A detailed look at furnace inspection.

BY DWAYNE HALL
It’s summer time, which means heat, humidity and more heat. While your customers probably aren’t thinking about their furnaces right now, as a heating professional you know that winter will be here before you know it and you will be performing lots of residential heating startup PMs in the next two months. Following these maintenance guidelines will ensure your customers experience perfect air year-round.

We recommend that a furnace be serviced once a year, particularly before it is turned on for the fall. The importance of servicing a furnace regularly—and doing it properly—goes beyond creating perfect air. It’s a matter of safety. As a technician, it’s your responsibility to make sure your customer’s furnace is safe by servicing it correctly and thoroughly. It’s an important task, which is why specific, step-by-step instructions on proper heating startups and furnace servicing are so important.

This article will detail what to look for during a visual inspection of the furnace; what to look for once the furnace is turned on; how to check the pressure switch; and how to check a flame sensor.

**VISUAL INSPECTION CHECKLIST**

The visual inspection of the furnace, before you even turn it on, could be the most important part of the inspection.

1. When you approach the furnace for an inspection, document the model number and serial model of the furnace. This might seem so basic, but it is incredibly important and something even seasoned technicians can easily overlook.
2. Check the electrical connections for loose wiring, including the connections within the unit, the voltage at the indoor unit and the amperage of the indoor motor. Are the connections tight? Did you check all the Jack plug pins? Make sure the unit is secure and well grounded.
3. Make sure all gas pipe and connections are tight, secure and free of leaks.
4. Now, do the same thing with the vent connections. The vent pipe can come apart, so check it all the way through to make sure it’s not separated anywhere.
5. Check the condition and cleanliness of the filters, burners, heat exchangers and blower assembly. You may have to pull the parts out and clean them, brushing them down with a wire brush. Check the heat exchanger for rust and vacuum
it if necessary. Guidelines to test the heat exchanger per the AHRI test procedure can be found here: https://bit.ly/2Sk0mSX.

6. Determine the fuel type. While 95% of furnaces are natural gas, it’s good to confirm.

7. Inspect the condensate trap and drain for leaks and cracks, and clean it as required. Blow it out, flush it with water and refill with clean water—just make sure it’s clean. The filter should be checked and cleaned before you do any of your heating operations check.

8. Ensure sufficient combustion air is available to the furnace. Fresh air grilles and louvers (on the unit and in the room where the furnace is installed) must be properly sized, open and unobstructed to provide combustion air.

9. On non-condensing furnaces, inspect the furnace venting system to make sure it is in place, structurally sound and without holes, corrosion or blockage. The vent system must be free and clear of obstructions and must slope upward away from the furnace. On condensing furnaces, inspect the furnace intake and exhaust pipes to ensure they are in place, structurally sound, without holes, blockage or leakage and the exhaust pipe slopes toward the furnace. Inspect terminations to ensure they are unobstructed and structurally sound.

10. Inspect the furnace return air duct connection to ensure the duct is sealed to the furnace. Check for air leaks on supply and return ducts and seal where necessary.

11. Check the condition of the furnace cabinet insulation and repair if necessary.

12. Use a voltmeter to check the voltage and record the number.

Now you get to the fun part! Turn on
the furnace to perform a general system test. Please note before you begin that the following inspection guidelines apply to furnaces with an Annual Fuel Utilization Efficiency (AFUE) of 90% or above.

HEATING OPERATIONS CHECKLIST

1. Hook up the manometer and verify the static line gas pressure is within the range listed on the nameplate.

2. Turn on the heat and check the manifold pressure (CSA requires the target manifold pressure be on the nameplate of the unit). On a two-stage unit, check the high fire and the low fire.

   Tip: While checking the manifold pressure, put the thermometer in the duct to record temperature rise, but make sure to keep the thermometer out of the line of sight of the heat exchanger to avoid incorrect readings. This way, the temperature reading will be ready when you arrive at that step.

3. Now, clock the gas meter to determine the furnace BTU input to make sure you receive full heating capacity. To calculate BTU, record the little hand on the gas meter for 60 seconds, then follow this formula: \[ \text{Cubic Feet per Hour (CFH)} = \frac{3600 \times \text{Dial Size}}{\text{Time (seconds)}} \]. Multiply that number by the BTU heat content of 1 cubic ft. of gas provided by the utility if it is 1,000 (which is common for natural gas).

4. To calculate recorded temperature rise and actual temperature rise, take your thermometer and place it in the supply and the return ducts (unless you did it while checking the manifold pressure—if so, you’re one step ahead!). Record those temperatures, subtract and you’ll get the heat rise. Note that the nameplate will have a heat-rise range listed on it. The range depends on the unit, and is established by the manufacturer to provide the best heat exchanger life.

5. Check the pressure switch to make sure it’s operating properly. Connect the manometer to the switch to determine where it opens and closes (see “Pressure Switch Inspection Checklist” below).

6. Now, check the flame signal (see “Flame Sensor Inspection Checklist”). It’s a safety measure to ensure the...
flames are lit. If there's a low signal, clean the flame sensor with a soft wire brush. Do not use sandpaper, because it will leave silicon deposits on the flame sensors.

7. Check the primary limit operation by restricting the airflow across the heat exchanger and wait for the limit to open. Restrict the airflow to approximately 75% by inserting a piece of sheet metal or cardboard into the inlet side of the return air filter. Two to three minutes after starting the furnace in the heating mode, the primary limit should open at the temperature listed on the limit control. Once it does, remove the air restriction and allow the heat exchanger and primary limit to cool. After the primary limit resets, check that the furnace will operate properly in the heating mode. Note that some communicating variable speed motors may behave differently and reduce rate to continue heating.

8. Perform a complete combustion check to record flue gas levels and ensure proper combustion and operation. Run the furnace for 8-10 minutes to get to a steady state of operation before you check your carbon monoxide and carbon dioxide levels using a combustion analyzer.

9. Finally, make sure the thermostat is set and level using a pocket level. Depending on how thorough you are, servicing the furnace should take at a minimum 30 minutes, but it typically takes 45 minutes to an hour.

To check the pressure switch differential, use the provided fittings and tubing, and follow the steps below:

**PRESSURE SWITCH INSPECTION CHECKLIST**

1. Remove the thermostat demand and let the unit cycle off.

2. Remove the tubing from the negative side and positive side of the pressure switch (leave both connected to the cold end header box).

3. Take a 2-in. length of the square tubing and connect it to the positive (+) side of the pressure switch. Take a 10-in. length of the square tubing and tee it into the tubing from the positive side of the cold end header box and the other side of the 2-in. square tubing. Connect the other end of the 10-in. square tubing to the positive (+) side of the measuring device.

4. Using a second piece of the 2-in. length of square tubing, connect to the negative (-) side of the pressure switch.

5. Take the second piece of the 10-in. length of the square tubing and tee it into the tubing from the negative (-) side of the cold end header box and the other side of the 2-in. square tubing. Connect
the other end of the 10-in. square tubing to the negative (-) side of the measuring device.

6. Operate the unit and observe the manometer reading. Readings will change as the heat exchanger warms.
   a. Take one reading immediately after start-up.
   b. Take a second reading after the unit reaches steady state (approximately eight to 10 minutes). This will be the pressure differential measured across the cold end header box air orifice.

7. Remove the thermostat demand and allow the unit to cycle off.
8. Replace the original pressure switch tubing.

To measure the flame signal, make sure to use a digital readout meter capable of reading DC microamps. Then proceed as follows:

**FLAME SENSOR INSPECTION CHECKLIST**
1. Set the meter to the DC amps scale.
2. Turn off supply voltage to the control.
3. Remove the sensor wire from the integrated control.
4. Connect the negative (-) lead to the flame sensor wire.
5. Connect the positive (+) lead to Terminal FS on the integrated control.
6. Turn the supply voltage on and close the thermostat contacts to the cycle system.
7. Let the main burners run for two minutes, then take the reading.

If you're a new technician, this should take you successfully through the furnace inspection process. But don't worry; it gets easier every time you do it. If you're an experienced technician, this should be a good refresher, and maybe even teach you a new method or two. If you follow these checklists—and make sure to check off everything on the list—your customer can enjoy perfectly comfortable air in their home year-round. You can find more training courses and HVAC tips on the Lennox blog at https://www.lennoxpros.com/hvac-training.

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