

## INSTALLATION AND SERVICE MANUAL

### low intensity gas-fired pressurized infrared heaters

### model LM/HM



## FOR YOUR SAFETY

### IF YOU SMELL GAS:

1. Open windows (indoor installation only).
2. Do not touch electrical switches.
3. Extinguish any open flame.
4. Immediately call your gas supplier.

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this unit is hazardous.

## ⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death, and could cause exposure to substances which have been determined by various state agencies to cause cancer, birth defects, or other reproductive harm. Read the installation, operating, and maintenance instructions thoroughly before installing or servicing this equipment.

## IMPORTANT

The use of this manual is specifically intended for a qualified installation and service agency. A qualified installation and service agency must perform all installation and service of these appliances.

## ⚠ CAUTION

As with all infrared equipment, clearances to combustible material are critical. Be sure all units have reflectors installed along the entire length of the tube, and that they are not mounted at an angle greater than 45° from the horizontal plane.

To prevent premature heat exchanger failure do not locate ANY gas-fired units in areas where chlorinated, halogenated, or acid vapors are present in the atmosphere.

### Inspection on Arrival

1. Inspect unit upon arrival. In case of damage, report it immediately to transportation company and your local Modine sales representative.
2. Check rating plate on unit to verify that power supply meets available electric power at the point of installation.
3. Inspect unit upon arrival for conformance with description of product ordered (including specifications where applicable).

# SPECIAL PRECAUTIONS

## SPECIAL PRECAUTIONS

THE INSTALLATION AND MAINTENANCE INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED TO PROVIDE SAFE, EFFICIENT AND TROUBLE-FREE OPERATION. IN ADDITION, PARTICULAR CARE MUST BE EXERCISED REGARDING THE SPECIAL PRECAUTIONS LISTED BELOW. FAILURE TO PROPERLY ADDRESS THESE CRITICAL AREAS COULD RESULT IN PROPERTY DAMAGE OR LOSS, PERSONAL INJURY, OR DEATH. THESE INSTRUCTIONS ARE SUBJECT TO ANY MORE RESTRICTIVE LOCAL OR NATIONAL CODES.

## HAZARD INTENSITY LEVELS

1. **DANGER:** Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.
2. **WARNING:** Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.
3. **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.
4. **IMPORTANT:** Indicates a situation which, if not avoided, MAY result in a potential safety concern.

## ▲ DANGER

Appliances must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

## ▲ WARNING

1. All field gas piping should be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
2. Gas pressure to the unit controls must never exceed 14" W.C. (1/2 psi).
3. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
4. All appliances must be wired strictly in accordance with the wiring diagram furnished with the unit. Any wiring different from the wiring diagram could result in a hazard to persons and property.
5. Any original factory wiring that requires replacements must be replaced with wiring material having a temperature rating of at least 105°C.
6. When servicing or repairing this equipment, use only Modine-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the unit for complete unit model number, serial number, and company address. Any substitution of parts or controls not approved by Modine will be at owner's risk.

## ▲ CAUTION

1. Purging of air from gas lines should be performed as described in ANSI Z223.1 – latest edition "National Fuel Gas Code". or in Canada in CAN/CGA-B149 codes.
2. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and replace any gas control which has been under water.
3. A built-in combustion air blower is provided – additional external draft hoods (diverters) or power exhausters are not required or permitted.
4. Installation must conform with local building codes or in the absence of local codes, with Part 7, Venting of Equipment, or the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) – latest edition. In Canada installation must be in accordance with CAN/CGA-B149.1 for natural gas units, and CAN/CGA-B149.2 for propane units.

## IMPORTANT

1. Approval requirements for infrared heaters specify that the suspended type heaters shall be installed in accordance with certain sections of the National Fire Codes published by the National Fire Protection Association and various ANSI standards. SOME of the requirements are listed below.

**Aircraft Hangars:** Approval requirements are contained in the current edition of ANSI/NFPA 409 (or in accordance with the enforcing authority for Canada).

**Public Garages:** Approval requirements are contained in the current edition of NFPA 88B (CAN/CGA B149 for Canada).

**Parking Structures:** Approval requirements are contained in the current edition of NFPA 88A.

**General:** All installations must be in accordance with the current edition of ANSI Z-223.1 (NFPA 54) National Fuel Gas Code and the current edition of the National Electric Code, ANSI/NFPA 70. For Canada, installations must conform with local building codes, or in the absence of local codes, in accordance with the current edition of CAN/CGA B149 and the Canadian Electric Code, C22.1.

2. Start-up and adjustment procedures should be performed by a qualified service agency.
3. To check most of the Possible Remedies in the troubleshooting guide listed in Tables 13.3 and 14.1, refer to the applicable sections of the manual

# SI (METRIC) CONVERSION FACTORS / UNIT LOCATION / AIR REQUIREMENTS

## Table of Contents

General Information/Installation Codes . . . . .	1
Inspection on Arrival . . . . .	1
Special Precautions . . . . .	2
SI (Metric) Conversion Factors . . . . .	3
Unit Location . . . . .	3
Location Recommendations . . . . .	3
Ventilation/Combustion Air Requirements . . . . .	3
Installation . . . . .	4
Unit Btu/hr Conversion . . . . .	4
Mounting . . . . .	4
Clearances to Combustibles . . . . .	4
General Installation Instructions . . . . .	5
Venting . . . . .	5
Gas Connections . . . . .	8
Electrical Connections . . . . .	9
Start-Up Procedure . . . . .	9
Main Burner Adjustment . . . . .	10
Control Operating Sequence . . . . .	11
Dimensions, Performance . . . . .	12
Maintenance . . . . .	13
Troubleshooting . . . . .	13
Service/Replacement Parts Ordering . . . . .	15
Model Number Designations . . . . .	15
Serial Number Designations . . . . .	15
Warranty . . . . .	19

**Table 3.1**  
**SI (Metric) Conversion Factors**

To Convert	Multiply By	To Obtain
"W.C. (inches water column)	0.24	kPa
psig	6.893	kpa
°F	subtract 32 and then multiply by 0.555	°C
inches	25.4	mm
feet	0.305	meters
cfm	0.028	m <sup>3</sup> /min
cfh	1.699	m <sup>3</sup> /min
btu/ft <sup>3</sup>	0.0374	mJ/m <sup>3</sup>
pound	0.453	kg
btu/hr	0.000293	kW/hr
gallons	3.785	liters

## Unit Location

**⚠ DANGER**

Appliances must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

**⚠ CAUTION**

As with all infrared equipment, clearances to combustible material are critical. Be sure all units have reflectors installed along the entire length of the tube, and that they are not mounted at an angle greater than 45° from the horizontal plane.

**IMPORTANT**

Approval requirements for infrared heaters specify that the suspended type heaters shall be installed in accordance with certain sections of the National Fire Codes published by the National Fire Protection Association and various ANSI standards. SOME of the requirements are listed below.

**Aircraft Hangars:** Approval requirements are contained in the current edition of ANSI/NFPA 409 (or in accordance with the enforcing authority for Canada).

**Public Garages:** Approval requirements are contained in the current edition of NFPA 88B (CAN/CGA B149 for Canada).

**Parking Structures:** Approval requirements are contained in the current edition of NFPA 88A.

**General:** All installations must be in accordance with the current edition of ANSI Z-223.1 (NFPA 54) National Fuel Gas Code and the current edition of the National Electric Code, ANSI/NFPA 70. For Canada, installations must conform with local building codes, or in the absence of local codes, in accordance with the current edition of CAN/CGA B149 and the Canadian Electric Code, C22.1.

### Location Recommendations

- When locating the heater, consider the general space and heating requirements and availability of gas and electrical supply.
- Be sure the structural support and chain/rod at the unit location is adequate to support the weight of the unit.
- Be sure that the minimum clearances to combustible materials and for servicing are maintained. The minimum clearances to combustibles are shown in Table 4.1, as well as affixed to burner's CSA rating plate.
- Mounting height (measured from the bottom of unit) at which heaters are installed is critical. Please refer to mounting height information in Table 12.3.
- Do not locate units in areas where chlorinated, halogenated, or acid vapors are present in the atmosphere.

### Ventilation/Combustion Air Requirements - Vented Applications

To insure adequate combustion air, positive air displacement of 4 cfm per 1000 Btu/hr for natural gas and 5 cfm per 1000 Btu/hr for propane is required. Tightly constructed, well-insulated buildings require mechanically powered systems, for example, exhaust fans and fresh air intake openings. Exhaust fans alone are not sufficient. Inlet air openings are required.

# AIR REQUIREMENTS / INSTALLATION

## Ventilation/Combustion Air Requirements - Unvented Applications

Maintain positive air displacement of 4 cfm per 1000 Btu/hr for natural gas and 5 cfm per 1000 Btu/hr for propane. The fresh air supply must be located in the immediate proximity of the unit(s). Fresh air intake openings are typically located high on the building sidewalls at a comparable level to the heaters. One square inch of net free inlet area per 1000 Btu/hr is required. Multiple inlets, well distributed, should be used and should direct air upward to prevent drafts at floor level. Inlets are typically limited to 1 to 2 square feet in size.

Modine recommends that units be interlocked with mechanical exhaust fans for unvented applications. Mechanical exhaust fans are typically located at high points of the building. For flat roof areas, a series of small exhausters should be distributed over the roof areas and interlocked with various heating zones.

## Utilizing Outside Combustion Air (Optional)

1. If utilizing outside combustion air, an accessory combustion air intake collar is required.
2. All units may utilize a maximum of 20' of 4" O. D. fresh air intake pipe with two (2) 90° elbows.
3. A minimum of 24" of intake pipe is recommended for optimum operation.
4. Keep intake opening at least 5 feet from any exhaust vent opening.
5. Insure that combustion air cap is protected from snow blockage.
6. If utilizing outside combustion air, Modine recommends using insulated pipe or schedule 40 PVC pipe to provide fresh air and limit condensation from forming on outer surface. A screened combustion air intake cap is required.

## Installation

### Unit Btu/hr Conversion

If installing an infrared burner kit, ensure that the unit is converted per kit instructions 9-559, latest revision, before continuing with installation.

### Mounting

Be sure the means of suspension is adequate to support the weight of the unit (see Tables 12.1 and 12.2 for system weights). Where permissible, Modine recommends flexible mounting. Modine offers chain mounting sets as an accessory. In the absence of this chain set, Modine recommends Number 1/0 Tenso chain (200 lb. working load). "S" hooks should be a minimum 1/4" in diameter and the ends must be closed after installation.

Under no circumstances should the gas supply line or the electrical supply line to the heater provide any assistance in the suspension of the heater. Do not locate any gas or electric service lines directly above or below the heater.

Insure that:

1. Clearances to combustibles (as shown on the rating plate and in Table 4.1) are maintained.
2. In locations used for storage of combustible materials, signs shall be posted to specify the maximum permissible stacking height to maintain required clearances from the heater to the combustibles. See Figure 4.2.
3. Both gas piping and suspension mounting are flexible to prevent fatigue failure from vibration or thermal expansion.
4. Adequate clearances to sprinkler heads are maintained,

which are dependent upon the setting of each individual sprinkler head. As a guideline, LM/HM certified minimum distance to combustible material is based on the combustible material surface not exceeding 160°F.

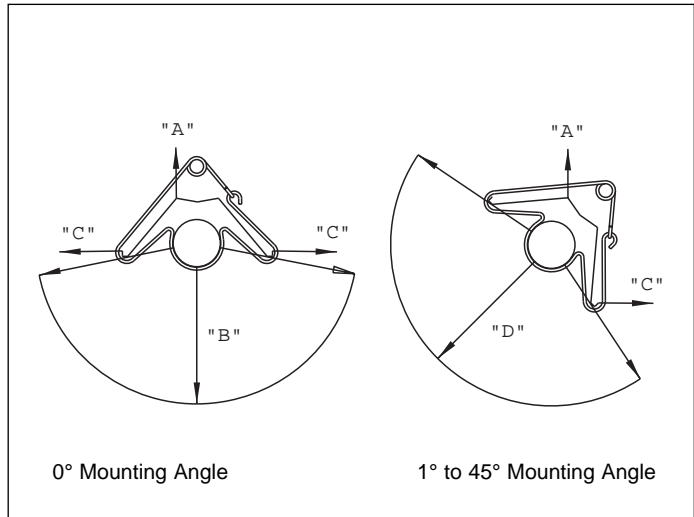
**Table 4.1**  
**Combustible Material Clearances** ①②

Model No.	Minimum Clearances to Combustible Materials (Inches)			
	Top "A"	Bottom "B"	Side "C"	Front "D"
LM 40/50	9	40	12	40
LM 60	9	52	12	52
LM 75/85/100	9	66	36	66
HM125	12	72	36	72
HM150	12	96	36	96
HM175	12	112	42	112
HM200	12	112	42	112

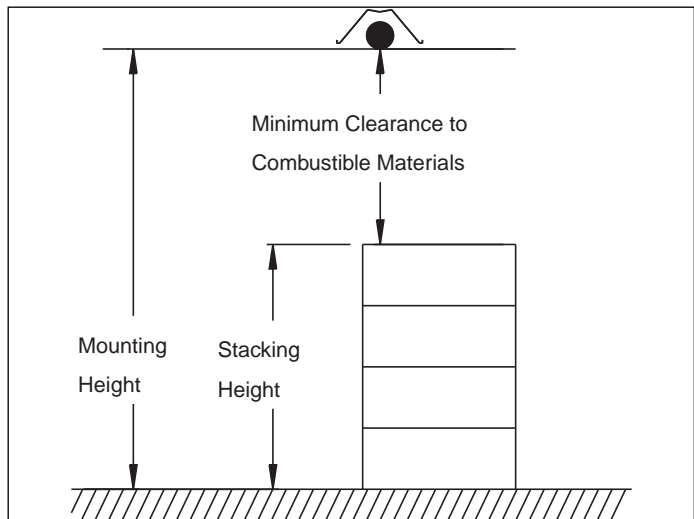
① Clearance to each end and above the U-tube is 12 inches.

② In unvented applications, clearance to vent cap is 36".

**Figure 4.1**  
**Combustible Material Clearances**



**Figure 4.2**  
**Stacking Height**



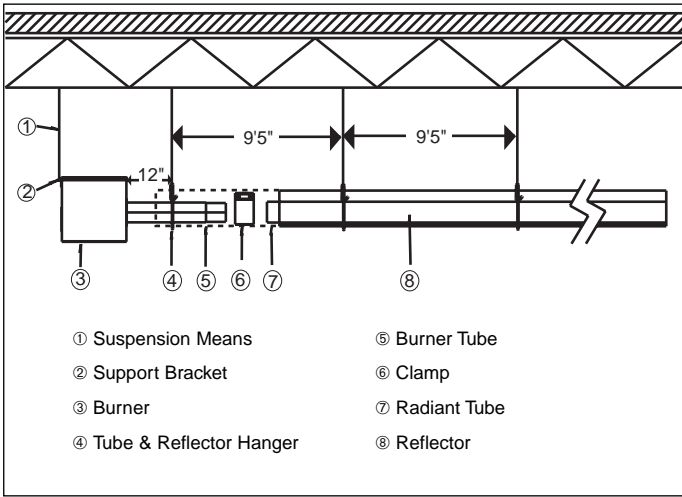
Stacking Height = Mounting Height - Minimum Clearance to Combustible Material

# INSTALLATION / VENTING

## General Installation Instructions

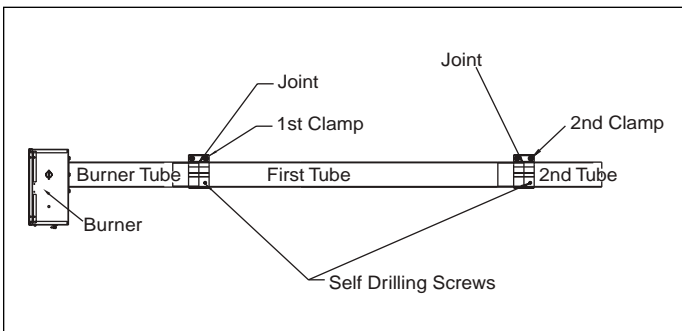
1. See Figure 5.1 for reference numbers of unit components.

**Figure 5.1  
Unit Components**



2. The burner must be supported independently by suspension means utilizing the support brackets (ref. #2), which are an integral part of the burner box.
3. The first tube and reflector suspension point must be located 12" from the burner box. The subsequent suspension means must be installed approximately 9' 5" apart, and must be perpendicular to the tube.
4. Fasten tube and reflector hangers (ref. #4) to the suspension means (ref. #1) using "S" hooks, which must be closed upon installation.
5. Starting from the burner end, insert first section of radiant tube (ref. #7) with non-swaged end facing the burner (ref. #3). **The welded seam must be directed toward floor.**
6. The first tube of units with burners of 150,000 Btu/hr and higher are constructed of titanium aluminized steel, and is stenciled "First Tube" with high temperature paint. The two clamps used with this tube are stainless steel. The stainless steel tube clamps are recognizable due to the high gloss finish. (See Figure 5.2 for a detailed picture useful when installing stainless steel clamps). It is essential that these items be installed closest to the burner.

**Figure 5.2  
Installation of Stainless Steel Clamps**



7. Slide clamp onto burner section tube (ref. #5), but do not tighten.
8. Insert second section of tube into first section. Slide clamp over seam and tighten to 50 ft•lb.

9. Repeat this method until full length of radiant tube is installed. The last section of radiant tube includes an air turbulating baffle, and is marked "Last Tube" with high temperature paint.
10. Unit must always be installed with reflector (ref. #8), which must extend the full length of the tube system. A reflector is not required over the U-tube for U-tube systems. The reflector must be mounted at an angle from 0° to 45° from the horizontal plane. Burner box must always remain level.
11. Slide reflectors through tube and reflector hangers beginning 12" from burner box and overlap each reflector 4" for support during expansion and contraction of the reflectors. Similarly, the ends of the complete reflector system should extend beyond the first and last hangers by at least 4" to ensure proper support.
12. Every other joint must be fastened together with self-tapping sheet metal screws. For example, the first and second reflectors are fastened, as are the third and fourth.
13. End cap must be fastened to end of reflector farthest from burner using sheet metal screws. The end cap will cover the discharge of the last tube.

## Additional Recommendations for Outdoor Installation

When utilized in an outdoor installation or in aircraft hangars, abide by the following recommendations:

1. A screened combustion air intake cap is required.
2. Because of potentially windy environments, the burner must be rigidly mounted using threaded rod to limit sideways movement. The rest of the unit must still utilize flexible mounting to allow for expansion and contraction of tubes.
3. Fasten reflectors to reflector hangers to eliminate movement during windy conditions.
4. All electrical connections must be water tight and suitable for outdoor use.

## Venting

### ⚠ CAUTION

1. A built-in combustion air blower is provided – additional external draft hoods (diverters) or power exhausters are not required or permitted.
2. Installation must conform with local building codes or in the absence of local codes, with Part 7, Venting of Equipment, or the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) – latest edition. In Canada installation must be in accordance with CAN/CGA-B149.1 for natural gas units, and CAN/CGA-B149.2 for propane units.

Modine model LM/HM is certified for use in vented or unvented applications.

## Unvented Applications

1. Insure that adequate combustion air and ventilation are supplied to the space as specified on page 4 under "Ventilation/Combustion Air Requirements - Unvented Applications".
2. An unvented unit must be terminated with one of the following approved vent caps: Gary 1092, Briedert Type L, Field Controls SK-4, Household Mfg. 365198, or Nu-Era GFAS4.
3. Maintain 36" clearance to vent cap in any direction.



# VENTING

## General Venting Instructions

The vent pipe may be installed in either a vertical or horizontal method. Certified vent pipe lengths are as follows:

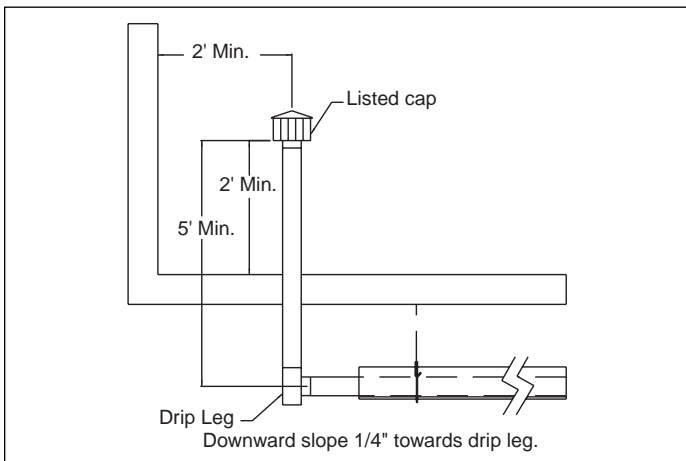
**Table 6.1**  
**Maximum Vent Length**

Tube Length (Ft.)	Maximum Vent Length (Ft.) <sup>①</sup>
20	20
30	20
40	40
50	30
60	20
70	10

① Used in conjunction with a maximum of two (2) 90° elbows.

1. Do not use any vent pipe smaller than 4" in diameter. Refer to the National Fuel Gas Code for the minimum material thickness.
2. Avoid venting through unheated space when possible. When single wall pipe does pass through an unheated space, insulate runs greater than 5' to minimize condensation. Inspect for leakage prior to insulating and use insulation that is noncombustible with a rating of not less than 600°F. Install a tee fitting at the low point of the vent system and provide a drip leg with a clean out cap as shown in Figure 6.1. The drip leg should be cleaned annually.

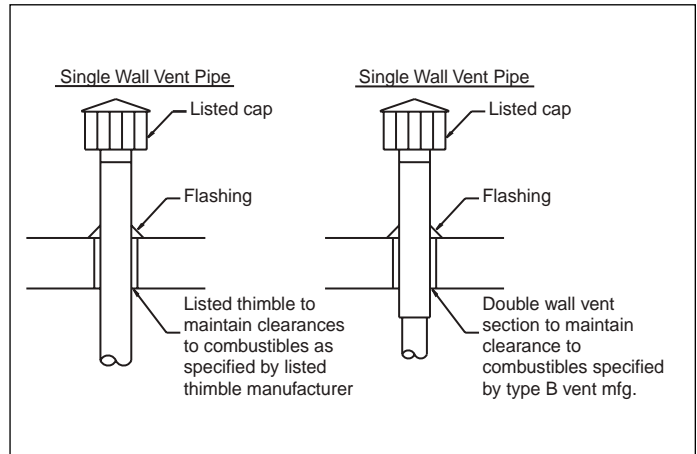
**Figure 6.1**  
**Vertical Venting**



3. Type B vent can only be used to terminate the vent system. The type B double wall vent must be one continuous section.
4. All vents must be terminated with one of the following approved vent caps: Gary 1092, Briedert Type L, Field Controls SK-4, Household Mfg. 365198, or Nu-Era GFAS4.
5. Keep single wall vent pipe at least 6" from combustible material. For double wall vent pipe maintain clearances listed on vent pipe. The minimum distance from combustible material is based on the combustible material surface not exceeding 160°F.
6. Where the vent passes through a combustible wall or floor or ceiling, a listed metal thimble 4" greater than the vent diameter is necessary. If there are six feet or more of vertical vent pipe in the open space between the unit

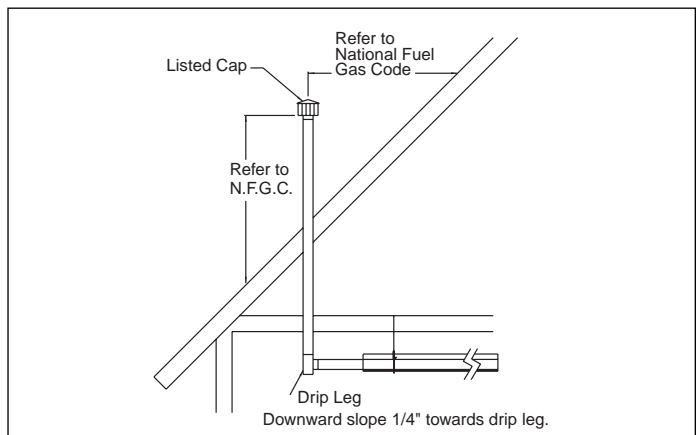
heater and where the vent pipe passes through the floor or roof, the thimble need only be 2" greater than the diameter of the vent pipe. If a thimble is not used, all combustible material must be cut away to provide a 6 inch clearance. Any material used to close an opening must be noncombustible. Vent pipes must be adequately supported and sealed with a 600°F RTV silicone sealant.

**Figure 6.2**  
**Construction through Combustible Floor or Ceiling**



7. The top of the vertical stack should extend at least 2' above any portion of a building within a horizontal distance of 2' (see Figure 6.1)
8. For pitched roof vertical venting, refer to the National Fuel Gas Code for the vertical distance that the cap must extend above the pitched roof (see Figure 6.3)

**Figure 6.3**  
**Vertical Venting through Sloped Roof**

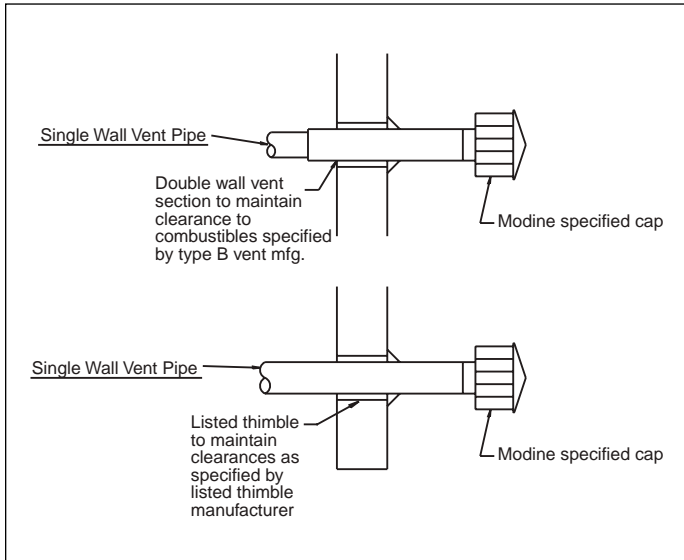


## Additional Requirements for Horizontal Venting

1. All horizontal vents must be terminated with one of the following approved vent caps: Gary 1092, Briedert Type L, Field Controls SK-4 or Household Mfg. 365198. In the United States, the vent cap must be 24" from wall, while in Canada, a distance of 48" from the wall is required.
2. When horizontal vents pass through a combustible wall (up to 8 inches thick), use a thimble with 2" clearances to the vent and insulate between thimble and vent. The vent passage may also be constructed and insulated as shown in Figure 6.2. Where horizontal vents pass through a non-combustible wall, no clearances to the wall are required.

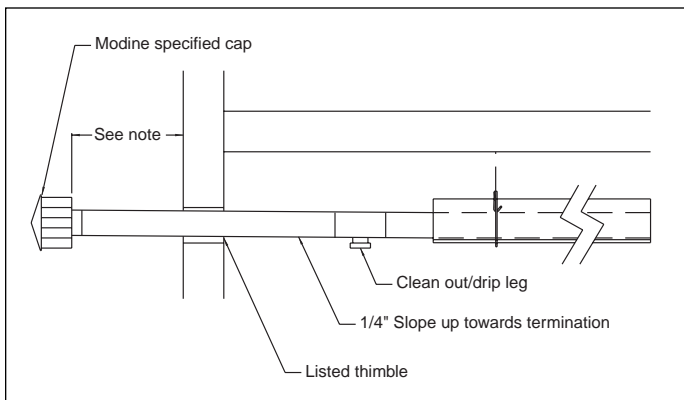
# VENTING

**Figure 7.1**  
**Vent Construction through Combustible Wall**

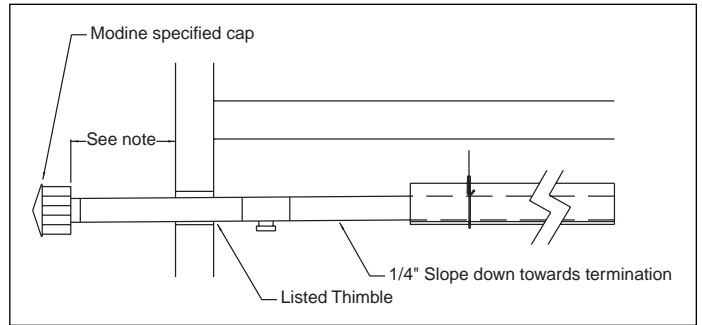


3. The vent system shall terminate at least 3' above any forced air inlet (except direct vent units) located within 10', and at least 4' below, 4' horizontally from, or 1' above any door, window or gravity air inlet into any building. The bottom of the vent terminal shall be located above the snow line or at least 1' above grade; whichever is greater. When located adjacent to public walkways the vent system shall terminate not less than 7' above grade.
4. Vent must extend beyond any combustible overhang of the building.
5. The vent system shall not terminate over public walkways, building entrances, or where condensate or vapor could cause a nuisance or hazard or could be detrimental to the operation of regulators, relief openings, or other equipment.
6. When vented horizontally, maintain a 1/4" per foot rise away from the heater. Place a drain tee and clean out near the vent connector (see Figure 7.2). Where local authorities have jurisdiction, a 1/4" downward slope is acceptable. Use a drain tee with a clean out near the exit of the vent (see Figure 7.3) or allow the condensate to drip out the end (see Figure 7.4).

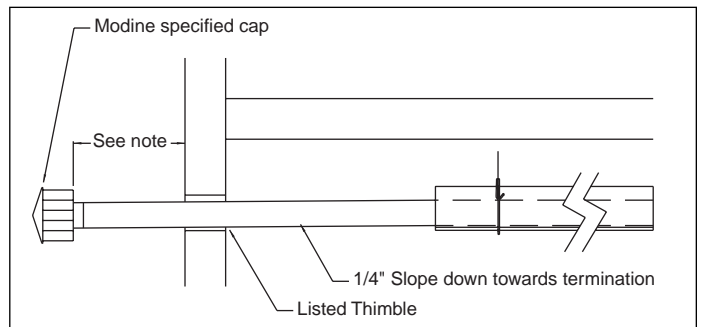
**Figure 7.2**  
**Horizontal Venting w/Upward Pitch**



**Figure 7.3**  
**Horizontal Venting w/Downward Pitch (w/drip leg)**



**Figure 7.4**  
**Horizontal Venting w/Downward Pitch (w/out drip leg)**

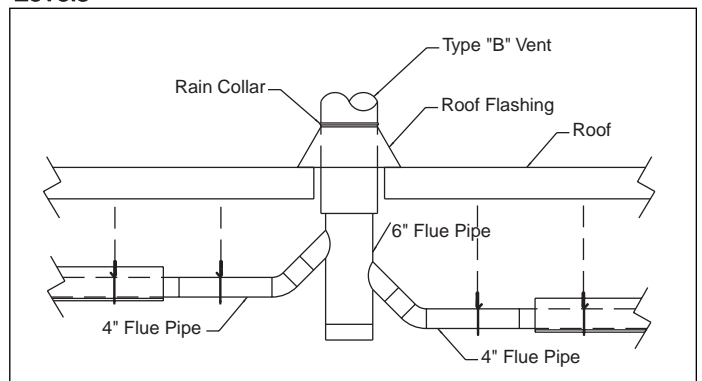


Note: In the United States, the vent cap must be 24" from wall, while in Canada, a distance of 48" from the wall is required.

### Additional Requirements for Common Venting

1. Only two identical units of the same Btu/hr rating and tube length may be common vented utilizing a 6" diameter or greater vent pipe. The individual vents can connect to the common vent as shown in Figure 7.5 or 8.1.
2. The common vent system can be either horizontal or vertical. For through-wall penetrations, refer to horizontal or vertical vent instructions.
3. Both units must be controlled by one thermostat. Literature number 9-410, Multiple Wiring of Low Intensity Infrared, latest revision.
4. Limit the length of horizontal run to 3/4 the length of vertical run when common venting vertically. Maintain certified vent lengths.
5. The vent length of each unit must be identical.
6. If the system does not utilize a 4" x 4" x 6" wye as shown in Figure 8.1, the individual vents must enter the common vent at different levels, as shown in Figure 7.5.

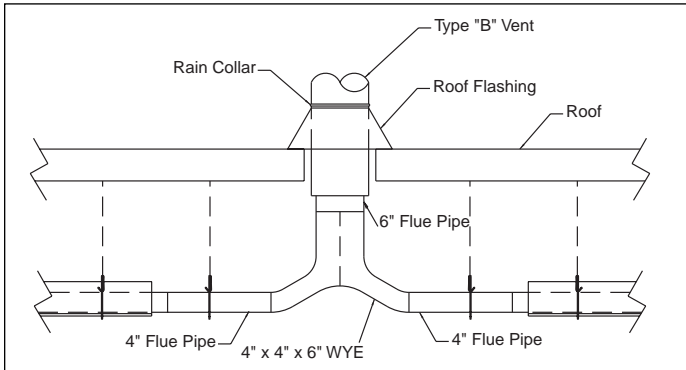
**Figure 7.5**  
**Common Venting - Individual Vents Entering at Different Levels**



# GAS CONNECTIONS

**Figure 8.1**

**Common Venting Utilizing a 4" x 4" x 6" Wye**



**Gas Connections**

**⚠ WARNING**

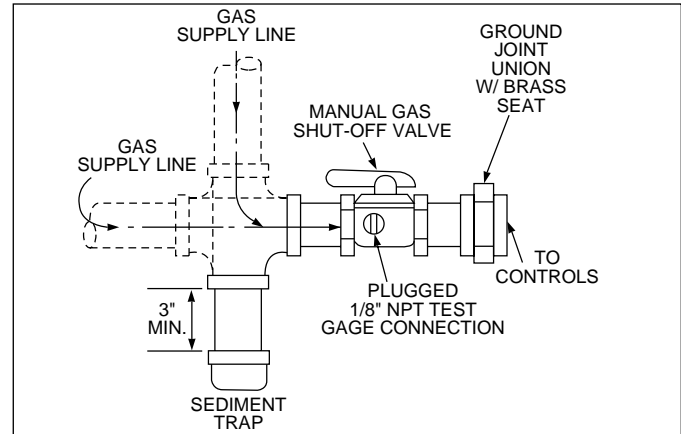
1. All field gas piping must be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
2. Gas pressure to unit controls must never exceed 14" W.C. (1/2 psi).

1. Installation of piping must conform with local building codes, or in the absence of local codes, of the National Gas Fuel Code, ANSI Z223.1 (NFPA 54) – Latest Edition. In Canada, installation must be in accordance with CAN/CGA-B149.1 for natural gas units and CAN/CGA-B149.2 for propane units.
2. Piping to units should conform with local and national requirements for type and volume of gas handled, and pressure drop allowed in the line. Refer to Table 11.1 to determine the cubic feet per hour (cfh) for the type of gas and size of unit to be installed. Using this cfh value and length of pipe necessary, determine the pipe diameter from Table 9.1. Where several units are served by the same main, the total capacity, cfh, and length of main must be considered. Avoid pipe sizes smaller than 1/2". Table 9.1 allows for a 0.3" W.C. pressure drop in the supply pressure from the building main to the unit. The inlet pressure to the unit must be 6-14" W.C. for natural gas and 11-14" W.C. for propane gas. When sizing the inlet gas pipe diameter, make sure that the unit supply pressure can be met after the 0.3" W.C. has been subtracted. If the 0.3" W.C. pressure drop is too high, refer to the Gas Engineer's Handbook for other gas pipe capacities.
3. Install a ground joint union with brass seat and a manual shutoff valve adjacent to the unit for emergency shut-off and easy servicing of controls, including a 1/8" NPT plugged tapping immediately upstream of the gas supply connection to the heater, accessible for test gauge connection. See Figure 8.2.
4. Installation of a sediment trap in the gas supply line before each unit is required to minimize the possibility of loose scale or dirt within the gas supply line entering the heater gas control system. See Figure 8.2.
5. An approved flexible connector may be used (local codes permitting) as a convenient method of connecting the heaters to the gas supply and to avoid placing stress on the gas supply line. During operation tubes will expand in the length. To avoid stress, the installation of the flexible gas connector must be made to accommodate the expansion of the low intensity infrared tubes.

6. Certified flexible connectors are recommended to be installed as illustrated in Figures 8.3 and 8.4, in one plane without sharp bends, kinks or twists. The gas take off from the drop line must be parallel to the burner gas inlet connection.
7. When pressure/leak testing pressures above 14" W.C. (1/2 psi), close the field installed shut-off valve, disconnect the unit, and its combination gas control from the gas supply line, and plug the supply line before testing. When testing pressures 14" W.C. (1/2 psi) or below, close the manual shut-off valve on the unit before testing.

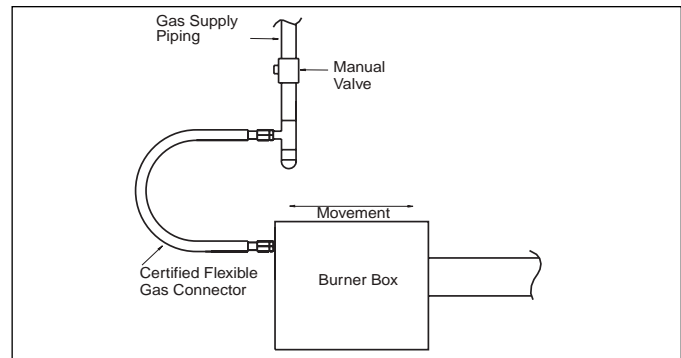
**Figure 8.2**

**Recommended Sediment Trap/Manual Shut-Off Valve Installation**



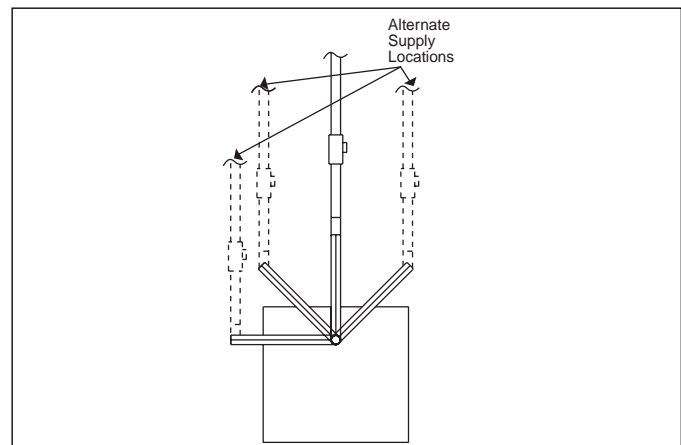
**Figure 8.3**

**Recommended Installation of Flexible Gas Connector - Side View**



**Figure 8.4**

**Recommended Installation of Flexible Gas Connector - End View**





# ELECTRICAL CONNECTIONS / START-UP PROCEDURE

**Table 9.1  
Gas Pipe Capacities**

Gas Pipe Capacities (Up to 14" W.C. Gas Pressure through Schedule 40 Pipe) Cubic Feet per Hour with Pressure Drop of 0.3" W.C. Natural Gas Specific Gravity – 0.60, Propane Specific Gravity – 1.50												
Length	Pipe Diameter (Inches)											
Of Pipe	1/2		3/4		1		1-1/4		1-1/2		2	
(Ft)	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane
10	132	83	278	175	520	328	1050	662	1600	1008	3050	1922
20	92	58	190	120	350	221	730	460	1100	693	2100	1323
30	73	46	152	96	285	180	590	372	890	561	1650	1040
40	63	40	130	82	245	154	500	315	760	479	1450	914
50	56	35	115	72	215	135	440	277	670	422	1270	800
60	50	32	105	66	195	123	400	252	610	384	1150	725
70	46	29	96	60	180	113	370	233	560	353	1050	662
80	43	27	90	57	170	107	350	221	530	334	990	624
90	40	25	84	53	160	101	320	202	490	309	930	586
100	38	24	79	50	150	95	305	192	460	290	870	548
125	34	21	72	45	130	82	275	173	410	258	780	491
150	31	20	64	40	120	76	250	158	380	239	710	447

## Electrical Connections

### **⚠ WARNING**

Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.

All units must be wired strictly in accordance with wiring diagram furnished with the unit. Any wiring different from the wiring diagram could result in a hazard to persons and property.

Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.

1. Installation of wiring must conform with local building codes, or in the absence of local codes, of the National Electric Code ANSI/NFPA 70 - Latest Edition. Unit must be electrically grounded in conformance to this code. In Canada, wiring must comply with CSA C22.1 Part 1, Electrical Code.
2. Provide only the voltage to the heater as stamped on the heater serial plate.
3. The power supply to the unit should be protected with a fused disconnect switch.
4. The heater is not to be energized until gas is available at the heater. Failure to observe this point may result in failure of control components.
5. Control wire used to connect the heater to the thermostat must have adequate ampacity and insulation temperature rating for the total connected load.
6. Wiring must not be located directly above or below the heater to avoid overheating of the wires.
7. All electrical connections must be water tight and suitable for outdoor use.
8. Ensure proper AC wiring of unit and power source.

## START-UP PROCEDURE

### **⚠ CAUTION**

Purging of air from gas lines should be performed as described in ANSI Z223.1 - Latest Edition "National Fuel Gas Code", or in Canada, CAN/CGA-B149 codes.

### **IMPORTANT**

Start-up and adjustment procedures should be performed by a qualified service agency.

1. Turn 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.
2. Check that the supply voltage matches the unit supply voltage listed on the serial plate. Verify that all wiring is secure and properly protected. Trace circuits to insure the unit has been wired according to the wiring diagram.
3. If utilizing indoor air for combustion and an unvented situation, insure adequate ventilation for intake of fresh air and adequate exhaust of products of combustion.
4. Perform a visual inspection of the unit to make sure no damage has occurred during installation.
5. Recheck the gas supply pressure. The inlet pressure to the unit must be 6-14" W.C. for natural gas and 11-14" W.C. for propane gas. The gas supply pressure must never exceed 14" W.C. If the pressure exceeds 14" W.C., a gas pressure regulator must be added upstream of the combination gas valve.
6. Open the field installed manual shutoff valve and turn power on to the unit.
7. Check to make sure that the main gas valve opens upon a call for heat from the thermostat.
8. Check to insure that gas controls sequence properly (See Control Operating Sequence, page 11).

# START-UP PROCEDURE

Before you start use the following steps to verify that the venting system is adequately sized:

1. Seal any unused openings in the venting system.
2. Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code ANSI Z223.1 or CAN/CGA B149.1 or .2 Installation Code – latest edition and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies, which could cause an unsafe condition.
3. In so 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 any exhaust fans so they shall operate at maximum speed. Do not operate a summer exhaust fan.
4. Place the unit being inspected in operation. Adjust thermostat so that the unit will operate continuously.
5. 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 unit to their previous condition of use.
6. If improper venting is observed during any of the above tests, the venting system must be corrected.
7. If the venting system must be resized, it must conform with the National Fuel Gas Code ANSI Z223.1 or CAN/CGA B149.1 or .2 Installation Code – latest edition. If the venting system must be resized, it should be resized to approach the minimum size as determined using the appropriate table in Appendix G of the National Fuel Gas Code ANSI Z223.1.

## 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 (see Figures 10.1 & 10.2).

## To adjust the manifold pressure:

1. The correct manifold pressure is 5" W.C. for natural gas and 10" W.C. for propane gas. Adjust the main gas pressure regulator spring to achieve the proper manifold pressure (see Figures 10.1 & 10.2).
2. Move the field installed manual shut-off valve to the "OFF" position.
3. Remove the 1/8" pipe plug in manifold pressure tap in combination gas control and attach a water manometer of "U" tube type that is at least 12" high.
4. Replace cover of burner box to insure pressure switch will sense accurate pressure.
5. Move the field installed manual shut-off valve to the "ON" position.
6. Create a call for heat from the thermostat.
7. After adjustment, move the field installed manual shut-off valve to the "OFF" position, remove burner box cover and replace the 1/8" pipe plug. Replace burner box cover.
8. After the plug is in place, move the field installed manual shut-off valve to the "ON" position and recheck pipe plugs for gas leaks with a soap solution.

Figure 10.1  
Combination Gas Valve/Ignition Controller -  
LM 40 through HM 150

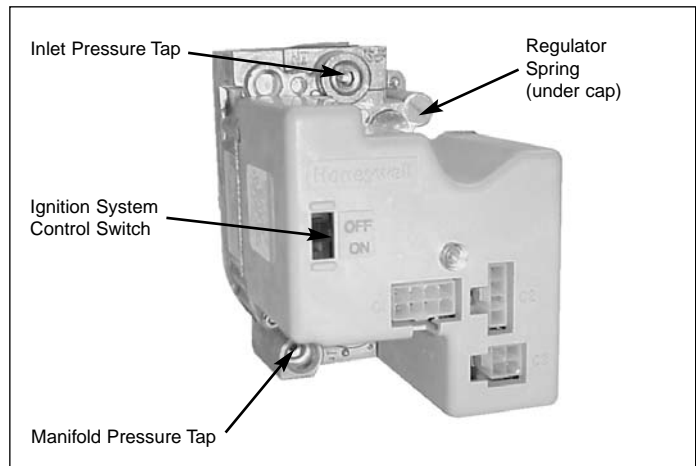
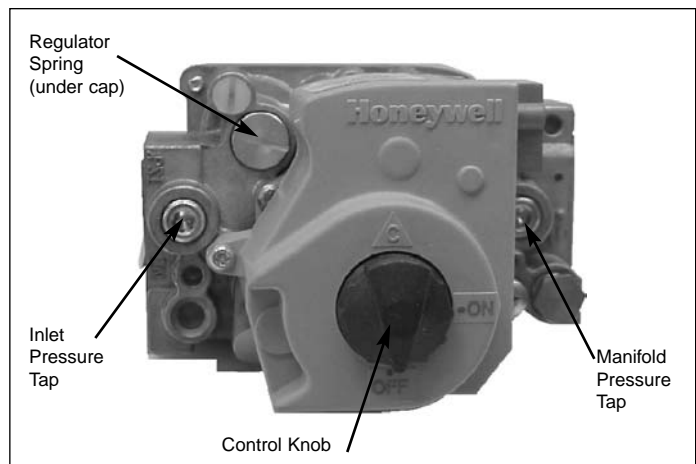


Figure 10.2  
Gas Valve - HM 175 & 200



# START-UP PROCEDURE

**Table 11.1  
Manifold Pressure and Gas Consumption**

Model Size	Type of Gas	Natural	Propane	No. of Orifices
	Btu/ft <sup>3</sup>	1040	2500	
Specific Gravity		0.60	1.53	
Manifold Pressure " W.C.		5.0	10.0	
LM 40	cfh	38.4	16.0	1
	Orifice Drill Size	#36	#49	
LM 50	cfh	48.1	20.0	1
	Orifice Drill Size	#31	#45	
LM 60	cfh	57.7	24.0	1
	Orifice Drill Size	#30	#43	
LM 75	cfh	72.1	30.0	1
	Orifice Drill Size	#21	#37	
LM 85	cfh	81.7	34.0	1
	Orifice Drill Size	#18	#34	
LM 100	cfh	96.2	40.0	1
	Orifice Drill Size	#13	#30	
HM 125	cfh	120.2	50.0	1
	Orifice Drill Size	#6	#28	
HM 150	cfh	144.2	60.0	1
	Orifice Drill Size	#2	#23	
HM 175	cfh	168.3	70.0	1
	Orifice Drill Size	B	19	
HM 200	cfh	192.3	80.0	1
	Orifice Drill Size	D	#16	

## CONTROL OPERATING SEQUENCE

### LM 40 through HM 150

These models utilize a combination gas valve/ignition controller and a single stage thermostat.

1. The thermostat calls for heat.
2. The combustion air blower is energized and begins a fifteen to thirty (15-30) second pre-purge cycle. The pre-purge clears any residual gas left over from the previous operation.
3. The pressure switch closes during the pre-purge, energizing the amber indicator light.
4. After the pre-purge, the hot surface igniter is energized and begins a seventeen (17) second warm-up period.
5. After this warm-up period, the gas valve is energized.
6. The main gas valve opens and the hot surface igniter attempts to light the gas at the burner. Ignition trial time is 7 seconds. The hot surface igniter attempts to light the gas during this ignition trial time.
7. Upon proper ignition, the unit continues to operate until the thermostat is satisfied, at which time the thermostat contacts open and de-energize the main gas valve until another call for heat from the thermostat.

8. If a flame is not sensed for any reason, the main gas valve will close and there will be a short purge period before ignition is tried again.
9. If flame is not sensed after four tries, there will be at least a one hour wait before ignition is tried again. Power can be interrupted during this one-hour lockout to reset the sequence of operation.

### HM 175 and HM 200

These models utilize a single-stage combination gas control, an ignition control, and a single-stage thermostat.

1. The thermostat calls for heat.
2. The combustion air blower is energized and begins a ten (10) second pre-purge cycle. The pre-purge clears any residual gas left over from the previous operation.
3. The pressure switch closes during the ten (10) second pre-purge, energizing the amber indicator light.
4. After the ten (10) second pre-purge, the hot surface igniter is energized and begins a forty-five (45) second warm-up period.
5. After this warm-up period, the gas valve is energized.
6. The main gas valve opens and the hot surface igniter attempts to light the gas at the burner. Ignition trial time is 7 seconds. The hot surface igniter attempts to light the gas during this trial time.
7. Upon proper ignition, the unit continues to operate until the thermostat is satisfied, at which time the thermostat contacts open and de-energize the main gas valve until another call for heat from the thermostat.
8. If ignition is not proven (the burner does not light) within seven (7) seconds, the system will lockout, de-energizing the gas valve and ignition control system. The sequence will try three (3) times beginning with the pre-purge cycle then hot surface igniter 45 second warm-up period.
9. If ignition is not proven after three tries, the system will lockout for one (1) hour, after which it will try the full sequence again. Power can be interrupted during this one-hour lockout to reset the sequence of operation.

# DIMENSIONS / PERFORMANCE

Figure 12.1  
LM/HM Burner Drawing

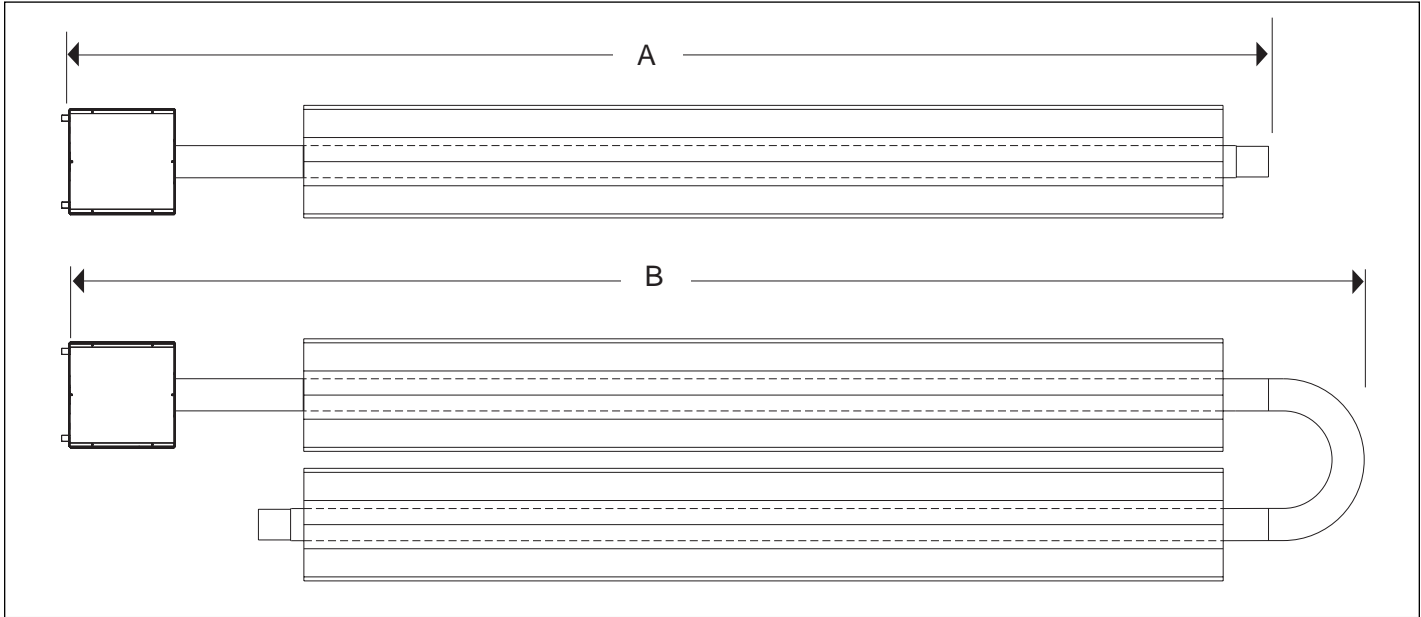


Table 12.1  
Tube Systems Data

Tube Length (Ft.)	Straight Tube		U-Tube System	
	System Length "A" (Ft.)	System Weight (Lb.)	System Length "B" (Ft.)	System Weight (Lb.)
20	23	78	13	89
30	33	112	18	132
40	43	146	23	157
50	53	180	28	200
60	63	214	33	225
70	73	252	38	277

Table 12.2  
Burner Shipping Weights

Model	Shipping Wt. (Lb.)
All LM/HM Burners	43

Table 12.3  
Performance

	Model Number									
	LM 40	LM 50	LM 60	LM 75	LM 85	LM 100	HM 125	HM 150	HM 175	HM 200
Btu/hr Input	40,000	50,000	60,000	75,000	85,000	100,000	125,000	150,000	175,000	200,000
Tube Lengths (Ft.)	20, 30	20, 30	20, 30 40	20, 30 40	30, 40 50	30, 40 50, 60	40, 50 60	40, 50 60, 70	50, 60 70	40, 50 60, 70
Recommended Mounting Height (Ft.) <sup>①</sup>	10 – 12	10 – 12	10 – 12	12 – 14	12 – 14	12 – 14	15 – 22	15 – 22	18 – 28	20 - 30

① Mounting height values are recommendations for full building heat only and may need to be adjusted to meet requirements of actual installation.

# MAINTENANCE / TROUBLESHOOTING

## MAINTENANCE

A qualified gas service personnel should service all heating equipment before each heating season to assure proper operation. The following items may require more frequent service based on the environment in which the unit is installed, and how long the unit is operated.

### 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.

## IMPORTANT

To check most of the Possible Remedies in the troubleshooting guide listed in Tables 13.3 and 14.1, refer to the applicable sections of the manual.

### LED Diagnostic Capability

The LED on the ignition controller indicates the condition of the control system. The diagnostic codes and their respective definitions follow:

**Table 13.1**  
LED Diagnostic Capability - LM 40 through HM 150

FLASHES	REASON
Off	No power to system
Bright-Dim	Normal operation
2	Pressure switch closed longer than 30 seconds
3	Pressure switch open longer than 30 seconds
5	Flame signal sensed out of sequence
6	System lockout

### Burner Orifice

Remove burner orifice, clean, and reinstall on the heater manifold. Drill sizes can be found in Table 11.1.

### Combustion Air Blower

The combustion air blower should be cleaned and lubricated every six months of operation. Use ten (10) drops of SAE 10W or 20W non-detergent oil.

### Electrical Wiring

The electrical wiring should be checked annually for loose connections or deteriorated insulation.

### Gas Piping & Controls

The gas valves and piping should be checked annually for general cleanliness and tightness. The gas controls should be checked to insure that the unit is operating properly.

**Table 13.2**  
LED Diagnostic Capability - HM 175 & HM 200

FLASHES	REASON
0	No power or proper operation
1	Failed ignition lockout
2	Loss of flame (3 times in one call for heat)
3	Internal fault
4	Pressure switch stuck open (10 seconds)
5	Pressure switch stuck closed (46 seconds)

**Table 13.3**  
Troubleshooting

Trouble	Possible Cause	Possible Remedy
No Gas	<ol style="list-style-type: none"> <li>1. Main gas is off.</li> <li>2. Power supply is off.</li> <li>3. Air in gas line.</li> <li>4. External regulator malfunctioning.</li> <li>5. External regulator reversed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Open manual gas valve.</li> <li>2. Turn on main power.</li> <li>3. Purge gas line.</li> <li>4. Replace external regulator.</li> <li>5. Remove and properly install regulator.</li> </ol>
Thermostat contacts closed, no unit operation	<ol style="list-style-type: none"> <li>1. Defective thermostat.</li> <li>2. Power supply is off.</li> <li>3. Loose or disconnected wire.</li> <li>4. Defective combustion air blower.</li> <li>5. Blown fuse.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace thermostat.</li> <li>2. Turn on main power.</li> <li>3. Replace as required.</li> <li>4. Lubricate, repair or replace as required.</li> <li>5. Replace fuse.</li> </ol>
Combustion air blower operates, hot surface igniter is not energized	<ol style="list-style-type: none"> <li>1. Loose or disconnected wire.</li> <li>2. Restricted exhaust vent.</li> <li>3. Restricted or defective pressure switches.</li> <li>4. Defective hot surface igniter.</li> <li>5. Control box cover open.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace as required.</li> <li>2. Remove restrictive object(s).</li> <li>3. Clean pressure switch line or replace pressure switch.</li> <li>4. Replace hot surface igniter.</li> <li>5. Replace cover to closed position.</li> </ol>



# TROUBLESHOOTING

**Table 14.1**  
**Troubleshooting Continued**

<b>Trouble</b>	<b>Possible Cause</b>	<b>Possible Remedy</b>
Burner fires but cycles after lit for 5-10 seconds	1. Reversed polarity of the AC wiring at the unit.	1. Check for proper AC wiring of unit and power source.
Burner fires but cycles after lit for over 1 minute	1. Defective gas valve and/or ignition controller. 2. No electrical power to gas valve. 3. Unit not properly grounded. 4. Defective flame sensor. 5. Improper thermostat wiring. 6. Manual valve closed on combination gas valve.	1. Replace gas valve and/or ignition controller. 2. Check wiring to gas valve. 3. Properly ground unit. 4. Replace flame sensor. 5. Verify wiring compared to diagram. 6. Turn knob to ON position on combination gas valve.
Hot surface igniter fails to ignite burner	1. Hot surface igniter improperly positioned. 2. Hot surface igniter cracked. 3. Hot surface igniter wiring is loose or damaged. 4. Low manifold gas pressure. 5. Gas valve fails to open. 6. Ignition detection control defective.	1. Relocate to correct position. 2. Replace hot surface igniter. 3. Replace as required. 4. Provide proper gas pressure. 5. Replace gas valve. 6. Replace ignition control module.
Heater will not turn off	1. Defective thermostat. 2. Gas valve stuck open. 3. Unit undersized.	1. Repair or replace thermostat. 2. Replace gas valve. 3. Check design conditions. If the unit is undersized, additional heater(s) may be required.
Carbon formation inside burner tube	1. Misaligned or incorrect orifice. 2. Low or high gas pressure. 3. Wrong gas supplied to the heater.	1. Insure proper alignment or replace orifice. 2. Provide proper gas pressure. 3. Check label for gas required.
Low heater output	1. Low inlet or manifold gas pressure. 2. Orifice partially blocked with foreign matter. 3. Products of combustion not adequately vented. 4. Manifold misaligned from excessive torque applied at time of gas pipe installation. 5. Gas supply piping too small. 6. Unit undersized.	1. Adjust to proper gas pressure. 2. Remove orifice, clean, and reinstall. 3. Provide adequate ventilation for products of combustion. 4. Replace the manifold. 5. Replace piping or increase gas supply pressure. 6. Check design conditions. If unit is undersized, an additional unit(s) or other heat source must be added.
Gas odor	1. Loose pipe connection	1. Check all connections with a soap solution and tighten as necessary.

# SERVICE

## ⚠ WARNING

When servicing or repairing this equipment, use only Modine-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the unit for complete unit model number, serial number, and company address. Any substitution of parts or controls not approved by Modine will be at owner's risk.

## ⚠ CAUTION

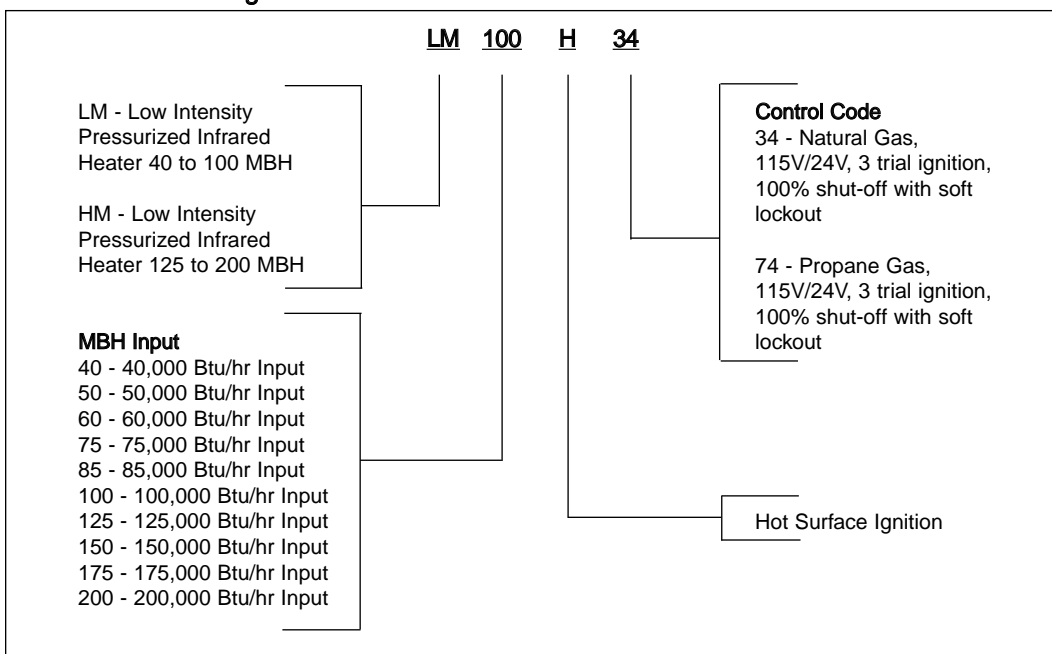
Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and replace any gas control, which has been under water.

### FOR SERVICING

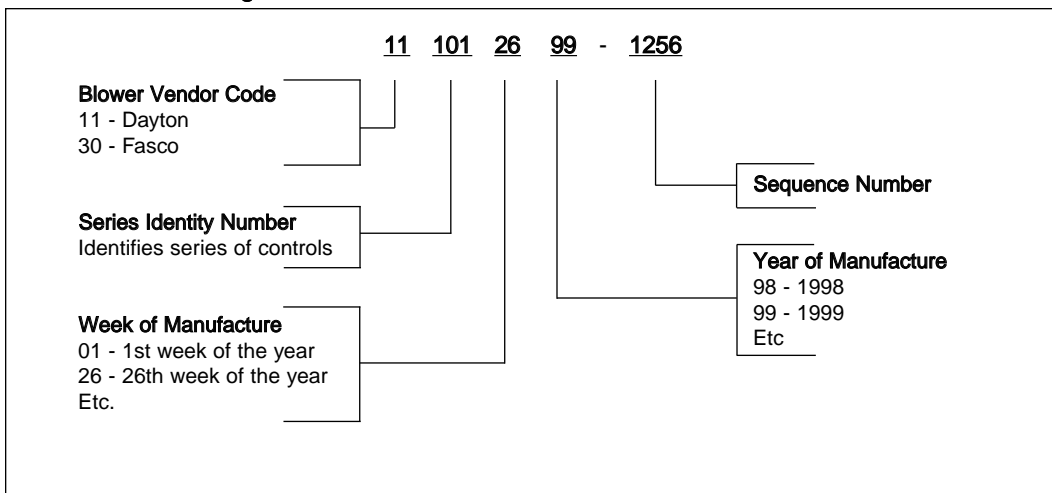
If a qualified service agent cannot solve a problem with the installation, please consult with your local gas company or Modine representative.

The serial plate is located on the side of the burner. For a complete description of the Model Number or Serial Number, see Figures 15.1 and 15.2.

**Figure 15.1**  
**Model Number Designations**



**Figure 15.2**  
**Serial Number Designations**











# WARRANTY

## Warranty

Seller warrants its products to be free from defects in material and workmanship, EXCLUSIVE, HOWEVER, of failures attributable to the use of materials substituted under emergency conditions for materials normally employed. This warranty covers replacement of any parts furnished from the factory of Seller, but does not cover labor of any kind and materials not furnished by Seller, or any charges for any such labor or materials, whether such labor, materials or charges thereon are due to replacement of parts, adjustments, repairs, or any other work done. This warranty does not apply to any equipment which shall have been repaired or altered outside the factory of Seller in any way so as, in the judgment of Seller, to affect its stability, nor which has been subjected to misuse, negligence, or operating conditions in excess of those for which such equipment was designed. This warranty does not cover the effects of physical or chemical properties of water or steam or other liquids or gases used in the equipment.

BUYER AGREES THAT SELLER'S WARRANTY OF ITS PRODUCTS TO BE FREE FROM DEFECT IN MATERIAL AND WORKMANSHIP, AS LIMITED HEREIN, SHALL BE IN LIEU OF AND EXCLUSIVE OF ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, WHETHER ARISING FROM LAW, COURSE OF DEALING, USAGE OF TRADE, OR OTHERWISE, **THERE ARE NO OTHER WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE, WHICH EXTEND BEYOND THE PRODUCT DESCRIPTION CONFIRMED BY BUYER AND SELLER AS OF THE DATE OF FINAL AGREEMENT.**

This warranty is void if the input to the product exceeds the rated input as indicated on the product serial plate by more than 5% on gas-fired and oil-fired units, or if the product in the judgment of SELLER has been installed in a corrosive atmosphere, or subjected to corrosive fluids or gases, been subjected to misuse, negligence, accident, excessive thermal shock, excessive humidity, physical damage, impact, abrasion, unauthorized alterations, or operation contrary to SELLER'S printed instructions, or if the serial number has been altered, defaced or removed.

### Heat Exchangers

For Seller's non-separated combustion gas-fired unit heaters and packaged rooftop units

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER WHICH SHALL, WITHIN TEN YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN ONE HUNDRED TWENTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER. FOR GAS-FIRED PRODUCTS INSTALLED IN HIGH HUMIDITY APPLICATIONS AND UTILIZING STAINLESS STEEL HEAT EXCHANGERS, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO TEN YEARS

FROM DATE OF SHIPMENT FROM SELLER.

For Seller's Low Intensity Gas-Fired Infrared Heaters BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER WHICH SHALL, WITHIN FIVE YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 66 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

**Heat Exchanger (Condensers)** for all Seller's products except non-separated combustion gas-fired unit heaters and infrared heaters, and Burners and Sheet Metal for all products.

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER (CONDENSER) OR BURNER WHICH SHALL, WITHIN ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN EIGHTEEN MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

### Burners

For all Seller's Low Intensity Gas-Fired Infrared Heaters BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY BURNER WHICH SHALL, WITHIN TWO YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TWO YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 30 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

# WARRANTY

## **Burners/Heat Exchangers**

For all Seller's High Intensity Gas-Fired Infrared Heaters BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY BURNER WHICH SHALL, WITHIN TEN YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 126 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

## **Packaged Rooftop Unit**

BUYERS REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF THE SELLER ANY PART OR PARTS WHICH SHALL BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF THE SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE AS FOLLOWS.

**COMPRESSOR** - WITHIN FIVE YEARS FROM DATE OF FIRST BENEFICIAL USE BY THE BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN SIXTY MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST.

**COILS** - WITHIN THREE YEARS FROM DATE OF FIRST BENEFICIAL USE BY THE BUYER OR ANY OTHER USER, WITHIN THREE YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN THIRTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST.

## **All Other Components Excluding Heat Exchanger (Condenser), Burner, and Sheet Metal**

All Seller Heating Products except St. Paul Produced products, Packaged Rooftop Units, and High Intensity Gas-Fired Infrared Heaters BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY PART OR PARTS WHICH SHALL, WITHIN TWO YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TWO YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN THIRTY MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT

THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER. St. Paul Produced Products, Packaged Rooftop Units, and High Intensity Gas-Fired Infrared Heaters BUYER'S REMEDY FOR BREACH OF WARRANTY EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW IS LIMITED TO REPAIR OR REPLACEMENT AT THE SELLER'S OPTION ANY PART OR PARTS WHICH SHALL WITHIN A PERIOD OF ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 18 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF THE SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE.

BUYER AGREES THAT IN NO EVENT WILL SELLER BE LIABLE FOR COSTS OF PROCESSING, LOST PROFITS, INJURY TO GOODWILL, OR ANY OTHER CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND RESULTING FROM THE ORDER OR USE OF ITS PRODUCT, WHETHER ARISING FROM BREACH OF WARRANTY, NONCONFORMITY TO ORDERED SPECIFICATIONS, DELAY IN DELIVERY, OR ANY LOSS SUSTAINED BY THE BUYER.

## **Cancellation – Inspection – Rejection**

Orders for material or equipment are not cancelable, either in whole or part, nor is material returnable for credit. Seller will replace any material or equipment not conforming to the product description as agreed upon by Buyer and Seller as of the date of shipment only if the Buyer notifies Seller, at the address on the Seller's INVOICE, of the particular details of non-conformance or defect of such material of equipment, by written or electronic notice, either before or immediately upon delivery, and only if such non-conforming material or equipment is returned, sold, or otherwise disposed of in accordance with instructions of Seller. Buyer agrees to inspect all of the ordered material or equipment either before or upon delivery and waives all his rights to reject or refuse to accept any non-conforming material or equipment unless notice is given to Seller in the aforesaid time and manner. Buyer may inspect the ordered material at Seller's plant in an area designated by Seller. Buyer agrees that the right of rejection of non-conforming material or equipment, as limited herein, and the right to replacement by Seller with material or equipment, as limited herein, and the right to replacement be Seller with material or equipment conforming to the ordered specifications, are exclusive of all other remedies provided by law. Written authorization must be issued by Seller before any material is returned to its plant.

## **Governing Law**

It is agreed that the parties hereto intend that all questions as to validity, interpretation, and required performance arising out of this contract are to be governed by the laws of the State of Wisconsin (Uniform Commercial Code).