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# Selecting Infrared Heaters

## Tubular vs. panel-type gas-fired infrared heaters

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Gas infrared heaters are very versatile. They are found in many commercial facilities, including factories, warehouses, repair garages, aircraft hangers, trasportation terminals, parking garages, greenhouses, and loading docks. They are effective for spot or task heating and also work well for general space heating..

### WHY INFRARED HEAT?

Infrared units heat primarily by radiant heat transfer, similar to the way direct sunlight heats our bodies. Radiant (infrared) energy travels in straight lines and is absorbed by any object that is opaque. It passes through objects and materials that are transparent, such as air. Their physical characteristics make infrared heaters a good choice for heating people (we're all opaque) who are working or sitting in areas where there is substantial air movement, such as loading docks or grandstands. Heating the air in these places would be very inefficient.

When using gas infrared heaters, no walls are needed for effective zoning. They are a good choice for buildings with high ceilings, large volumes of air, or high air leakage rates because they heat objects, not the air.

### EQUIPMENT TYPES

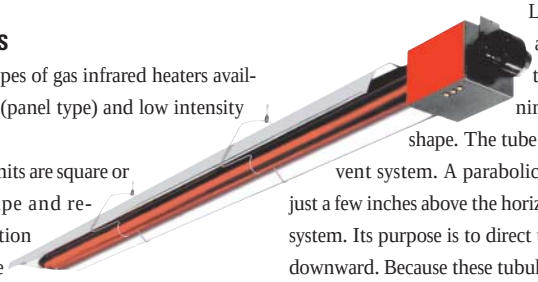
There are two types of gas infrared heaters available: high intensity (panel type) and low intensity (tubular type).

High intensity units are square or rectangular in shape and require adequate dilution air because they are unvented. The gas flame heats a ceramic or stainless steel mat, which, in turn, radiates to the objects or people to be heated. Output from one of these units can range from 20,000 to 200,000 Btuh.

Photos courtesy of Solaronics

***A low-intensity tube infrared heater (top) and a high intensity panel heater (bottom) typically range from 40,000 to 200,000 Btuh inputs. The tube heaters range between 10 and 70 ft in length, and the panel heaters can provide single- or two-stage heating.***

Panel heaters are best suited where spot heating is needed in spaces that are not totally enclosed from outdoor air. This includes stadium seating areas, covered walkways, golf driving ranges, aircraft hangers, and open loading docks. Strategically placed high intensity gas infrared heaters are often used today to extend the season of outdoor eating areas.



Low intensity units are tubular in shape, the tube either running straight or in a U-shape. The tube is actually part of the vent system. A parabolic reflector is attached just a few inches above the horizontal part of the vent system. Its purpose is to direct the infrared radiation downward. Because these tubular units are vented to the outside, they do not require dilution air.

Tubular heaters are ideal for fire stations, farm buildings, large assembly areas, auto shops, and other areas that are usually, but not always, closed to the outdoor air. They work well where there are high ceilings and large open areas to heat.

### INSTALLATION BASICS

When locating and installing infrared heaters, a few cautions are in order. Be aware of sprinkler system outlets and clearances between the heaters and stored items. Use with caution where the air is filled with dust or paint overspray. If the air contains chlorine or chlorinated compounds, the heater's life span will be shortened. Next month's article will review in depth how and where to install these units.

### PAYBACK

If an owner is considering installing either an array of electric infrared heaters or an array of natural gas infrared heaters, and the gas heaters cost $2,000 more to install, how many years will it take for the owner to recover the additional cost of the gas units? Assuming that the operating cost of the gas units is $500 per year and the operating cost of the electrical is $1,500 per year, the payback is two years (the additional cost divided by the annual savings, $2,000/$1,0000 = 2). In other words, the extra money invested for the gas heaters will be regained in two years.

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# Installing Infrared Heaters

## Proper installation guarantees safe and comfortable use

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Last month, the sizing and selection of commercial, gas-fired infrared units was discussed. Another key factor in determining the correct type and size of a unit for an application is to examine how the unit will be installed. Proper installation is at least as important as sizing and selecting the type of infrared unit heater to be used in an application.

A number of general infrared installation requirements are common to all commercial, gas-fired equipment:

• The installation work must be done by a qualified installation agency.

• Gas-fired equipment should never be installed in areas exposed to potentially explosive or flammable fumes, especially those where chlorinated, halogenated, or acidic vapors are present.

• Manufacturer requirements for clearance to combustibles and recommended mounting heights must be adhered to strictly.

• Installations must conform not only to local and national building codes, but also to the requirements of the manufacturer described in the installation and service manual.

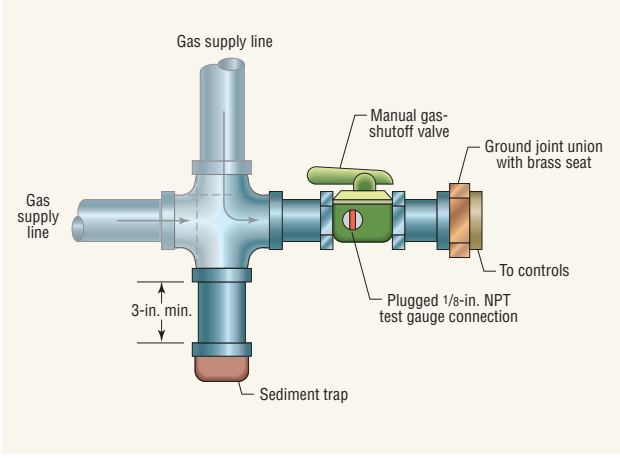


***FIGURE 2.2 A ground joint union and manual shutoff valve should be installed in the gas supply line adjacent to the unit.***

When equipment is selected for a job, the sizing and selection process should produce a plan drawing that shows where each unit will be located in the building. Make sure this plan drawing is available before installing the equipment.

No matter how neat and clean the installation, if the installation does not comply with a properly designed plan, there will be heat related complaints from the building occupants. The plans should include location, mounting height, and angle of reflectors.

Next, determine if the supporting structure is adequate to support the unit and ensure the required electric and gas utilities are available. For vented applications, the unit must be located so it is vented per the requirements in the installation and service manual.

Operating temperature is also a factor that must be considered. High and low-intensity infrared units operate at high temperatures. The ceramic tiles in high-intensity infrared units reach temperatures in excess of 1,700° F, while low-intensity units can produce tube temperatures in excess of 1,000° F near the burner. As a result of these high temperatures, clearances to combustibles must be strictly adhered to. Be aware of clearances to the following:

• Combustible materials.

• Stacked materials (signs are to be posted in locations with stacked materials to indicate the maximum permissible stacking height (Figure 2.1).

• Lights.

• Sprinkler heads.

• Overhead cranes.

• Objects on lifts (like automobiles inside repair shops).

Infrared units, like all gas-fired equipment, need clean combustion air to operate. High-intensity units and unvented low-intensity units require a minimum air displacement of 4 cfm per 1,000-Btuh input for natural gas and 5 cfm per 1,000-Btuh input for propane gas. Not all low-intensity installations can be unvented. Check the installation-and-service manual provided by the manufacturer. Ventilation and combustion-air requirements for both vented and unvented applications must be adhered to.

Photos courtesy of Modine Manufacturing

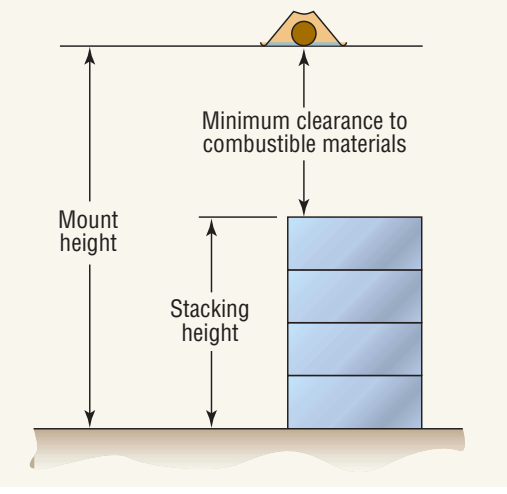


***FIGURE 2.1 Post maximum stacking heights below infrared heaters.***

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It is recommended that local authorities be contacted to assure the ventilating system and heater installation are in compliance with any applicable local and/or state codes.

With the plan drawing in hand, now comes the task of mounting the units. The installer typically encounters, or should be cognizant of, the following items when installing both high-intensity and/or low-intensity gas-fired infrared units:

• Gas or electrical supply should never be used for system support. The weight of the unit must be borne by the support structure, which may consist of threaded rods or chains.

• Gas connections and piping must be properly sized for the total unit capacity. Under-sized piping can lead to underfiring the units, poor performance, and poor combustion.

• Gas supply must never exceed the maximum rating for a unit heater. This is typically 14 in. of water column supply pressure for both natural gas and LP units.

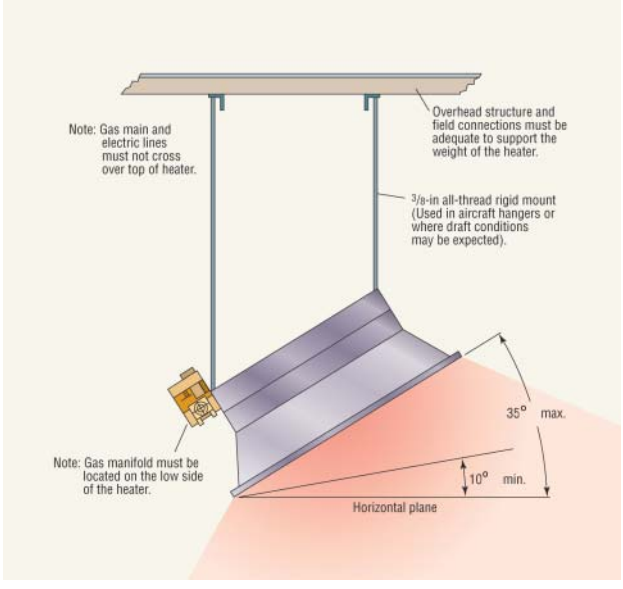


***FIGURE 3.1 Panel-type high intensity units must be installed between the angles of 10 and 35 degrees from horizontal for the unit to operate properly. The manifold assembly should always be located at the lower end of the installation.***

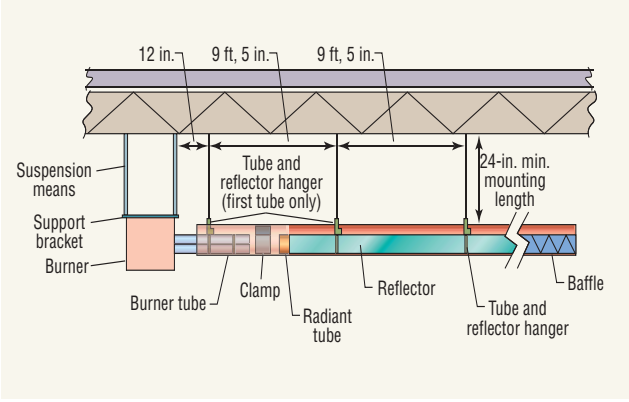


***FIGURE 3.2 Low-intensity, tubular infrared-heater installation.***

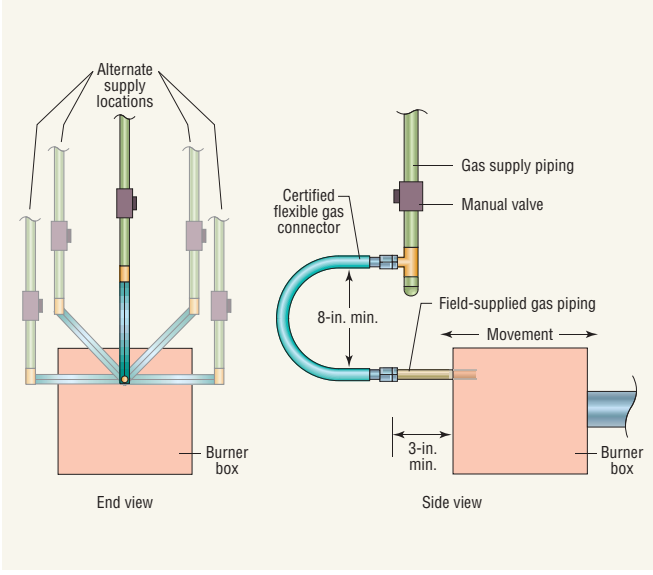


***FIGURE 3.3 If local code allows, use flexible gas connectors for tubular IR heaters.***

• A ground joint union and manual shutoff valve should be installed in the gas supply line adjacent to unit. Install a gas line sediment trap immediately prior to unit gas controls (Figure 2.2 ).

• Gas connections must be properly sealed and tested for leaks using a soap solution or an equivalent test. Never use an open flame.

• Electrical supply voltage should match the voltage on the unit serial plate. Connections must conform to applicable local codes and the National Electric Code. Some manufacturers offer a millivolt, self-energizing control system. These units do not require external power, which is beneficial to minimizing installation cost.

• Electrical supply to the unit is to be protected with a fused disconnect or circuit breaker.

• Wiring must be sized properly for unit ampacity per the National Electric Code. Wiring polarity must also be correct.

• Gas and electric utilities should not be run above the unit heaters. This avoids overheating.

In addition to the above items, there are general requirements common to all types of infrared heater installations.

**For high intensity units (Figure 3.1):**

• Units can be hung with a threaded rod where code allows. Chain-mounting kits provide an easy means for suspending the unit heaters.

• Units must be installed between the angles of 10 and 35 degrees from horizontal for the unit to operate properly. The manifold assembly should always be located at the lower end of the installation (Figure 3.1).

**For low-intensity units (Figure 3.2):**

• Flexible mounting should be used for low-intensity tube heaters to allow for expansion and contraction of the tube sys-

tem. Most manufacturers provide chain-mounting kits for this purpose.

• Low-intensity units are installed burner box first; then tube systems are installed one tube at a time, starting from the burner and working toward the terminating end. While the tube system should be suspended with flexible mounting, the burner box should be rigidly mounted to avoid placing strain on the gas- and electrical-supply connections. If code allows, the use of flexible gas connectors may be used (Figure 3.3).

• Units must be installed in the horizontal plane.

• Low-intensity units must have reflectors along the entire tube length and must be overlapped by at least 4 in. to accommodate expansion and contraction.

• Units are to be vented as required by the installation and service manual, paying careful attention to the following:

• Maximum length.

• Maximum number of elbows.

• Using venting material/systems matching the appliance venting category.

• Pitching the vent and using properly drained drip legs for removal of condensate.

• Terminating the vent system per the manufacturer requirements.

• Following requirements of the National Fuel Gas Code.

• Outdoor equipment must have weatherized electrical connections.

Before any equipment is put into operation, the unit should be properly commissioned. This will be a topic for a future article.

**CONCLUSION**

By following a properly designed gas-fired infrared unit heater layout, along with installing this unit per the guidelines found above, you should be provided with an easy, cost-effective means of heating a number of applications. Good literature exists to help you make the right decisions. I recommend the "Infrared Design and Engineering Guide." (LIT # 9-200 available at modine.com/publications) There also is a wealth of valuable information from manufacturers' websites.

*For previous Equipment Notebook articles, visit* www.hpac.com.

# Solutions for Infrared Heaters

## Poor installation is usually the root cause of problems

By MIKE SCHIRES
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Many infrared-performance issues are caused by improper installation, most often installing the units too low or too high. (Proper installation was covered in last month's Equipment Notebook article "Installing Gas-Fired Infrared Heaters.") Once the product is properly selected and installed, a preventative maintenance program is the key to long and trouble-free product life.

Infrared manufacturers include an operation and maintenance manual with every unit. If there is a transfer of ownership, the manual should be left with the new owner.

A qualified gas-service technician should service all heating equipment before each heating season to ensure proper operation. Some items may require more frequent service based on the environment in which the unit is installed and how long the unit is operated. Refer to the recommendations and service intervals in the operation and maintenance manual provided with the equipment.

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Below are procedures that should be included in any comprehensive preventive maintenance schedule for gas infrared heaters:

**Burner assembly.** Disconnect all electrical power to the heater and close the gas supply valve installed adjacent to the heater. With an air hose regulated to 15 psig maximum, blow off any dust and dirt that has accumulated on the heater. For high intensity, this includes blowing across the ceramic burner (not directly at the ceramic burner). Do not insert the air hose into the inlet of each venturi tube.

**Burner orifice.** Gas orifices are to be cleaned using drill sizes indicated in the operation and maintenance manual supplied with the equipment. Remove the burner orifice and then clean and re-install it on the heater manifold. The pilot orifice should also be cleaned.

**Combustion air blower (low intensity units).** Combustion air blower motors are typically permanently lubricated, requiring no additional lubrication. Refer to the operation and maintenance manual for details. An air-restrictor plate (Photo A) sized for the appropriate fuel type and burner input is installed by the factory and must not be field-adjusted.

**Electrical wiring.** The electrical wiring should be checked annually for loose connections or deteriorated insulation. If the application is especially dirty, periodically clean the thermostat contacts.

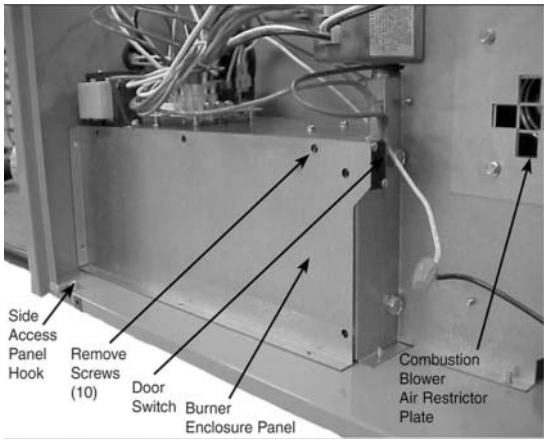
**Gas piping and controls.** The gas valves and piping should be checked annually

for general cleanliness and tightness. The thermostat should be cycled and gas controls checked to ensure that the unit is operating properly. Refer to the sequence of operation in the operation and maintenance manual shipped with the unit. Some manufacturers include diagnostic LEDs on the unit to make this check easier.

**Troubleshooting**. Most manufacturers provide troubleshooting guides to make problem diagnosis quicker and easier. Some are setup in a "Trouble–Possible Cause–Possible Remedy" matrix, which can ease the troubleshooting process.

Do not attempt to re-use any mechanical or electrical components that were exposed to water. They must be replaced with a factory-approved component.

When servicing or repairing infrared equipment, use only factory-approved service replacement parts. A complete replacement-parts list can be obtained by contacting the manufacturer. Refer to the rating plate on the unit for complete unit model number, serial number, and company contact information.




Photos courtesy of Modine Manufacturing

***PHOTO A. Infrared burner enclosure panel and air restrictor plate.***

*For previous Equipment Notebook articles, visit* www.hpac.com.

# Commissioning Infrared Heaters

## A checklist every installer of gas-fired IR heaters should use

By MIKE SCHIRES
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Over the last few editions of *HPAC Engineering*, we have discussed the selection, installation, and servicing of gas-fired infrared heaters. This month we tackle the subject of commissioning. The proper commissioning of an infrared installation ensures that once an installer leaves the job site, they will not be called back.

Infrared manufacturers include an operation and maintenance manual with every unit. This manual includes start-up procedures recommended by the manufacturer and should be referred to during commissioning. It is crucial that all start-up and adjustment procedures are performed by a qualified service agency.

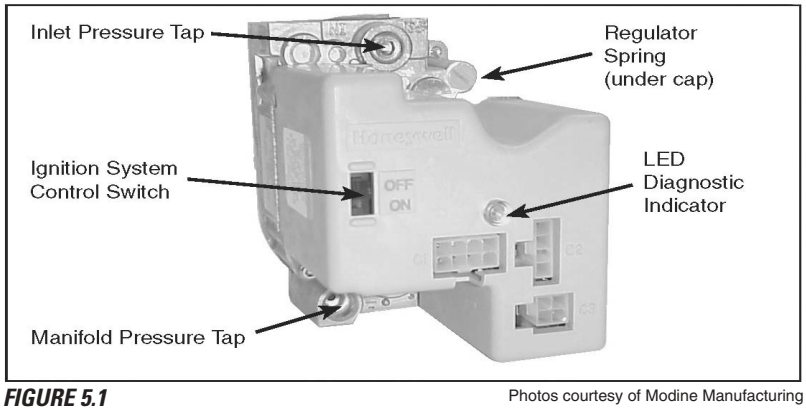


***FIGURE 5.1***

Photos courtesy of Modine Manufacturing

### START-UP PROCEDURE CHECKLIST

❑ Start by turning off power to the unit at the disconnect switch. Check that fuses or circuit breakers are in place and sized correctly. Turn all hand gas valves to the "OFF" position.

❑ Next, check that the supply voltage matches the supply voltage listed on the serial plate. Verify that all wiring is secure and properly protected. Trace circuits to ensure the unit has been wired according to the wiring diagram.

❑ If utilizing indoor air for combustion and/or the unit is in an unvented installation area, ensure adequate combustion air and ventilation is supplied to the space as specified in the operation and maintenance manual.

❑ Perform a visual inspection of the unit to make sure no damage has occurred during installation.

❑ Re-check the gas supply pressure. The inlet pressure for natural gas is typically 5 to 7-in w.c. for low intensity and 7 to 14-in. w.c. for high intensity. For propane, the pressure is typically 12 to 14-in. w.c. for low intensity and 11 to 14-in. w.c. for high intensity. Refer to the operation and maintenance manual for the manufacturer's recommendations. The gas supply pressure must never exceed 14-in w.c. If it does, a gas pressure regulator needs to be added upstream of the combination gas valve.

❑ Open the field-installed manual shut-

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off valve and turn the power "ON".

❑ Make certain the gas line is purged of air prior to attempting to operate the unit. Follow the procedure on the heater's lighting instruction label to put the heater into operation.

❑ For units equipped with a pilot, check the pilot flame length and adjust as necessary per the manufacturer's instructions.

❑ Check to make sure the main gas valve opens upon a call for heat from the thermostat.

❑ Check to ensure the gas controls sequence properly.

**MAIN BURNER ADJUSTMENT**

The gas pressure regulator (integral to the combination gas control) is adjusted at the factory for average gas conditions. It is important that gas be supplied to the heater in accordance with the input rating on the serial plate. Actual input should be checked and necessary adjustments made after the heater is installed. Over-firing, a result of too high an input, reduces the life of the unit and increases maintenance. Under no circumstances should the input exceed that shown on the serial plate. Measuring the manifold pressure is done at the manifold pressure tap on the main gas valve on the heater, as shown in Figure 5.1.

To adjust the manifold pressure:

1. Adjust the main gas pressure regulator spring to achieve the proper manifold pressure.

2. Move the field-installed manual shut-off valve to the "OFF" position.

3. Remove the ⅛-in. pipe plug-in manifold pressure tap in the combination gas control and attach a 12-in.-high U-tube-type water manometer.

4. Move the field-installed manual shut-off valve to the "ON" position.

5. Create a call for heat from the thermostat, check the manometer reading and adjust pressure per manufacturer instructions as required.

6. After adjustment, move the field-installed manual shut-off valve to the "OFF" position and replace the ⅛-in. pipe plug.

7. After the plug is in place, move the shut-off valve back to the "ON" position and re-check pipe plugs for gas leaks with a soap solution. Never use a flame to check for leaks.

**VENTING CHECKLIST**

If the heater being commissioned is a low-intensity, vented unit, use the following steps to verify the venting system is adequately sized.

❑ Inspect the venting system for proper size and horizontal pitch as required in the National Fuel Gas Code and the instructions in the operation and maintenance manual. Determine there is no blockage or restriction, leakage, corrosion and other deficiencies that could cause an unsafe condition.

❑ As far as practical, close all building doors and windows and all doors between the space in which the unit(s) connected to the venting system are located and other spaces of the building. Turn on all exhaust fans to their maximum speeds. Do not operate a summer exhaust fan.

❑ Place the unit being inspected in operation. Adjust thermostat so that the unit will operate continuously.

❑ After it has been determined that each unit connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, and any other gas-burning units to their previous condition.

❑ If improper venting is observed during any of the above tests, the venting system must be corrected. See the operation and maintenance manual for the manufacturer's recommendations.

By following the equipment manufacturer's commissioning procedure, you should be assured trouble-free equipment operation, reduced maintenance costs and, most importantly, customer satisfaction.

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