MODINE

9-500.3
5H75283A

November, 2003

INSTALLATION AND SERVICE MANUAL
high intensity gas-fired infrared heaters
model MT

⚠ 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.

⚠ CAUTION

As with all infrared equipment, clearances to combustible material are critical.

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

FOR YOUR SAFETY

If you smell gas:
1. Open windows.
2. Don't touch electrical switches.
3. Extinguish any open flame.
4. Immediately call your gas supplier.

FOR YOUR SAFETY

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

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 units.

Inspection on Arrival

1. Inspect unit upon arrival. In case of damage, report it immediately to the transportation company and your local sales representative.
2. Check rating plate on unit to verify that the 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).

THIS MANUAL IS THE PROPERTY OF THE OWNER.
PLEASE BE SURE TO LEAVE IT WITH THE OWNER WHEN YOU LEAVE THE JOB.

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 potentially explosive or flammable atmosphere.

⚠ 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).
3. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
4. All units 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 replacement must be replaced with wiring material having a temperature rating of at least 105°C.
6. When servicing or repairing this equipment, use only manufacturer-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 non-approved parts or controls will be at the owner's risk.
7. To prevent flame bail-out from the heater, the gas input to the appliance, as indicated on the serial plate, must not exceed the rated input by more than 5% or fall below the rated input by more than 5%.
8. To prevent gas control circuit malfunction, the supply voltage to the unit, as indicated on the serial plate must not exceed or fall below the rated input voltage by more than 5%.

⚠ CAUTION

1. Units are designed for indoor installation only. DO NOT LOCATE UNITS OUTDOORS.
2. 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.

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 trouble shooting guide listed in Tables 10.1 and 11.1, refer to the applicable sections of the manual.

Table of Contents

SI (METRIC) CONVERSION FACTORS / UNIT LOCATION / INSTALLATION

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 (ft^3/min)	0.028	m^3/min
cfh (ft^3/hr)	1.699	m^3/min
Btu/ft^3	0.0374	mJ/m^3
pound	0.453	kg
Btu/hr	0.000293	kW/hr
gallons	3.785	liters

UNIT LOCATION

⚠ DANGER

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

⚠ CAUTION

Units are designed for indoor installation only.
DO NOT LOCATE UNITS OUTDOORS.

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

1. When locating the heater, consider the general space and heating requirements and availability of gas and electrical supply.
2. Be sure the structural support and chain at the unit location is adequate to support the weight of the unit.
3. Be sure that the minimum clearances to combustible materials and for serving are maintained. The minimum clearances to combustibles are shown in Table 3.2.
4. Mounting height (measured from the bottom of unit) at which heaters are installed is critical. Please refer to mounting height information in Table 4.1.
5. Do not locate units in areas where chlorinated, halogenated, or acid vapors are present in the atmosphere.

INSTALLATION

Mounting

Figures 4.2 and 4.3 illustrate typical rigid and chain mounting arrangements, respectively, for a model MT infrared heater. Check local codes for mounting requirements and use of flexible gas connectors. Local codes may require rigid mounting. Heaters must be mounted at angles from 10° to 35° from horizontal. The gas manifold must be located on the low end of the heater, in a horizontal position (parallel to the floor).

Where permissible, chain mounting is recommended. 5' chain mounting sets are available as an accessory, allowing for 10° to 35° mounting angles. In the absence of this chain set, Number 1/0 Tenso chain (200 lb. working load) is recommended. “S” hooks should be a minimum 1/4" in diameter and the ends must be closed after installation. Heaters located in aircraft hangers or near overhead doors must be rigidly mounted to prevent swinging. Under no circumstances should the gas supply line or the electrical supply line to the heater be used to 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 3.2) are maintained.
2. For proper operation, the unit must be mounted on an angle ten to thirty-five degrees (10° to 35°) from the horizontal with the gas manifold located at the low end of the heater. See Figure 4.1.
3. 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 4.4.
4. Either gas piping or suspension mounting is flexible to prevent fatigue failure from vibration or thermal expansion.
5. Adequate clearances to sprinkler heads are maintained.

Table 3.2
Combustible Material Clearances ①

Model No.	Minimum Clearances to Combustible Materials (inches)			
	Top	Sides	Rear	Bottom
MT28/30/33	30	30	24	72
MT56/60/66	36	36	33	88
MT84/90/99	48	42	39	104
MT112/120/132	54	48	45	120
MT160	60	54	51	136

① See figure 4.1 on page 4.

INSTALLATION

Figure 4.1
Combustible Material Clearances

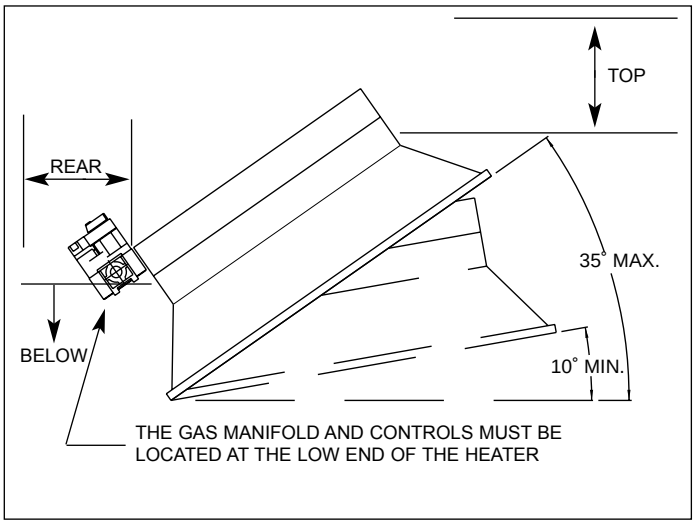


Figure 4.2
Typical Rigid Mounting Configuration

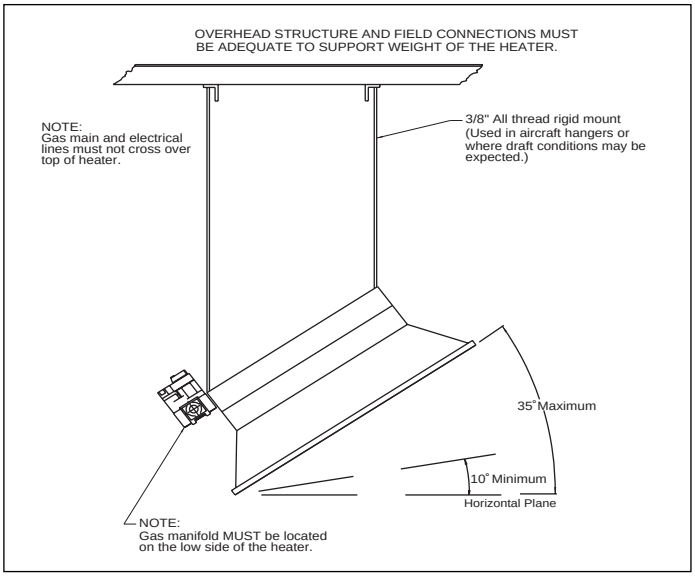


Figure 4.3
Typical Chain Mounting Configuration

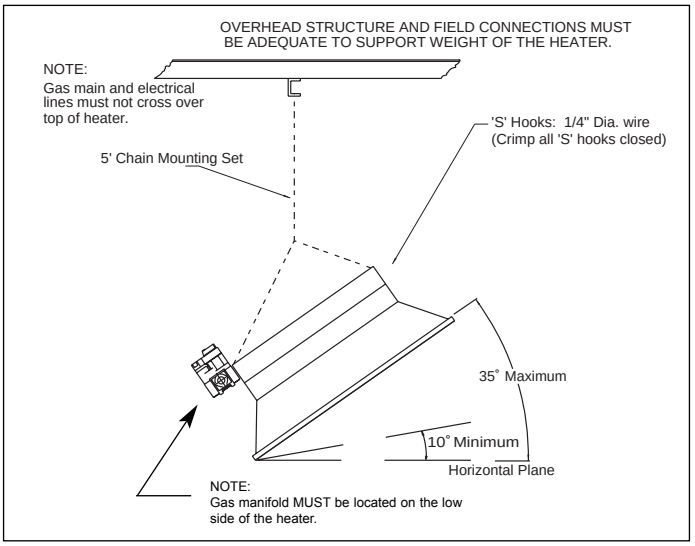


Figure 4.4
Stacking Height

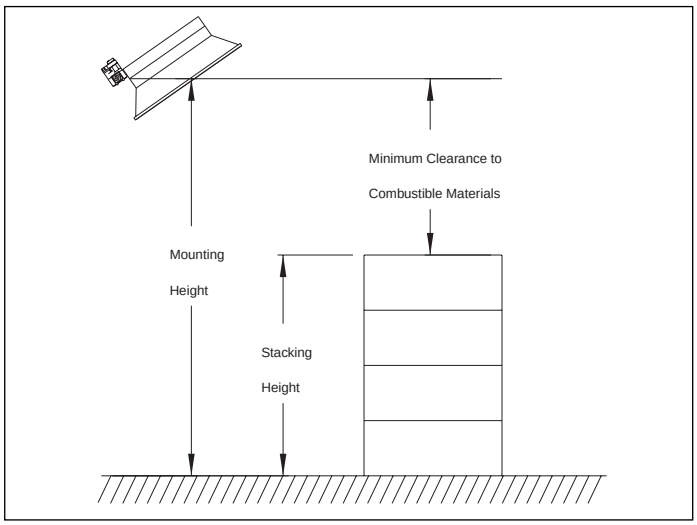


Table 4.1
Typical Mounting Height for Full Building Heating

Model No.	Typical Mounting Height at Min/Max Mounting Angles (feet)①	
	10°	35°
MT28, 30, 33	8-14	7-12
MT56, 60, 66	14-20	12-16
MT84, 90, 99	20-26	16-24
MT112, 120, 132	26-32	20-30
MT160	26-40	22-38

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

Combustion/Ventilation Air Requirements

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.

It is recommended 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.

INSTALLATION

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).
3. To prevent flame bail-out from the heater, the gas input to the appliance as indicated on the serial plate, must not exceed the rated input by more than 5% or fall below the rated input by more than 5%.

1. Installation of piping must conform with local building codes, or in the absence of local codes, of 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.
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 7.1 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 the length of pipe necessary, determine the pipe diameter from Table 5.1. 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 5.1 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 7-14" 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 Engineers Handbook for other gas pipe capacities.
3. Install a ground joint union with brass seat and a manual shut-off 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 5.1.
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 5.1.
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.
6. When pressure/leak testing pressures above 14" W.C. (1/2 psi), close the field installed shut-off valve, disconnect the appliance, 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 appliance before testing.

Figure 5.1
Recommended Sediment Trap/Manual Shut-Off Valve Installation

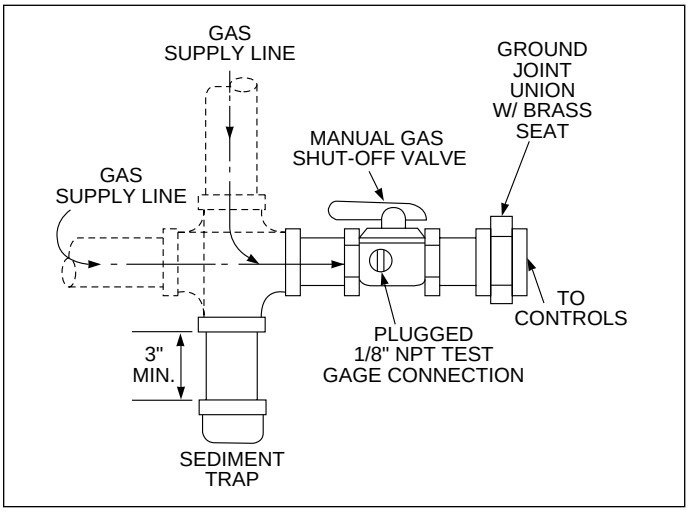


Table 5.1
Gas Pipe Capacities

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 Of Pipe (feet)	Pipe Diameter											
	1/2"		3/4"		1"		1-1/4"		1-1/2"		2"	
	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

INSTALLATION / START-UP PROCEDURE

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.

To prevent gas control circuit malfunction, the voltage to the unit, as indicated on the serial plate, must not exceed or fall below the rated input voltage by more than 5%.

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. The power supply to the unit should be protected with a fused disconnect switch.
3. Provide only the voltage to the heater as stamped on the heater serial plate. Do not provide external power to a heater equipped with a millivolt, self-energizing control system (Control Codes 27 or 67).
4. Heaters equipped with 25V controls (Control Codes 04, 48, or 75) require a step-down transformer having a VA rating in excess of the total connected electrical load.
5. 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.
6. Wiring must not be located directly above or below the heater to avoid overheating of the wires. The wires must not touch the sides of the heater.
7. Control wire used to connect the heater to the thermostat must have adequate ampacity and insulation temperature rating for the total connected load.

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. Verify that there is adequate ventilation for intake of fresh air and 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 7-14" 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 shut-off valve and turn power on to the unit.
7. Follow the procedure on the heater’s Lighting Instruction Label to put the heater into operation. Be certain the gas line is purged of air prior to attempting to operate the unit.
8. For units equipped with a pilot, check the pilot flame length (See Pilot Flame Adjustment section).
9. Check to make sure that the main gas valve opens upon a call for heat from the thermostat.
10. Check to insure that gas controls sequence properly (See Control Operating Sequence, page 8).

START-UP PROCEDURE

Pilot Flame Adjustment (Intermittent Pilot and Millivolt Standing Pilot control systems – Control Codes 04, 08, 27, and 67

The pilot burner is orificed to burn properly with an inlet pressure of 7-14" W.C. on natural gas and 11-14" W.C. on propane gas, but final adjustment must be made after installation. If the pilot flame is too long or large, it is possible that it may cause soot on the burner assembly. If the pilot flame is shorter than shown, it may cause poor ignition and result in the controls not opening the combination gas control. A dirty pilot orifice may cause a short flame. Pilot flame condition should be observed periodically to assure trouble-free operation.

To adjust the pilot flame:

1. Create a call for heat from the thermostat.
2. Remove the cap from the pilot adjustment screw. For location, see the combination gas control literature supplied with unit.
3. Adjust the pilot flame length by turning the screw in or out to achieve a soft steady flame 3/4" to 1" long and encompassing 3/8"-1/2" of the tip of the flame sensing rod or power-pile (See Figure 7.1).
4. Replace the cap from the pilot adjustment screw.

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 appliance and increases maintenance. Under no circumstances should the input exceed that shown on the serial plate.

Measuring the manifold pressure is done at the test port on the main gas valve on the unit (See Figure 7.2).

To adjust the manifold pressure:

1. The correct manifold pressure is 6" 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 Figure 7.2).
2. Move the field installed manual shut-off valve to the “OFF” position.
3. Remove the 1/8" pipe plug in the gas valve adjacent to the manifold and attach a water manometer of “U” tube type that is at least 12" high.
4. Move the field installed manual shut-off valve to the “ON” position.
5. Create a call for heat from the thermostat.
6. After adjustment, move the field installed manual shut-off valve to the “OFF” position and replace the 1/8" pipe plug.
7. 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.

Table 7.1
Manifold Pressure and Gas Consumption

Model Size	Type of Gas	Natural	Propane	No. of Orifices
	Btu/Ft.^{3}	1040	2500	
	Specific Gravity	0.60	1.53	
Manifold Pressure In. W.C.		6.0	10	
MT-28	cfh	26.4	-	1
	Orifice Drill Size	#43	-	
MT-30	cfh	28.8	12.0	1
	Orifice Drill Size	#42	#52	
MT-33	cfh	32.2	-	1
	Orifice Drill Size	#41	-	
MT-56	cfh	52.9	-	2
	Orifice Drill Size	#43	-	
MT-60	cfh	57.7	24.0	2
	Orifice Drill Size	#42	#52	
MT-66	cfh	64.4	-	2
	Orifice Drill Size	#41	-	
MT-84	cfh	79.3	-	3
	Orifice Drill Size	#43	-	
MT-90	cfh	86.5	36.0	3
	Orifice Drill Size	#42	#52	
MT-99	cfh	96.6	-	3
	Orifice Drill Size	#41	-	
MT-112	cfh	105.8	-	4
	Orifice Drill Size	#43	-	
MT-120	cfh	115.4	48.0	4
	Orifice Drill Size	#42	#52	
MT-132	cfh	128.8	-	4
	Orifice Drill Size	#41	-	
MT-160	cfh	153.8	64.0	4
	Orifice Drill Size	#38	#49	

Figure 7.1
Correct Pilot Flame (Millivolt Powerpile shown)

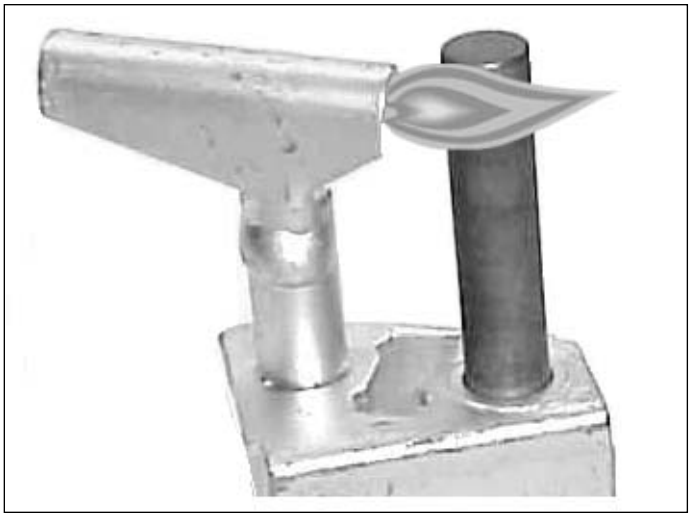
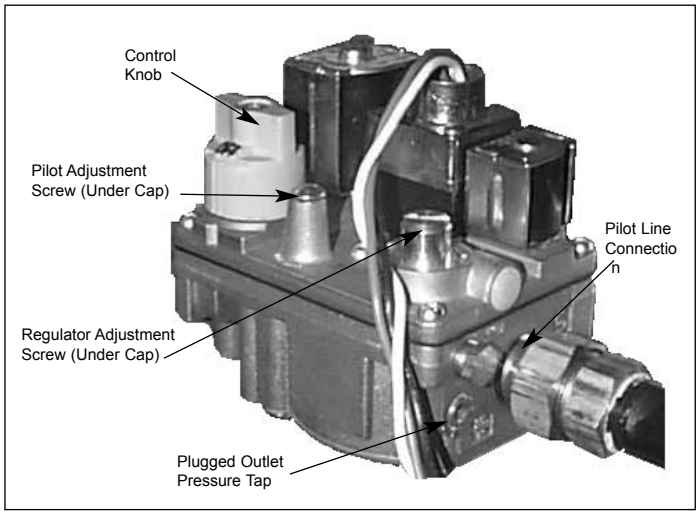


Figure 7.2
Gas Valve Features



START-UP PROCEDURE

Control Systems Options

The MT series infrared heaters are available with a choice of three different gas control options. The available controls and associated control codes are (see Table 8.1 for description of Control Codes):

- Direct spark ignition with 100% safety lockout with manual reset
  Natural Gas – Control Code 47 or 48
  Propane Gas – Control Code 97 or 75

- Intermittent pilot ignition with non-100% shut-off
  Natural Gas only – Control Code 08 or 04

- Millivolt, self-energizing with standing pilot and 100% safety shutoff
  Natural Gas – Control Code 27
  Propane Gas – Control Code 67

Control Operating Sequence

Direct Spark Ignition Gas Controls – Control Codes 47, 48, 97, and 75

Utilizes a single-stage combination gas control, an ignition control, and a single-stage thermostat.

1. The thermostat calls for heat.
2. The main gas valve opens and the spark igniter sparks in an attempt to light the gas at the ceramic burner.
3. Once the burner is lit, the flame sensor proves ignition and stops the spark igniter from sparking. If ignition is not proven (the burner does not light) within 15 seconds, the system will lockout, de-energizing the gas valve and ignition control system. If the system locks out, it may be reset by an interruption of the power source. The system will then attempt to light the burner, if a call for heat from the thermostat remains.
4. The unit continues to operate until the thermostat is satisfied, at which time the main gas valve closes 100% and the unit shuts off.

Intermittent Pilot Ignition with Non-100% Shut-Off Gas Controls – Control Codes 08 and 04

Utilizes a single-stage combination gas control, an ignition control, and a single-stage thermostat.

1. The thermostat calls for heat.
2. The pilot gas valve opens and the pilot spark igniter sparks in an attempt to light the pilot.
3. The pilot flame sensor attempts to prove pilot ignition. If the pilot does not light, ignition sparking and pilot gas flow will continue until the pilot flame is established.
4. Once the pilot is lit, the pilot flame sensor proves ignition and stops the spark igniter from sparking. At the same time the main gas valve is opened and the ceramic burner is lit. The unit continues to operate until the thermostat is satisfied, at which time the main gas and pilot gas valves are closed 100% and the unit shuts off.

Millivolt, Self-Energizing with Standing Pilot and 100% Safety Shutoff Gas Controls – Control Codes 26 and 67

Utilizes a single-stage combination gas control and a single-stage millivolt thermostat.

1. The pilot is manually lighted with the gas valve control knob depressed in the PILOT position and held (approximately 1 minute) until the millivolt generator is heated sufficiently to keep the pilot valve open. The control knob is then turned to the ON position.
2. Upon a call for heat, the millivolt thermostat contacts close, completing the circuit to the gas valve. The gas valve will open and the ceramic burner is lit from the standing pilot.
3. Once the millivolt thermostat is satisfied, the main gas valve closes 100% and the unit shuts off, with the pilot valve remaining open with a standing pilot.
4. If the pilot goes out, the millivolt generator will cool and interrupt the circuit to the pilot valve. Both the pilot and main gas valves are closed 100%. The unit remains inactive until step 1 is repeated.

Table 8.1
Performance and Available Control Systems ① ②

	Direct Spark Ignition of Burner ① 100% Safety Lockout with Manual Reset				**Intermittent Pilot** ① Non 100% Shut Off		**Millivolt, Self Energizing** Standing Pilot, 100% Safety Shut Off	
	Control Code - Supply/Thermostat Voltage				**Control Code** - Supply/Thermostat Voltage		**Control Code** - Thermostat Voltage	
	Natural Gas		Propane Gas		Natural Gas		Natural Gas	Propane Gas
Model No.	**47** - 115V ②	**48** - 25V	**97** - 115V ②	**75** - 25V	**08** - 115V ②	**04** - 25V	**27** - Millivolt	**67** - Millivolt
MT-28	•	•	N/A	N/A	•	•	•	N/A
MT-30	•	•	•	•	•	•	•	•
MT-33	•	•	N/A	N/A	•	•	•	N/A
MT-56	•	•	N/A	N/A	•	•	•	N/A
MT-60	•	•	•	•	•	•	•	•
MT-66	•	•	N/A	N/A	•	•	•	N/A
MT-84	•	•	N/A	N/A	•	•	•	N/A
MT-90	•	•	•	•	•	•	•	•
MT-99	•	•	N/A	N/A	•	•	•	N/A
MT-112	•	•	N/A	N/A	•	•	•	N/A
MT-120	•	•	•	•	•	•	•	•
MT-132	•	•	N/A	N/A	•	•	•	N/A
MT-160	•	•	•	•	N/A	N/A	N/A	N/A

① Model MT high intensity infrared heaters with direct spark or intermittent pilot ignition are equipped with 25 volt controls.

② Control codes specified for line voltage supply include 115V/25V step-down transformers.

DIMENSIONS / MAINTENANCE

Figure 9.1
Unit Drawing

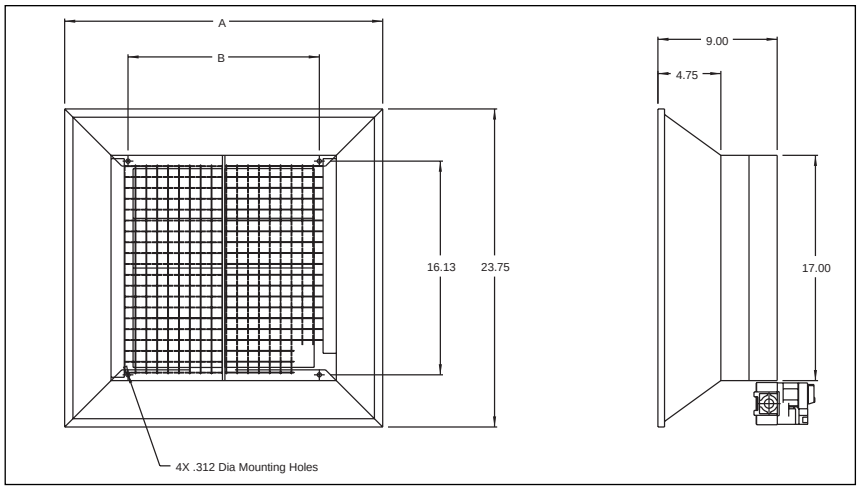


Table 9.1
Dimensions

Model Numbers	Dimensions (Inches)		Radiating Area (Sq. Inches)	Shipping Weight (Lbs.)
	A	B		
MT28,30,33	17.12	7.63	93	30
MT56,60,66	24.00	14.44	186	40
MT84,90,99	30.75	21.25	279	48
MT112,120,132,160	37.58	28.08	372	59

Note: All models except MT160 include a secondary re-radiating grid screen (shown in drawing above).

MAINTENANCE

All heating equipment should be serviced 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, by 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

Remove each burner orifice, clean, and reinstall on the heater manifold. Drill sizes can be found in Table 7.1.

Pilot Assembly (not applicable for Direct Spark Ignition)

Remove the pilot burner assembly. With an air hose regulated to 15 psig maximum, blow the assembly clean and replace in the original position.

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.

SERVICE & TROUBLESHOOTING

⚠ WARNING

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

⚠ CAUTION

Do not attempt to reuse any mechanical or electrical controllers which have been wet. Replace defective controller.

IMPORTANT

To check most of the Possible Remedies in the troubleshooting guide listed in Tables 10.1 and 11.1, refer to the applicable sections of the manual.

Table 10.1 - Troubleshooting

Trouble	Possible Cause	Possible Remedy
No Gas	1. Main gas is off. 2. Power supply is off. 3. Air in gas line. 4. External regulator malfunctioning. 5. External regulator reversed.	1. Open manual gas valve. 2. Turn on main power. 3. Purge gas line. 4. Replace external regulator. 5. Remove and install regulator properly.
Pilot does not light	1. Main gas is off. 2. Power supply is off. 3. Air in gas line. 4. Dirt in pilot orifice. 5. Gas pressure out of proper range. 6. Pilot valve does not open. 7. No spark at igniter. a. Loose wire connections. b. Pilot sensor is grounded. c. Defective ignition controller.	1. Open gas shut-off valve. 2. Turn on main power. 3. Purge gas line. 4. Check for plugged pilot orifice and clean with compressed air if necessary. 5. Adjust to a maximum of 14" W.C. Minimum for Natural Gas - 7" W.C. Minimum for Propane Gas - 11" W.C. 6. Check wiring for 24 volts to valve. Defective ignition controller or gas valve. 7. a. Check all ignition controller wiring. b. Replace sensor if cracked or worn. c. Replace ignition controller.
Pilot goes out on 100% shut-off when hold down button is released	1. Defective pilot interrupter in combination gas valve . 2. Defective pilot flame sensor. 3. Insufficient heat on pilot flame sensor. 4. Improper pilot flame sensor location. 5. Connection is poor contact at valve end of the sensing element. 6. Low gas pressure.	1. Replace combination gas valve. 2. Replace pilot flame sensor. 3. Check pilot orifice for size. Clean pilot burner. 4. Check position with respect to pilot. 5. Insure clean and tight contact. 6. Provide proper gas pressure.
Main burners do not light (Pilot is lit)	1. Defective valve. 2. No electrical power to gas valve. 3. Defective pilot sensor. 4. Defective ignition controller. 5. Improper thermostat wiring. 6. Manual valve closed on combination gas valve.	1. Replace valve. 2. Check wiring to gas valve. 3. Replace pilot sensor. 4. Replace ignition controller. 5. Verify wiring compared to diagram. 6. Turn knob to ON position on combination gas valve.
Direct spark fails to ignite main burner(s)	1. Electrode improperly located 2. Electrode ceramic cracked 3. Electrode wire is loose, broken, or frayed. 4. Low manifold gas pressure. 5. Gas valve fails to open. 6. Ignition detection control defective.	1. Relocate to correct position. 2. Replace electrode 3. Reconnect loose wire or replace broken or frayed wire and/or electrode. 4. Provide proper gas pressure. 5. Replace gas valve. 6. Replace ignition control module.
Flashback (burning of gas/air mixture inside plenum)	1. Heater mounted at incorrect angle. 2. Excessive drafts. 3. Gas leak at manifold, gas valve, and/or pilot tube connections. 4. Separation of ceramic tiles. 5. Ceramic grid(s) cracked.	1. Angle to be 10° to 35° from horizontal. 2. Shield or relocate heater from drafts. 3. Check all connections with soap solution and tighten as necessary. 4. Replace burner assembly. 5. Replace burner assembly.
Unit cycles off and on	1. Insufficient heat on pilot element. 2. Excessive drafts.	1. Check pilot orifice, clean pilot burner. 2. Shield or relocate unit from drafts.

Table 11.1
Troubleshooting Continued

Trouble	Possible Cause	Possible Remedy
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.
Dark spots on ceramic	1. Foreign matter behind the ceramic tile(s).	1. Clean ceramic tiles or replace.
Carbon formation on ceramic surface of burner	1. Misaligned orifice. 2. Pilot depositing carbon. 3. Obstruction in venturi tube. 4. Low gas pressure. 5. Wrong gas supplied to the heater.	1. Replace orifice. 2. Clean pilot burner, check pilot orifice. 3. Clean with a soft brush. 4. Provide proper gas pressure. 5. 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. Foreign matter in venturi tube. 6. Gas supply piping too small. 7. Unit undersized.	1. Adjust for proper gas pressure. 2. Remove orifice, clean, and reinstall. 3. Provide adequate ventilation for products of combustion. 4. Replace the manifold. 5. Clean with a soft brush. 6. Replace piping or increase gas supply pressure. 7. 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.
Control assembly overheating	1. Heater not mounted correctly. 2. Heater mounted too close to ceiling.	1. Angle to be 10° to 35° from horizontal. 2. Check to maintain proper top clearance.

For Servicing

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

When servicing, repairing or replacing parts on these units, locate the model identification plate of the unit and always give the complete Model Number and Serial Number from the model identification plate. The serial plate is located on the side of the reflector. For a complete description of the Model Number or Serial Number, see Figures 11.1 and 11.2.

Figure 11.1
Model Number Designations

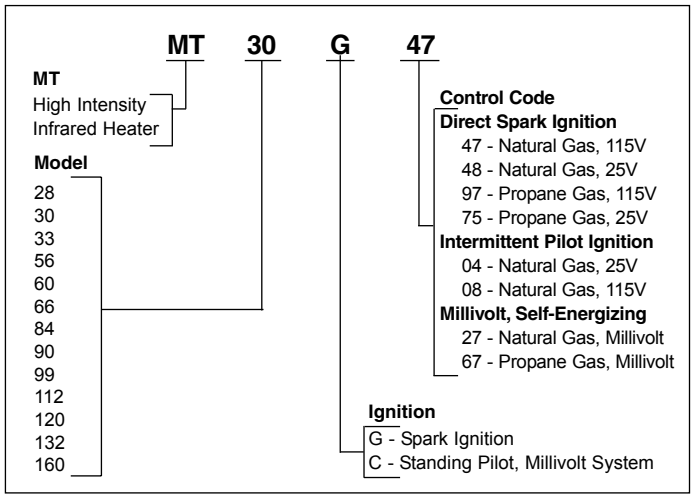
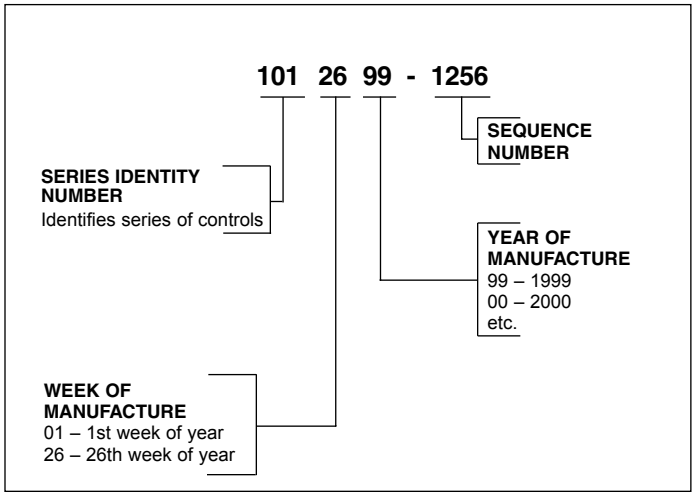


Figure 11.2
Serial Number Designations



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

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, all Burners except Infrared Heaters, and Sheet Metal for all Seller's 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 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.

For 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.

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

For all Seller's products except Direct-Fired Heaters 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.

For Seller's Direct-Fired Heaters 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.

MODINE

Commercial HVAC&R Division

Modine Manufacturing Company
1221 Magnolia Avenue
Buena Vista, Virginia 24416
Tel: 1-800-828-4328 (HEAT)
Fax: 540-261-1563 / 540-261-1903 (Service & Parts)

 11/03 - 4.5M Litho in USA