TECH TIP # 45

HEATING, AIRCONDITIONING & REFRIGERATION DISTRIBUTORS INTERNATIONAL

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CONDENSING FURNACE INSTALLATION NOTES

Venting

Installation practices prescribed in existing codes and standards were developed over a number of years based on field experience with contemporary appliance designs. However, with the recent stress on energy conservation, manufacturers are designing higher efficiency gas-fired equipment which is not specifically addressed by these present codes and standards. In order to provide information on new appliance designs which will require consideration of new installations. A.G.A. [1] has developed this fact sheet on the venting requirements of the new, highly efficient appliances: the condensing furnace and boiler. (Although other types of condensing appliances, such as water heaters, are not currently available, the information contained herein will be applicable to them.)

Non-condensing appliances generate vent gases at temperatures up to 550º F: hot enough to be buoyant and permit natural-draft venting. As a result, such appliances produce flue gases in which water generated by the combustion process remains in the gaseous state and the latent heat of vaporization is not recovered. The efficiency of appliances which operate in a non-condensing mode is in the 75-85 percent range. On a seasonal basis, this number is further reduced where usable heat is lost up the chimney through a draft hood during the cool-down period at the end of end heating cycle.

Condensing appliances do not employ draft hoods. Flue products are cooled to approach the dew point while still within the furnace or boiler. Some of the latent heat of vaporization is recovered as usable energy. This results in higher efficiencies and low vent gas temperatures. Depending on the type of condensing appliance, efficiencies can be in the low-to-mid 90 percent range, vent gas temperatures may be as low as 100ºF, and there are few, if any, off-cycle losses.

Such low temperatures may allow, and in fact may dictate, the use of venting materials unsuitable for non-condensing appliances: for example, PVC[2] plastic (up to about 106º F) and CPVC[2] plastic (up to about 210º F). In addition, the volume of the flue products is relatively small from a condensing appliance because of the low temperatures and low excess air, permitting vent pipes as small as 1 ½ to 2 inches in diameter. If outdoor air is brought in for combustion, a similar reduction in plastic pipe size is appropriate.

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As to venting systems, non-condensing, naturally vented appliances have draft hoods and vent atmospherically through a vertical vent or chimney above the roof line. The vent gas temperatures from condensing appliances, however, generally do not contain the energy needed to vent by natural draft and must be vented mechanically: either by a pulse combustion burner which generates an internal pressure that expels the flue gases through the heat exchanger and vent pipe, or by use of a power burner or power vent operation. In view of mechanical venting, the venting system must be "dedicated," not interconnected with the vents of naturally-vented appliances, and must not terminate in a masonry chimney. Because of these restrictions, condensing appliances are often vented through the nearest wall of the structure. In view of the low flue gas temperatures, this vent pipe can be installed with smaller clearances to combustible construction than the vent pipe from a non-condensing appliance.

When this vent pipe exits the building structure, it shall terminate at least 3 feet above any forced air inlet located within 10 feet, and 4 feet below, 4 feet horizontally from or 1 foot above any door, window or gravity air inlet. These distances, which allow for ample dilution of the vent gases, are specified in the National Fuel Gas Code (ANSI) Z223.1/NFPA 54).[3]

Various appliance standards outline the information which is to be included in the manufacturer's installation instructions, including the type, size and maximum length of venting materials to be used, how the venting system is to be installed, and minimum clearances to combustible materials. Questions as to the venting of condensing appliances, therefore, should be addressed by the manufacturer's installation instructions which are verified by the certification agency under standard test conditions. Since designs vary as well as their installation requirements, these instructions are the only authoritative source of the proper information.

CONDENSATE REMOVAL

The condensate produced by a condensing type appliance has a pH range of 3.5 to 6.5 on a pH scale of 0 to 14 (a pH of 7.0 is considered neutral, neither acidic nor alkaline). By contrast, normal household waste water tends to be alkaline (on the high side of a pH of 7.0). The combined effluent, waste water and condensate would approach a neutral pH while dilution would further weaken the strength of the solution. Canadian experience with condensing type gas appliances over a twenty-year span has not revealed any known adverse effects on sewage systems. However, studies are continuing on changes in the pH factor which may be expected as a result of condensate discharge and its effect on sewage system materials.

The condensate is removed from the appliance by the use of pipes or hoses (as specified in the appliance manufacturer's installation instructions), similar to the way condensate is removed from an air conditioning system. This piping (which may originate both at the flue outlet of the appliance and, depending on design, also from an internal appliance drain) should be run to a household drain, and should not be interconnected with other condensate discharges.

Various appliance standards specify that complete information for proper installation be included in the manufacturer's installation instructions. Questions as to removing condensate from condensing appliances, therefore, should be addressed by the manufacturer's installation instructions which are verified by the certification agency under standard test conditions. This information must include the type of material and size of the piping system to be used for condensate removal and how it is to be installed. Since designs vary as well as their installation requirements, these instructions are the only authoritative source of the proper information.

Although existing codes[3] and standards may not specially mention condensing appliances, they do recognize that appliances should be "installed in accordance with the terms of its listing and the manufacturer's installation instructions". Words to this effect appear in each of the following:

The National Fuel Gas Code
The BOCA Basic Mechanical Code
CABO One and Two Family Dwelling
The ICBO uniform Mechanical Code
The SBCCI Standard Mechanical Code

The text of the sections listed above, are, for the most part, general in nature. Similar reference is made in most of the above codes for installing specific types of equipment.

[1]. Reference: American Gas Association Marketing Services "Fact Sheet"
[2]. PVC - Polyvinyl Chloride
CPVC - Chlorinated Polyvinyl Chloride
[3]. Code Organizations:
ANSI - American National Standards Institute
BOCA - Building Officials and Code Administrators International
CABO - Council of American Building Officials
ICBO - International Conference of Building Officials
NFPA - National Fire Protection Association
SBCCI - Southern Building Code Congress International

* BOCA, ICBO and the SBCCI are now combined into the International Code Council