

TECHNICAL INFORMATION COMMUNICATION



**United
Technologies**

Building & Industrial Systems

Quality and Continuous Improvement

Number: TIC2014-0002

Date: 5/22/2014

Title: Residential Condensing Furnace Concentric Vent Freezing

Product Category: Gas Furnaces

Products Affected

35" residential condensing gas furnaces

Situation

The factory has become aware of installations in which condensing gas furnaces were oversized for the building heating loads resulting in one or more of the following:

- 1) Resident comfort complaints: too hot or cold, air noise and drafts
- 2) Blower electrical consumption reduction failed to meet local energy requirements
- 3) Freezing concentric vents resulting in no heat

Further investigation into the cause of freezing concentric vents revealed short run times (2-3 minutes) caused by condensing furnaces with outputs two times (2X) or greater than the residential heating load at the outdoor temperature corresponding to the design conditions were preventing the furnaces from reaching steady-state flue temperature.

The factory found the condensing furnaces selected were oversized for one or more of the following reasons:

- 1) A load calculation was not performed.
- 2) Request for quotes specifying equipment that meets new energy initiatives for high efficiency HVAC equipment without regard to heating load. The HVAC contractor fulfilled the equipment requirement without ensuring the equipment was appropriate for the application and sized correctly.
- 3) A condensing furnace with a heat output appropriate for the application was not available.

Technical Information

Best performance occurs with nearly continuous and stable operation, which is achieved by selecting gas furnaces with outputs no more than 40% greater than the calculated residential heating load, per ACCA Manual J & S. A residential heating load calculation should be performed on all new condensing furnace installations. Site investigations revealed freezing vents have occurred when the furnace output is 2X (100%) greater than the heating load. However, freezing vents can occur at a lower percentage of oversizing depending on other site factors, such as outdoor temperature and location of the vent pipe.

Only trained and qualified personnel should design, install, repair and service HVAC systems and equipment. All national standards and safety codes must be followed when designing, installing, repairing and servicing HVAC systems and equipment. It is the responsibility of the Dealer to ensure local codes, standards, and ordinances are met.

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Testing at -10°F (-23°C) outdoor ambient showed that a minimum 8 minute run time is required to prevent concentric vent freezing when the furnace output is twice (2X) the heating load (provided the product is installed per the installation instructions).

Field Corrective Action

Oversized furnaces running less than 8 minutes at -10°F (-23°C) are unable to supply enough heat to the vent system to prevent freezing. The field corrective action supplements the vent with heat the furnace would have added if running longer cycles. The minimum requirements for existing installations with outdoor air temperatures of -10°F (-23°C) and above are as follows. All four requirements must be met to prevent vent pipe and termination freezing.

- 1) Coil 12 feet (4 meters) of self-regulating heat tape designed for roof application around the vent pipe, starting from the base of the concentric vent termination moving back toward the furnace. (Or, 12 feet (4 meters) of heat tape on the vent pipe starting 1 foot (0.3 meter) from the inside roof/wall penetration moving back toward the furnace.) Heat tape temperate should not exceed 130°F (54°C) and must allow insulation coverage. Apply the heat tape per the manufacturer's instructions.
- 2) Apply R7 insulation or greater to the vent pipe from the furnace to the base of the termination. The vent pipe and termination outside the structure does not need insulation.
- 3) Pull the combustion air from a properly ventilated space or change to an indirect vent combustion air configuration. If changing from a direct vent to an indirect vent configuration, ensure the space has enough ventilation for combustion air.
- 4) Increase the run time to a minimum of 5 minutes with no night setback. Night setback can resume when outdoor air temps are 32°F (0°C) or higher. A minimum run time can be achieved by applying a timing relay. If night setback must be used, a run time longer than 5 minutes is required.

Additional heat tape, insulation and longer run time may be needed for areas that experience outdoor temperatures lower than -10°F (-23°C).

References

ACCA/ANSI Manual J-2011 Residential Load Calculation

ANSI/ACCA 3 Manual S-2004 Residential Equipment Selection

ANSI/ASHRAE Standard 103-2007 Method of Testing Annual Fuel Utilization of Residential Central Furnaces and Boilers

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