Mechanical Room Ventilation by John Siegenthaler, P.E.

Any central heating appliance that burns fuel requires air. Builders installing furnaces, boilers, or direct-fired water heaters must provide a source of air adequate for three purposes:

- to provide oxygen for combustion of the fuel
- to ventilate the space around the appliance, preventing it from over heating
- to dilute flue gases and ensure their safe passage up the chimney

Depriving an appliance of the air it needs can cause serious problems. A lack of sufficient combustion air can cause incomplete combustion, which in turn increases the production of poisonous carbon monoxide and other dangerous gases. Inadequate combustion air also causes excessive soot formation in oil-fired appliances, which significantly reduces efficiency.

A lack of ventilation air, on the other hand, can lead to dangerously high temperatures within the space where the appliance is located.

So how can you know if you're providing the correct air supply? The standards for supplying air to combustion appliances come from the National Fire Protection Association (NFPA). You can purchase both the current standard for gas-fired appliances, the National Fuel Gas Code (NFPA 54 ANSI Z223.1, 1992), and the Current standard for oil-fired appliances, Installation of Oil-Burning Equipment (ANSI/NFPA 31, 1992), by calling NFPA at 800/344-3555.

Confined or Unconfined Space?

The requirements of the NFPA standards vary depending on whether the unit is installed in a confined space (like a mechanical room or closet) or an unconfined space (Such as an open basement).

Installations in unconfined spaces are okay, but builders installing burners in confined mechanical rooms have to provide some kind of vent either to the outdoors or to an indoor space big enough that the combined area of the rooms meets the definition of "unconfined." If a house has very tight construction, a vent to the indoor spaces isn't enough - you must make a connection to the outdoors.

Definitions. So when is a space "unconfined"? That depends on how big the appliance is. The NFPA rule defines "unconfined space" as a space having a volume of at least 50 cubic feet for each 1,000 Btu/hour of fuel input rating for all fuel-burning appliances in that space combined.

For example: A furnace with a gas input rating of 60,000 Btu/hour, installed in an open basement with a floor area of 1,500 square feet and an 8 foot ceiling height, would be considered in unconfined space because the volume of the space (1,500 x 8 = 12,000 cubic feet) divided by the fuel input rating in thousands of Btu/hour (60) equals 200, welt above the 50-cubic-foot threshold. However, a combination of appliance, (say, a direct-fired water heater and a furnace) with a combined fuel input rating of 290,000 Btu/hour, installed in the same basement, would not meet this criterion, since 12,000/290 = 41.4.

To do this calculation, you need the fuel input rating. The ratings are listed in techinical data sheets, as well as on the rating plates of most furnaces and boilers. For oil-fired appliances, the rating may be stated in gallons per hour (gph). To get Btu/hour from gph, multiply the gph input rating by 140,000 Btu/gallon.

Venting Confined Spaces

Any space that doesn't meet the definition of unconfined space must he treated as confined space. The NFPA standards provide several options for supplying the necessary ventilation and combustion air to appliances located in confined spaces. These include:

- Venting to interior spaces: Connect the confined space to another interior spaces so that the combined volume of both spaces meets the definition of unconfined space. (Without additional measures, this method may not always meet the requirement in a tightly sealed house - see below.)
- Direct venting to outdoors: Provide openings directly through exterior walls of mechanical rooms.
- Duct to the outdoors: Provide horizontal or vertical ducts from interior mechanical rooms to the outdoors, or to spaces that "communicate" directly with the outdoors, such as ventilated crawlspaces and attics.

You may want to choose different methods for different projects, depending on the difficulty, cost, and aesthetic effect of making the required openings.

Venting with Openings

If you choose to make wall openings between your "confined" mechanical room and another indoor space, there must be two openings, one beginning within 12 inches of the mechanical room ceiling, and the other beginning within 12 inches of the mechanical room floor (see illustration, above). This combination of high and low openings creates natural convection airflow with the mechanical room to prevent overheating.

Give some thought to placing these openings. Don't put them where objects such as boxes or furniture could be pushed up against the openings and block airflow, A louvered door on the mechanical room can work well, assuming total vent area meets the NFPA requirements.

Those requirements cover not just the placement, but the size of the vents as well. Each opening must have a free area of not less than 1 square inch for each 1,000 Btu/hour of fuel input rating to the appliances in the mechanical room. The gas code (but not the oil code) also sets a minimum free area of 100 square inches for any opening used for this purpose.

The free area is reduced by any grille that may cover the opening. Metal louvers are generally considered to reduce the free area to between 60% and 75% of the nominal "projected" area. Wood louvers reduce the area further, down to only 20% or 25%. It's important to increase the size of the opening to account for the effect of any louvers.

Venting with Horizontal Ducts

If you install air supply ducting, the ducts must be positioned just like a direct vent opening: One duct must end within 12 inches of the mechanical room ceiling, the other within 12 inches of the floor.

The free area of each duct must be no smaller than 1 square inch for each 2,000 Btu/hour of fuel input rating of all appliances in the mechanical room. Any screen over the outside of the duct cannot be finer than 1/4-inch mesh, and the minimum dimension of either duct cannot be less than 3 inches. The free area of any louver the duct connects to must be at least as great as the area of the duct.

Venting with vertical ducts. If you run vertical ducting to outside air, each duct must have at least 1 square inch of area for each 4,000 Btu/hour of fuel input rating of all appliances in the mechanical room. The same provisions for screening, minimum dimension, and free area of louvers apply to vertical ducting as to horizontal ducting.

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Venting Arrangements for Mechanical Rooms