
TT-33

December 2006

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# Condensation in Type B Gas Vent: Why It Forms and How to Prevent It

**by Dave Fetters**

A recurring theme in my work is the question from many quarters about why condensation is occurring in a Type B gas vent and what to do about it. Unfortunately, the condensation usually drips out of an elbow in the attic, wets the insulation, and stains a bedroom ceiling before it is noticed elsewhere. Condensate will form in the coldest part of the vent (near the termination) when the flue gas cools to its *dew point temperature*. This is the temperature at which the flue gas, with its heavy load of moisture in the form of water vapor, starts to condense ("dew" forms) on the cooler walls of the vent.

A 100,000-BTUH furnace burning for one hour will generate a gallon of water in the form of vapor in the flue gas. The vent, through proper design and sizing, must keep the moisture in the vapor state until it exits the vent. This is one reason why the B vent sizing tables are so important! With the Department of Energy likely to increase efficiency requirements of gas-fired appliances by 2 percentage points in the near future, adhering to the tables to prevent condensation becomes critical. The following is a list of reasons for condensate development in the approximate order of priority, based on my experience.

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1. **Single-wall connectors used with 80% appliances.** It's okay to use single-wall connectors with these non-draft hood-equipped appliances, **IF** one uses the proper sizing table. The **FAN MIN** input from the single-wall connector sizing table must be met or exceeded to prevent condensation. Be careful of 2-stage and modulating equipment. Use the lowest firing rate for determining FAN MIN.



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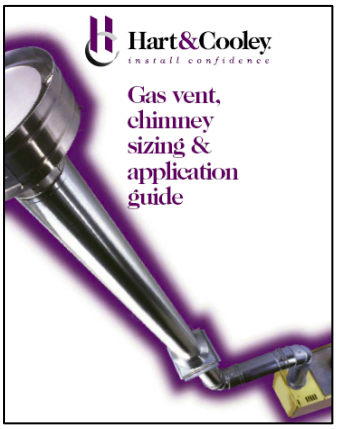
2. **Water heater connector is too small.** In multiple-appliance systems, a 3-inch diameter connector will not accommodate water heater inputs greater than about 35,000 BTUH, even though water heaters with inputs as high as 50,000 BTUH still use 3-inch draft hood collars. Use a 4-inch connector on every 3-inch water heater collar to eliminate this problem. Do not assume that because the water heater has a 3-inch draft hood collar that 3-inch connector is always appropriate.
3. **Offsets (laterals, horizontal runs) in connectors and common vents that are too long.** A single-appliance vent sizing table provides data that tells you how far the horizontal run may be. However, for a multiple-appliance connector or for the common vent in multiple-appliance systems, the limit is 1½ feet of horizontal run per inch of connector or vent diameter. This can be a significant limitation, especially for common vents, but, if exceeded, leads directly to condensate formation.
4. **Combustion and make-up air issues.** The code is very clear about how to calculate and provide proper openings for combustion and make-up air. These days with tight homes, larger bath fans, fancy cooking appliances, dryers, and decorative gas-fired appliances consuming indoor air, it becomes imperative to provide air for the heating appliances in the required amounts. Condensation is only one sign of restricted air. Spillage, no draft, and, in a worst case, carbon monoxide are other consequences.
5. **The common vent is too small, too large, or exposed on an outside wall.** A common vent that is too small will obviously have to be made larger, have an appliance removed from the system, or be engineered to work. To prevent a common vent from being too large, its area shall not be more than 7 times the **area** of the smallest connected appliance collar. A vent shall not be exposed to the outdoors below the roofline. These are existing fuel gas code requirements and have been for some time.
6. **An interior masonry chimney venting 80% appliances.** Neither single nor multiple fan-assisted 80% appliance(s) shall be vented into an interior masonry chimney without a dedicated relining system.
7. **Venting into exterior masonry chimneys.** Even though the National Fuel Gas Code has sizing tables for this scenario, they are very complicated and restrictive. The best choice, especially for the northern tier states, is to plan for and install a properly sized, listed gas appliance relining system approved for this use.
8. **Not properly accommodating appliances with vent dampers.** An appliance with a built-in powered vent damper must be sized using **NAT MAX** in combination with **FAN MIN** from the sizing tables.

Insulating B vent to try to solve a condensation problem will not work, and B vent manufacturers do not want their B vents insulated. The insulation is treating the symptom, not the problem.

Although condensate formation may manifest itself in the vent extremities, the cause more often than not may be in the mechanical room. The Hart & Cooley ***Gas vent, chimney sizing & application guide*** has a lot of good information, which includes sizing tables and combustion air opening requirements. To receive a free copy, please contact your Customer Service Representation. Or, if you prefer, you can view the guide on our web site at **www.hartandcooley.com**.

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