Rooms Containing Fuel-Burning Appliances - Code Compliance Brief

Overview:

The intent of this brief is to provide code-related information about rooms containing fuel-burning appliances to help ensure that the measure will be accepted as being in compliance with the code. Providing notes for codes officials on how to plan review and conduct field inspections can help builders or remodelers with proposed designs and provide jurisdictional officials with information for acceptance. Providing the same information to all interested parties (e.g., code officials, builders, designers, etc.) is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

As houses are being built "tighter" to meet stricter air leakage requirements (e.g., climate zones 1-3 at 5 ACH/50 [air changes per hour at 50 Pa]) and climate zones 3-8 at 3 ACH/50 in the 2015 International Energy Conservation Code (IECC) and International Residential Code (IRC), concern has risen for installing natural-draft gas *appliances*[1] (*vented*[2] *or direct-vented appliances*[3]) in these tighter homes without dealing with issues related to back-drafting due to possible increased negative pressure near the *combustion*[4] *appliance* and drawing carbon monoxide into the building. For example, this scenario could potentially occur in a somewhat tight home tested at 900 cfm (cubic feet per minute) (e.g., a 2000-square foot home with 9-foot ceiling heights = 18,000 cubic feet/volume) by turning on one exhaust fan (e.g., 300 cfm), which could depressurize the home to the point that no natural-draft gas *appliance* could safely draft under these conditions[5].

In an attempt to deal with these combustion issues, an entirely new section in the 2015 IECC/IRC regarding fuel-burning *appliances* basically requires the *appliance* to be isolated from the *building thermal envelope*,[6] located either outside or within a separate room if the fuel-burning appliance is supplied by open combustion air ducts. The room must be insulated and sealed off from the rest of the conditioned space. Furthermore, a NEW Appendix 'RA' has been added providing for a Code Official's option to require a Combustion Appliance Zone (CAZ) test to verify "manufacturer's operational parameters" for venting byproducts of combustion in a "tight" <5 ACH/50 (air changes per hour) home.

This brief provides an overview of the requirements and further details of approving the actual "room," based on equipment choices and location of installed equipment, approving the "open combustion air ducts" as to the installation, insulation and sealing of the ducts, and any other ducts or water lines in the "room."

[1]"Appliance" is defined in the 2015 IECC/IRC as any apparatus or device that uses a fuel or raw material to produce light, heat, power, refrigeration, or air conditioning.
[2]"Appliance, vented" is defined as an appliance designed and installed in such a manner that all of the products of combustion are conveyed directly from the appliance to the outside atmosphere through an approved chimney or vent system.
[3]"Direct-vent appliance" is defined as an appliance that is constructed and installed so that all air for combustion is derived directly from the outside atmosphere and all flue gases are discharged directly to the outside atmosphere.
[4]"Combustion" is defined as in the context of the code referring to rapid oxidation of fuel accompanied by the production of heat or heat and light.
[5]Article on *"IECC/IRC Code Conflict Regarding House Depressurization"*, Journal of Light Construction, Doug Garrett, Building Performance and Comfort, Inc., September 2013, **http://www.jlconline.com/projects/energy-efficient/iecc-irc-code-conflict-regardign-house-depressurization_o** [1].
[6]"Building Thermal Envelope" is defined as the basement walls, exterior walls, floor, roof, and any other building elements that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.

Plan Review:

Per the ***2015 IECC/IRC, Section R103.3/R106.3, Examination of Documents.*** The code official/building official must examine, or cause to be examined, construction documents for code compliance.

This section lists the applicable code requirements followed by details helpful for plan review regarding the provisions to meet the requirement for "rooms containing fuel-burning appliances." The first bullet item below is the code requirement itself. The remaining bullets are items to meet the requirement.

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- ***2015 IECC/IRC, Section R402.4.4/N1102.4.4, Rooms Containing Fuel-Burning Appliances*.** In Climate Zones 3 through 8, where **open combustion air ducts** provide combustion air to **open combustion fuel-burning *appliances***, the appliances and combustion air opening shall be located **outside the *building thermal envelope*** or enclosed in a roomthat is **isolated from inside the thermal envelope**. Such "rooms" must be sealed and insulated in accordance with the envelope requirements of *the Insulation and Fenestration Requirement by Component Table R402.1.2/N1102.1.2*, where the walls, floors and ceilings meet not less than the basement wall R-value requirement. The door into the room should be fully gasketed and any water lines and ducts in the room insulated according to Section R403 (IECC)/Section N1103 (IRC) regarding Systems. The combustion air duct(s) should be insulated to a minimum of R-8 where it passes through conditioned space.

  Exceptions:

  1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
  2. Fireplaces and stoves complying with Section R402.4.2 (IECC)/N1102.4.2 (IRC) and Section R1006 (IRC).

  — **Construction Documentation**. Review the construction documents to identify the equipment, system controls, design, and ventilation choices for combustion air or supply air to equipment. If combustion air *vented appliances* will be installed, confirm the provisions of the code provided in this brief.

  - ***2015 IECC/IRC, Section R103.2/N1101.5 Information on Construction Documents.*** Construction documents should include:
    - Insulation materials and their R-values
    - Mechanical system design criteria
    - Mechanical and service water-heating system and equipment types, sizes, and efficiencies
    - Equipment and system controls
    - Duct sealing, duct and pipe insulation and location
    - Air sealing details.

  — ***Insulation.*** Review the construction documents and confirm that the insulation R-values specified meet or exceed the minimum insulation requirements for the "room."

  2015 IECC/IRC, Insulation and Fenestration Requirements by Component Table R402.1.2/N1102.1.2

  Code Compliant Minimum Insulation Levels for the "Room"

Climate Zone	3	4 except Marine	5 and Marine 4	6	7, 8
Ceiling R-Value	38	49	49	49	49
Wood Frame Wall R-Value	20 or 13+5	20 or 13+5	20 or 13+5	20 or 13+5	20+5 or 13+10
Floor R-Value	19	19	30	30	38
Basement Wall R-Value[a]	5/13	5/13	15/19	15/19	15/19

  Note: The actual code provision does not explicitly address requirements for any windows, skylights, slab-on-grade, or the door leading into the "room." If the "room" has any windows or skylights or is located as part of the building thermal envelope where one or more of the walls are exterior walls on a slab-on-grade foundation, then those components should meet the minimum insulation and fenestration values per Table R402.1.2/N1102.1.2. Also, because the "room" is to be isolated from the rest of the home, it should have an exterior type door (i.e., insulated door), not an interior door (i.e., hollow core) and should not have any grills or openings in it.

  a The first R-value is continuous insulation with no thermal breaks; the second R-value is cavity insulation between studs or framing members. Either one will meet the minimum insulation requirements for the "room."

  — **Air Sealing/Air Leakage Control.** The same air sealing provisions for the building thermal envelope apply to the room.

Climate Zone	3	4 except Marine	5 and Marine 4	6	7, 8
Ceiling, Wood Frame Walls, Floor R-Value[a]	5/13	5/13	15/19	15/19	15/19

  - ***2015 IRC/IECC, Air Barrier and Insulation Installation Table R402.4.1/N1102.4.1.1***
    - ***Continuous air barrier***[7] – Confirm that construction documents specify a continuous air barrier for the building components that define the "room" to include the ceiling, walls, and floor.
    - ***Door*** – Confirm that the door leading into the room specifies a gasketing material and threshold.

  — **Combustion Air Requirements.** There are five distinct methods in the IECC/IRC residential provisions where open combustion air ducts, provide combustion air, ventilation, and dilution air to fuel-burning appliances. To assist with which method would need to be met and that applies to an open combustion appliance in regards to where the air is being obtained for combustion, ventilation, and dilution of flue gases for the appliance and would result in having to meet the new provision for the "room," each method is listed below and states whether the requirement (method) must be met (applies or does not apply). Only one of the methods applies to the ***2015 IECC/IRC, Section R402.4.4/N1102.4.4, Rooms Containing Fuel-Burning Appliances***. Chapter 24, Fuel Gas, in the 2015 IRC is extracted from the 2015 edition of the International Fuel Gas Code (IFGC). The numbers in parentheses after each section number are the section numbers of the corresponding text in the IFGC, and the language in red and underlined explains why a particular method does or does not apply.

  1. ***G2407.5 (304.5) Indoor Combustion Air.*** ((NO! IECC/IRC R402.4.4/N1102.4.4 DOES NOT APPLY, as all the combustion air is obtained by way of abundant "indoor volume" in the home.))
     i. ***G2407.5.1 (304.5.1) Standard Method.*** The minimum required volume shall be 50 cubic feet per 1000 Btu/h (4.8 m^3/kW) of the appliance input rating.

     ii. ***G2407.5.2 (304.5.2) Known Air-Infiltration-Rate Method.*** Where the air infiltration rate of a structure is known, the minimum required volume shall be determined per the equations cited in this section.