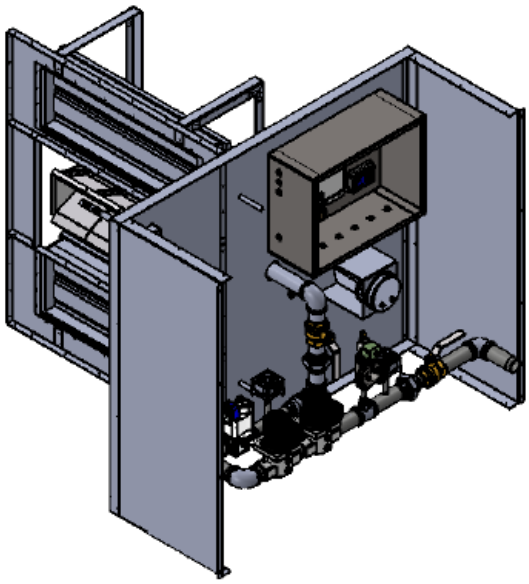
INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

DF Series
Direct Gas-Fired Heater Modules

RECOGNIZED COMPONENT
ETL LISTED C US
Intertek
3035443



c US
MH63817

This Product is intended for installation by Original Equipment Manufacturers Of Listed Heating Equipment in duct or cabinet mounted applications on the Negative pressure side of the circulating air blower.

The direct gas-fired heater modules covered by these instructions become a component of a "Listed" product, subject to the guidelines of application provided in these instructions and as designated by the Certifying Agency in the Manufacturer's Listing Procedure

WARNING !

Improper installation, adjustment, alteration, service or maintenance can cause injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

Manufactured by:
Heatco Inc
50 Heatco Court
Cartersville, Ga. 30120

DF-OEM-MAN-LIST-5

FOR YOUR SAFETY

WHAT TO DO IF YOU SMELL GAS:

1. **OPEN WINDOWS IF APPLIANCE IS INDOORS**
2. **DON'T TOUCH ELECTRICAL SWITCHES**
3. **EXTINGUISH ANY OPEN FLAME**
4. **IMMEDIATELY CALL 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.

Inspection on Arrival

This direct gas-fired heater module was test fired and inspected at the factory prior to crating and was in satisfactory working order. A copy of the Test and Inspection sheet is included in the information package provided. Inspect the packaging on delivery for any signs of damage. Report any damage immediately to the transporting agency. After uncrating inspect direct gas-fired heater module for any concealed damage.

Table of Contents

I. General Instructions for DF Series Direct Gas-Fired Modules

This product **MUST BE INSTALLED IN A NON-COMBUSTIBLE cabinet. See clearance to combustibles on ratings label.**

This product **is intended to be installed upstream of any cooling coils.**

A **Nameplate / Rating Plate** is attached to the direct gas-fired heater module to identify the model and serial number of this product. This plate must be left attached when the module is installed in the end product for identification purposes. This plate also contains information including gas type, maximum and minimum input rating, manifold pressure, maximum and minimum inlet gas pressure, maximum and minimum airflow requirements, and electrical ratings for this module.

The final determination of the safety and suitability of this product for the specific application shall be the responsibility of the manufacturer of the "Listed" equipment and the listing Agency.

This product **must be applied** in accordance with the requirements of the listed product in which it is installed. Consider maximum input ratings, maximum and minimum temperature rise and maximum and minimum airflow.

Equipment access panels and doors should be sized and located to provide easy access for servicing, adjustment and maintenance of the direct gas-fired units installed. Consideration should be given to components that might require replacement during the life of the product. All set-up and test points as well as operating controls should be visible and readily accessible from the front of the vestibule or access opening.

II. General Information to include in Installation and Operating Instructions

The "Listed" equipment manufacturer's Installation and Operating Instructions shall provide all necessary information, instructions and labels as required by ANSI Z83.4 – CSA 3.17 Standard for Non-recirculating Direct Gas-fired and Forced Ventilation Appliances for Commercial and Industrial application.

Reference to the following information must be included in the instructions that the OEM provides with the finished product.

- All unit installations shall conform to all applicable local codes and ordinances, or in the absence of local codes must be in accordance with the National Fuel Gas Code ANSI Z223.1 (NFPA 54) in the US and Can/CGA-B149.1 Natural Gas and Propane Installation Code in Canada..
- For module(s) to be installed in an airplane hangar, refer to ANSI/NFPA 409. For module(s) to be installed in a parking garage, refer to ANSI/NFPA 88A. For module(s) to be installed in a service garage, refer to ANSI/NFPA 88B.
- A **WARNING** that the direct gas-fired heater modules are not designed for use in hazardous atmospheres containing, flammable vapors or combustible dust, in atmospheres containing chlorinated or halogenated hydrocarbons, or in applications with airborne substances containing silicone.
- A **WARNING:** The use and storage of gasoline or other flammable vapors and liquids in the vicinity of this appliance is hazardous.
- **WARNING labels** attached to exterior of cabinet as required by ANSI Z83.4 – CSA 3.17.
- Safety, lighting, operating and shutdown instructions.
- An electrical disconnect switch having adequate ampacity (See heater marking for voltage and ampacity), if not provided as part of heater module assembly, shall be installed in accordance with Article 430 of the *National Electric Code,* ANSI/NFPA 70. All electrical equipment must be grounded and wired be in accordance with NFPA 70 in the US and the Canadian Electric Code (CSA C22.1) in Canada.
- A statement to cover replacement wiring **" If any original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105 °C (221 oF)."**

Additionally the **Original Equipment Manufacturer** of the **"Listed"** equipment shall provide the following in accordance with its product listing:

An enclosed vestibule area to house and protect gas controls, burner assemblies, gas trains, and electrical controls from direct water spray, rain or dripping water.

An **airflow switch** in the cabinet or duct to prove circulating airflow. The device should prevent operation of the gas heater in the event of failure of the circulating air fan. An airflow probe should be installed upstream of the heating section (See Figure 1).

A **manual reset auxiliary limit** to prevent overheating of the heating unit in the event of a circulating air fan failure or reverse air flow. (See Figure 2 for location)

Removable access panels or access doors in cabinet or duct immediately upstream and downstream of duct furnace to allow for inspection of the direct-fired gas burners. These openings should be large enough to observe the burners in their entirety. Attach covers so as to prevent air leakage.

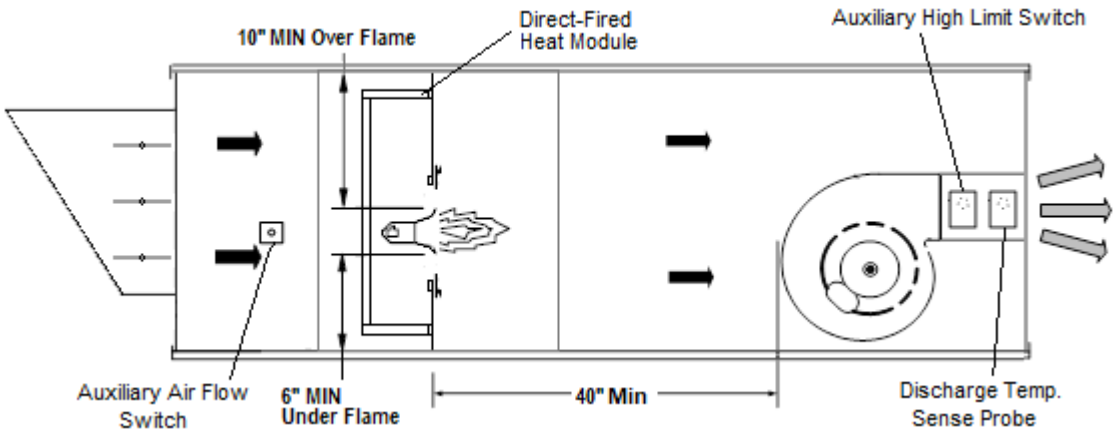
Clearances to combustibles as appropriate for the product category, but in no case less than the following unless determined by test as part of the manufacturer's equipment listing:

- Sides …… **8 in**. (203mm)
- Bottom …… **6 in.** (152mm)
- Top …… **10 in**. (254mm)

It is up to manufacturer to test these clearances in the end product to verify proper dimensions.

III. Direct-Fired Heat Module Application

Figure 1 – Typical Pull-Thru Installation



Direct fired burners are designed to operate in a fresh flowing airstream. Gas is fed directly to the burner and the airstream provides oxygen for combustion.

Minimum distance between the burner and blower should ensure proper stratification of the combustion air. Uniform airflow MUST be directed over the profile plate opening.

The direct gas-fired heater module must be installed to fire with,and parallel to, the air flow.

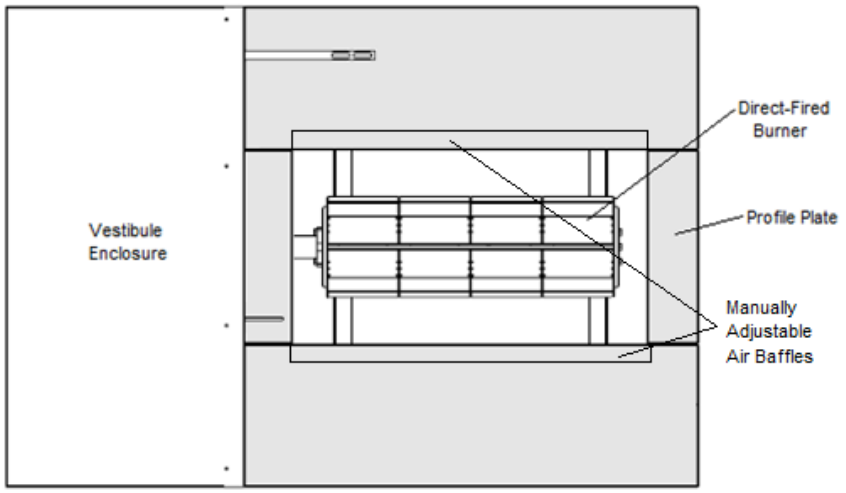
The burner performance is dependent on its application and installation in the air handler. Manufacturer does not guarantee combustion results prior to performing actual combustion tests. The supply fan is positioned to draw air across the burner. The burner is designed to operate on 100% outside (fresh) air. Airflow across the burner must be laminar and velocity must be within the specified range to insure desired capacity and turndown.

The direct gas-fired heater module profile plate mounting rails and profile plate sheet metal must be securely fastened in the ductwork or cabinet. Provisions should be made so that downstream materials within 48” to 60” are rated for at least 300oF.

The direct-fired heat module should be centered with the circulating air blower.

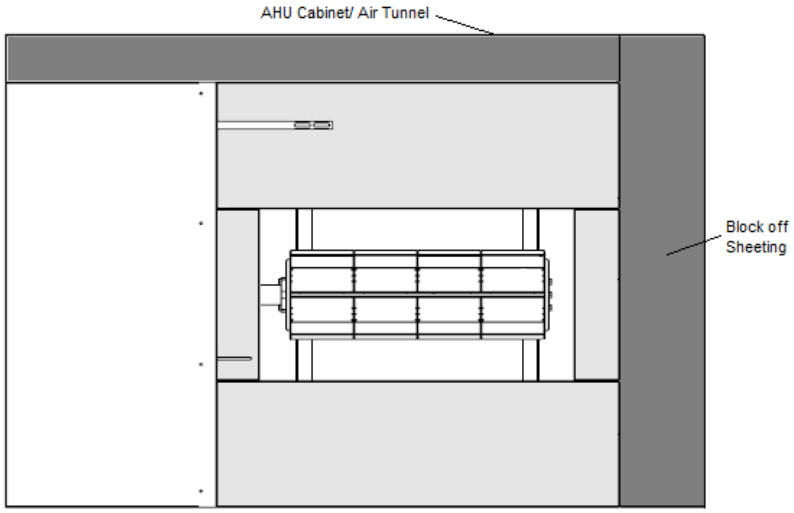
The heat module must be sheeted off to provide an air tunnel properly sized to direct airflow over the burner, profile plate and optional dampers to eliminate unwanted by-pass air, as shown in Figure 2.

Figure 2 – Heat Module Air Tunnel



If air tunnel opening is larger than module profile, provide panels to block by-pass air and direct all airflow over the designed burner, profile plate, and optional dampers as shown in Figure 3.

Figure 3 – Air Tunnel

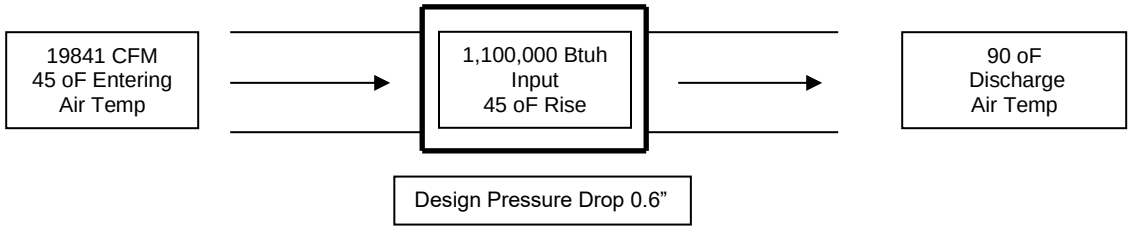


IV. Airflow Distribution & Multiple Heaters Application

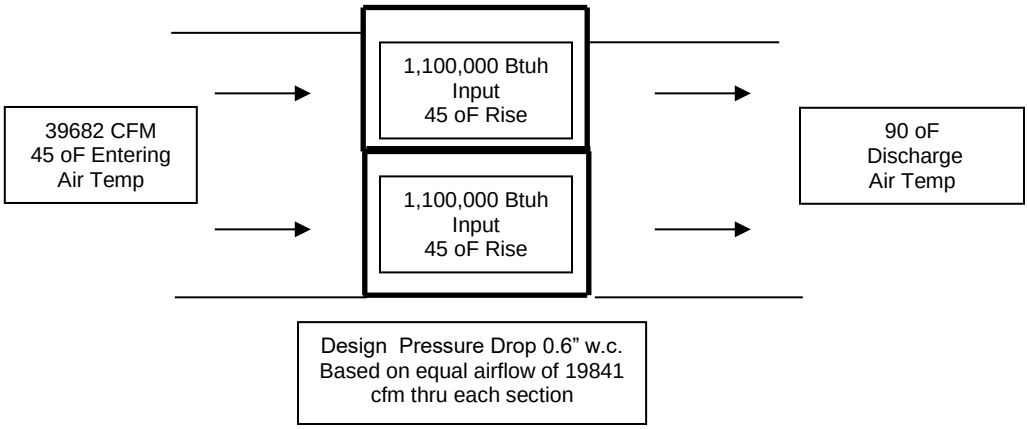
Selection of direct gas-fired heater modules to provide desired conditions requires careful consideration of necessary discharge air temperature, airflow (volume), airflow (direction), pressure drop across burners, air tunnel dimensions and module configurations. Modules may be installed individually or in parallel. Refer to examples in Figure 4 for suggested configurations. The maximum allowable discharge air temperature is 160 oF for direct gas-fired heater module,

Figure 4 – Recommended Heater Installations

Single Unit – Side View



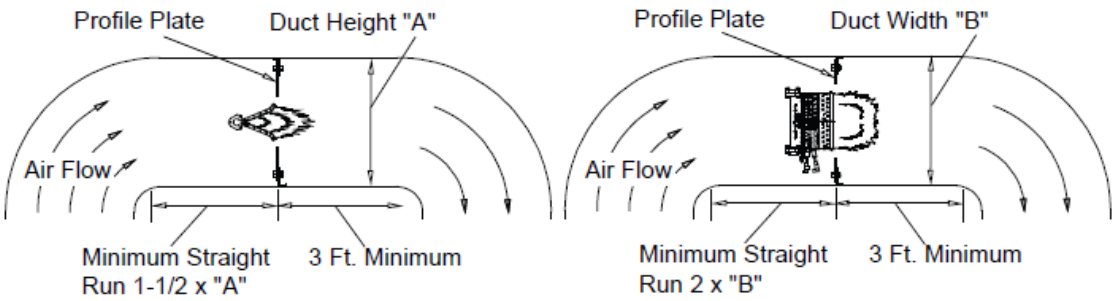
Parallel Unit – Side View



V. Installation in a Duct

An air straightener and/or turning vanes may be used in the elbows to keep the circulating air uniform around a turn. See Figure 5 for Duct dimensions upstream and downstream of the direct gas-fired gas heat module.

Figure 5 – Elbow/Bend Duct Considerations



VI. Cabinet Installation Guidelines

Verify the following before installing the direct gas-fired heater module:

1. **Electrical supply and gas supply** match ratings and gas type marked on the direct gas-fired heater module rating plate **before installing the module.**
2. Direct gas-fired heater module is installed in orientation marked on vestibule. Orientation is specific to airflow direction through the burners of the direct gas-fired heater module.
3. Direct gas-fired module section must be installed in a **non-combustible duct or cabinet.**

Carefully support and lift module into position and slide into cabinet. Provide proper support or rigging using vest panel and profile plate support brackets to support module during installation into cabinet. Fasten to cabinet.

WARNING !

Do not use burners, gas train, or manifold pipe as load bearing support during handling or installation of direct gas-fired heater module in cabinet. Severe damage may result to burners, profile plate, gas train, or pilot line assembly that result in unsafe operation, severe personal Injury, death or significant property damage.

The following must be included as part of the installation in the heating unit:

1. An **air flow proving switch** wired to prove operation of the system circulating air blower.
2. An auxiliary **Manual Reset Limit** to shut-off heater in the event of low airflow conditions due to filter blockage, coil blockage and or damper failure.
3. **Electrical control panels mounted** away from heated surfaces.
4. **Completed electrical connections** from direct gas-fired heater module to the control panel.
5. Properly supported wiring in vestibule area. **Wiring should not contact metal surfaces** which **may be hot** during direct gas-fired heater module operation.
6. Pipe sealant **resistant to LP gases on all thread gas connections.**
7. For gas regulators located indoors and not equipped with vent limiters, a properly sized vent to the outdoors.
8. Properly sized and located equipment access panels and doors to provide easy access for servicing, adjustment and maintenance of the heating units installed.

VII. Auxiliary Limit and Airflow Proving Switch

An airflow proving switch and auxiliary manual reset temperature limit must be installed in the duct direct gas-fired heater module application.

The airflow proving switch prevents operation of the gas direct gas-fired heater module in the event of failure or restriction of the circulating air fan. The airflow probe should be installed upstream of the heating section (See Fig. 1) to detect a negative pressure. The airflow switch would open the heat enable circuit to the flame safeguard control if the correct minimum pressure is not detected by the switch. An airflow proving switch kit is available for this module.

A **manual reset auxiliary limit** provides additional protection from overheating of the appliance or air handler in the event of a circulating air fan failure or reverse air flow. Under such conditions the integral primary high limit would cycle the heater resulting in heat build-up and possible damage to the module or appliance. A properly located auxiliary limit is critical (See Fig. 1). The auxiliary limit will function to shut-off the gas supply to the burners by opening the heat enable circuit to the flame safeguard control. An auxiliary manual reset limit kit is available for this module.

VIII. Circulating Air Supply

DF Series Direct gas-fired heater modules should ALWAYS be installed with burners in parallel with the circulating airflow direction.

The circulating air is to be uniform across the full length of profile plate opening.

The direct gas-fired module is designed to operate with **all circulating air passing over the burners taken directly from outdoors.**

IX. Burner Air Pressure Differential Adjustment

The direct gas-fired heater modules have an ideal standard design airflow condition of 2850 fpm and a flame length of 15" at high fire (full input capacity 550 MBtuh per foot of burner) with 70 °F air.

Proper air velocity over the burner is critical to satisfactory operation of direct gas-fired units. If air velocity is not within specifications, the unit may not operate efficiently or maintain satisfactory combustion emissions levels. To obtain the desired operating condition, the proper pressure differential across the burner should be set as follows:

- Natural Gas: 0.60 in. w.c. (+/- .02")
- Propane Gas: 0.75" in. w.c. (+/- .02")

Connect a manometer to the burner differential pressure sensing probes (See Fig. 7) to measure the pressure drop across the burner.

Adjust circulating air fan RPM with adjustable motor sheaves or VFD (if equipped) to achieve proper pressure drop. Be sure motor amp draw does not exceed motor nameplate Full Load amperage (FLA).

Burner profile plates come with manually adjustable air baffles. These baffles may be used in the field at final installation to optimize the circulating air velocity and pressure drop across the burners. The profile plate baffles are constructed such that the width is fixed, and adjustments are incorporated above and below the burner (typical adjustment is +/- 2" per baffle). If fan RPM cannot be adjusted, evenly adjust the baffles above and below the burner, keeping the burner centered in the opening until the required pressure is obtained. To increase the static pressure, decrease the opening. To decrease the static pressure, increase the opening.

If the burner baffles have been adjusted, this process may need to be repeated until the proper pressure drop is obtained. This adjustment will change the air quantity delivered by the unit, so recheck delivered air quantity.

A direct gas-fired heater module rated for 100 °F temperature rise and 70 °F outlet temperature at a design velocity of 2850 fpm and a design pressure drop of 0.6"w.c., will actually have a velocity of 2300 fpm over the burner with a 0.36" w.c. pressure drop when air enters at -30 °F. Therefore the burner has an allowable pressure drop range of the burner is 0.2" w.c. to 1.2" w.c., and velocity across the burner of 1,500 fpm to 3,500 fpm. C**areful design and implementation of the direct gas-fired heater module is necessary to provide expected operation and performance.**

X. Maximum / Minimum Airflow (VAV)

A variable air volume (VAV) option is recommended when a building's exhaust volume may vary. This option enables the make-up air volume to track the exhaust volume, providing only the required volume of make-up air.

A burner bypass damper is required for proper operation of variable volume units. It functions to maintain proper combustion by providing constant airflow over the burner as outside air volumes change.

At design airflow, the bypass damper will be fully open and approximately 50% of the total airflow will pass through damper area, while the remaining air will flow over the burner. As the supply air is reduced, the bypass damper will begin to close. This reduces the amount of air passing through the damper area and maintains a constant volume of air passing over the burner. At minimum airflow the bypass damper will be nearly closed and all the air will flow through the burner profile plate opening. Thus, airflow through the burner profile stays relatively constant throughout the range of operation.

A dampered bypass with damper control monitoring burner pressure drop may be installed to ensure proper operating burner pressures. A two position damper with potentiometer or modulating damper with Photohelic control may be used.

When providing a variable speed blower fan, the burners can operate normally at a 50% turndown. Design burner pressure drop should be 1.0" w.c. When the blower is turned down 50% the burner pressure drop will be close to 0.25" w.c. These operating parameters are within the combustion air switch high and low limits (0.2" w.c. to 1.2" w.c.).

Figure 6 – Variable Profile Plate Damper Construction

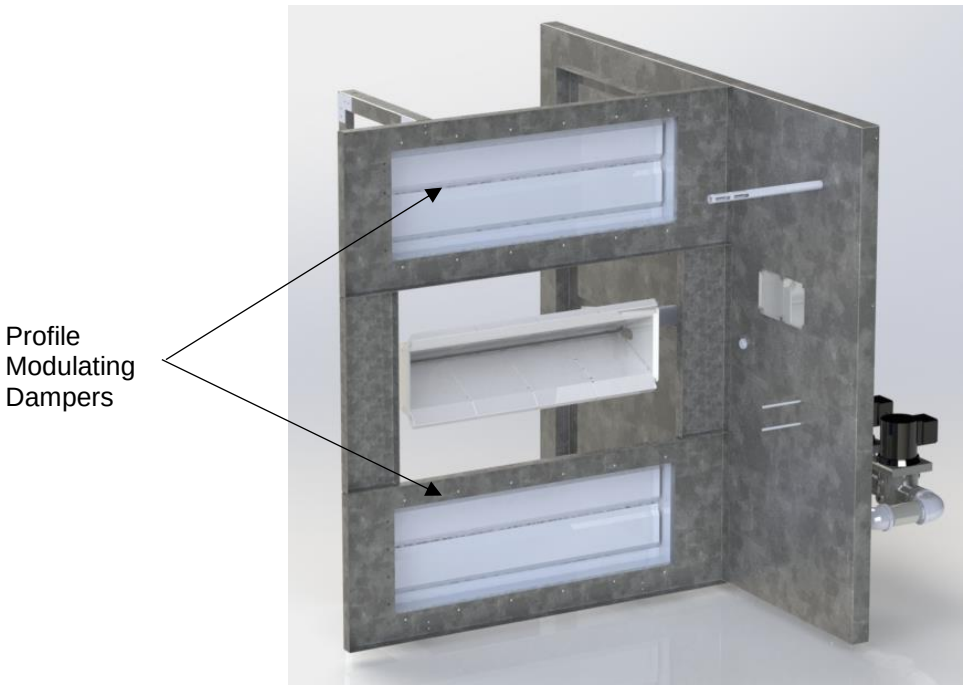
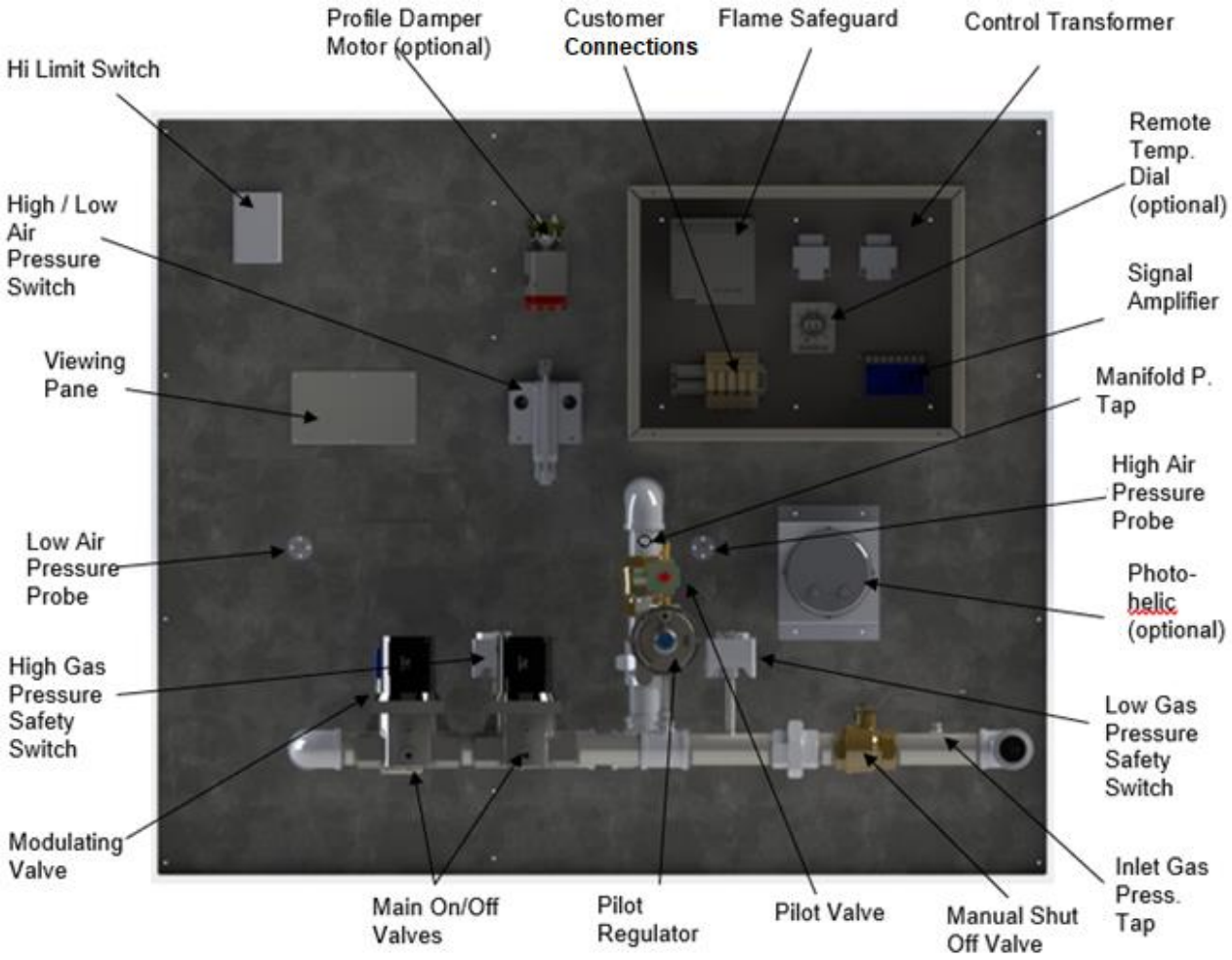


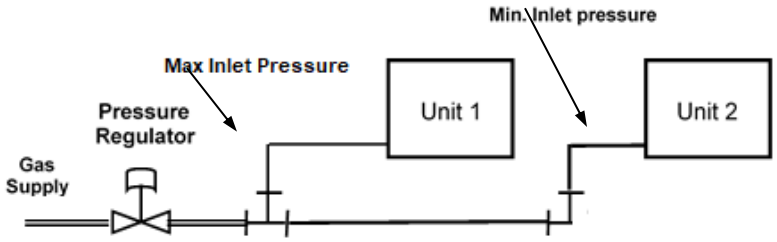
Figure 7 – Component Locations (Typical)



XI. Gas Supply, Piping and Connections

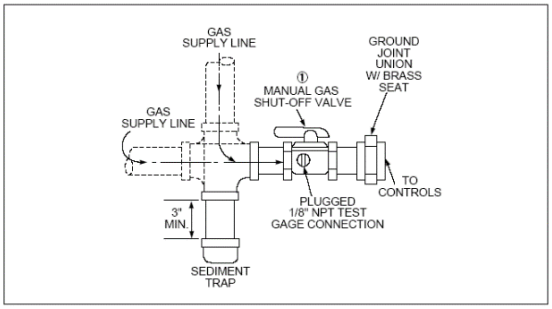
1. Installation and sizing of piping must conform with local building codes and ordinances, or with ANSI Z223.1 the National Fuel Gas Code. In Canada, installation must be in accordance with CAN/CGA –B149.1 Installation Codes.
2. Use a pipe sealant **resistant to LP gases** on Gas supply connections to heater.
3. **Properly support gas train components with back-up wrench**, during supply pipe installation to prevent loosening valve or damage to burner assembly or manifold.
4. Gas piping must be sized for the total Btu input of all units (heaters) serviced by a single supply.
5. Be sure that gas regulators servicing more than one heater have the proper pipe and internal orifice size for the total input of all heating units serviced by the regulator. (See Figure 8)
6. Direct Gas-Fired modules require a **minimum** inlet gas pressure. These pressure values are specific to the job site location. See burner module ratings plate.
7. Connect a fitting suitable for connection to a pressure gauge capable of measuring gas pressure to 1/8" NPT tap provided on the inlet side of the gas valve or manual shut-off valve tapping (See Figure 7). Measure inlet pressure to each module serviced by a single regulator with all modules in operation. (See Figure 8)

Figure 8



8. A drip leg (sediment trap) and a manual shut off valve must be provided immediately upstream of the gas control on the heating unit. To facilitate servicing of unit, installation of a union is recommended. (See Figure 9)

Figure 9



9. The burner module gas piping was leak tested prior to shipping. However, during shipping and installation connections may have loosened. Check for leaks using a soap solution and correct any leaks before placing direct gas-fired heater module in operation.

10. Vent valves (when used) must be piped to the outdoors and outside the vestibule cabinet and in accordance with applicable codes.

WARNING !	WARNING !
1. All field gas piping must be pressure / leak tested prior to operation. NEVER use and open flame to check for leaks. Use a soap solution or other leak detecting solution. **2. Gas pressure to appliance controls must never exceed what is found on the rating label.**	**1. When pressure testing at ½ PSI or less, close the manual shut-off valve on the appliance before testing.** **2. When pressure testing gas supply line at ½ PSI or higher, close manual gas valve and disconnect heater from supply line to be tested. Cap or plug the supply line.**

Inlet Gas Supply Pipe Connection Sizes

Gas supply pipe connection sizes are based on definitive job site specifications. The gas train design is based on fuel type, full rate capacity, design inlet gas supply pressure, pressure drop, valve arrangement, and local or national gas piping codes.

Each direct gas-fired heater module is **supplied with a gas train piping diagram showing arrangement, sizing, and selection.**

XII. Direct Gas-Fired Heat Module Controls

Customer Air Control:

CA (Customer Provided Modulating Signal): The integral Maxitrol SC11 converts a building controller's DC output signal of 4-20 mA or 0-10 VDC to a 0-20 VDC signal used to control the Maxitrol Selectra modulating valve. See Figure 10A.

Discharge Air Controls:

DA (Discharge Air): The integral Maxitrol A1014R references a desired set point temperature (either set on the A1014R or an optional remote selector) to the measured discharge air duct temperature, while outputting the 0-20 VDC signal to the Modulating valve to modulate the gas input into the gas burner. See Figure 10B.

DR (Discharge Air w/ Room Override): Provides space temperature control by raising the discharge air temperature to a pre-selected point – when used in conjunction with the remote temperature selector.

DI (Discharge Air w/ Inlet Air Sensor): Provides inverse change in discharge air temperature for each degree change in inlet air – when installed in a convenient duct location upstream of the burner.

Room Air Controls:

RA (Room Air w/ Selectrostat): The integral Maxitrol A1044R references a desired set point temperature set by the Selectrostat in the heated space, to the measured room air temperature and then outputs a 0-20 VDC signal to the Modulating valve to modulate the gas input into the gas burner. See Figure 10C.

RR (Room Air w/ Remote Sensing &Temperature Selector): The Maxitrol A1044R references a desired set point temperature set by a remote temperature selector (does not have to be in the heated space), to the measured room air temperature and outputs the 0-20 VDC signal to the Modulating valve to modulate the gas input into the gas burner.

XIII. Operation and Adjustment

SEE Heatco website for informational and start-up procedure videos.

1. Most direct gas-fired heater module modules come with a pilot. If the module is < 400 MBH it is equipped with a direct spark ignition device that automatically lights the gas burner. **DO NOT try to light burners by hand.**

2. BEFORE OPERATING, leak test all gas piping up to and including heater gas valve train. Smell around the unit area for gas. If odor of gas is detected, **DO NOT** attempt to place heater in operation until source of gas leak is identified and corrected.

3. Use tools with only hand force. If regulator adjustments do not operate by hand force, replace gas valve prior to starting the unit. Forcing or attempting to adjust or repair the gas valve may result in fire or explosion.

4. Each DF module comes with a Time Purge Delay Relay. This Time delay relay pauses the call for heat signal to the ignition control for the set time. This time is factory set during operation tests. In the field this Purge Time Delay Relay may be adjusted to satisfy the standard listing of (4) four complete air changeovers in the heater cabinet section and attached discharge duct work.

Start-up

1. A pressure tap is used to measure the differential at the burner and to set high fire gas pressure **(See Manifold Pressure Adjustment on Page 17-18).** The manifold pressure tap is 1/8" and located between modulating valve and the burner(s).

2. Close the inlet manual shut off valve and open the manual shut off located between the modulating valve and the burner. Turn the circulating blower on to full operating CFM and record the negative pressure on a u-tube manometer or gas pressure gauge. This reading is used for high fire burner pressure adjustment during operation.

3. After recording the negative burner manifold pressure, temporarily leave the manometer attached to the 1/8"tap. It will be used later to check high fire gas pressure. Close the manual shut off valve located between the modulating valve and the burner.

4. Open the inlet manual shut off valve. Verify supply inlet pressure does not exceed maximum rated gas pressure as stated on the rating plate. See Figure 8 for measuring location.

5. Set the supply gas pressure at the stepdown regulator (normally outside of the enclosure if one is installed), according to the nameplate rating inlet gas pressure specifications.

6. Before proceeding, check Start-up wiring changes for the corresponding installed heater control (Step 12). **Make necessary wiring changes only when the module is powered OFF**.

Only perform Steps 7 - 10 if a pilot is installed.

7. Place a u-tube manometer or gas pressure gauge on the tee at the downstream side of the pilot pressure regulator. Open the inlet manual gas valve and close the manual gas valve downstream of the modulating valve.

8. Supply correct source voltage to heater control. Give a call for heat (close contacts between T1 and T2), Once flame safeguard lights the pilot, adjust the pilot pressure regulator to 3.5 in w.c. for natural gas or 2.0 in w.c. for LPG.

9. Verify that the burner flame control has a flame signal of 2-5 UA or 2-5 VDC.

10. Remove the call for heat (open contacts between T1 and T2), and open the manual gas valve downstream of the modulating valve.

11. Give a call for heat (close contacts between T1 and T2). Allow flame safeguard to ignite the pilot (if installed), open main gas valve(s), and prove the main flame.

12. Depending on which Burner Control is installed follow subsequent steps for each controller type to check full input range of the gas modulation.

CA: Provide 10 VDC to terminals 5 & 6 on the SC11 (See Figure 10A) signal conditioner control. **Polarity is sensitive (Positive to Terminal 6, Negative to Terminal 5).** After a 30 second warm up period the unit will run at high fire. Check that manifold pressure is manifold pressure recorded on Ratings Label. If high fire manifold pressure adjustment is needed **(See Manifold Pressure Adjustment)** and a MR212 modulating valve is installed, see Figure 11 for adjustment location. If a M 411, 511, 611 modulating valve is installed, adjust high fire manifold pressure by adjusting the combination gas valve (See Figure 13 or 14), or the Regulator Valve upstream of main gas valve(s).

Provide 0 VDC to terminals 5 & 6 on the SC11 signal conditioner control. Heat module will run at low fire. Manifold pressure will be slightly negative. Check to make sure that there is not a loss of flame. If manifold pressure adjustment is needed see Figure 11 or 12 for low fire bypass adjustment location. View flame through viewport to ensure there is a steady even flame across the full length of the throat of the burner (See Figure 17).

DA / DI / DR: If using a remote Temperature selector, remove the leads off of Terminals 1 & 2 on the Maxitrol A1014R (See Figure 10B) and flip Dip Switch to "Integral". Place the supplied 10,000 Ohm resistor across Terminals 1 & 2. Rotate the onboard temperature selector dial fully CW to run unit at full high fire. Check that manifold pressure correlates to the differential manifold pressure recorded on Ratings Label. If high fire manifold pressure adjustment is needed **(See Manifold Pressure Adjustment)** and a MR212 Modulating valve is installed, see Figure 11 for adjustment pot location. If a M 411, 511, 611 Modulating valve is installed, adjust high fire manifold pressure by adjusting the Regulator Valve upstream of on/off valves, or the combination gas valve (See Figure 13 or 14).

Rotate the onboard temperature selector dial fully CCW to run unit at low fire. The manifold pressure will be negative. Check to make sure that there is not a loss of flame. If manifold pressure adjustment is needed see Figure 11 & 12 for low fire bypass adjustment location. View flame through viewport to ensure there is a steady even flame across the full length of the throat of the burner (See Figure 17).

After checking both high and low fire, power down module, correct dip switch setting if needed, replace remote temperature selector if needed, and select correct temperature setting either using onboard pot or remote selector.

RA / RR: If using a remote Temperature selector, remove the leads off of Terminals 4 & 5 on the Maxitrol A1044R. (See Figure 10C) Place the supplied 12,000 Ohm resistor across Terminals 4 & 5. Rotate the on board

temperature selector dial fully CW to run unit at full input high fire. Check that manifold pressure correlates to the differential manifold pressure recorded on Ratings Label. If high fire manifold pressure adjustment is needed **(See Manifold Pressure Adjustment)** and a MR212 Modulating valve is installed, see Figure 11 for adjustment location.
If a M 411, 511, 611 Modulating valve is installed, adjust high fire manifold pressure by adjusting the Regulator Valve upstream off on/off valves, or the combination gas valve (See Figure 13 or 14).

Rotate the onboard temperature selector dial fully CCW to run unit at low fire. Manifold pressure will be negative. Check to make sure that there is not a loss of flame. If manifold pressure adjustment is needed see Figure 11 & 12 for low fire bypass adjustment location. Adjust modulating valve until there is a nice steady even flame across the full length of the throat of the burner (See Figure 17), view flame through viewport.

After checking both high fire and low fire, power down heat module, replace remote Selectrostat wire leads, and select correct temperature setting either using onboard pot or remote Selectrostat.

Figure 10A– SC11

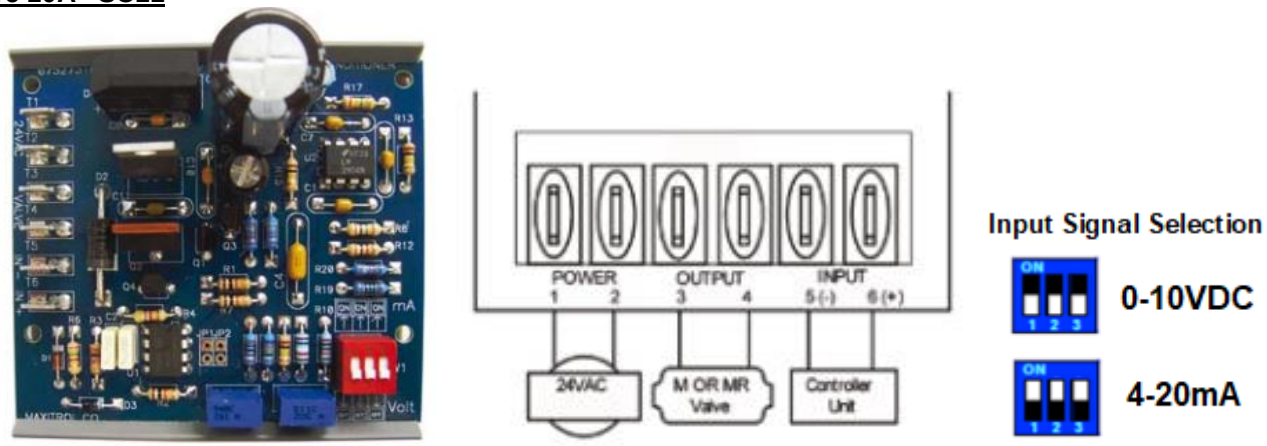


Figure 10B – A1014R

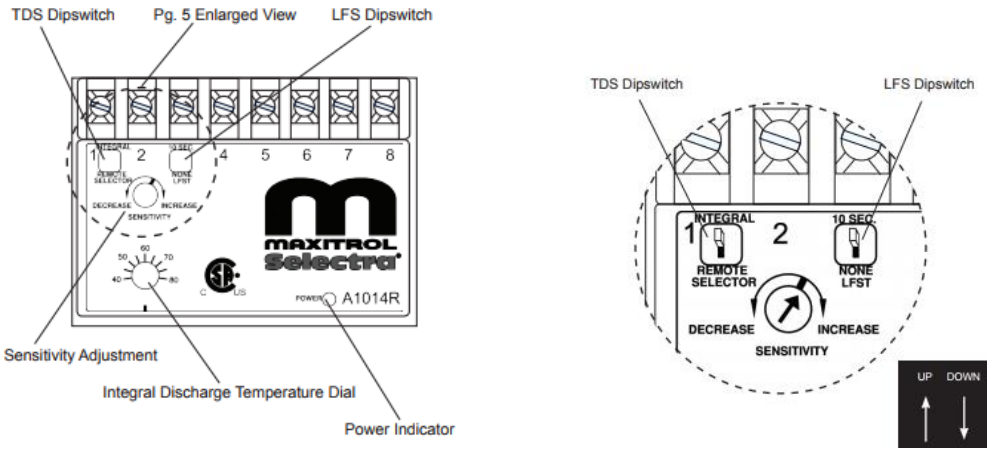


Figure 10C– A1044R

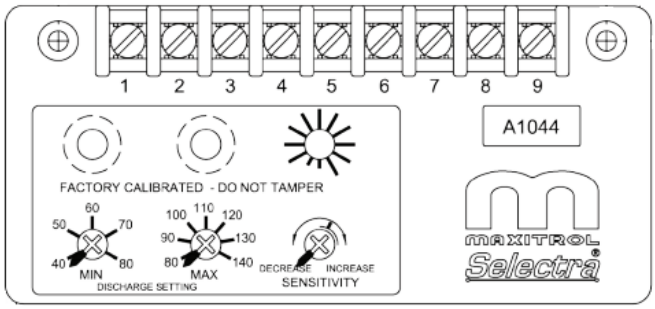


Figure 11– MR 212 Modulating Regulator Valve

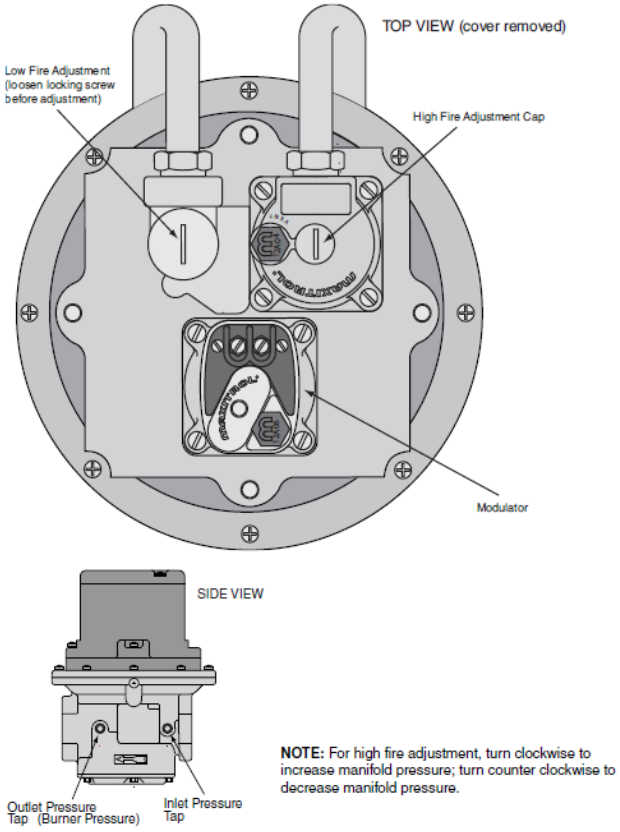


Figure 12 – M 411, 511, 611 Modulating Valve

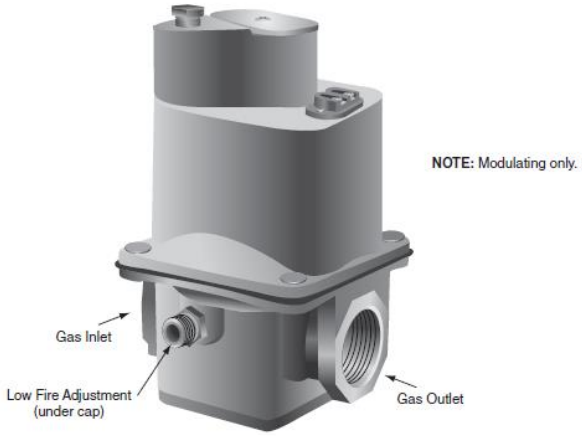


Figure 13 – Robertshaw Regulator / Pilot Gas Valve

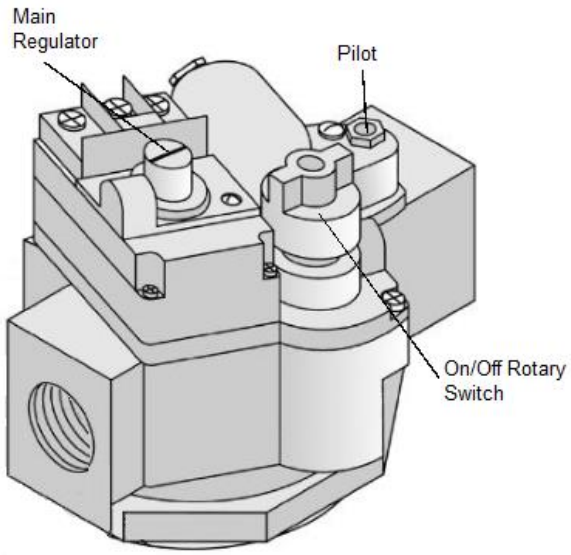
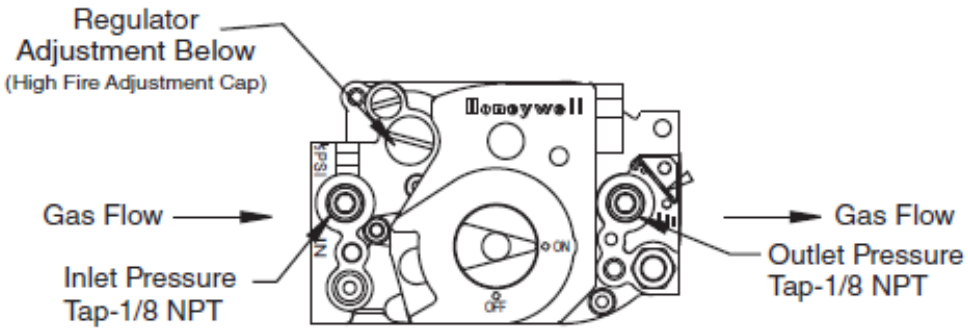


Figure 14 – Honeywell Regulator Valve



XIV. Burner Trouble Shooting

The Midco Burner is only a component of the complete system. For trouble shooting of the equipment, contact the OEM (Original Equipment Manufacturer) or the component manufacturer.

If the pilot fails to light: install a manometer on the pilot pressure tap. Check for 3.5″ W.C. for natural gas or 2″ W.C. for propane, using a natural gas pilot or 5″ to 7″ using a propane pilot with orifice # 58 drill (.042”). If no gas, check for voltage to pilot solenoid valve. If no voltage check operating controls or primary flame safeguard. If voltage to pilot solenoid valve is present and if there is 3.5″ W.C. gas pressure at pilot pressure tap then check for spark or flame rod settings. See Figure 7. If there is no voltage to pilot solenoid valve, refer to Flame Safety control specifications or contact the original equipment manufacturer.

If Main Burner fails: If no main flame, check manifold pressure. If no manifold pressure, check for voltage to the gas solenoid valve and check if main manual fi ring valve is open. If no voltage to gas valve, refer to Flame Safety control specifications or contact the original equipment manufacturer. If the pilot fails as main gas valves open, the first adjacent gas port hole (next to the pilot) might need to be plugged with direct gas-fired heater module cement. For high fire start units see Figure 7 - Pilot Configuration.

XV. Manifold Pressure Adjustment

The correct input capacity of the direct gas-fired heater module is controlled by the burner gas manifold pressure. A pressure tap is provided in each heat module gas train manifold. **Manifold pressure must be checked at start-up and during any service or maintenance.** See Figures 11 through 14 for Gas Valve adjustment locations. Verify proper low fire adjustments as outlined in the Sequence of Operation for the operating control system provided.

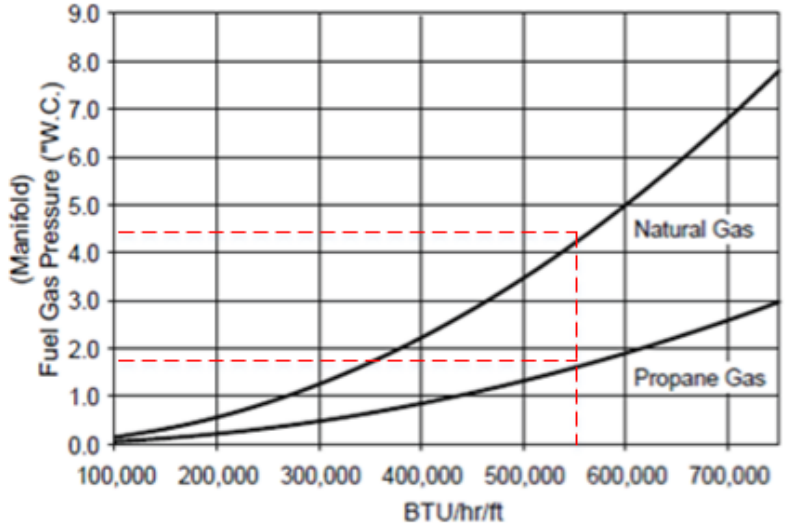
All direct gas-fired heat modules **require the manifold pressure listed on the module ratings plate.**

Differential Manifold Pressure is the difference between the negative pressure measured before start-up and the set high fire pressure during operation.

Example: With -1.0"w.c. measured with the heat module off and a rated differential manifold pressure of 4.2"w.c., the set manifold pressure at high fire should be 3.2"w.c.

Direct gas-fired heat modules are designed on 550M Btu/H/r./ft of burner. This rate corresponds to a 4.2" w.c. manifold pressure for natural gas and 1.6" w.c. for propane (See Figure 15) with Midco HMA-2A Burners. Maxon NP1-LE Burners operate at 3.9" w.c. manifold pressure for natural gas and 1.6" w.c. for propane (curves not shown).

Figure 15 – Btu/hr/ft vs. Manifold Pressure



Manifold pressure set at a specific Btu/ft. can be correlated to a flame length at high fire operation based on pressure drop across the burner (See Figure 16).

Figure 16 – Flame Length vs. Pressure Drop

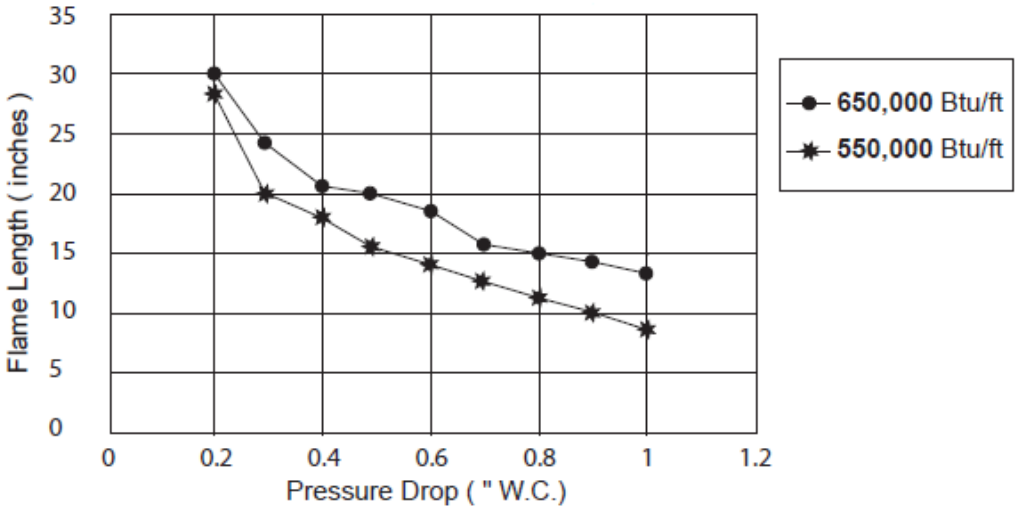
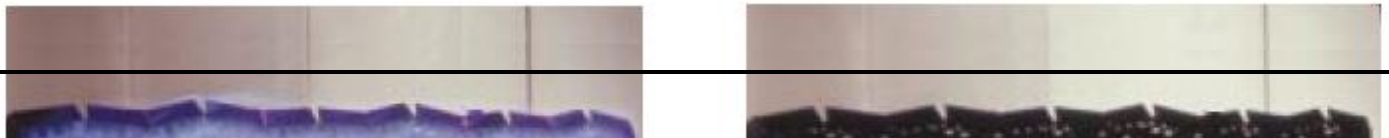


Figure 17 – Flame Appearance



High Fire (550 MBH/ ft of burner)	Low Fire (20 MBH/ ft of burner)

XVI. Electrical Controls & Wiring

All electrical wiring must be done in accordance with the National Electric Code, ANSI/NFPA No. 70.

Operating electrical controls are mounted within the heat module vestibule or on the vestibule panel.

Controls locations should be selected to prevent exposing the controls to the following:

- Moisture, especially wind driven rain or snow
- High temperatures- surfaces or ambient conditions must be less than 160 oF
- Avoid mounting controls on or adjacent to surfaces that may be hot during heater operation.

Wiring connections are quick-connect type or screw-terminal to facilitate interconnection to the heat module gas valves, pressure switches and limits.

Minimize length of **high voltage spark lead(s) and route this wire independently** of all control wiring to reduce radio frequency interference (RFI) with the electronic controls.

Electrical Supply

The direct gas-fired heater module control system requires both line voltage and low voltage circuits with correct polarity, and clean neutral and ground. Line voltage readings between L1 and Neutral as well as L1 and Ground should be within +/- 3 volts.

Refer to electrical supply information on duct direct gas-fired heater module rating plate.

Instructions and Wiring Diagrams

Each heat module is shipped with its own wiring diagram, sequence of operation, and control diagnostic information for the control system provided on the heat module as part of the OEM information package.

Each heater is test-fired at the factory and a copy of the Test and Inspection sheet is also included.

These documents should be retained by the air handling unit manufacturer for future reference.

XVII. Burner Maintenance

Annual maintenance of the Midco HMA 2A burner is recommended to ensure trouble free operation.

1. Clean the burner plates
2. Clear the burner gas and air ports
3. Change the spark rod igniter
4. Insure the flame sensor is in good condition

Use a stiff wire brush to clean the burner plates. Scrub both sides of the stainless-steel burner plates to remove any soot or other crud, which may be on the burner. All of the burner plate holes must be clear, so air can pass through them unrestricted. The holes in the burner plate allow air to mix with the gas in increasing amounts, as the flame gets longer. Scrub the rust, soot and other foreign material from the burner orifice area. After the burner plates are cleaned inspect them for cracking. Cracks occurring between one or two holes are normal and should be of no concern. If the cracking is more extensive, the affected plates should be replaced. Clean the burner gas and air ports using a drill or piece of wire of the appropriate size in table below.

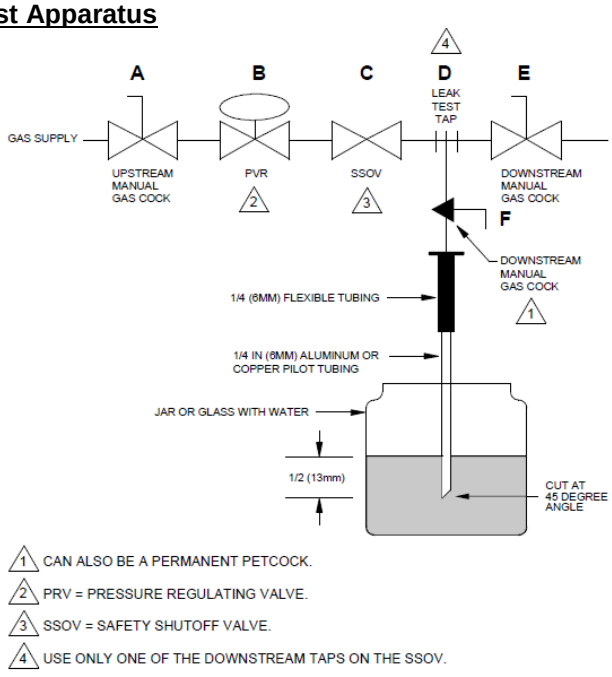
Burner Section and Gas Type		Gas Port Drill Size Wire Gauge	Decimal	Air Port Drill Size Wire Gauge	Decimal
HMA 2A	Natural / Propane	1/8"	.125	42	.093

After the burner plates and orifices are cleaned inspect the spark rod. The tip should be clean and free of dirt and carbon. The porcelain must be intact. If it is cracked, replace it. Pull the flame rod or ultraviolet scanner as well. If the flame sensor is a scanner, clean the lens with a clean damp soft rag. The flame rod's metal rod should be clean and free of dirt and carbon. Like the spark rod igniter, the porcelain on the flame rod must be intact as well. Replace it if it is cracked.

Safety Shut-off Valve Leak Test

Safety shut-off valves need to be checked annually for closure tightness using the following procedure. A small amount of leakage is normal. However, leakage rates exceeding those in the table below require replacement of gas valve. This test must only be performed by an experienced, qualified technician.

Figure 18 – Leak Test Apparatus



1.) De-energize the control system to make sure no power goes to SSOV **(C)**. .

2.) Close upstream manual gas cock **(A).**
3.) Make sure manual test cock **(F)** on leak test tap assembly is closed.
4.) Remove leak test tap plug and connect test apparatus to leak test tap **(D).**
5.) Close the downstream manual gas cock **(E).**
6.) Open the upstream manual gas cock **(A)**.
7.) Momentarily enable the SSOV **(C)** through the safety system.
8.) Immerse the ¼" tube into the water approximately ½" deep.
9.) Slowly open test cock **(F)** on the leak assembly.
10.) When the rate of bubbles coming through the water stabilizes, count the number of bubbles appearing during a ten (10) second period. Each bubble represents approximately 0.001 cfh. Reference leakage rate chart below.
11.) Check each SSOV separately.

Chart 1 – Allowable Valve Leakage Rate

Manufacturer	Pipe size (in.)	Model	Maximum leakage rate (bubbles/10sec.)
Honeywell	1, 1¼	V4943, V8943	13
	1½, 2	V4943, V8943	16
	¾, 1, 1¼, 1½	V5055, V5097	14
	2, 2½ ,3	V5055, V5097	24
ASCO	¾	K3A551/651	6
	1	K3A551/651	6
	1 ¼	K3A551/651	7
	1 ½	K3A551/651	9

Following leak test

1.) Close upstream manual gas cock. **(A)**
2.) Close manual test cock **(F)**, remove test apparatus, and close leak test tap **(D)**.
3.) Make sure downstream manual gas cock **(E)** is closed.
4.) Open the upstream manual gas cock **(A)**, and energize the SSOV through the safety system.
5.) With a soap solution leak test the tap connection (D) and pipe / valve mating points.
6.) De-energize the SSOV **(C)**.
7.) Open downstream manual gas cock **(E)**.
8.) Restore system to normal operation.

NOTES:

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