Fact Sheet

AHRI Air-Conditioning, Heating, and Refrigeration Institute

Induced-draft Furnace Heat Exchanger Inspection Procedure

Gas Furnace Safety

Gas furnaces are known for their safety, performance and longevity. This is largely due to their certification to nationally recognized safety standards and the building standards and codes that require equipment be installed according to the manufacturers' installation instructions.

Despite the excellent safety record of gas furnaces, there have been infrequent reports of gas furnace heat exchanger problems. To address these situations, an industry-accepted procedure known as the "Three-Step Method for Detecting Unacceptable Flue Gas Leakage from Furnace Heat Exchangers" has been used since the early 1980's to conduct field inspections of gas-fired furnace heat exchangers.

Though this procedure has been effective for testing heat exchangers in natural draft furnaces, its effectiveness for testing heat exchangers on induced-draft furnaces that maintain a significant negative pressure within the heat exchanger has been questioned. Though it is unlikely for an induced-draft furnace to leak flue products from the heat exchanger to the circulated airstream, a new test procedure has been developed that enhances the existing three-step methodology to make it more applicable, reliable and repeatable for the inspection of induced-draft furnace heat exchangers.

Five-Step Method[1]

Step 1: Look for Flame Disturbances

- Start the furnace and observe any changes in the flame pattern as the circulating air blower starts operating. Look for floating flames, flame roll out or flame distortion.

  These conditions indicate a possible split seam, open crack, severe deterioration of the heat exchanger or gasketing material, or physical separation of the connected parts.

  Flame disturbance that occurs after the blower comes on is a good indication that a heat exchanger problem may exist.

- Other air leaks in the vicinity of the burners may also cause flame disturbances and should be corrected. If these disturbances are significant and cannot be corrected by eliminating the air leaks near the burners, *skip to Step 5* for physical inspection of the heat exchanger.

- If no flame disturbances are observed, *proceed to Step 2* below.

Step 2: Measure CO Levels in the Airstream

NOTE: ***To ensure accuracy of the measurements, take more than one reading and average the results to obtain the CO level.***

- With the furnace still running, measure the CO level in the return airstream near the furnace and record the value.

- Then measure the CO level in the supply airstream at a location in the system where the air is well mixed. Generally, a location downstream of one or more bends in the ductwork is a good place to take the sample for this measurement. Record this value.

- **If there is no measurable difference in the CO in the return and supply airstreams**, it is

likely the furnace is not leaking CO into the air stream. If the measured value is below 9 ppm, the OHSA acceptable maximum, go to Step 3.

Step 2 Con'd.:

- **If there is no difference in the CO concentration between the return and supply air, but there is CO detected in the air stream**, there may be another source of CO in the home such as other gas-fired appliances, an automobile operating in a garage, or a fireplace in operation. Discuss the elevated CO levels and the possible sources with the home owner.

- **If the CO in the supply air is less than the CO in the return air**, it is possible that there is an error in the measurement. *Repeat Step 2* with a different gas analyzer if possible.

- **If the CO in the supply air is greater than the CO in the return air**, it is possible that the furnace is generating the CO that is leaking into the airstream. *Proceed to Step 5*.

- NOTE: If the inspection *described in Step 5* does not show holes, cracks or separated seams, further investigation is necessary to determine the source of the CO contamination.

Step 3: Measure CO Levels in Flue Pipe

- Allow the furnace to run for at least five minutes.
- Then measure the CO in the flue pipe, using a properly calibrated combustion analyzer. If the CO reading is less than 200 ppm, no further action is necessary. If the CO reading is 200 ppm or higher, *proceed to Step 4*.

Step 4: Verifying Proper Installation

- Verify that the furnace installation complies with the manufacturer's requirements and any applicable codes. Refer to the manufacturer's installation instructions if available.
- Verify the gas orifice size, gas input rate and manifold pressure, proper conversion for fuel type and altitude (if applicable), vent lengths, duct static pressure and the provision for adequate combustion air to the furnace.
- Check the furnace for any damaged or disconnected wires or hoses.
- Check for misaligned burners.
- Inspect the vent system and combustion air pipe (if applicable) to check for holes or blockage.

Make corrections as necessary and then recheck CO in a flue gas sample. If the CO is still at 200 ppm or higher in the flue gas, *proceed to Step 5.*

Step 5. Visually Inspect Heat Exchanger

Disassemble the furnace until you can visually inspect all heat exchanger exterior surfaces.

Any crack or hole that is big enough to affect combustion will be easily visible to the naked eye. **DO NOT use water or smoking agents to check for leaks.**

Furnace heat exchangers joints are not hermetically sealed, so a small amount of leakage is normal. If there are any abnormal splits, cracks or holes, the heat exchanger must be replaced.

[1] *This procedure is intended for use by qualified individuals trained and experienced in the servicing of this type of furnace. All instrumentation used in the execution of this procedure must be in good working condition and calibrated appropriately. A gas analyzer capable of measuring CO concentration with 1PPM resolution is required for this procedure.*