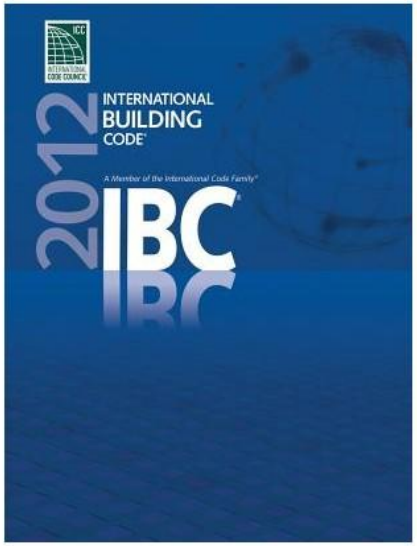
CITY OF MISSION
KANSAS

2018 Code Adoption Study Session
February 19, 2020

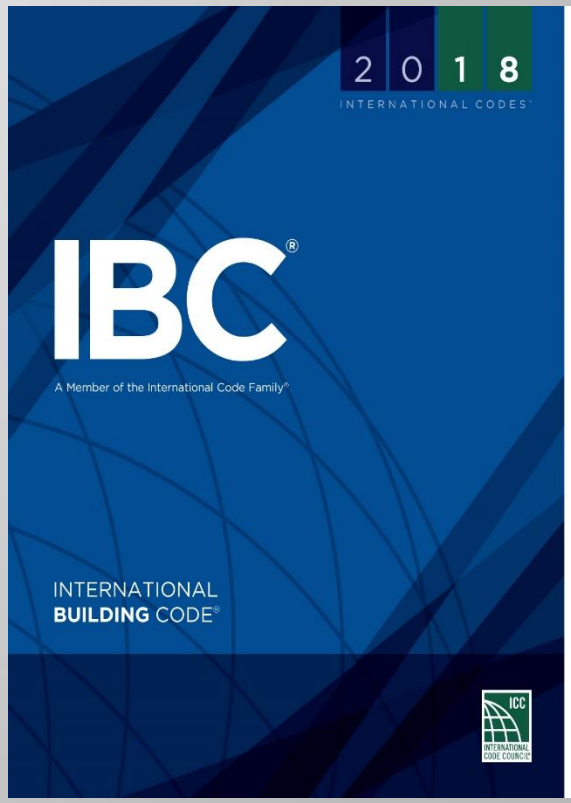
Significant Changes between the 2012/2018 Editions of the International Building Code, International Residential Code, International Fire Code, International Plumbing Code, International Fuel Gas Code, International Mechanical Code, International Energy Conservation Code and the 2011/2017 Edition of the National Electrical Code

2012/2018 IBC

2012 IBC



2018 IBC



International Building Code (IBC)

Section 202 Definitions. New definitions added:

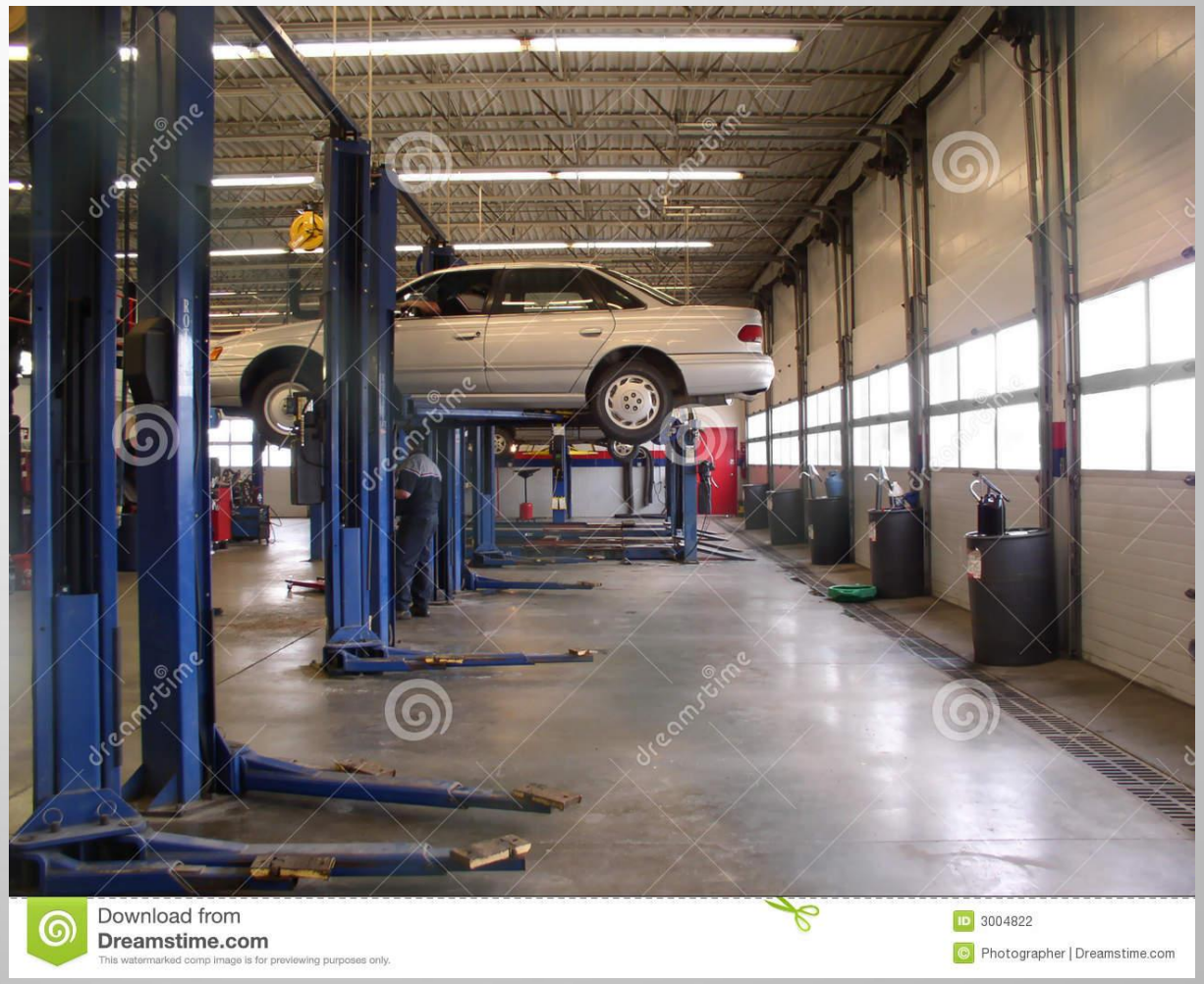
Greenhouse. A structure or thermally isolated area of a building that maintains a specialized sunlit environment used for and essential to the cultivation, protection or maintenance of plants.

Repair garage. A building, structure or portion thereof used for servicing or repairing motor vehicles.

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.

Greenhouse

Repair garage



Sleeping unit

International Building Code (IBC)

Section 202 & 304.2 Definitions. Definitions located in different sections of the code have been removed and are now consolidated in Chapter 2.

- **Section 302.1 Occupancy clarification.** This section has been revised to clarify that “occupied roofs” are to be classified in a manner consistent with the inside the building. For example, when a rooftop contains a restaurant, has dining seating for 50 or more persons, the occupied roof would be classified an A-2 occupancy.

Rooftop dining area

International Building Code (IBC)

303.4 Assembly Group A-3. This section has been revised to now clarify that greenhouses for the conservation and exhibition of plants that allow public occupancy shall be classified as an A-3 occupancy.

309.1 Mercantile Group M. When a greenhouse allows public occupancy for the purpose of display and sale of plants a Group M occupancy is applicable.

311.1.1 Accessory storage space. This section has been revised to clarify that storage rooms and storage spaces(regardless to size) that are accessory to other uses are to be classified as part of the use to which they are accessory.

Accessory storage space

International Building Code (IBC)

903.2.1 Group A Occupancies. This section has been revised to clarify the extent of automatic sprinkler systems in multi-story Group A occupancies. Inconsistent text regarding different floor levels such as “level of exit discharge” and “intervening floors” has been clarified.

903.2.3 Group E. Criteria for occupant load threshold and location within a building have been added to the automatic sprinkler provisions for Group E occupancies. It is commonplace for schools to serve multiple functions in the community such as club meetings, parent/teacher conferences, open houses, etc. As a result, fire sprinklers are required in Group E occupancies with an occupant load of 300 or more, regardless of fire area size. The code also requires fire sprinklers where the Group E fire area is on a level other than the level of exit discharge.

Group A Occupancy

Group E Occupancy

International Building Code (IBC)

903.3.1.2.1 Balconies and decks. This section clarifies that when non rated decks and balconies are permitted as projections in Type IIIA and VA construction fire sprinkler protection is required.

Balconies and Decks

International Building Code (IBC)

904.13 Domestic cooking systems. This section has been revised to clarify that domestic cooking operations in I-1(assisted living facility, group homes, halfway houses, etc), I-2 (hospitals, nursing homes, etc) and R-2 college dormitories shall be protected with a UL 300A fire extinguishing system.

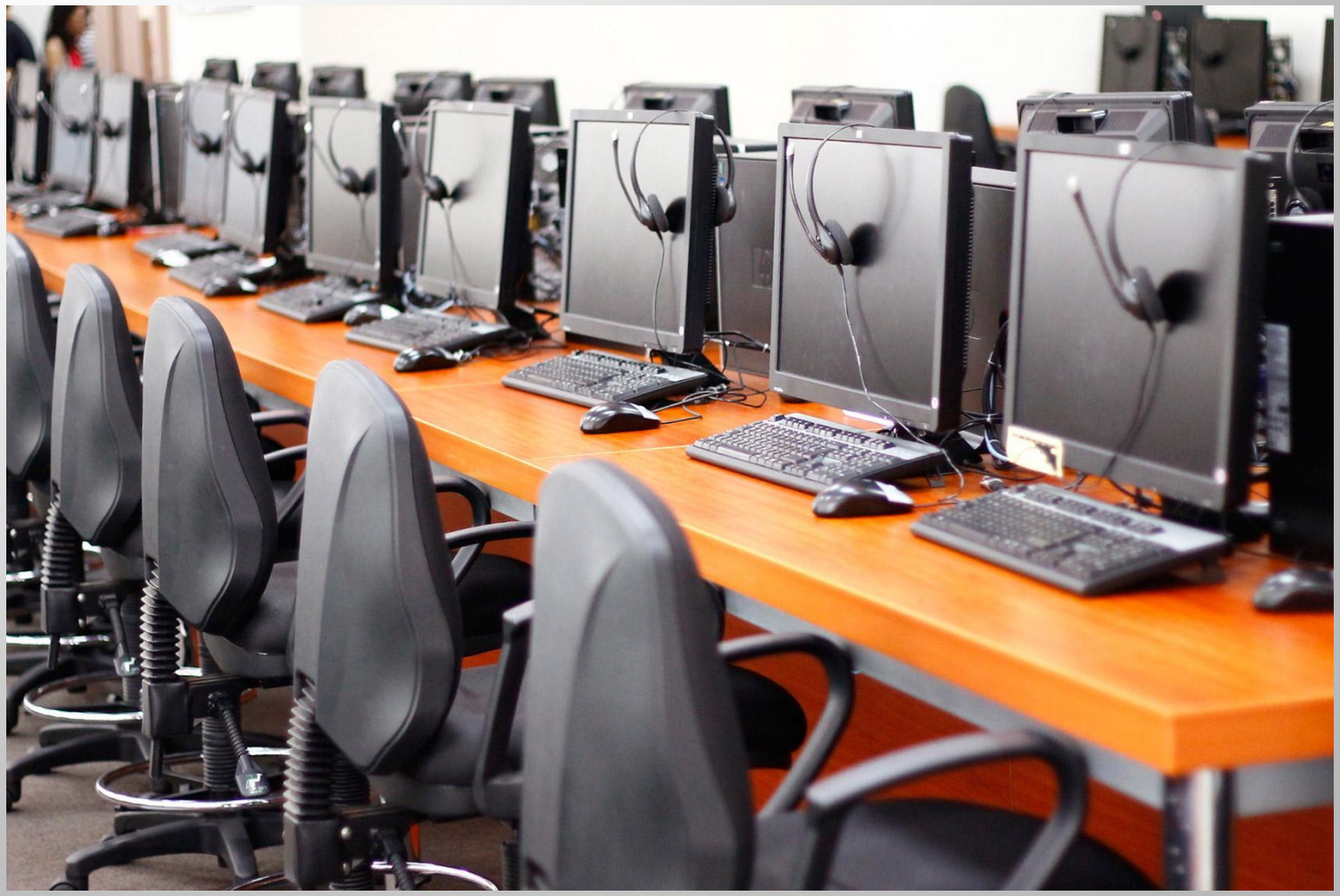
907.2.1 Group A. This section has been revised to now require a manual fire alarm system in Group A occupancies where the occupant load is more than 100 persons above or below the level of exit discharge. The new text is underlined as follows:
" A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group A occupancies where the occupant load due to the assembly occupancy is 300 or more, <u>or where the Group A occupant load is more than 100 persons above or below the lowest level of exit discharge.</u>

Domestic fire extinguishing system

International Building Code (IBC)

Table 1004.5 Maximum floor area allowances per occupant
This table has been revised for business areas to change the occupant load factor from 100 to 150 gross square feet per occupant. This change reflects a more realistic occupant load for typical business uses. In addition to address the increased occupant load in B occupancies (such as call centers, trading floors, etc.) a new Section 1004.8 Concentrated business use areas, has been established. This new section will allow not less than one occupant per 50 square feet when approved by the building official.

Call center



International Building Code (IBC)

Table 1008.2.3 Exit discharge.
This section has been revised to now require illumination along the path of travel for the exit discharge from each exit to the public way/safe dispersal area. This means illumination of the entire exit discharge path.

Exit discharge illumination

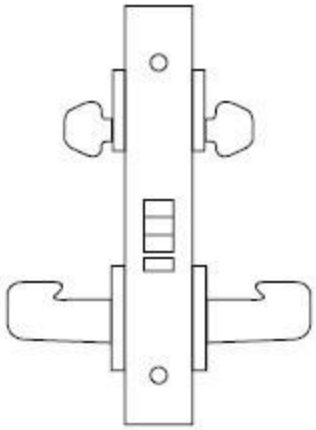
International Building Code (IBC)

1010.1.4.4 Locking arrangements in educational occupancies. This section has been revised to provide enhanced security measures for educational occupancies. Egress doors from classrooms, offices and other occupied rooms are permitted to have locking arrangements to keep intruders from entering the room when all of the following conditions are met:

1. The door shall be capable of being unlocked from outside the room with a key or other approved means.
2. The door shall be openable from inside the room.
3. Modifications shall not be made to listed panic hardware, fire door hardware or door closers.

8200 Line

SARGENT



CLASSROOM
SECURITY
INTRUDER

ELECTROMAGNATIC LOCK

International Building Code (IBC)

1013.2 Low level exit signs in Group R-1.
Where exit signs are required in group R-1 occupancies (hotels, motels, boarding houses) additional low-level floor exit signs are now required in all areas serving guest rooms. This section has been expanded to now allow the bottom of such sign to be mounted 18 inches above the floor.
The 2012 IBC required the sign to be installed not less than 10 inches nor more than 12 inches above the floor level.

FLOOR LEVEL EXIT SIGNS

International Building Code (IBC)

1109.2.1.2 Family or assisted-use toilet rooms.
This section has been revised to allow the following additional fixtures in a family or assisted-use toilet room:

1. 1. A urinal.
2. 2. A child-height water closet.
3. 3. A child height lavatory.

1110.4.13 Play areas.
This section has been revised to specifically require access to children's play areas. Play areas must now be on an accessible route.


FAMILY RESTROOM
Reorder: RRE-7035-Black_on_White www.ComplianceSigns.com


SWING
FUN

International Building Code (IBC)

Table 1607.1 Minimum Uniformly Distributed Live Loads.
Item 5. Balconies and decks has been revised to state as follows: "1.5 times the live load of the occupancy served, not required to exceed 100 psf."
For example, a deck serving a private room of a multi-family dwelling must be designed for 60 psf. (1.5 times the private room served @ 40 psf equates to 60 psf)

International Building Code (IBC)

3310.1 Stairways required.
This section has been revised to require at least one temporary stairway for buildings under construction where the height above fire department vehicle access is 40 feet or more.

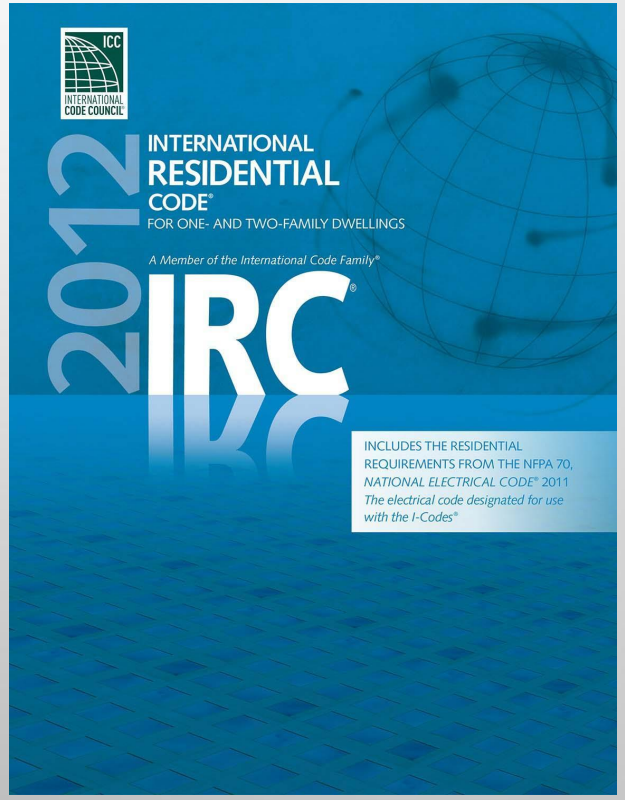
International Building Code (IBC)

3314 Fire watch during construction.
New provisions have been established to give the fire code official the authority to require a fire watch during construction. Since multi-floor wood construction (apartments, etc) are especially vulnerable to a fire event during construction, this becomes a valuable tool for the fire code official. The new section is as follows:

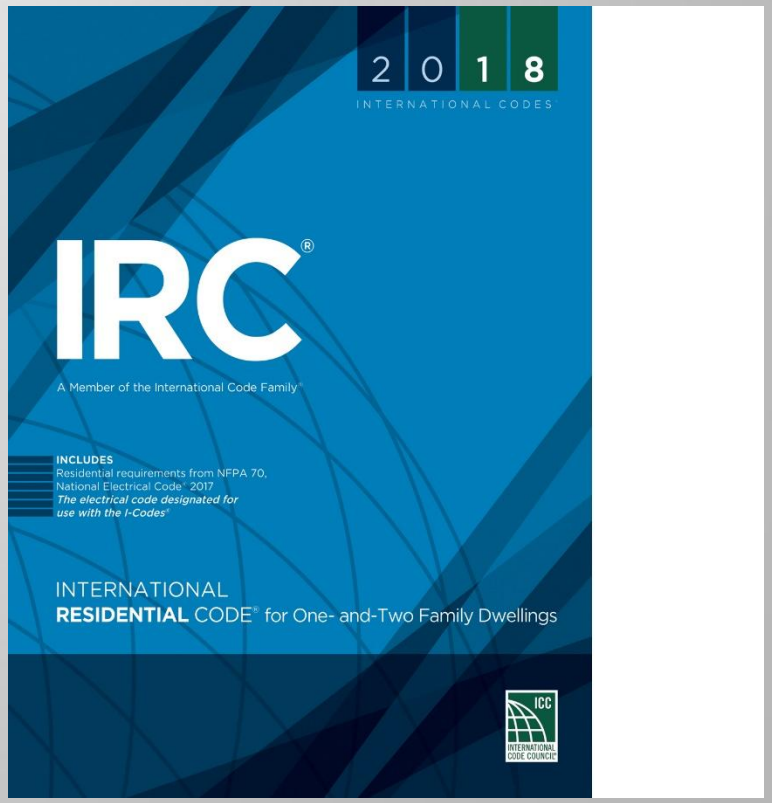
3314.1 Fire watch during construction.
Where required by the fire code official, a fire watch shall be provided during non-working hours for construction that exceeds 40 feet in height above the lowest adjacent grade".

2012/2018 IRC

2012 IRC



2018 IRC



International Residential Code (IRC)

R101.2 Scope.

Exceptions have been expanded as follows:

The following shall be permitted to be constructed in accordance with this code where provided with a residential fire sprinkler system complying with Section P2904:

1. 1. Live/work units located in townhouses.
   2. Owner-occupied lodging houses with five or fewer guestrooms.
   3. A care facility with five or fewer persons receiving custodial care within a dwelling unit.
   4. A care facility with five or fewer persons receiving medical care within a dwelling unit.
   5. A care facility for five or fewer persons receiving care that are within a single-family dwelling.

Live-work unit

Owner-occupied lodging

Custodial care facility

Assisted living facility

International Residential Code (IRC)

R202 Definitions. (new)

Access (to): That which enables a device, appliance or equipment to be reached by ready access, or by a means that first requires the removal or movement of a panel, door, or similar obstruction.

Crawl space: An underfloor space that is not a basement.

Carbon monoxide alarm. A single or multi-station alarm intended to detect carbon monoxide gas and alert occupants by a distinct audible signal. It incorporates a sensor, control components and an alarm notification appliance in a single unit.

Carbon monoxide detector: A device with an integral sensor to detect carbon monoxide gas and transmit an alarm signal to a connected alarm control unit.

Crawl space

Carbon monoxide detector/alarm

CARBON MONOXIDE DETECTOR

CARBON MONOXIDE ALARM

International Residential Code (IRC)

R302.5 Dwelling-garage opening and penetration protection. This section has been revised to allow another option for the self-closing fire door between the garage and residence. The door may be equipped with a self closing device or automatic closing device.

Self closing device & Automatic closing device

International Residential Code (IRC)

R302.13 Fire Protection of Floors.
The 2012 IRC required installation of ½ inch gypsum board, 5/8 inch wood structural panel, or other approved material on the underside of floor assemblies consisting of i-joists, manufactured open web floor trusses, cold-formed steel framing and other materials and products considered most susceptible to collapse in a fire. The 2018 IRC expands the requirement to the underside of the floor assembly over a crawl space when fuel-fired or electric-powered heating equipment is installed in the crawl space.

I-JOISTS

OPEN-WEB FLOOR JOISTS

FIRE PROTECTION- UNDERSIDE OF FLOOR ASSEMBLIES

Fire protection- Underside of Crawl Spaces

International Residential Code (IRC)

R310.3 Emergency escape and rescue doors.
The terminology for, “bulkhead enclosures” has been replaced with “area wells”. The revised sections are as follows:

R310.3.2 Area wells. Area wells shall have a width of not less than 36 inches. The area well shall be sized to allow the emergency escape and rescue door to be fully opened.

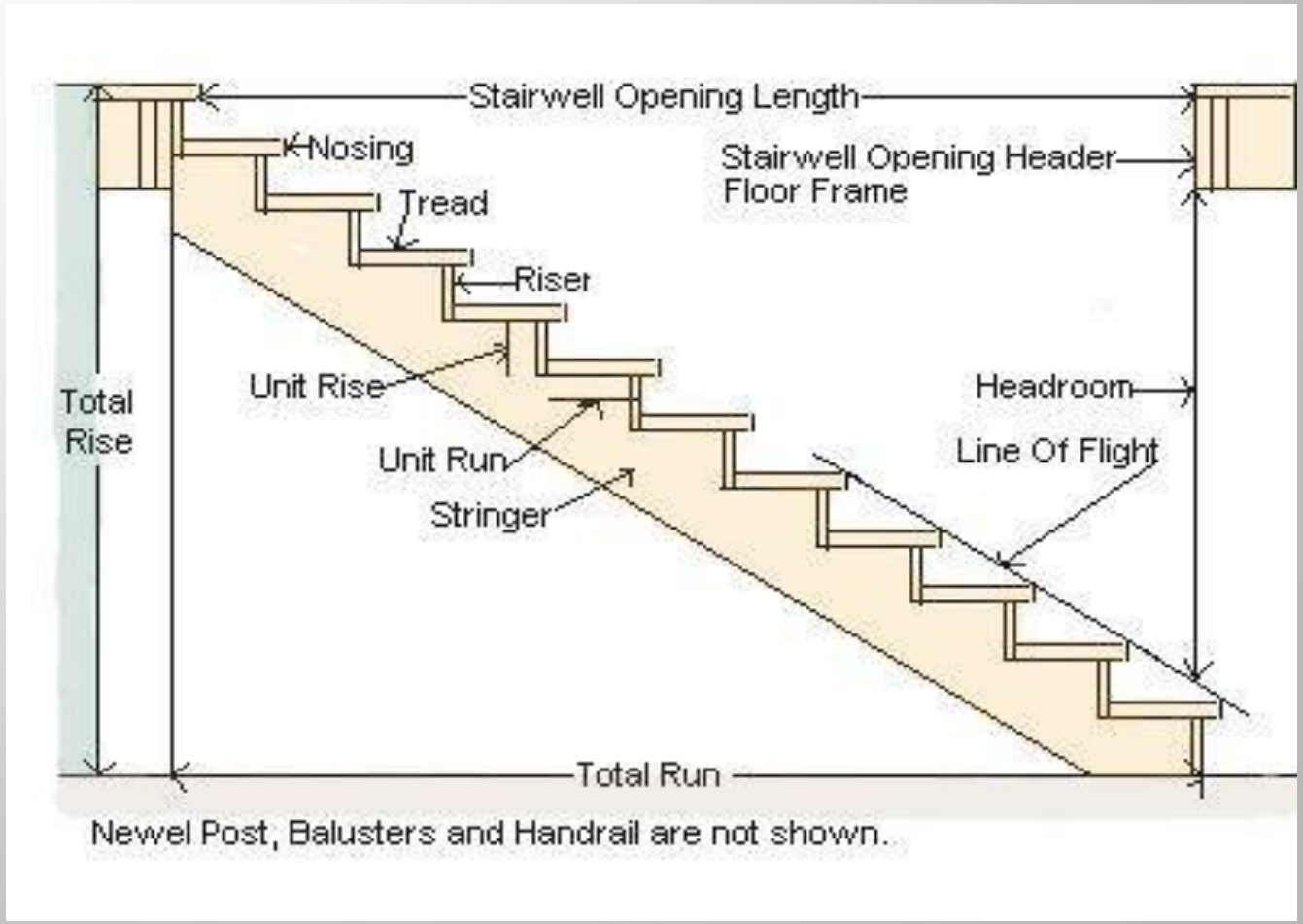
R310.3.2.1 Ladders and steps. Area wells with a vertical depth greater than 44 inches shall be equipped with a permanently affixed ladder or steps usable with the door in the fully open position.

Basement area well

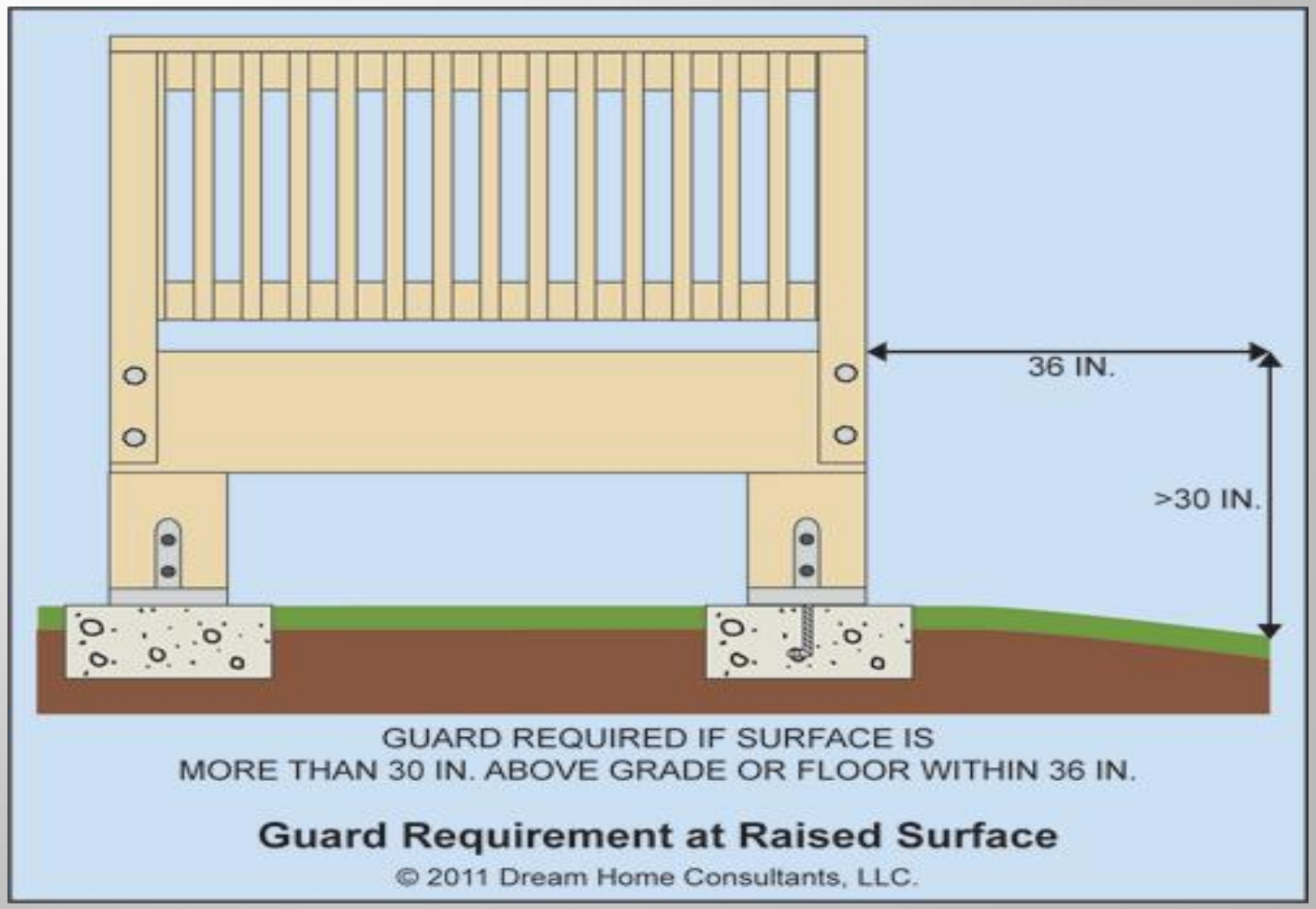
International Residential Code (IRC)

R31.7.3 Vertical rise. The maximum rise for a flight of stairs has increased from 147 to 151 inches (12 feet 3 inches to 12 feet 7 inches) This increase addresses the common 12 foot plus story height of modern home designs.
R312.1 Guards. This section has been revised to clarify the guard requirement only applies to that portion of the open-sided walking surface that exceeds 30 inches in height, measured vertically to the floor or grade below at any point within 36 inches horizontally to the edge of the open side.
R314 Smoke alarms. Wireless smoke alarms are now readily available and are affordable. With the advancement in this technology the exemption for interconnection of smoke alarms triggered by alterations, repairs or additions has been removed.
R315 Carbon monoxide alarms. Where more than one carbon monoxide alarm is required to be installed within an individual dwelling unit, the alarm devices are now required to be interconnected.

Vertical rise



Guard


36 IN.
>30 IN.
GUARD REQUIRED IF SURFACE IS
MORE THAN 30 IN. ABOVE GRADE OR FLOOR WITHIN 36 IN.
Guard Requirement at Raised Surface
© 2011 Dream Home Consultants, LLC.

Wireless smoke alarm

Wireless carbon monoxide alarm

Wireless combination smoke and carbon monoxide alarm

International Residential Code (IRC)

Table R507.6 Deck joist spans for common lumber species.
This table has been revised to include the maximum deck joist span and now includes the maximum cantilevered span also. The cantilever spans are controlled by one fourth the span length (measured from center of support to center of support) or the tabular cantilever value in the table, whichever is less.

R703.2 Water- resistive barrier. The exception for detached accessory buildings has been removed. A water-resistive barrier for the exterior walls of detached accessory structures is now required.

Water-resistive barrier

Cantilevered joists

International Residential Code (IRC)

N1101.6 Air barrier. The definition of air barrier has been revised for clarification as follows: (Section R202)

"Air Barrier. One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the building thermal envelope and its assemblies.

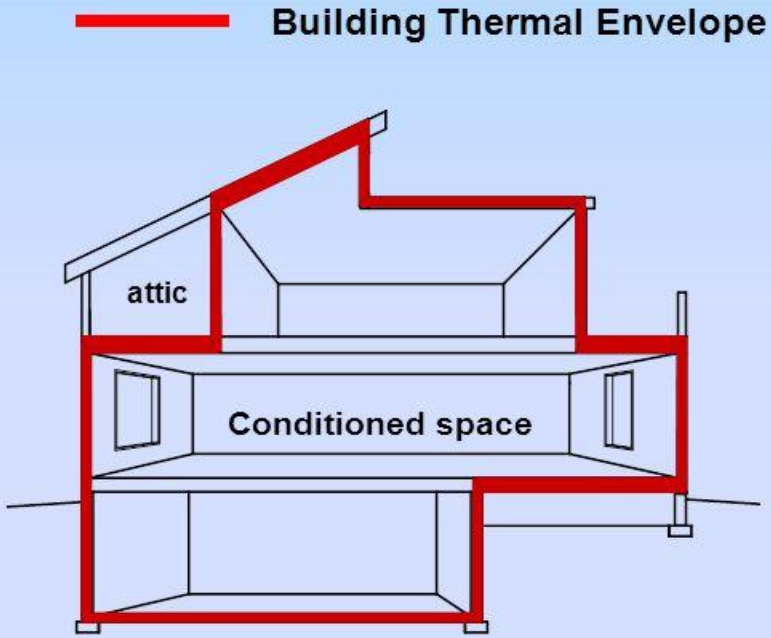
N 1106.6 Building thermal envelope. The definition of building thermal envelope has been revised to further clarify it is an assembly to provide a boundary between conditioned space and unconditioned space.

R703.2 Water- resistive barrier. The exception for detached accessory buildings has been removed. A water-resistive barrier for the exterior walls of detached accessory structures is now required.

Building Thermal Envelope

Definitions

Building Thermal Envelope:
The basement walls, exterior walls, floor, roof, and any other building element that enclose the conditioned space. This boundary also includes the boundary between conditioned space and any exempt or unconditioned space.



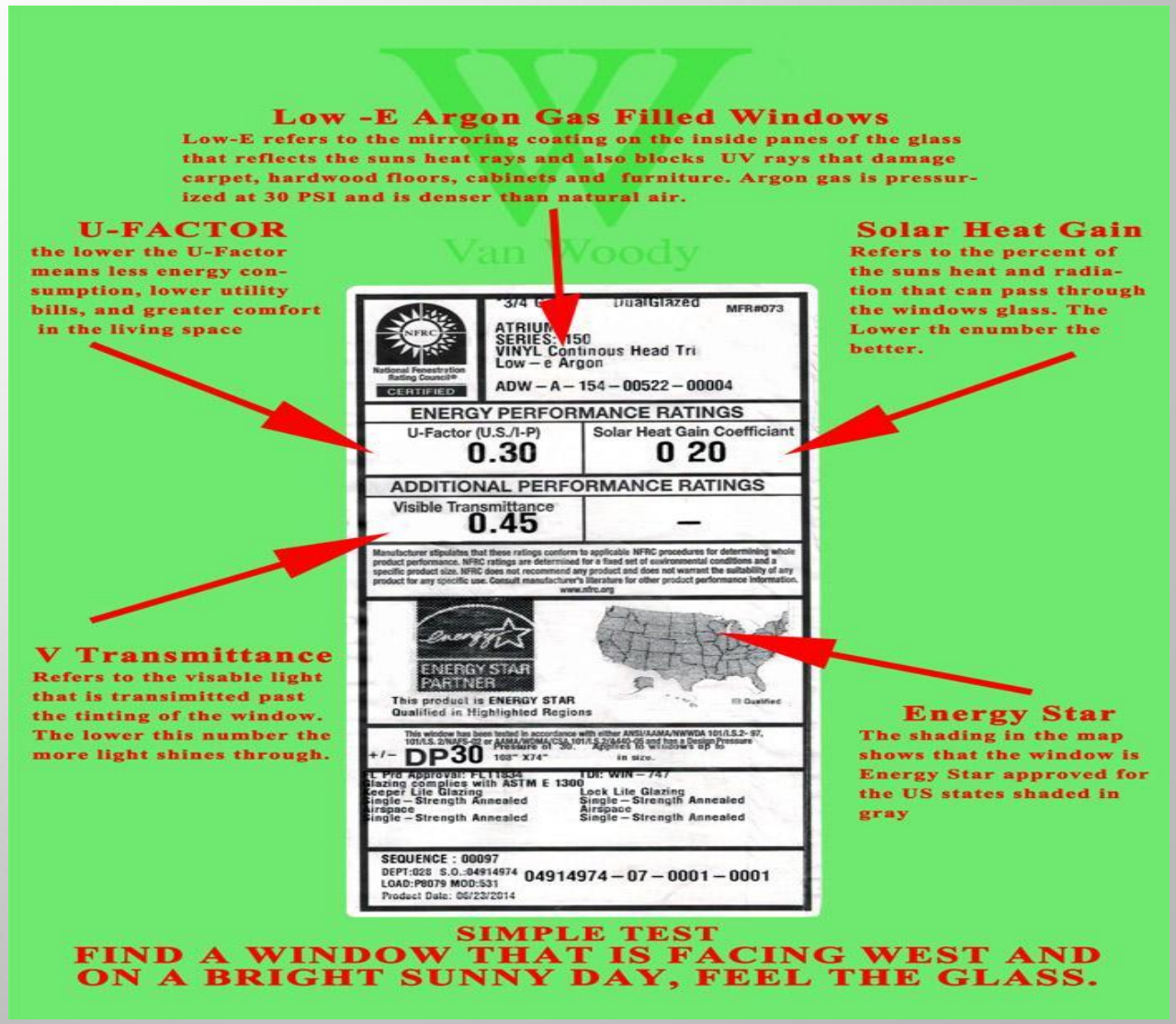
7

Water resistive air barrier

International Residential Code (IRC)

Tables N1102.1.2 & N1102.1.4 Insulation and fenestration requirements. The tables have been revised to reflect a lower fenestration U-factor for dwellings and townhouses which will result in improved energy efficiency. The U-factor has been reduced slightly from 0.35 to 0.32. This is due to the low cost for improving U-factors and the increasing number of windows and doors already meeting and exceeding the 0.32 U-factor.
A study by the American Council for Energy Efficient Economy shows that 80% of all windows and doors installed in Climate zones 4-8 have a average 0.27 U-factor. (this area is in Climate Zone 4)

Energy Performance Window Label

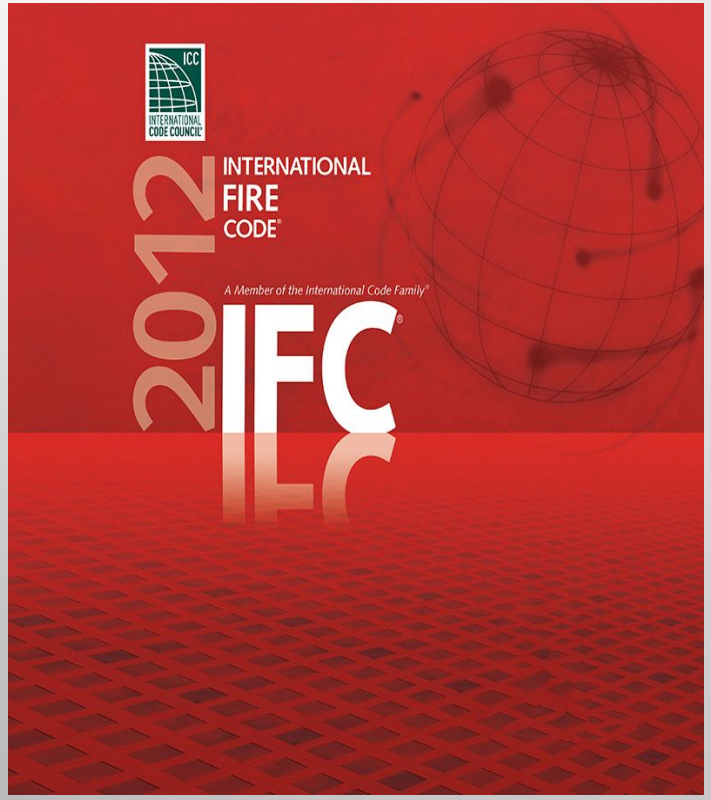


International Residential Code (IRC)

N1104.1 Lighting equipment (mandatory). This section has been revised to now required 90% of all permanently installed lighting fixtures to have high efficacy bulbs (i.e., LED lamps) Previous requirement was 75%.

2012/2018 IFC

2012 IFC



2018 IFC

International Fire Code (IFC)

315.3.1 Ceiling clearance.
This section has been modified to allow an increase in height for storage along walls in sprinklered buildings. The code text as revised is as follows:

"Storage shall be maintained 2 feet or more below the ceiling of nonsprinklered areas of buildings or not less than 18 inches below sprinkler head deflectors in sprinklered areas of buildings."

Exceptions:
1. The 2 foot ceiling clearance is not required for storage along walls in nonsprinklered areas of buildings.
2. The 18 inch clearance is not required for storage along walls in areas of buildings equipped with an automatic sprinkler system.


eppendorf
Correct

International Fire Code (IFC)

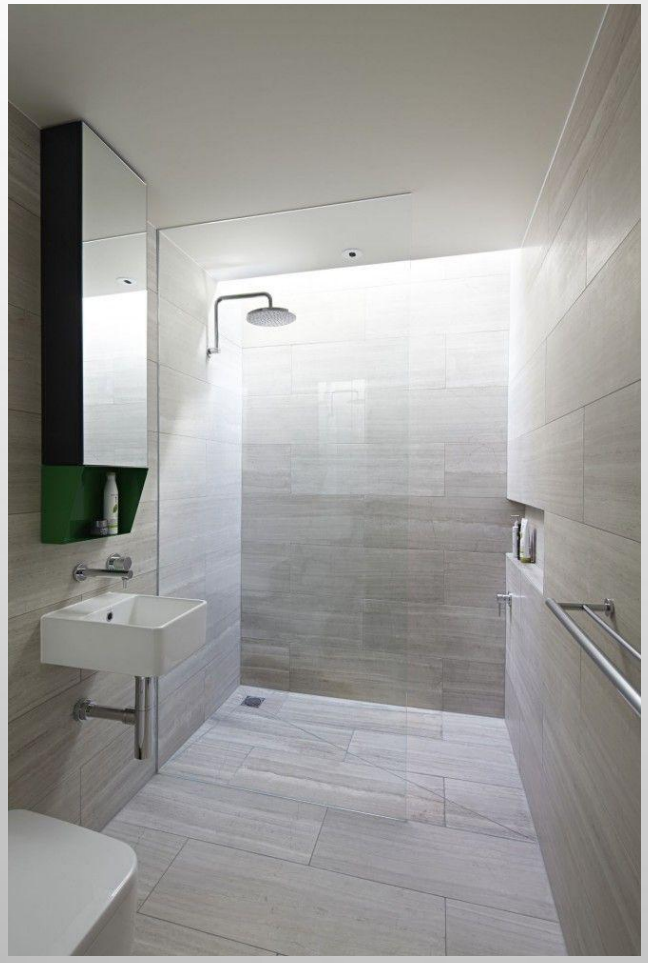
807.2 Combustible decorative materials.
This section has been clarified to define the limitations of combustible decorative materials in Groups A, B, E, I, M, & R-1 dormitories of R-2 occupancies. Such materials shall not exceed 10% of the specific wall or ceiling area to which such materials are attached. Note: the 10% limit does not apply to curtains, draperies and similar combustible materials used for window coverings.

International Fire Code (IFC)

903.3.1.1.2 Bathrooms. This section has been revised to remove the fire sprinkler requirements from small bathrooms in R-4 occupancies. (assisted living facility, group home, alcohol/drug centers, rehab facilities, etc)

903.3.1.2.1 Balconies and decks. This section clarifies that when non rated decks and balconies are permitted as projections in Type V construction fire sprinkler protection is required. Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that their deflectors are within 1 inch to 6 inches below the structural members & a maximum of 14 inches below balconies and decks constructed of open wood joist construction.

R-4 bathroom & Balcony/deck



International Fire Code (IFC)

907.2.1 Group A. This section has been revised to now require a manual fire alarm system in Group A occupancies where the occupant load is more than 100 persons above or below the level of exit discharge. The new text is underlined as follows:

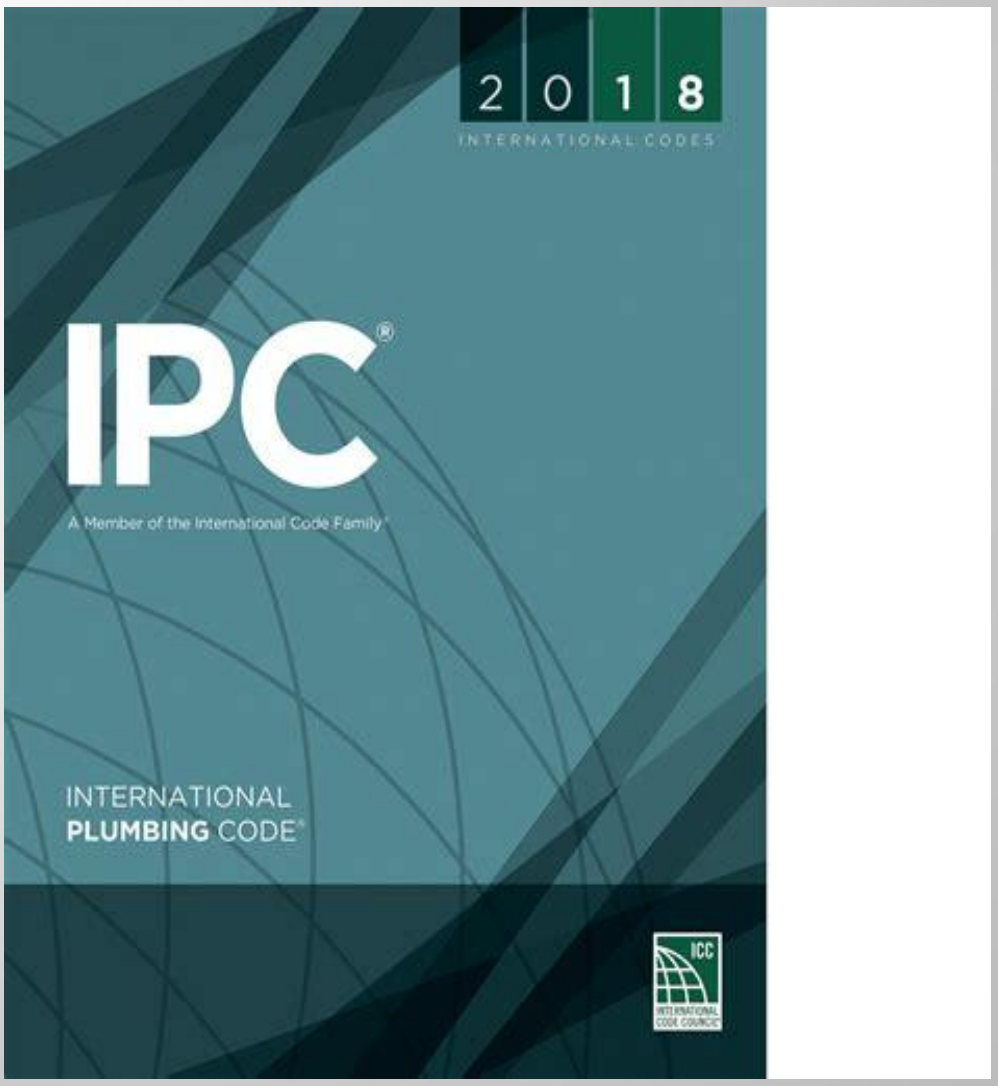
“ A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group A occupancies where the occupant load due to the assembly occupancy is 300 or more, or where the Group A occupant load is more than 100 persons above or below the lowest level of exit discharge.

VOICE/ALARM COMMUNICATION SYSTEM

International Fire Code (IFC)

1010.1.10 Panic and fire exit hardware.
This section has been revised to allow sensor release of electrically locked swinging doors equipped with panic or fire exit hardware. Activation of the panic or fire exit hardware will automatically release the electronic lock assembly for the door(s).

ELECTROMAGNATIC LOCK

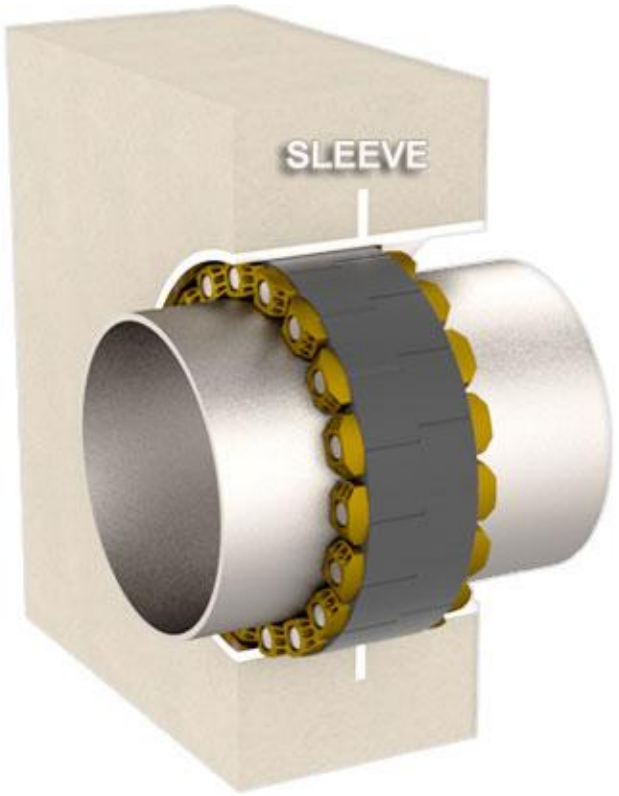

2018
INTERNATIONAL CODES
IPC®
A Member of the International Code Family®
INTERNATIONAL
PLUMBING CODE®
ICC
INTERNATIONAL CODE COUNCIL

International Plumbing Code (IPC)

305.1 Protection against contact.
This section has been revised to more clearly define areas where metallic piping is to be protected against direct contact with concrete, cinder blocks, concrete floors, steel framing members (new) and corrosive soils (new).

Table 308.5 Hanger Spacing.
The table has been revised to include the hanger spacing requirements for cross-linked polyethylene (PEX) pipe 1 ¼ inch and larger and polyethylene of raised temperature (PE-RT) pipe 1 ¼ inch and larger. In both cases, the maximum horizontal spacing is 4 feet and the maximum vertical spacing is 10 feet.

Protection Against Contact



GALVANIZED WALL SLEEVES

PVC WALL SLEEVES

Hanger spacing PEX

Typical PE-RT piping installation

International Plumbing Code (IPC)

411.3 Water supply.

This new section states as follows:

“ Where hot and cold water is supplied to an emergency shower or eyewash station, the temperature of the water supply shall only be controlled by a temperature actuated mixing valve complying with ASSE 1071.”

Emergency shower/eyewash station

ASSE 1071 Compliant Mixing Valve

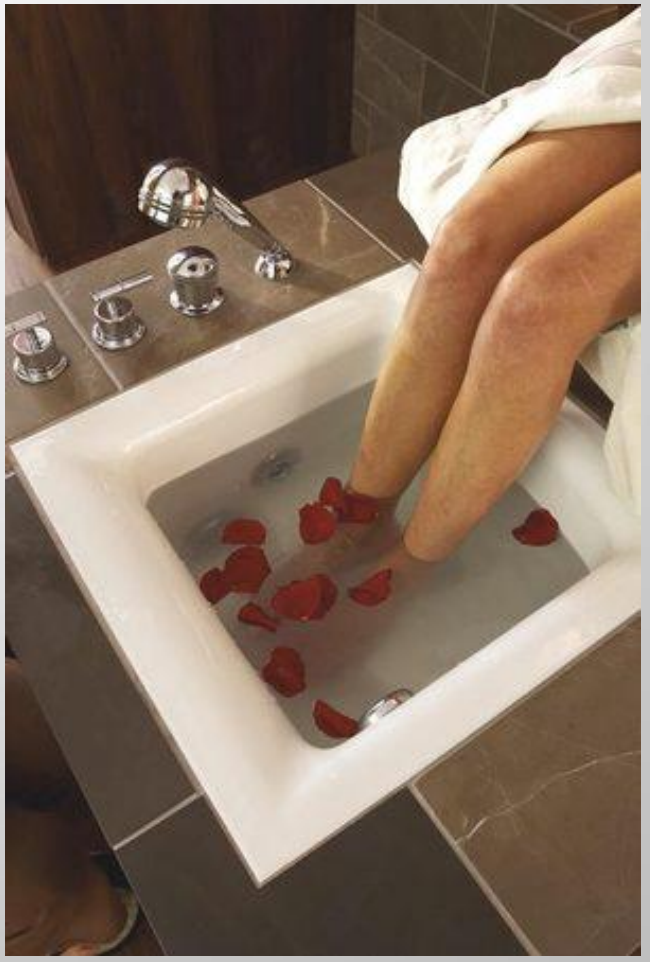
International Plumbing Code (IPC)

412.10 Head shampoo sink faucets.
This new section limits the hot water temperature to not more than 120 degrees F. In addition, each faucet shall have integral check valves to prevent crossover flow between the hot and cold water supply connections.

423.3 Footbaths and pedicure baths.
This new section limits the hot water temperature to not more than 120 degrees F. The water-temperature-limiting device must conform to ASSE1070/ASME A112.1070/CSA B125.70 or CSA B125.3.

Head shampoo station

Footbaths and Pedicure baths




New
2018
IFGC
INTERNATIONAL
FUEL GAS CODE
AGA
American Gas Association

International Fuel Gas Code (IFGC)

303.3.1 Fireplaces and decorative appliances in Group I-2, Condition 2 occupancies. This section has been revised to allow a gas fireplace appliance or decorative gas appliance in Group I-2, Condition 2 occupancies where such appliances are direct-vent appliances installed in public lobby and waiting areas that are not within smoke compartments containing patient sleeping areas. The appliance controls shall be located where they can only be accessed by facility staff.

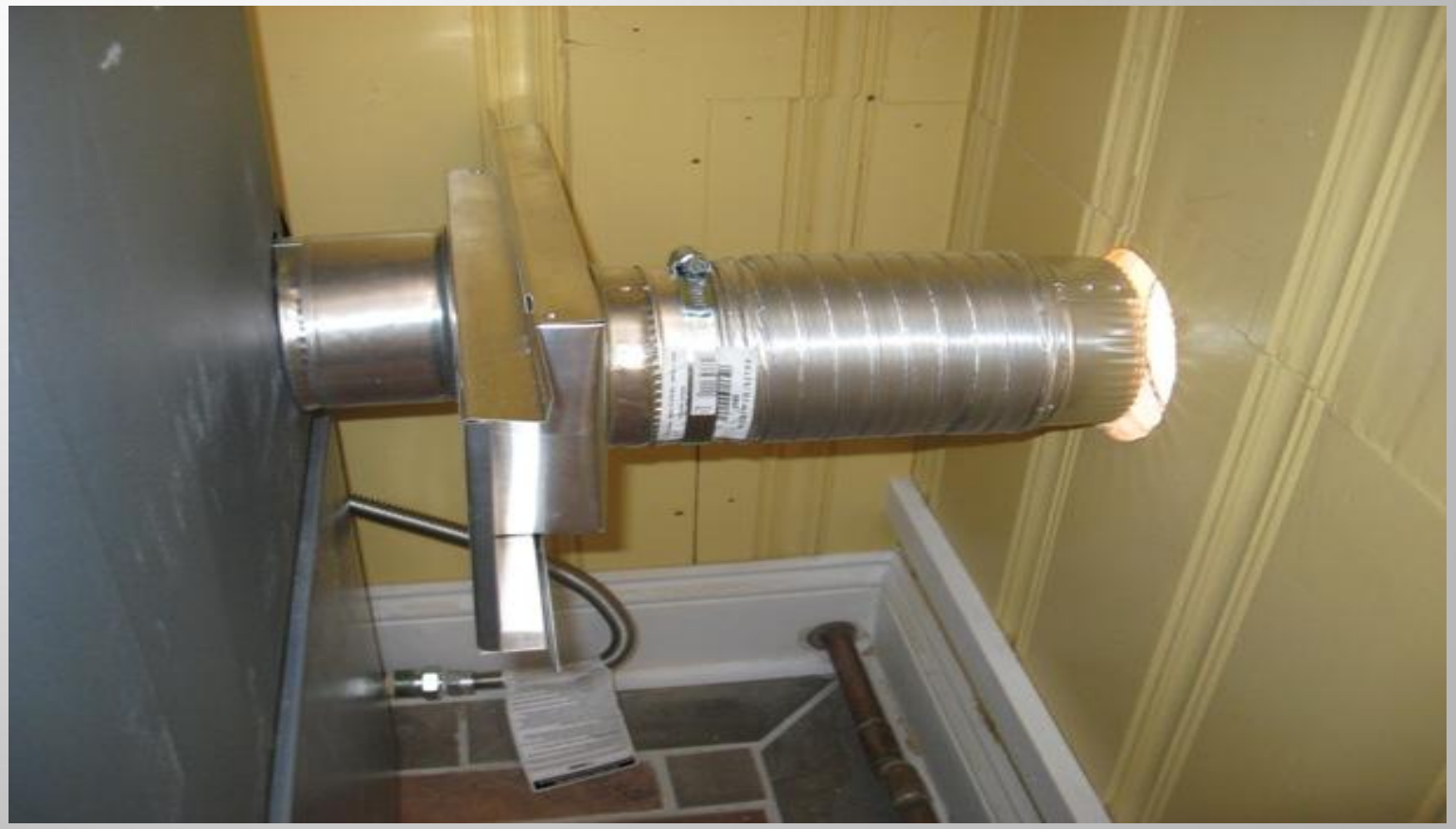
Gas fireplace appliance

International Fuel Gas Code (IFGC)

614.4 Exhaust installation. This section has been revised to clarify that clothes dryer exhaust ducts shall be sealed in accordance with Section 603.9 of the International Mechanical Code.

614.4.1 Exhaust termination outlet and passageway. This new section states as follows:
“ 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.”

Dryer Exhaust

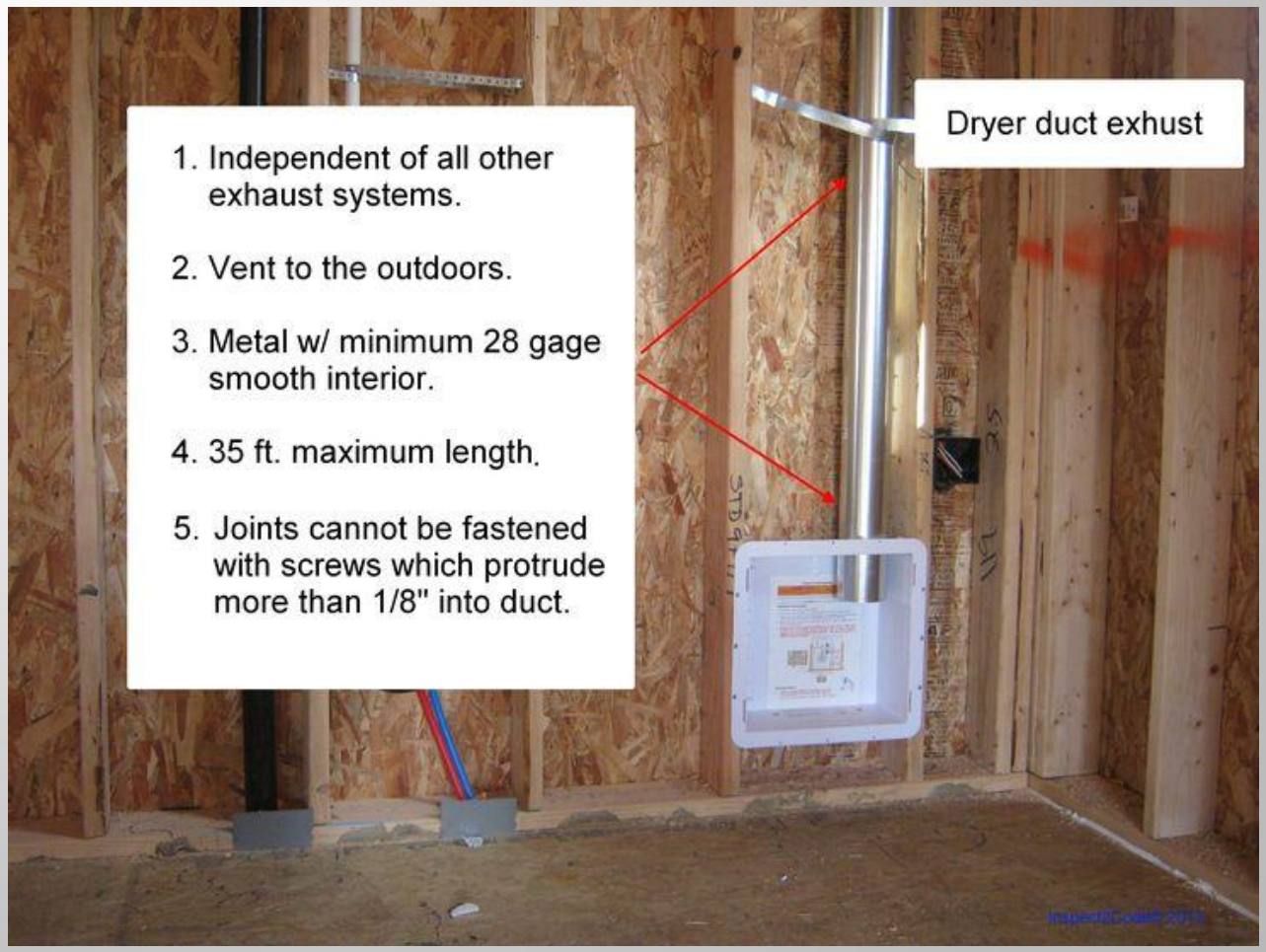



New
2018
INTERNATIONAL CODES
IMC
A Member of the International Code Family
INTERNATIONAL
MECHANICAL CODE

International Mechanical Code (IMC)

504.8.2 Duct installation.
This section has been revised to allow clothes dryer ducts to be joined with screws or similar fasteners that protrude more than 1/8 inch into the inside of the duct. An additional requirement has been added which states: “Where dryer exhaust ducts are enclosed in wall or ceiling cavities, such cavities shall allow the installation of the duct without deformation”.

Clothes dryer duct



International Mechanical Code (IMC)

507.2 Type 1 hoods.
This section has been revised to read as follows: “Type 1 hoods shall be installed where cooking appliances produce grease or smoke as a result of the cooking process. Type 1 hoods shall be installed over medium duty, heavy duty and extra heavy duty cooking appliances”. The requirement for “light duty cooking appliance” has been removed.

Light-Duty Cooking Appliance. Light-duty cooking appliances include gas and electric ovens (including standard, bake, roasting, revolving, retherm, convection, combination convection/steamer, countertop conveyorized baking/finishing, deck and pastry), electric and gas steam jacketed kettles, electric and gas pasta cookers, electric and gas compartment steamers (both pressure and atmospheric) and electric and gas cheesemelters.

International Mechanical Code (IMC)

Medium-duty cooking appliance.
Medium-duty cooking appliances include electric discrete element ranges (with or without oven) electric and gas hot- top ranges, electric and gas griddles, electric and gas double sided griddles, electric and gas fryers (including open deep fat fryers, donut fryers, kettle fryers and pressure fryers), electric or gas conveyor pizza ovens, electric and gas tilting skillets (braising pans) and electric and gas rotisseries.

Heavy-Duty Cooking Appliance. Heavy-duty cooking appliances include electric under-fired broilers, electric chain (conveyor) broilers, gas under-fired broilers, gas chain (conveyor) broilers, gas open-burner ranges (with or without oven), electric and gas wok ranges, smokers, smoker ovens, and electric and gas over-fired (upright) broilers and salamanders.

International Mechanical Code (IMC)

Extra Heavy-Duty Cooking Appliance. Extra heavy-duty cooking appliances are those utilizing open flame combustion of solid fuel at any time.

Solid Fuel (Cooking Applications). Applicable to commercial food service operations only, solid fuel is any bulk material such as hardwood, mesquite, charcoal or briquettes that is combusted to produce heat for cooking operations.

Cooking Appliances

LIGHT-DUTY

MEDIUM-DUTY

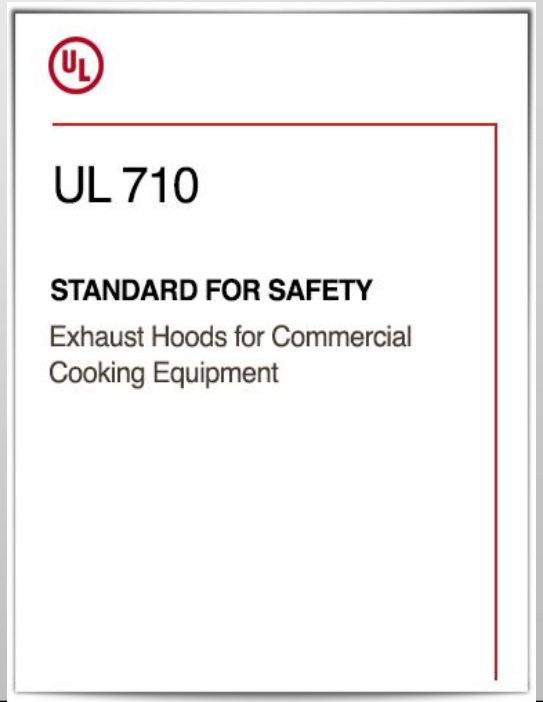
Cooking Appliances

HEAVY-DUTY

EXTRA HEAVY-DUTY

International Mechanical Code (IMC)

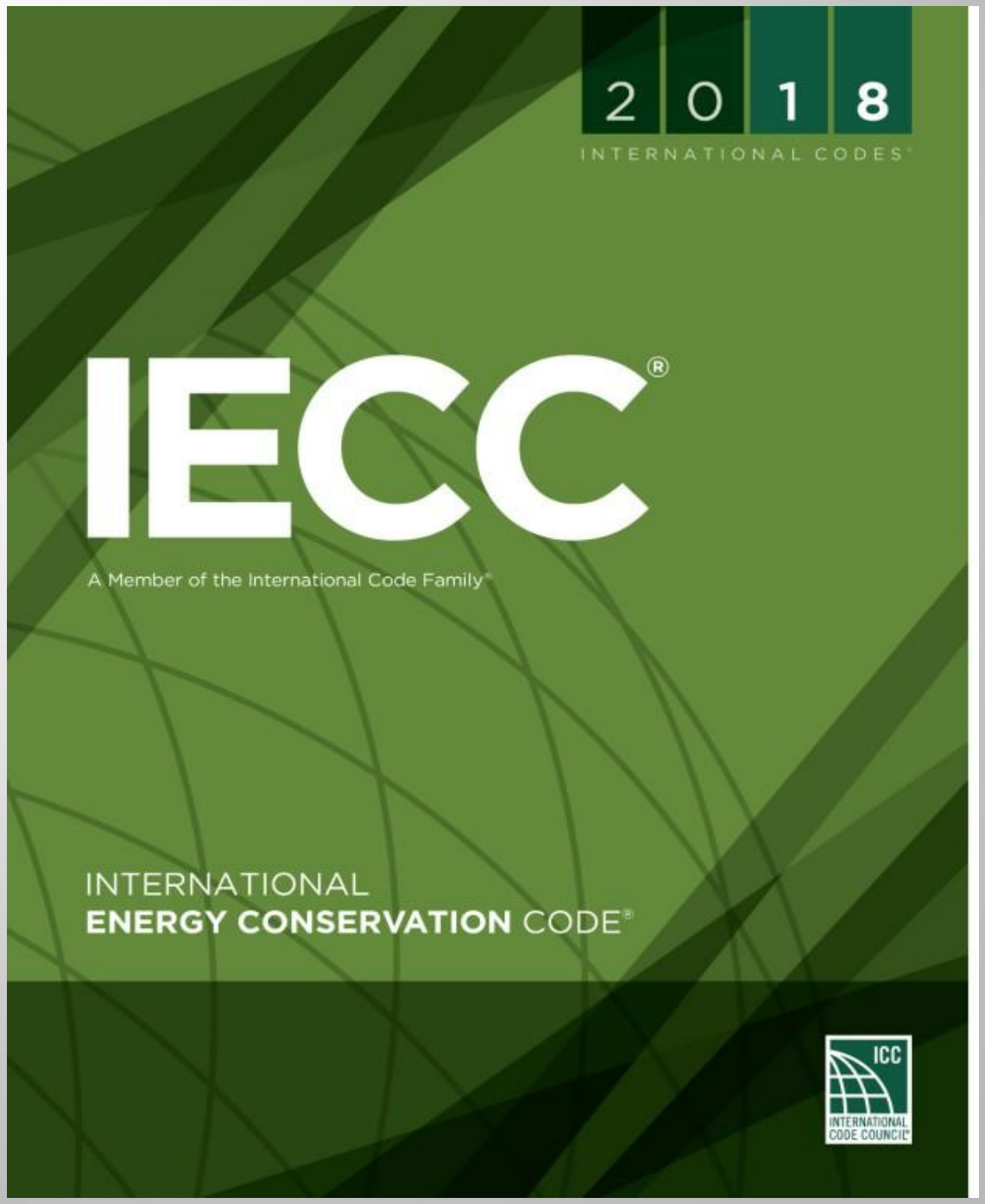
507.2.6 Clearances for Type I hood.
This section has been revised to include a second exception which states: " Type I hoods listed and labeled for clearances less than 18 inches in accordance with UL 710 shall be installed with the clearances specified by such listings".



International Mechanical Code (IMC)

805.7 Insulation shield.
This new section states as follows: “Where factory-built chimneys pass through insulated assemblies, an insulation shield constructed of steel having a thickness of not less than 26 gage shall be installed to provide clearance between the chimney and the insulation material. The clearance shall not be less than the clearance to combustibles specified by the chimney manufacturer’s installation instructions. Where chimneys pass through attic space, the shield shall terminate not less than 2 inches above the insulation materials and shall be secured in place to prevent displacement.

Insulation shield


2018
INTERNATIONAL CODES®
IECC®
A Member of the International Code Family®
INTERNATIONAL
ENERGY CONSERVATION CODE®
ICC
INTERNATIONAL CODE COUNCIL®

International Energy Conservation Code (IECC)

Table 402.1.1 Insulation and Fenestration Requirements by Components.
This table has been modified to reflect the climatic conditions in this area. (Climate Zone 4)

R402.4.1.1 Installation.
The components of the building envelope shall be installed in accordance with the manufacturer's instructions and the criteria of Table R402.4.1.1 as applicable to the method of construction. When required by the code official an approved third party shall inspect all components and verify compliance.

TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT (a)

Climate Zone	Fenestration U-factor (b)	Skylight U-factor (b)	Glazed Fenestration SHGC (b)	Ceiling R-value (f)	Wood frame wall R-value	Mass wall R-value(e)	Floor R-value	Basement wall R-value (c)	Foundation perimeter R-value (d)	Crawl space wall R-value (c)
4	0.32	0.55	0.40	49	13	8/13	19	10/13	10, 2 ft	10/13

- (a). R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed R-value shall not be less than the R-value specified in the table.
- (b). The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
- (c). 10/13 means R-10 continuous insulation on the interior or exterior, or R-13 cavity insulation at the interior of the finished basement walls only.
- (d). R-10, 2 ft. around perimeter of slab. R-5 shall be added to the required slab edge R-values for heated slabs.
- (e). The second R-value applies when more than half the insulation is on the interior of the wall mass.
- (f). Loose fill insulation shall be installed at the rate recommended by the manufacturer's statement "so many bags per 1000 square feet" Where the pitch of the roof restricts the "minimum thickness" at the exterior wall line, the insulation shall be blown into the cavity so as to achieve a greater compacted density to a point where the "minimum thickness" can be achieved. An alternate is to install high-density batts around the perimeter edge per N1102.2.

Energy Requirements and Terminology

What is R-value ?

It is the capacity of an insulating material to resist heat flow. The higher the R-value the greater the insulating power. Only resistance to heat flow is considered in the R-value and this is measured in a lab within a controlled environment. Unfortunately your home is built outdoors and subject to wind, storms, humidity and extreme temperature changes. In that regard, other elements of energy efficiency will come into play, such as thermal envelope to help assure comfort and savings.

Energy Requirements and Terminology

How many inches of fiberglass/batt insulation equate to:

R-13 = 3 ½ to 3 5/8 inches thick pending manufacturer

R-19 = 6 ¼ to 6 ½ inches thick pending manufacturer

R-30 = 9 ½ to 10 ¼ inches thick pending manufacturer

R-38 = 12 to 12 ½ inches thick pending manufacturer

R-49 = 15 ½ to 16 inches thick pending manufacturer

Energy Requirements and Terminology

What is U-factor ?

The lower the U –factor, the greater a window's resistance to heat flow and the better its insulating properties.

What is solar heat gain coefficient (SHGC) ?

The SHGC measures the fraction of solar energy transmitted and tells you how well the product blocks heat caused by sunlight. Typical ranges are 0.25 to 0.80.

Energy Requirements and Terminology

What is fenestration ?

Fenestration refers to the design, construction or presence of openings in a building. It includes windows, doors, louvers, vents, wall panels, skylights, store fronts, curtain walls and sloped glazed surfaces.

Energy Requirements and Terminology

What is air leakage ?

Air leakage is also called infiltration, which is the unintentional or accidental introduction of outside air into a building, typically through cracks in the building envelope and through doors for passage. In the summer infiltration can bring humid outdoor air into the building. Whenever there is infiltration there is corresponding exfiltration elsewhere in the building. In the winter this can result in warm moist indoor air moving in cold envelope cavities. In either case, condensation can occur in the structure, resulting in mold, mildew, or rot. In testing for air leakage the rate shall not exceed 5 air changes per hour (ACH).

Energy Requirements and Terminology

What is air changes per hour (ACH) ?

ACH is a measure of the air volume added or removed from a space (normally a room or house) divided by the volume of the space. For example, a room 10 feet x 10 feet x 8 feet high = 800 cubic feet. The supply grill is 10 inches x 6 inches with a 6 inch flexible duct delivering 80 cfm. In this case, the ACH = 60x80/800 = 6.0 ACH. It may also be calculated as 4800 cfh/800 which also equates to 6.0 ACH. The minimum ACH rate for a typical room is 4.0, with the range being 4.0 to 10.

Energy Requirements and Terminology

What is the building thermal envelope ?

The building thermal envelope is the physical separator between the conditioned and unconditioned environment of a building including the resistance to air, water, heat, cold, light and noise transfer.

- **What is RESNET and HERS Index ?**

The Residential Services Network (RESNET) was founded in 1995 as an independent, non-profit organization to help homeowners reduce the cost of their utility bills by making their homes more energy efficient. The Home Energy Rating System (HERS) Index is the industry standard by which a home's energy efficiency is measured. It is also the nationally recognized system for inspecting and calculating a home's energy performance.

Energy Requirements and Terminology

How does the HERS Index work ?

A certified Home Energy Rater assesses the energy efficiency of the home, assigning it a relative performance score. (Note: The lower the number the more efficient the home). The U.S. Department of Energy has determined that a typical resale home scores 130 on the HERS Index, while a standard new home is awarded a rating of 100. For example, a home with a HERS Index score of 70 is 30% more efficient than a standard new home. A home with a HERS Index score of 130 is 30% less efficient than a standard new home. (Note: A standard new home with a HERS Index score of 100 is based upon compliance with the 2006 IECC).

Energy Requirements and Terminology

The Energy Codes keep raising the bar :

The 2009 IECC is 15% more stringent than the 2006 version.

The 2012 IECC is 30% more stringent than the 2006 version.

The 2015 IECC target is to be 50% more stringent than the 2006 IECC.

The 2018 IECC target is to be 70% more stringent than the 2006 IECC.

The bar continues to raise in conjunction with the U.S. Department of Energy's Building Energy Codes Program (BECP) which mandates increased energy efficiency in America's residential and commercial buildings. Established in 1991 the BECP is part of the DOE's Energy Efficiency and Renewable Energy programs.

Energy Requirements and Terminology

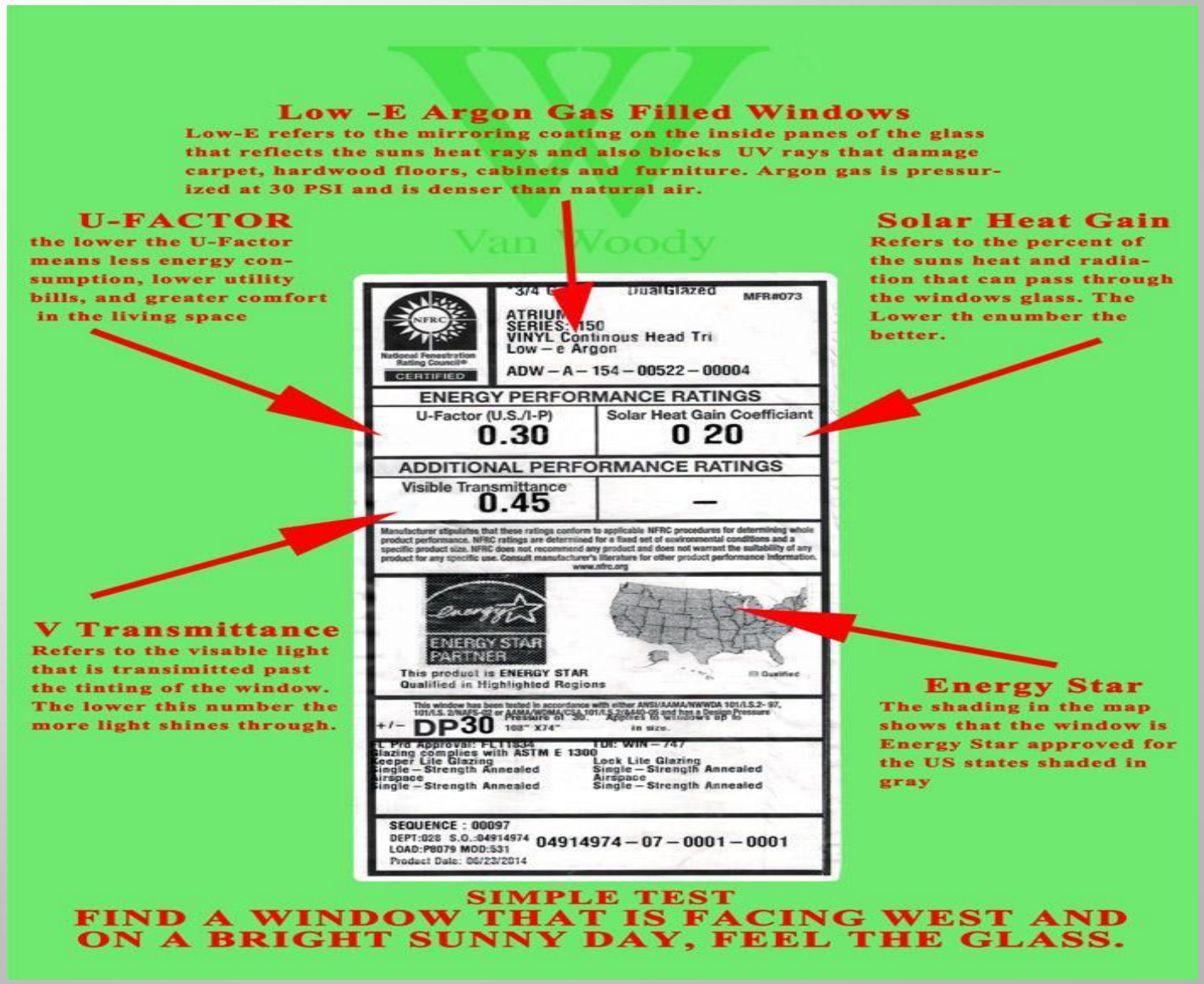
Model Code Development

Residential and commercial buildings use about 40% of the energy in the United States making them significant contributors to the energy problem. Building energy codes are a critical part of the energy solution. By continuing to improve the energy codes results in less energy is consumed by America's buildings resulting in less cost for consumers, less carbon added to the environment thereby reduced greenhouse gas emissions and a reduction in dependence on foreign energy sources. The Building Energy Codes Program (BECP) plays a key role in establishing more "stringent" baseline codes. A building constructed to meet a baseline code meets a minimum level of energy efficiency. BECP's reach does not stop at a minimum level. By increasing the stringency of baseline codes, above-code programs such as LEED and ENERGY STAR may be more readily achievable. The 2009 edition of the IECC marked the first milestone in BECP's goal of achieving a minimum 30% increase in energy efficiency.

International Energy Conservation Code (IECC)

Table R402.1.1 Insulation and fenestration requirements. The table has been revised to reflect a lower fenestration U-factor for dwellings and townhouses which will result in improved energy efficiency. The U-factor has been reduced slightly from 0.35 to 0.32. This is due to the low cost for improving U-factors and the increasing number of windows and doors already meeting and exceeding the 0.32 U-factor.
A study by the American Council for Energy Efficient Economy shows that 80% of all windows and doors installed in Climate zones 4-8 have a average 0.27 U-factor. (Note: this area is in Climate Zone 4)

Energy performance window label



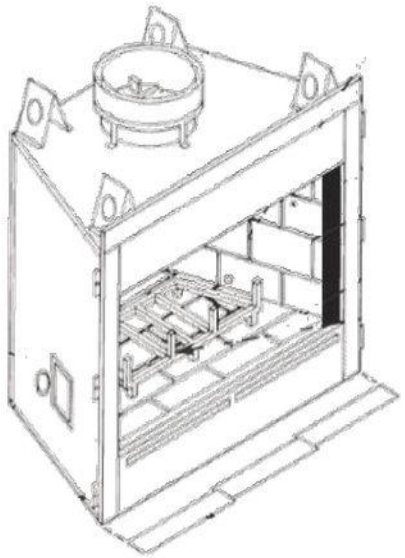
International Energy Conservation Code (IECC)

Table 402.4.1.2 Testing.
When required by the code official, the building or dwelling unit shall be tested and verified, by an approved third party, as having an approved air leakage rate. (3 air changes per hour)

R402.4.2 Fireplaces.
New wood burning fireplaces shall have tight fitting flue dampers and outdoor combustion air. The doors shall be tested and listed for the fireplace in accordance with UL 127.

UL 127 Factory Built Fireplaces

- Testing requirements for entire system
  - Fire chamber
  - Chimney
  - Roof assembly
  - Related components



International Energy Conservation Code (IECC)

R402.4.4 Recessed Lighting.
Recessed luminaires installed in the building thermal envelope shall be sealed to limit air leakage between the conditioned and unconditioned spaces. Recessed lighting shall be IC- rated and labeled as having an air leakage rate of not greater than 2.0 cfm. Recessed luminaires shall be sealed with a gasket or caulked between the housing and the interior wall or ceiling covering.

R403.2.2 Insulation.
Supply and return ducts in attics shall be insulated to a minimum of R-8 for ducts 3 inches in diameter and larger. Supply and return ducts in other portions of the building shall be insulated to a minimum R-6 for ducts 3 inches in diameter and larger and not less than R4.2 for ducts smaller than 3 inches in diameter. Exception: Ducts located completely within the building thermal envelope.

R404.1 Lighting equipment (mandatory). This section has been revised to now required 90% of all permanently installed lighting fixtures to have high efficacy bulbs (i.e., LED lamps) Previous requirement was 75%.

IC Rated Light Fixture

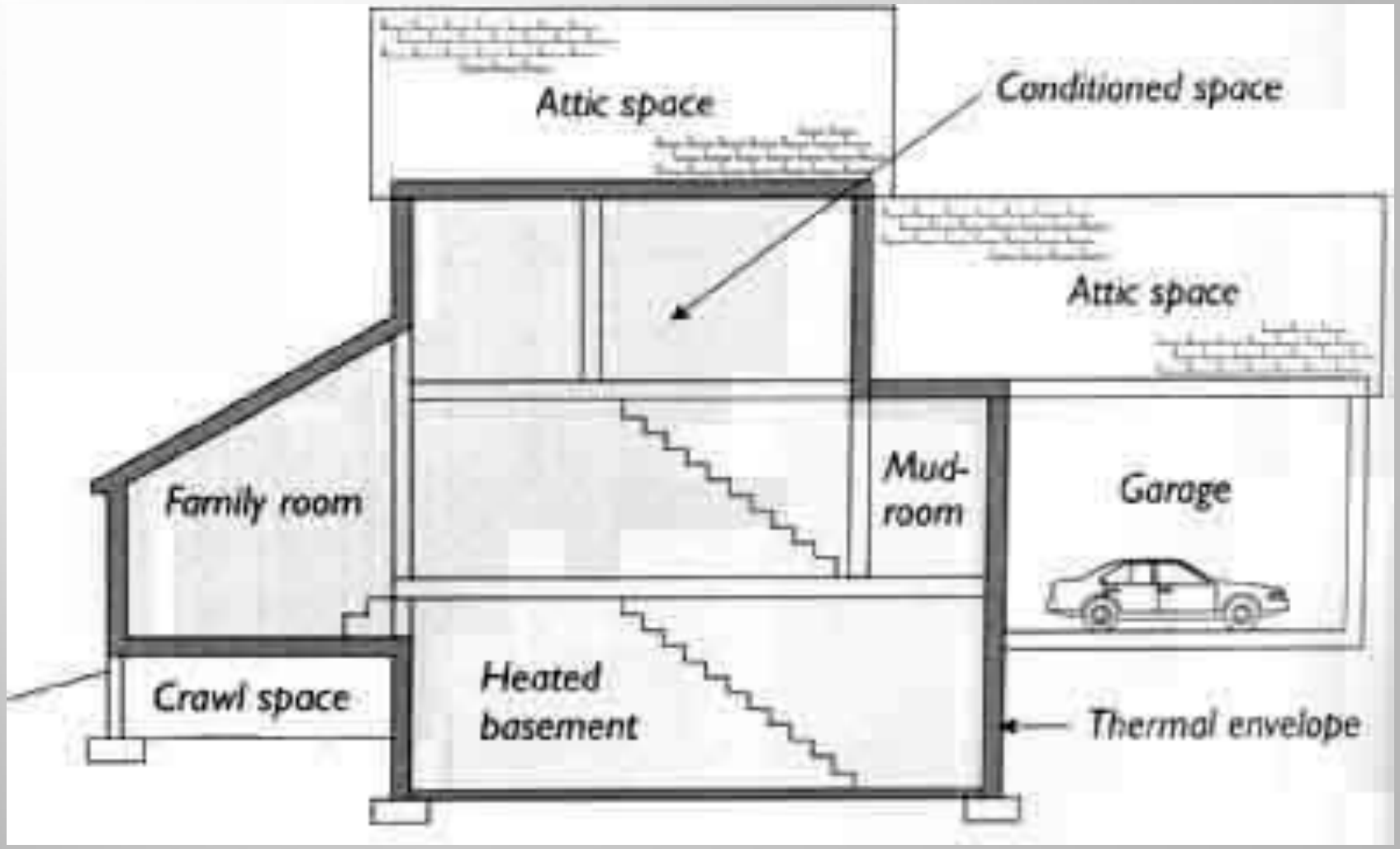
Non IC Rated: Not used with insulated ceilings

IC Rated: Used for insulated ceilings

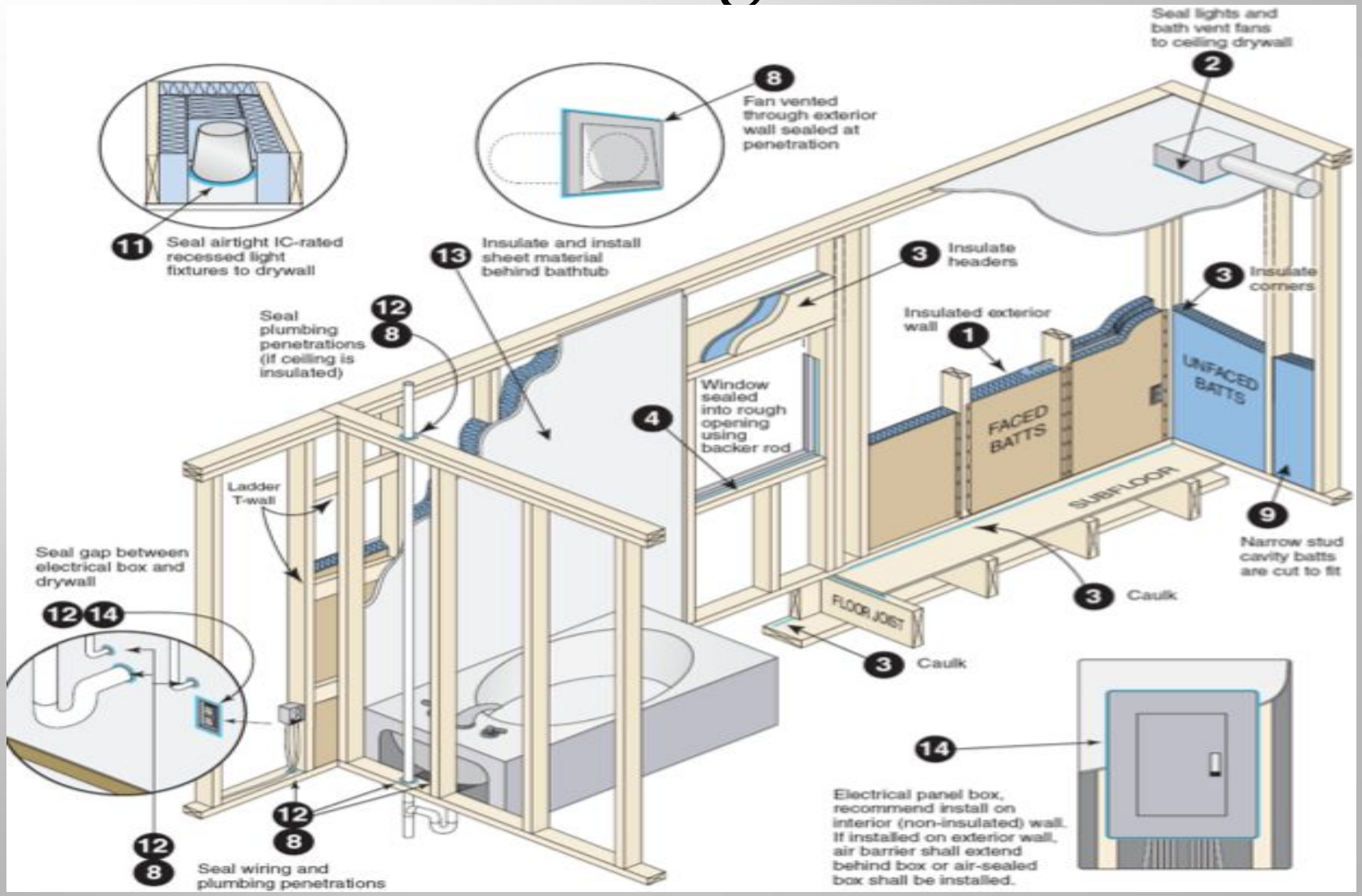
Insulated Duct

High efficacy bulbs

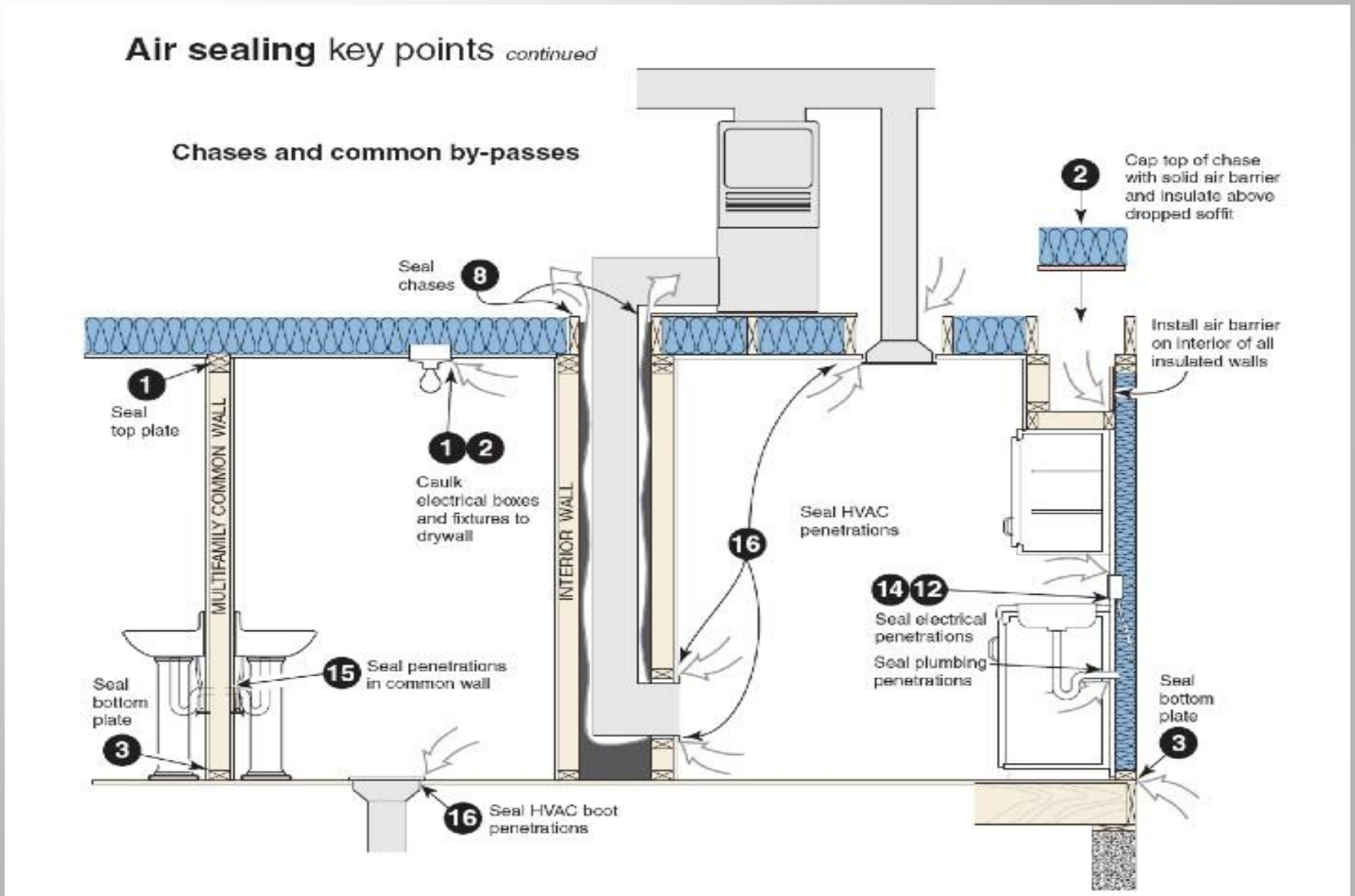
Building Thermal Envelope



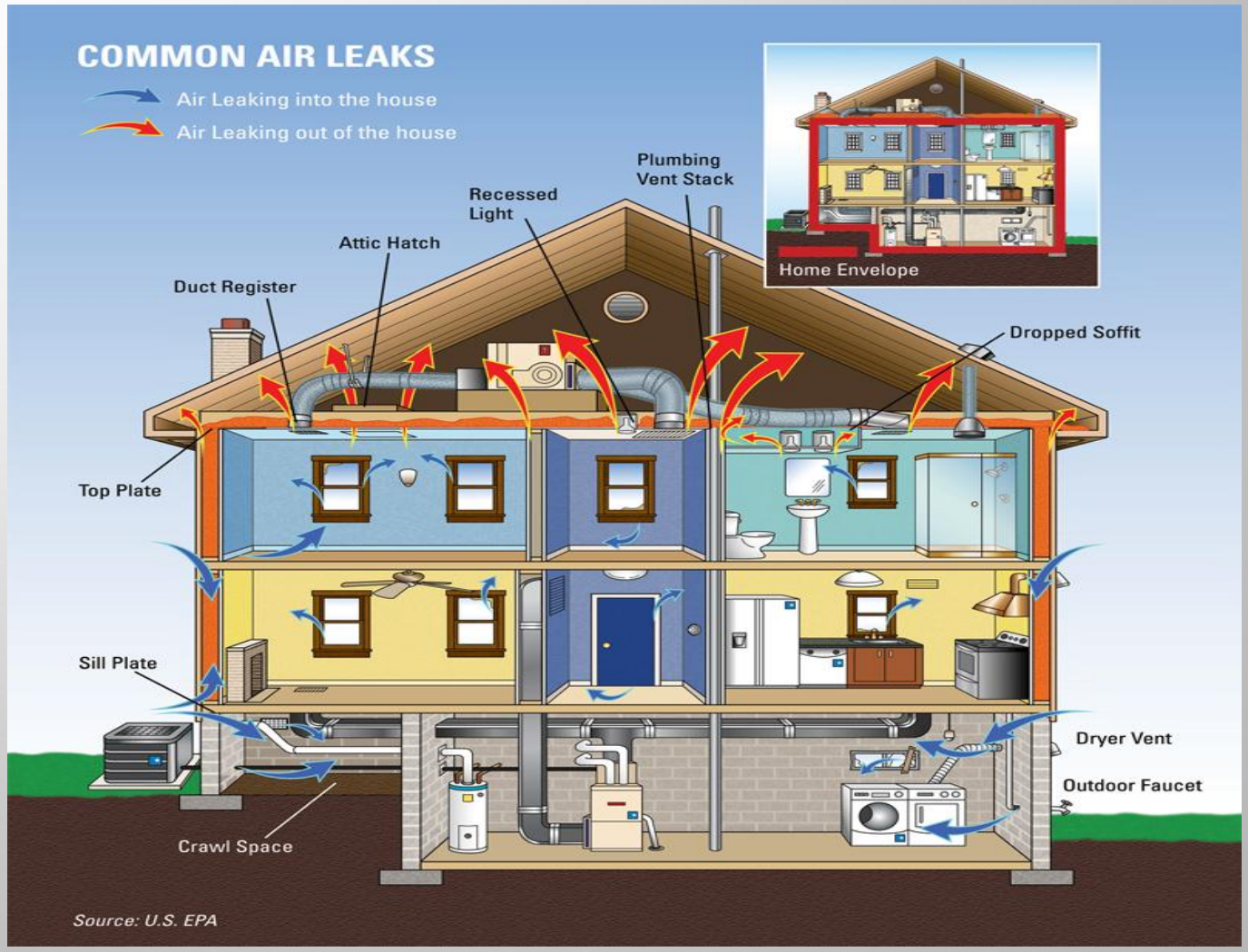
Air Sealing General

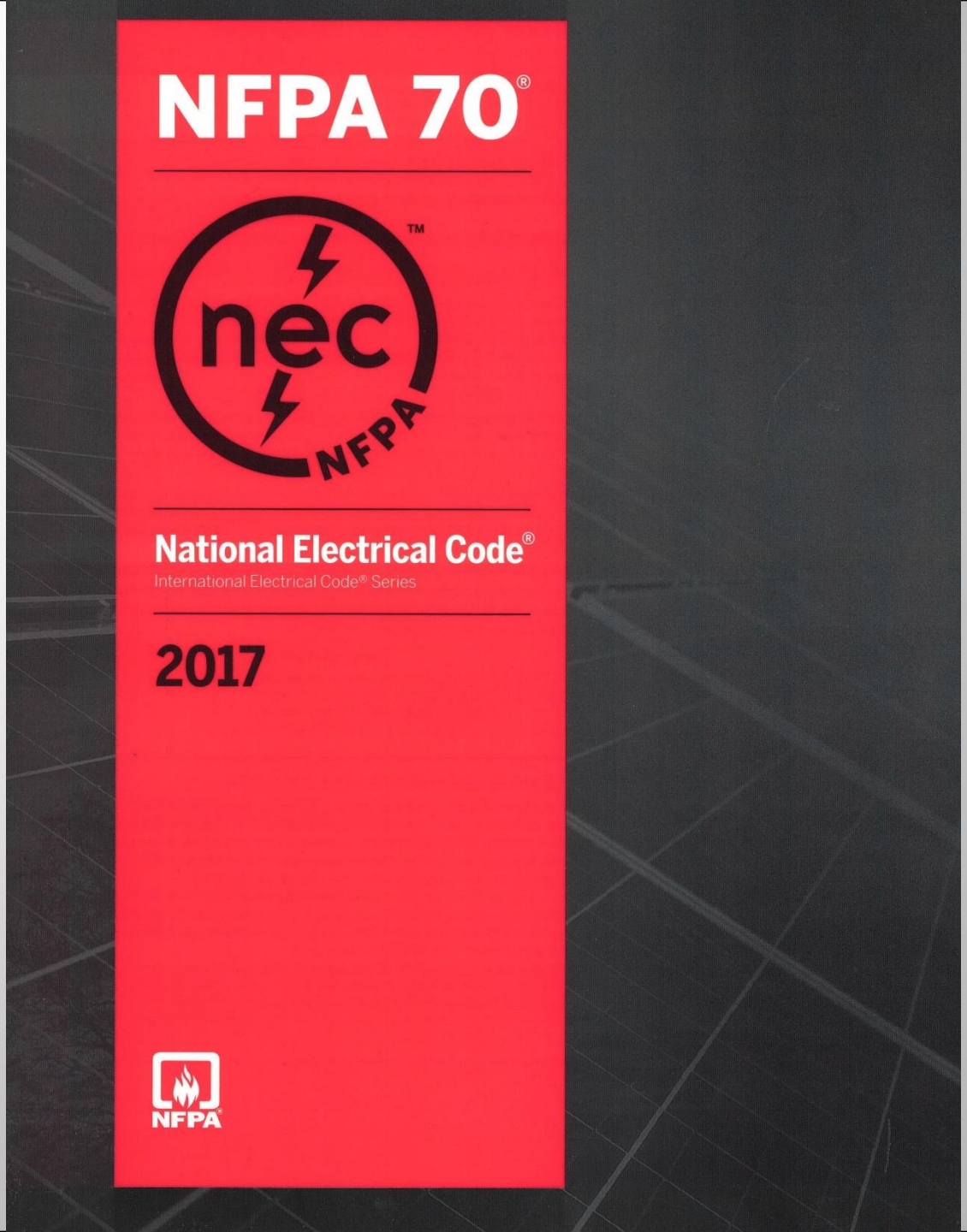


Air Sealing (Cont.)



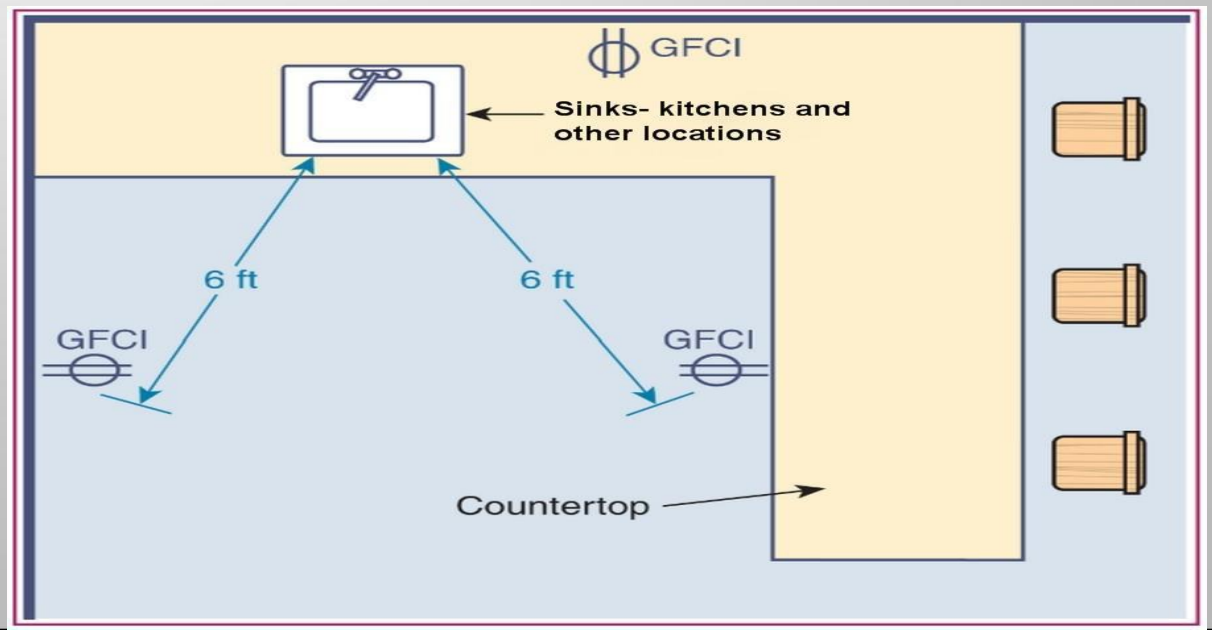
Air Leakage


COMMON AIR LEAKS
Air Leaking into the house
Air Leaking out of the house
Home Envelope
Plumbing Vent Stack
Recessed Light
Attic Hatch
Duct Register
Dropped Soffit
Top Plate
Sill Plate
Dryer Vent
Outdoor Faucet
Crawl Space
Source: U.S. EPA


NFPA 70®
nec
NFPA
National Electrical Code®
International Electrical Code® Series
2017
NFPA

National Electrical Code (NEC)

Article 210- 210.8 Ground-fault Circuit Interrupter Protection for Personnel; (B) Dwelling Units. (7) Sinks.
This section has been revised as follows:
“Sinks- where receptacles are installed within 6 feet from the top inside edge of the bowl of the sink.” (The 2011 edition stated “within 6 feet of the outside edge of the sink”).

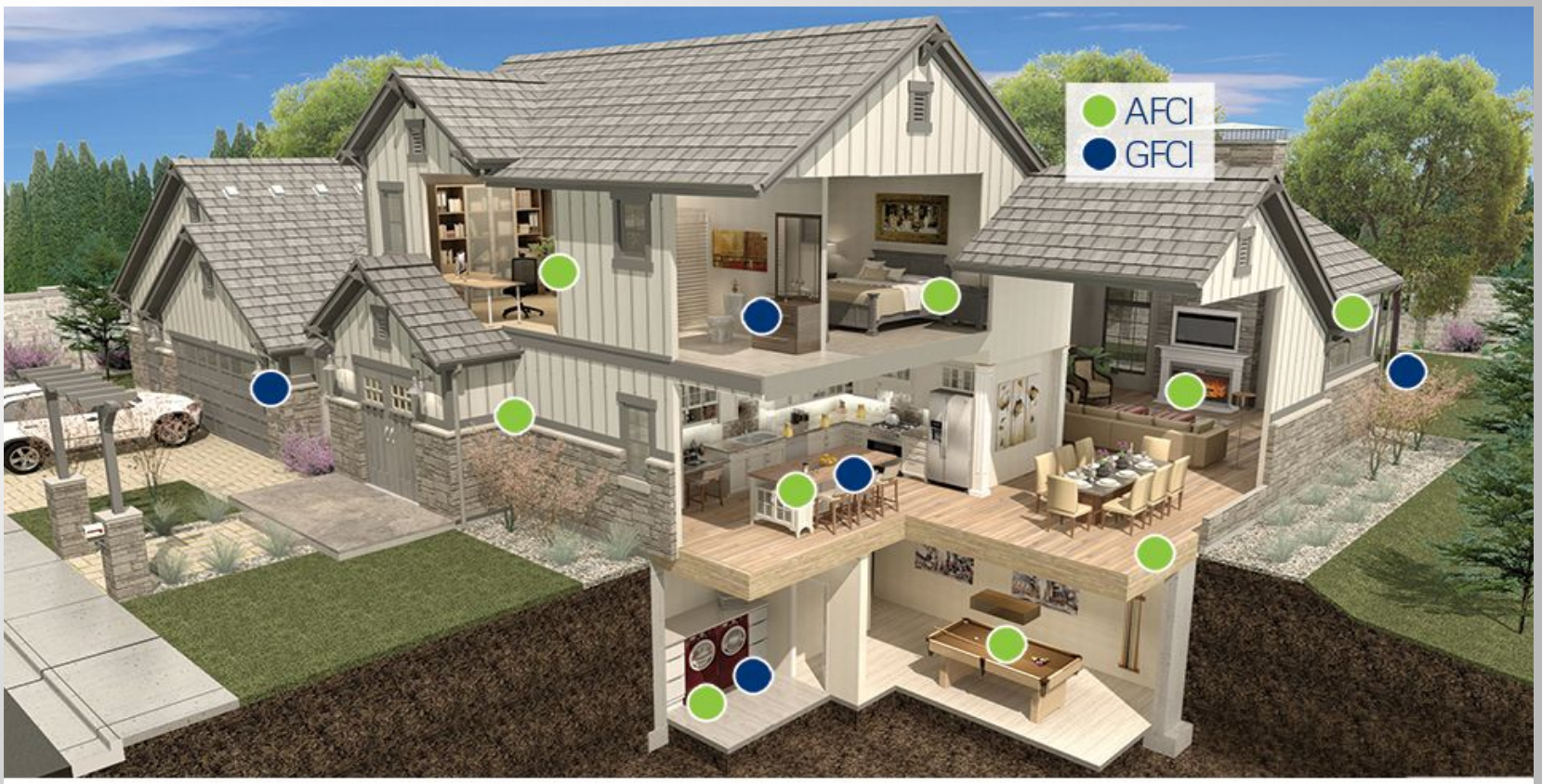


National Electrical Code (NEC)

Article 210- 210.12 Arc-fault Circuit Interrupter Protection; (A) Dwelling Units.

All 120 volt, single phase, 15 and 20 amp circuits supplying outlets installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas or similar rooms or areas shall be protected by any listed arc-fault circuit interrupter installed to provide protection of the branch circuit.

AFCI AND GFCI LOCATIONS



AFCI

Family Room
Dining Room
Living Room
Bedroom
Sunroom
Library
Kitchen
Den
Office
Hallways
Closets
Rec Rooms
Laundry Rooms
Similar Areas

GFCI

Kitchen
Bathroom
Garage
Porch
Pool Area
Laundry Rooms

*AFCI technology is also required in college dormitories

AFCI vs GFCI

Arc Fault Circuit Interrupter **Ground Fault Circuit Interrupter**

Though both provide enhanced electrical safety and have similar acronyms, AFCIs and GFCIs protect against very different things. Use this table to learn the differences and values of these safety technologies.

	AFCI	GFCI
Motto	"The best fire protection is prevention."	"Protecting people from the path to harm."
Protects Against	Arc faults – a dangerous electrical problem caused by damaged, overheated, or stressed electrical wiring or devices that may result in a fire.	Ground faults - an unintentional electrical path between a power source and a grounded surface. A person who becomes part of a path for leakage current will be severely shocked or electrocuted.
Maintenance	Test AFCIs each month. If the device does not trip when tested, it should be replaced. See page 6 for instructions.	Test GFCIs each month. If the device does not trip when tested, it should be replaced. See page 6 for instructions.
How they Work	AFCIs detect hazardous arcing conditions and shut down the electricity before a fire can start.	GFCIs prevent deadly shock by quickly shutting off power to the circuit if the electricity flowing into the circuit differs by even a slight amount from that returning, indicating a leakage current.
Need	The U.S. Consumer Product Safety Commission estimates that AFCIs could prevent roughly 50% of the electrical fires that occur every year.	A U.S. Consumer Product Safety Commission study found 47% of the electrocutions could have been addressed with the inclusion of GFCI protection in homes.
Typical Cost	Approximately $35 for Branch/feeder AFCIs.	As little as $15 for GFCI outlets.

As codes and standards evolve, AFCI receptacles were introduced in 2013 to offer added protection from arc faults.

AFCI and GFCI technologies can coexist with each other to provide the most complete protection that can be provided on a circuit.

ESFI.org

National Electrical Code (NEC)

Article 406- 406.12 Tamper- Resistant Receptacles in Dwelling Units. This section requires that all non-locking type 125volt, 15 and 20 ampere receptacles specified in 406.12 (1) through(7) shall be listed tamper-resistant receptacles: (1) dwelling units; (2) Guest rooms and guest suites of hotels; (3) child care facilities; (4) preschools and elementary education facilities; (5) business offices, corridors, waiting rooms and the like; (6) subsets of assembly occupancies such as transportation waiting areas, gymnasiums, skating rinks, auditoriums; (7) Dormitories.

There are 4 exceptions, which include:

1. Receptacles located more than 5 ½ feet above the floor.
2. Receptacles that are part of a luminaire or appliance.
3. A single receptacle or duplex receptacle for two appliances located within a dedicated space for each appliance that, in normal use, is not easily moved from one place to another and that is cord-and-plug connected. (i.e., stackable washer and dryer)
4. Nongrounding receptacles used as replacements.

Tamper Resistant Receptacles

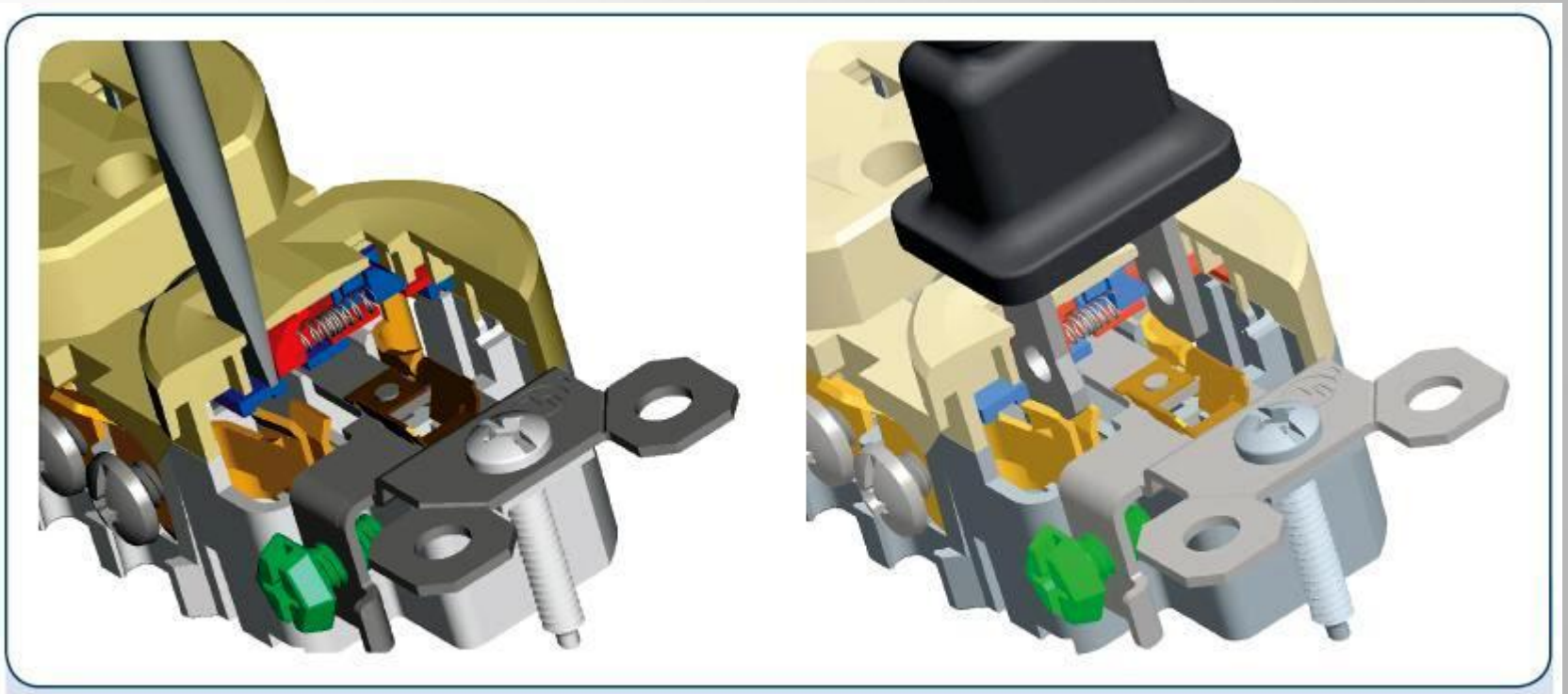
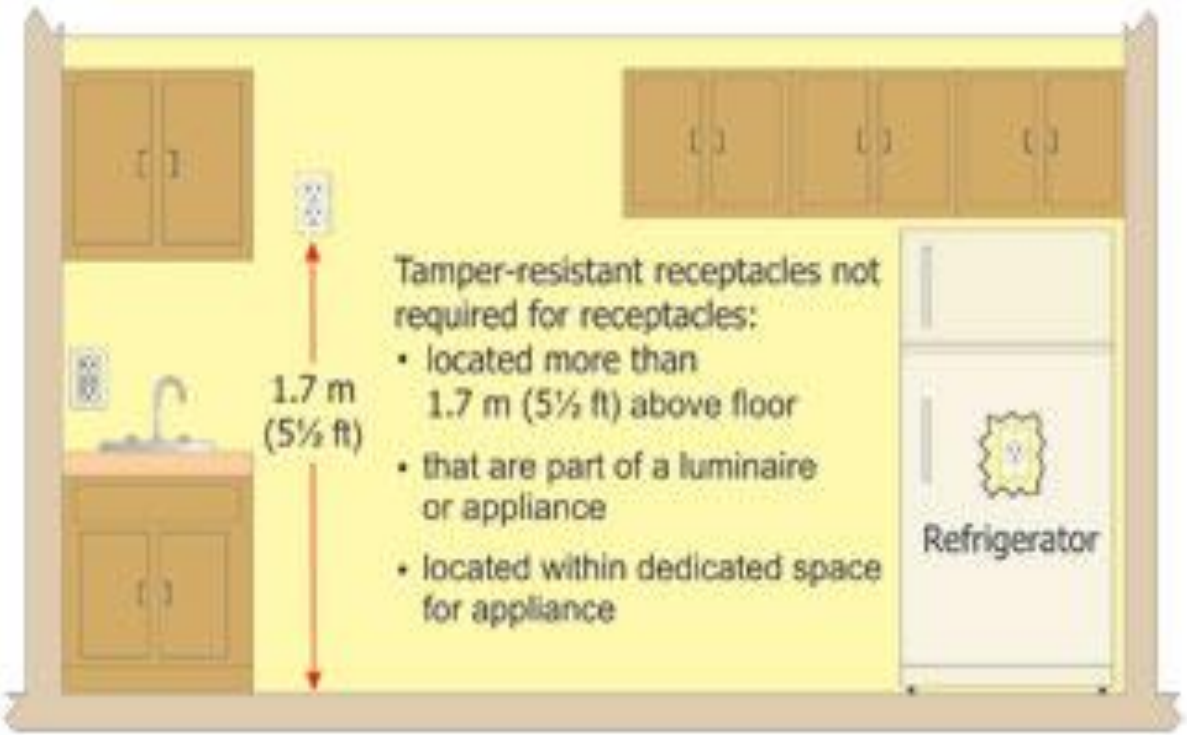


EXHIBIT 406.6 *Tamper-resistant receptacle. Insertion of an object in any one side does not open the shutter (left), but a two-bladed plug or grounding plug compresses the spring and simultaneously opens both shutters (right). (Courtesy of Legrand/Pass & Seymour®)*

406.12 Tamper-Resistant Receptacles



In all areas specified in 210.52, all nonlocking type 125-volt, 15- and 20-ampere receptacles required to be listed tamper-resistant receptacles

National Electrical Code (NEC)

Article 680- 680.22 Lighting, Receptacles and Equipment. (B) (7)

This new item (#7) will allow listed low voltage gas-fired luminaires, decorative fireplaces, fire pits and similar equipment using low-voltage ignitors that do not require grounding and are supplied by listed transformers to be located less than 5 feet from the inside walls of the pool.

Low voltage ignitor fire pit

National Electrical Code (NEC)

Article 690- 690-12 Rapid shutdown of PV systems on buildings. This new section requires a rapid-shutdown function for solar photovoltaic systems installed on or in buildings to reduce the shock hazard for emergency responders.

Rapid Shutdown Device

QUESTIONS AND COMMENTS