + 1)]$$



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## M1505.4.3 Mechanical ventilation rate 2021

**Exceptions:**

1. Ventilation rate credit. The minimum mechanical ventilation rate determined in accordance with Table M1505.4.3(1) or Equation 15-1 shall be reduced by 30 percent, provided that both of the following conditions apply:

1.1. A ducted system supplies ventilation air directly to each bedroom and to one or more of the following rooms:

1.1.1. Living room.

1.1.2. Dining room.

1.1.3. Kitchen.

1.2. The whole-house ventilation system is a balanced ventilation system.

2. Programmed intermittent operation. The whole-house mechanical ventilation system is permitted to operate intermittently where the system has controls that enable operation for not less than 25 percent of each 4-hour segment and the ventilation rate prescribed in Table M1505.4.3(1), by Equation 15-1 or by Exception 1 is multiplied by the factor determined in accordance with Table M1505.4.3(2)

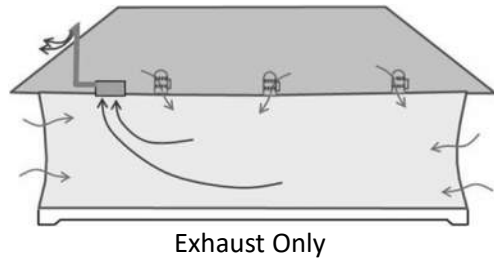


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## Three basic types of Whole House Ventilation Systems



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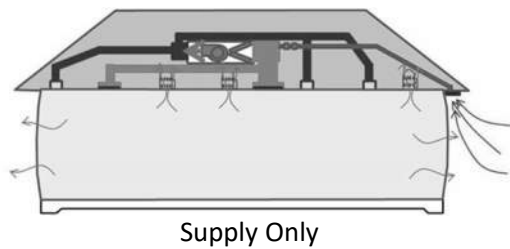
## Exhaust Only Whole House Ventilation System



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## Three basic types of Whole House Ventilation Systems



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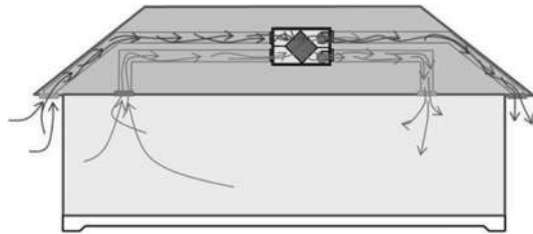
## Supply Only Whole House Ventilation System



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## Three basic types of Whole House Ventilation Systems



Balanced (with heat recovery) HRV or ERV



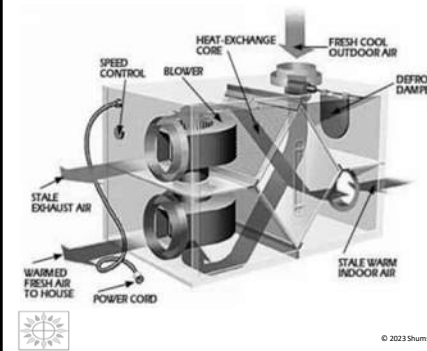
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## Balanced

- Heat Recovery Ventilator (HRV)
- or
- Energy Recovery Ventilator (ERV)



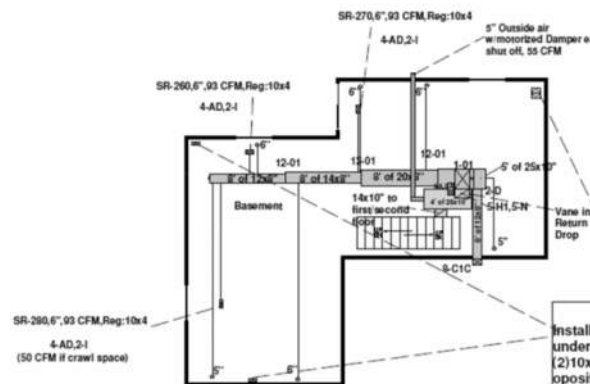
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## Field Inspections

- What is needed?
- 1. Duct Plan
- 2. Fittings used
- 3. Equipment Selection



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## Field Inspections

	4H	50	Round floor boot, hard bend
	4I	10	Round floor boot, straight
	2I	65 - 110	Round takeoff from top, equivalent length varies from 65 ft. (zero downstream branches) to 110 ft.
	4AD	60	Round ceiling boot, segmented



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## Field Inspections



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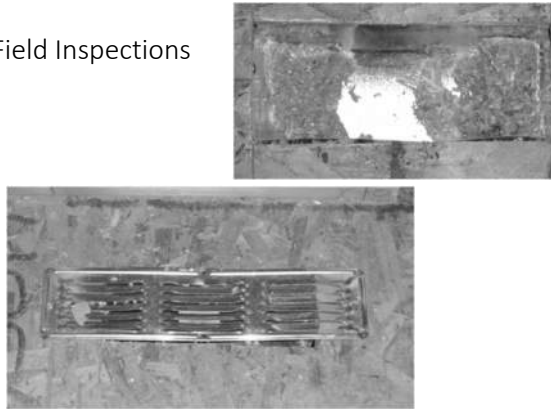
## Field Inspections



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# Field Inspections



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## Field Inspections



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## Common Code

- R404.1.7 Backfill Placement
  - Backfill shall not be placed against the wall until the wall has sufficient strength and has been supported by the floor above



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## Common Code

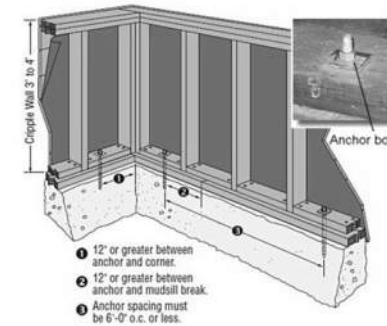
- R403.1.6
  - Exterior walls and interior braced walls
    - Minimum of  $\frac{1}{2}$ " bolts spaced no less than 6 feet on center
    - Or straps with equivalent anchorage
    - Located in the middle third
    - Extend a minimum of 7 inches into concrete
    - Minimum of two bolts per plate
    - One within 12 inches but not less than 7 bolt diameters from ends
    - Protect against decay and termites



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## Common Code



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## Common Code Violations



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## Common Codes

- Chapter 4 Foundation Drainage
  - R405.1 **Concrete or Masonry Foundations.** .....Perforated drains shall be surrounded with an approved filter membrane or the filter membrane shall cover the washed gravel or crushed rock covering the drain.....



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## Common Codes

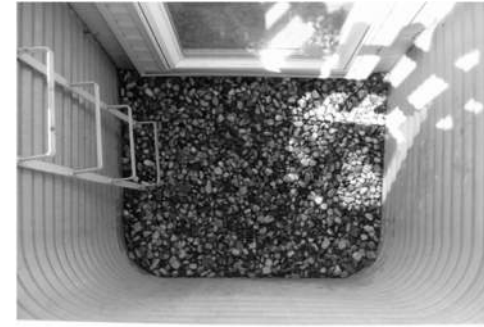
- Chapter 3
- R310.2.2 **Drainage.** Window wells shall be designed for proper drainage by connecting to the buildings foundation drainage system required by Section R405.1 or by an approved alternate method.
- Exception. A drainage system for window wells is not required when the foundation is on well-drained soil or sand-gravel mixture soils according to the United Soils Classification System, Group I Soils, as detailed in Table R405.1



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## Common Code

- P3201.4 Building Traps
  - Shall be prohibited
  - So shall Bell traps
  - "S" traps
  - Drum Traps
  - Traps with moving parts
  - And Separate Fixture traps with interior partitions. Except if made of plastic, Stainless steel or other noncorrosive materials



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## Common Code

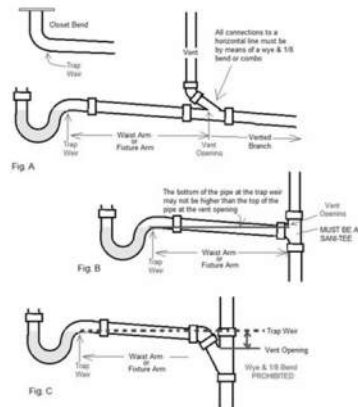
- P3105.2 Fixture Drains
  - Trap weir shall be below vent opening



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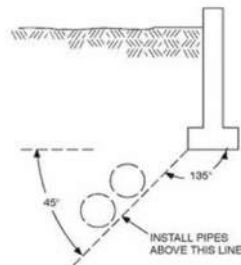


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## Code Basics

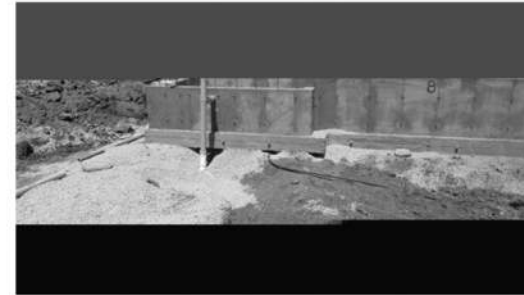
- 307 Structural Safety
  - Trench location
    - 45 degree bearing plane



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## Common Code

- R602.6 Drilling and notching of Studs
  - Notching on exterior or bearing studs
    - 25% of its width
  - Notching of interior partition walls
    - 40%



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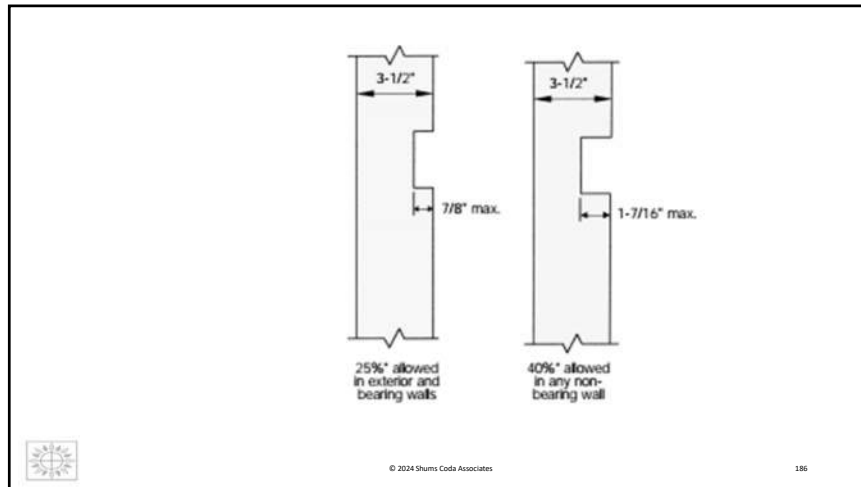
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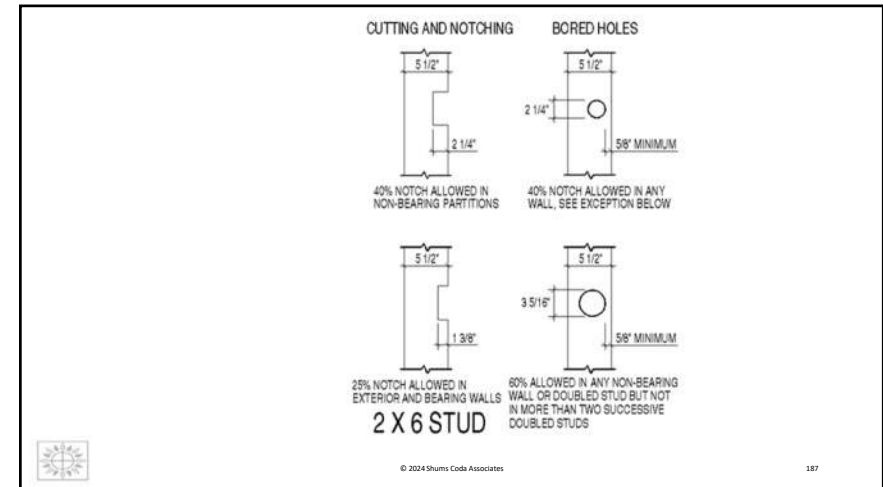
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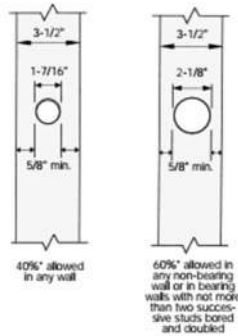


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### Common Code

- R602.6 Drilling and Notching of Studs
  - 60% on partition non bearing
  - 40% on exterior and bearing walls

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## Common Code

- R602.6 Drilling and Notching  
5/8" of edge required to remain



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## Common Code

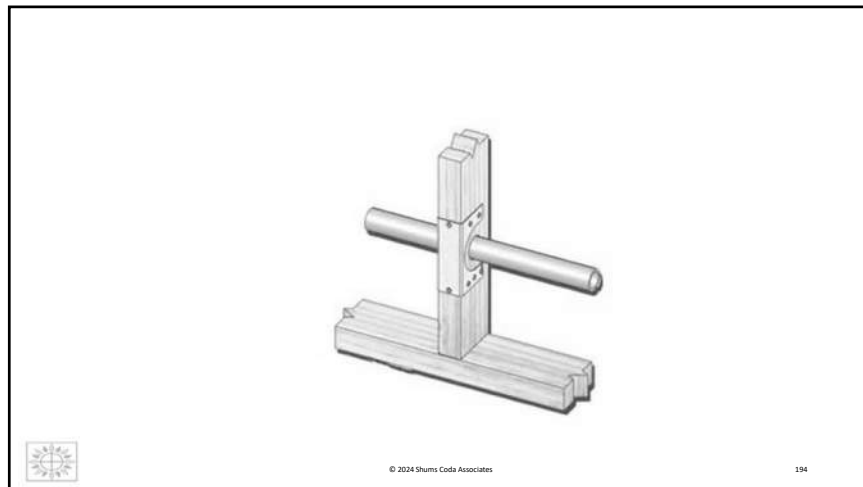
- R602.6 Drilling and Notching of studs
  - No more than two successive doubled studs shall be bored
  - Exception-stud shoes are used



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### Common Code

- 602.6.1 Drilling and Notching top plate
  - 50% or more removed by notch or bore
  - metal tie
    - 16 gauge
    - 1 1/2" in width minimum
    - 8 10d nails of 1 1/2" length on each side
    - Minimum of 6 inches past the opening

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- <https://www.youtube.com/watch?v=4lqMwBga8Vc>



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## Common Code

- P2603.2.1 Protection against physical damage
  - 1 ¼ inches from stud face
  - 16 gauge
  - 2 inches above and below plates



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## Common Code

- Protection in studs



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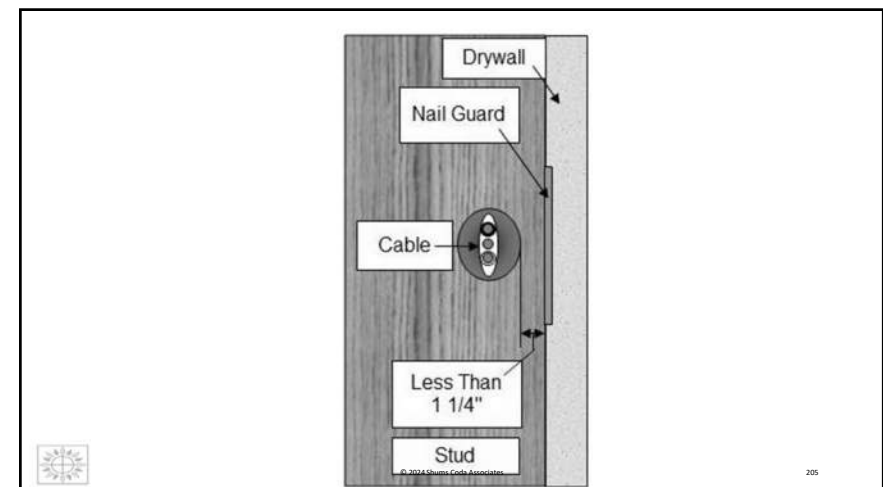
- Same requirement for electrical
  - E3404.10 guards
  - E3402.1 Drilling and notching
- Mechanical equipment piping
  - M1308.2.1 guards
    - 1 ½ inches



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## Common Code

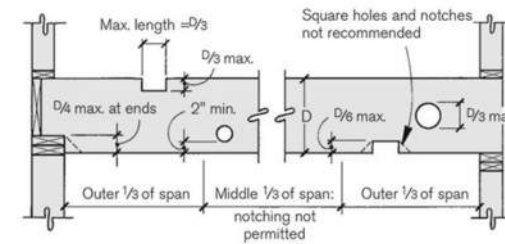
- R502.8 Cutting and Notching
- Cannot exceed figure R502.8



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## Common Code

- Table R602.10.6.1 Minimum Hold-down forces for ABW braced wall panels
- Table R602.10.5 Minimum length of Braced Wall Panels
  - SDC A, B, and C and wind less than 140 mph
  - 8 feet tall no less than 28 inches \*sample\*



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## Common Code



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## Common Code



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## Common Code



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## Common Code

- R602.3.2 Top Plate
  - End joints offset minimum of 24 inches
  - Shall not be less than 2 inch nominal thickness
  - Lap at corners and offsets



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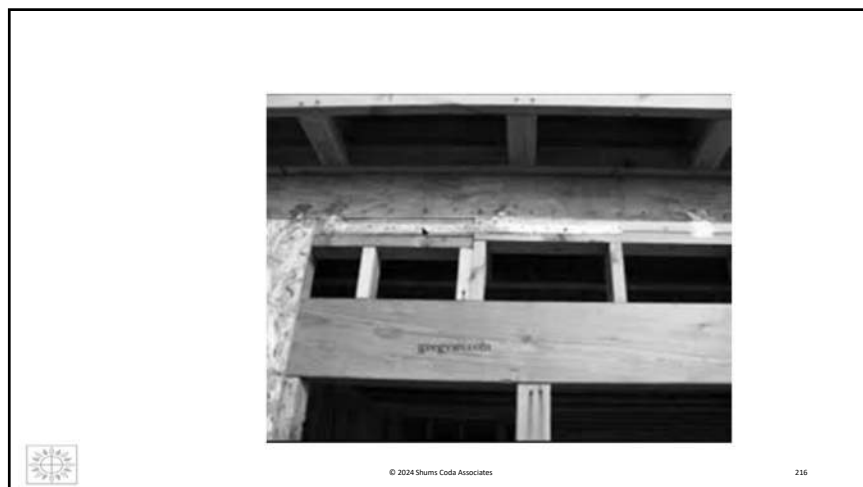
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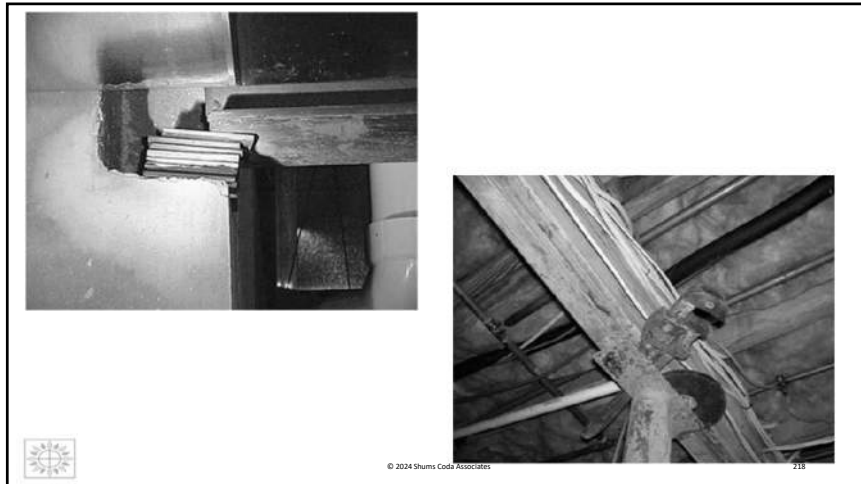


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### Common Code

- R606.6.3 Beam Supports
  - Beams and girders shall have bearing of not less than 3 inches on masonry and not less than 4 inches on approved steel plate if projecting from wall or surface.
  - Installed per manufacturer installation requirements

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### Common Code

- IMC 602.2.1.1 Wiring
  - Only plenum rated wires shall be installed in plenum rated raceways and areas.
- E3904.7 Air handling-stud cavity and joist spaces
  - Non-metalic can only pass perpendicular to long dimension



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Common code

- Where do we start here?



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Common code

- R403.1.6 Foundation Anchorage
  - Wood sill plates and walls supported directly on continuous foundations shall be anchored to the foundation
    - Bolt spacing pending locations for wind and seismic
  - Braced wall designs per Chapter 6



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## Common Code

- R602.9 Cripple walls
  - Shall not be less than 14" unless sheathed on both sides



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## Common code

- Engineered products per designer/manufacture specifications



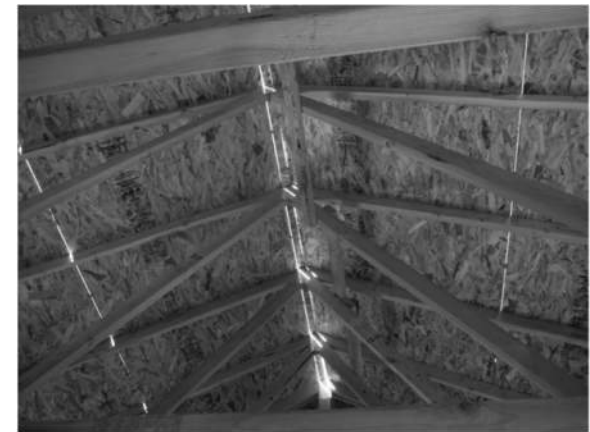
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## Common Code Violations

- Trusses

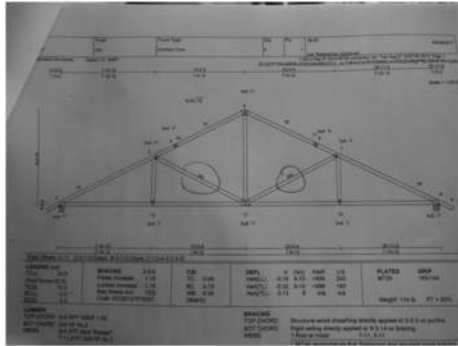


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## Common code violations



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## Common Code

- R802.10.4 Alterations to trusses
  - Shall not be cut, notched, drilled, spliced or otherwise altered
  - Engineer approval



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## Common Code Violations



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## Common code

- R403.1.6
  - A nut and washer shall be tightened on each anchor bolt



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## Common Code Violations



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## Common Code

- Anchor bolts



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## Common Code

- Again the word "S" trap comes up
- P3201.5 Prohibited trap designs



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Common code

- Clearances to combustibles
- Established by manufacturer



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Common Code



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Common Code

- G2419.4 Sediment trap
  - Installed downstream of the appliance shutoff valve
  - Tee fitting or other device
  - Not needed for ranges, vented fireplaces, clothes dryers, gas fireplace or outdoor grilles



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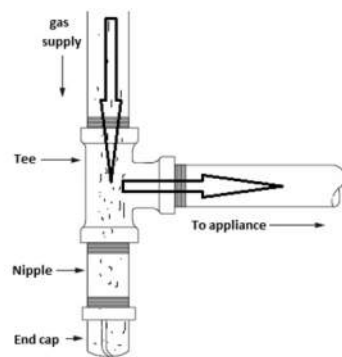
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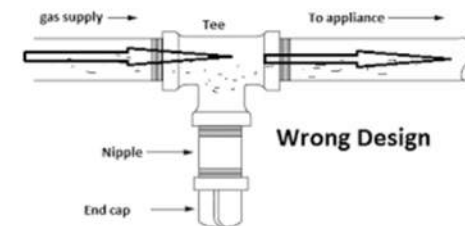
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### Common Code

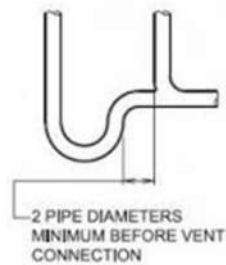
- P3105.3 Crown Vent prohibited
  - A vent shall not be installed within two pipe diameters of the trap weir



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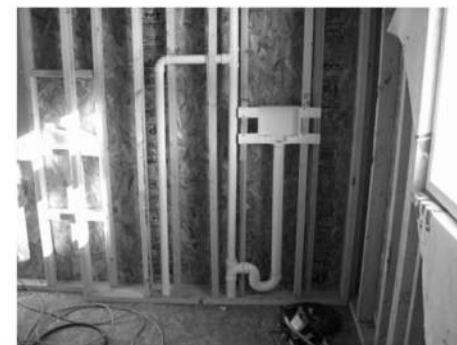
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## Common Code

- Toilet facilities for workers
- EPA facilitated with the Storm Water Pollution Prevention Act
- IPC 311 and ANSI Z4.3 at rate of 1 per 10 workers



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## Common Code

- E3905.12 Number of Conductors in outlet, device, and junction boxes, and conduit bodies
  - Box fill as marked on box or table E3905.12.1



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## Common Code



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## Common Code

- P3103.2 Frost Closure
  - 97.5 percent value is below 0 F
  - 3 inches in diameter
  - 1 foot inside thermal envelope



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## Common Code

- R308.4.5 Glazing and wet surfaces
  - Less than 60 inches above floor of standing or walking surface
  - Each pane



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## Common Code Violations



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## Common Code

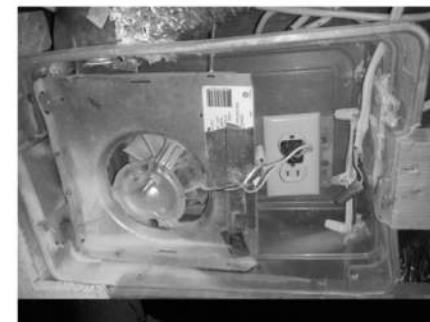
- E4002.11 Bathtub and Shower Space
  - No receptacles allowed within or directly over bathtub or shower stall



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## Common Code

- P2708 Showers
  - 900 sq in and no less than 30 inches
  - Lesser dimension allowed to 25 area increases to 1300 sq in



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## Common Code Violations



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## Common Code

- R303.3 Bathrooms
  - Bathrooms, water closet compartments or other similar rooms shall have openable windows.
  - 3 sqft on half openable
  - Exception
    - Mechanical ventilation of 5 air changes per hour exhausted directly to the outdoors



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## Common Code Violations



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## Common Code

- M1502 Clothes Dryer exhaust
  - Smooth interior finish
  - 4 inch minimum size
  - Supported not exceeding 12 feet
  - Transition duct shall not be concealed within construction



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## Common Code Violations



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## Common Code Violations



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## Common Code Violations



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## Common Code

- R903.2 Flashing
  - Prevent moisture from entering the structure
  - Wall and roof intersections
  - Shall be metal of minimum of 26 gauge



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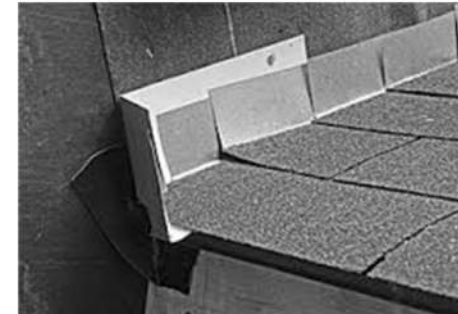
## Common Code Violations



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## Common Code

- P3114.1 Air Admittance Valve
  - Individual horizontal branch drain
  - No less than 4 inches above horizontal branch connection
  - Stack vent valves shall be located 6 inches above flood level rim of highest fixture
  - Vent only fixtures on same floor level
  - Per manufacturers specification
  - Open air and access



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## Common code violations



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## Common Code

- P2603.5 Freezing
  - Winter design temperature of less than 32 F
  - Outside, attics, crawl spaces, exterior walls
  - Any place subjected to freezing
  - Shall be protected



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## Common Code Violations



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## Common Codes

- R807.1 Attic access
  - Vertical height greater than 30 inches
  - Serving area not less than 30 sqft
- Opening not less than 22x30 inches
- No smaller than largest piece of equipment if serving mechanical equipment

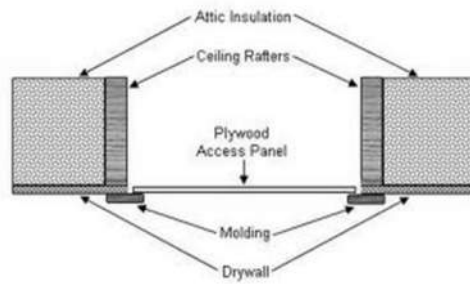


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## Common Code Violations



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## Common Code Violations



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# Questions?



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