The Weatherization Training Center

Confined Space Combustion Appliance Zones and the Code

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Technical Update

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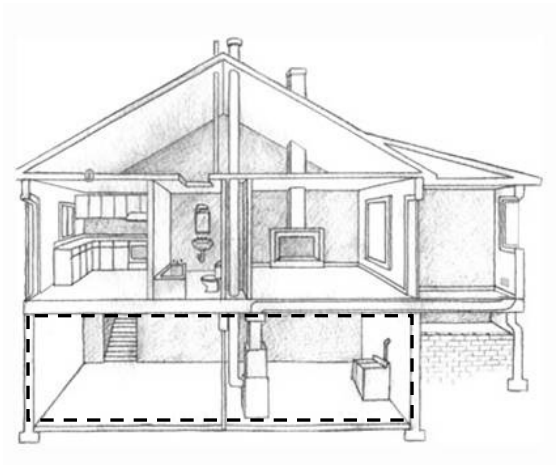
The recently implemented Uniform Construction Code in Pennsylvania may be impacting some Weatherization agencies regarding a requirement to provide make-up air for combustion appliances that reside in confined spaces. According to the International Residential Code (IRC 2003), M1702 and G2407, a confined space is defined as a room that contains one or more combustion appliances that has less than 50 cubic feet of volume for every 1000 Btu per hour of appliance input. M1702 applies to solid fuel burning appliances, whereas G2407 applies to gas and propane.

If the space does not meet the 50/1000 criteria, building inspectors in the affected municipalities are enforcing what is known as a "standard method". Two permanent openings totaling one square inch of free vent area per 1,000 Btu of appliance input shall be provided between the "confined space" to the outside or to "adjacent spaces" within the dwelling. A common example would be vents installed in a basement door that separates a Combustion Appliance Zone (CAZ) from the upstairs.



In a majority of cases in PA the combustion appliance zone is located in a basement

The rule does not apply to "two-pipe" systems common to high efficiency direct vent systems that also have dedicated combustion air. All other systems are subject to codes interpretation. The so-called standard method does not take into account that a mechanical room is often connected to adjacent spaces by air passages to the outside through the rim joist or by interior bypasses to the house. The degree to which a space is "connected" to the house or to the outside can be easily verified through blower door tests and zonal testing. "Worst Case Chimney Safety Performance Testing", which is required in the PAWAP, also provides assurances that a chimney is working properly.

If a chimney that serves a fossil fueled furnace and hot water tank has adequate draft, then it stands to reason that there must also be sufficient combustion air irregardless of the volume. Remember, one CFM of air out equals one CFM of air in. If draft is weak or spillage of combustion byproducts is occurring, then the problem may likely be associated with the venting system and not due to a lack of combustion air. That is unless the appliance is located in a tight closet. Typically, basements don't fit into that category because in most cases they are fairly leaky. Combustion air problems have much more to do with the appliance itself rather than available air around it.

All of these important variables aside, several weatherization agencies and state field representatives report that certain municipalities have offered only strict interpretations of the code. The calculation below is an example that uses the "standard method" for determining whether or not a furnace is located in a "confined space". A furnace and hot water heater totaling 120,000 Btu input occupies a 30' X 25' X 7' basement.

30 x 25 x 7 = 5,250 ft^3
Btu/h input 120,000 ÷ 1,000 = 120
5,250 ft^3 ÷ 120 = 43.75 ft^3

In this case the appliances are considered to reside in a "confined space" because that space does not have 50 cubic feet of volume per 1,000 Btu input. The codes official may now requires cutting louvered vents into the door that connects the basement to the upstairs as required by the code. This measure, of course, flies in the face of standard air sealing protocols. Many would argue that it is an added and unnecessary expense, but agencies maintain there is no way around it in some of their jurisdictions. Or is there?

Alternate Methods

Building codes officials may not be aware of approved alternate methods to the "standard method", which has been around for over half a century. One such method is described in IRC 2003, G2407.5.2 and National Fuel Gas Code (NFGC), section 8.3.2.2. It is somewhat more forgiving and takes infiltration into account when there is a "Known Air Infiltration Rate" (KAIR). An advantage with this method is that weatherization practitioners have the ability to quantify air exchange rates through the use of a blower door.

Another important feature of the KAIR method is that it recognizes the difference in combustion air requirements between fan assisted and non-fan assisted (atmospheric) appliances. Here's an example of the KAIR method using a natural infiltration rate of .50 ACH (natural) with the same variables described in the "standard method" example described above. The volume is 5,250 ft3 and the total input is 120 kbtu.

KAIR Method - Fan Assisted Combustion Appliance:

$(15ft^3 \div .50) \times 120 = 3{,}600\ ft^3$

In this case the CAZ should be defined as an "unconfined space" because the required volume for that space is less than the actual volume of 5,250 ft^3.

KAIR Method - Non-Fan Assisted Combustion Appliance:

$(21ft^3 \div .50) \times 120 = 5{,}040\ ft^3$

In this case the CAZ should also be defined as an "unconfined space" because the required volume for that space is less than the actual volume. There is one caveat with this method, however.

According to the National Fuel Gas Code (NFGC) the maximum air exchange rate that may be used in the KAIR method is .60ACH. This is to discourage the placement of a furnace into a small space such as a closet.

There is another method called the "Alternate Calculation Method" described in the NFGC, which uses a value of 20 times the volume and divided by the input rating to determine the maximum sized appliance that can be placed in a space with a known volume.

What can agencies do?

Advanced air sealing, diagnostic and safety protocols have enabled Weatherization practitioners to become much more effective at what they do. The Uniform Construction Code in PA is something the Weatherization network cannot avoid. It may appear to be a moving target, however, because of differences in enforcement and ordinances existing in the numerous townships and municipalities in PA.

Resolving confined space issues with codes officials may be a matter of educating them to the unique nature of the weatherization program and the systems it has in place to protect life and property. This is also their mission. Many direct hire or third party inspectors, who may have recently come on board, are just getting their feet wet on the codes. When education or direct negotiations with a building inspector fail, it may be necessary to utilize an appeals process, which every township must have in place.

Besides being aware of the applicable codes in their service areas, agencies need to understand the limits of code authority according what measures were installed in the effected space. If, for instance, a heating system is changed out then the code applies. It does not apply in the case of normal maintenance and tune-up.

It is also important to note that remodeling or renovation activities, which include Weatherization, are now exempt from the code unless superseded by local ordinance. For additional guidance on combustion air and confined spaces, please refer to the chapter titled "Combustion Air" on pages 93-99 in the Weatherization Field Guide for Pennsylvania, May 2004 Edition.