

OPERATION, SERVICE AND MAINTENANCE INSTRUCTIONS



HM and HH SERIES DUCT FURNACE MODULE



ANSI Z83.8 (2016) – CSA 2.6M (2016) Gas-Fired Duct Furnace

WARNING:

FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury, death or property damage.

Be sure to read and understand the installation, operation and service instructions in this manual.

Improper installation, adjustment, alteration, service or maintenance can cause serious injury, death or property damage.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance
- Do not touch any electrical switch; do not use any phone in your building
- Leave the building immediately
- Immediately call your gas supplier from a phone remote from the building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation must be performed by a qualified installer, service agency or gas supplier.

This manual must be kept with the appliance for future reference.



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H(M,H)-USM-MAN-8-2016-E

The information provided in this manual applies to the furnace module installed as part of a manufactured package system and to its operation, maintenance, and service. Refer to the system manufacturer's instructions for information related to all other components.

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Installation Requirements

All unit installations must be in accordance with the National Fuel Gas Code ANSI Z223.1 (NFPA 54) in the United States and Can/CGA-B149 Installation Code in Canada, and all other applicable local codes and ordinances. These requirements include but are not limited to:

- **Combustion air supply to the heating equipment**
- **Venting of the products of combustion (flue gases)**
- **Gas supply, piping and connections**
- **Unit Location and clearances**

All electrical equipment must be grounded and wired be in accordance with the National Electric Code (ANSI/NFPA 70) in the United States, and the Canadian Electric Code (CSA C22.1), in Canada

Installation

Verify the following before placing the equipment into service:

1. Electrical supply matches the voltage marked on the furnace module Rating Plate.
2. Gas supply provided matches the Gas Type marked on the furnace module Rating Plate.
3. Furnace module is installed in orientation marked on vestibule. Orientation is specific to airflow direction through the heating section of the unit.
4. There is an adequate supply of fresh air for the combustion and ventilation process. **Combustion air openings in the cabinet should be sized to provide 1 sq. in of free area per 4000 Btuh of input.**

WARNING !

The presence of chlorine vapors in the combustion air supplied to gas-fired heaters presents a substantial corrosion hazard.

5. **A properly designed vent system is connected to the furnace module unit** to convey the products of combustion (flue gases) outside the building. For outdoor applications be sure the flue gases are directed away from any combustion air inlets.
6. Furnace module is installed in a **non-combustible duct or cabinet on the positive pressure side of the circulating air blower.**
7. An **air flow proving switch** is installed and wired to prove operation of the system circulating air blower.
8. An auxiliary **Manual Reset Limit** is installed to shut-off furnace module in the event of low airflow conditions due to filter blockage, coil blockage and or damper failure.
9. A drain tube is installed for **disposal of condensate**, if the furnace module is equipped with modulating controls or is located downstream of cooling system.
10. Equipment access panels and doors are sized and located to provide easy access for servicing, adjustment and maintenance of the furnace installed.

WARNING !

Gas-fired furnaces 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.

WARNING !

This furnace is not listed or suitable for drying or process applications. Use in such applications voids any warranty and manufacturer disclaims any responsibility for the duct furnace and /or application.

Combustion Air Supply

All gas fired furnaces need an ample supply of air for proper and safe combustion of the fuel gas. If sufficient quantities of combustion air are not available to the heater, poor combustion and inefficient operation will result. The heating unit cabinet combustion air openings should be sized to provide 1 sq. in of free area per 4000 Btuh of input. For outdoor installations combustion air inlet and flue gas outlet **must be located in the same pressure zone** to minimize effects of wind on burner and heater performance.

Indoors, locate heating unit to insure an adequate supply of fresh air to replace air used in the combustion and ventilation process. Install air openings that provide a total free area in accordance with the National Fuel Gas Code (ANSI Z223.1 or NFPA 54) in the United States or CAN/CGA B-149 Installation Code in Canada.

Condensate Drains

1. In applications operating with modulating controls, temperature rises below 40 oF, or with outside make-up air, some condensation may occur in the heating cycle. In these applications connection of a condensate drain line is required to avoid condensate buildup and possible heat exchanger damage. If condensate drain lines are run through unheated spaces, apply heat tape to prevent condensate from freezing.
2. If furnace module is located downstream of a refrigeration system or cooling coil, condensation can occur during operation of the air conditioning, resulting in condensation from warm, moist air in the heat exchanger tubes and flue collector. This condensate is not harmful to the heat exchanger provided it is drained continuously. For these applications a ¼ NPT connection is provided for attachment of condensate drain line to remove condensate from heat exchanger.

A P-Trap is recommended as the system operates under a negative pressure. The use of a "Tee" fitting is recommended to allow for priming and cleaning the trap. Use a plug in the cleanout opening.

Do not use copper tubing for condensate drain lines. Flue gas condensate is slightly acidic.

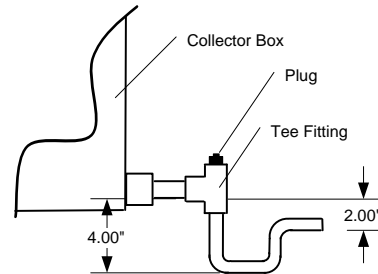
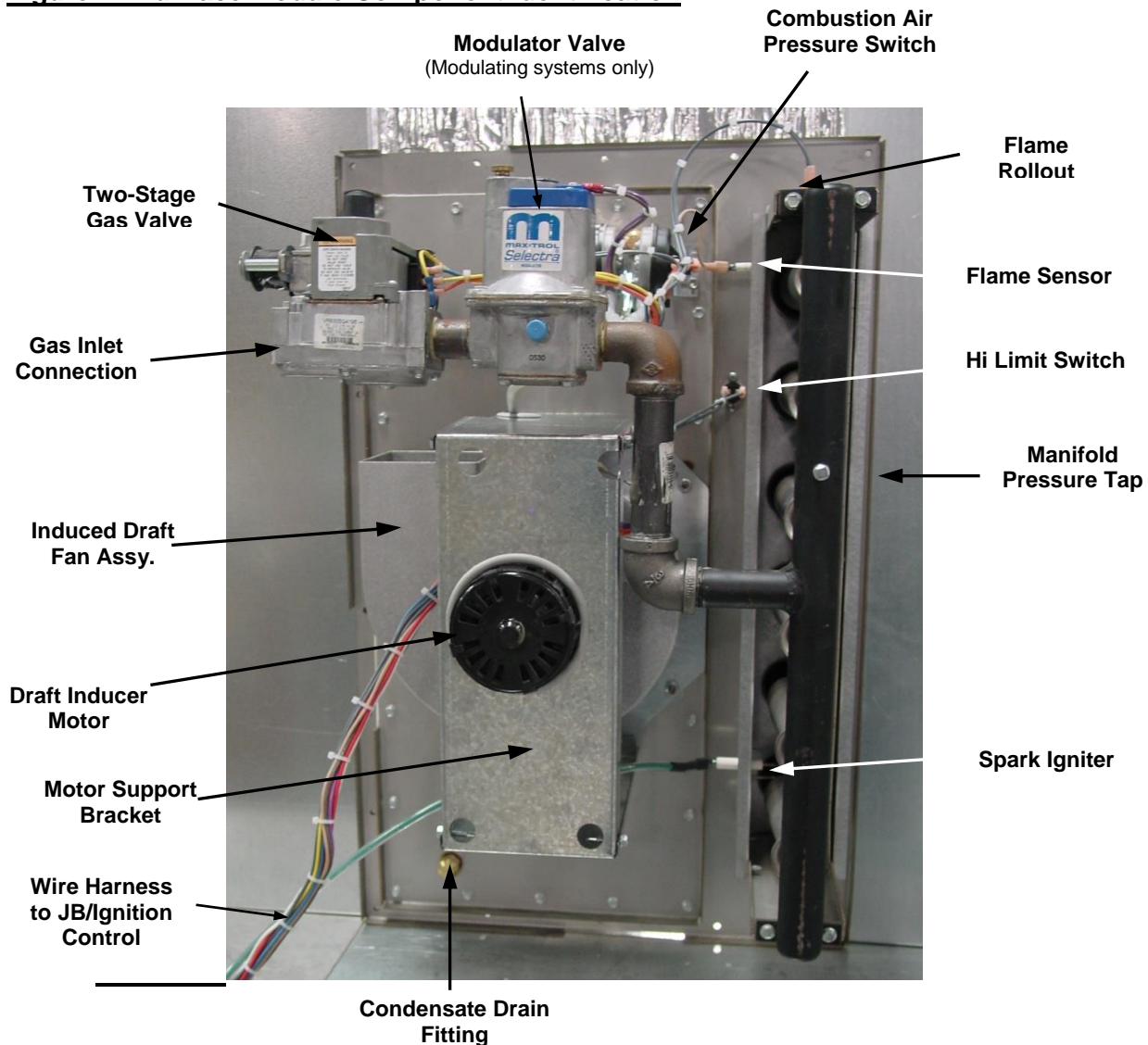


Figure 1 - Furnace Module Component Identification



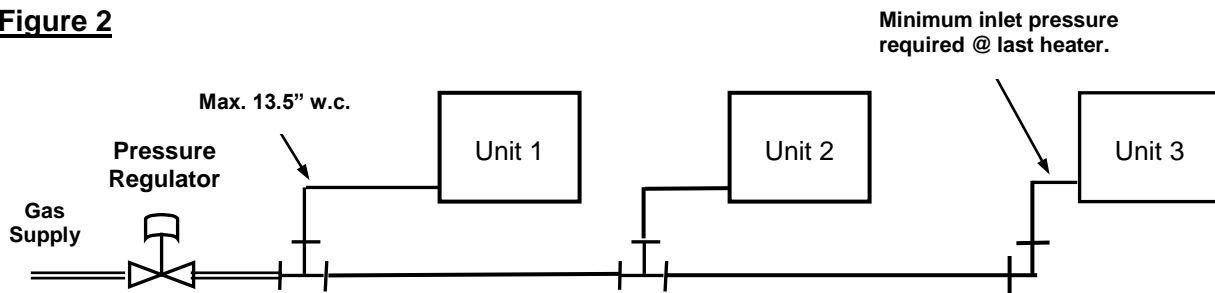
Gas Supply, Piping and Connections

1. Installation of piping must conform with local building codes and ordinances, or in the absence of local codes with ANSI Z223.1 the National Fuel Gas Code. In Canada, installation must be in accordance with CAN/CGA –B149.1 for Natural gas and B149.2 for propane units. Use a pipe sealant **resistant to LP gases** on Gas supply connections to heater.
2. Gas piping must be sized for the total Btu input of all units (heaters) serviced by a single supply.
3. Be sure that gas regulators servicing more than one heater have the proper pipe and internal orifice size for the total input of all heaters serviced by the regulator. (See Fig. 2)
4. Individual duct furnaces modules require a **minimum** inlet gas pressure as shown below.

	<u>Natural Gas</u>	<u>Propane Gas</u>
Minimum (50,000 to 400,000 Btuh models)	5.0" w.c.	11.0" w.c.
Minimum (401,000 and higher Btuh models)	6.0" w.c.	12.0" w.c.
Maximum Inlet	13.5" w.c.	13.5" w.c.

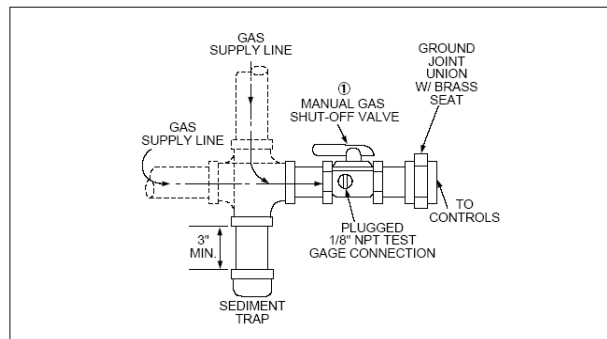
5. Connect a fitting and pressure gauge suitable for measuring gas pressure to 1/8" NPT tap provided on the inlet side of the gas valve (Fig. 8) or manual shut-off valve tapping (See Fig. 3). For multiple heater installations, measure inlet pressure to each heater serviced by a single regulator with all heaters in operation. (See Fig. 2)

Figure 2



6. 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 Fig. 3)

Figure 3



7. The duct furnace 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 furnace in operation.

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 13.5" w.c. (1/2 PSI)

WARNING !

1. When pressure testing at 1/2 PSI or less, close the manual shut-off valve on the appliance before testing.
2. When pressure testing gas supply line at 1/2 PSI or higher, close manual gas valve and disconnect heater from supply line to be tested. Cap or plug the supply line.

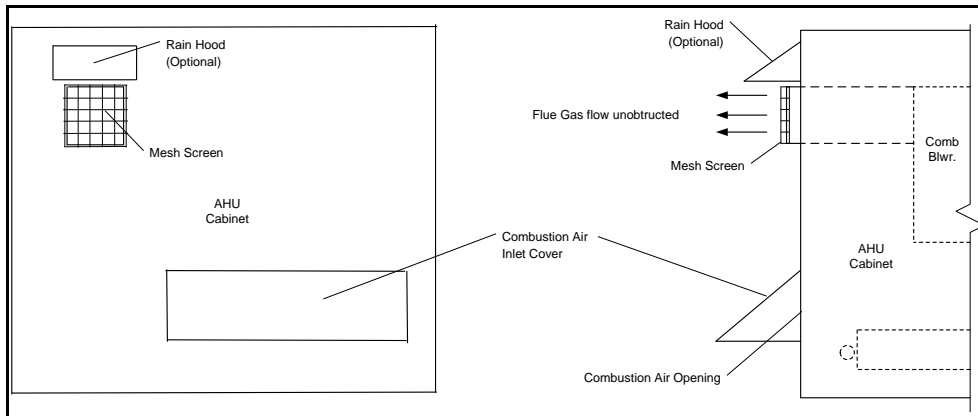
The individual duct furnace inlet gas supply pipe connection size is 3/4" NPT for gas inputs up to 400,000 Btuh and 1" NPT for gas inputs between 401,000 and 600,000 Btuh for all control systems.

Venting Outdoor Installations

The venting system is designed for direct discharge of flue gases to the outdoors. The vent discharge opening should be located to provide an unobstructed discharge to the outside and should be located as far from the combustion air inlet as possible but in the same pressure zone.

Vent duct should pitch down toward outlet, to insure that any condensate that occurs in vent duct drains away from combustion blower fan housing. The duct opening should be protected by a ½ in. x ½ in. (12mm x 12mm) mesh screen. An optional rain hood may be used over the discharge opening to prevent wind driven rain from entering the vent duct, but should not intersect the flue gas discharge path. See Fig. 4 below.

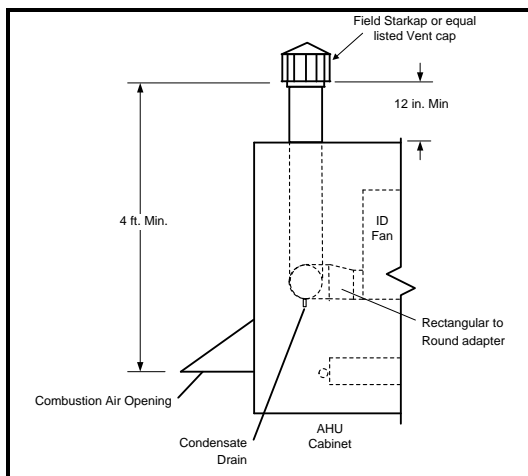
Figure 4 – Outdoor Horizontal Venting



Outdoor units must be individually vented, unless provided with a special vent system by the manufacturer. Where sufficient clearance for proper horizontal venting cannot be provided, or in jurisdictions requiring a 4 foot separation between flue gas discharge and combustion air inlet, flue gases need to be vented vertically. Refer to Fig. 5 for acceptable venting method.

Vent pipe must terminate at least 1 ft. above the cabinet. The vent must be located on the same side of the appliance as the combustion air inlet opening. Condensation in the vent pipe is likely during heater start-up cycle and provision for drainage must be provided

Figure 5



Caution !
Flue gases must be directed away from combustion air inlets, to avoid recirculation into combustion air supply.

Venting Indoor Installations

Furnace modules must be connected to a venting system to convey flue gases outside of the heated space. Proper venting of the heating units is the responsibility of the installer. Vent piping is supplied by others.

Vertically Vented Duct Furnaces – Category I

Vent systems must be sized and installed in accordance with ANSI Z223.1 (NFPA 54), Chapters 12 and 13.

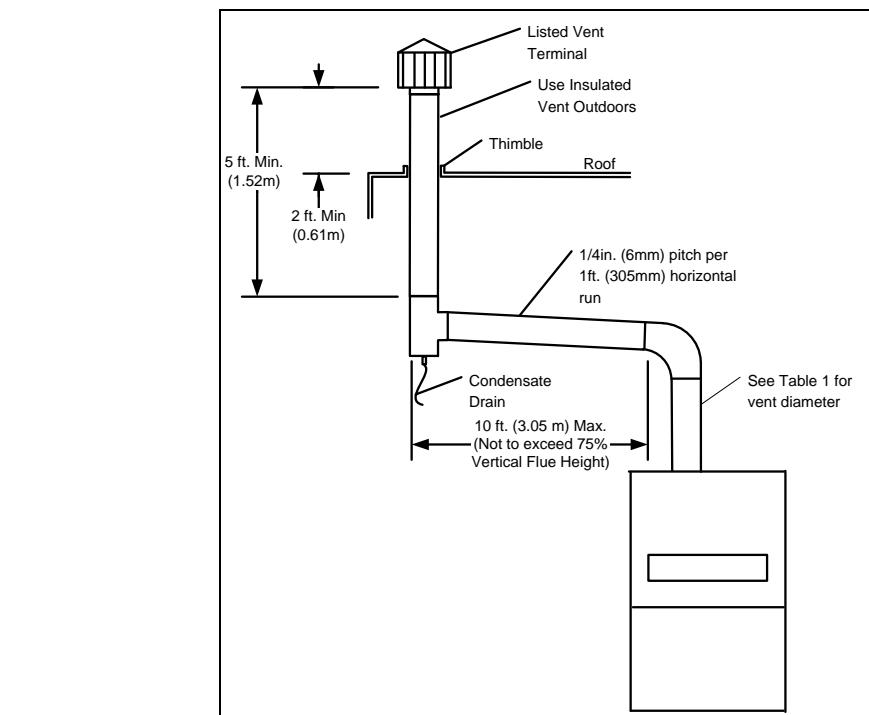
1. Use single wall or double wall (Type B) vent pipe of diameters listed in Table 1.

Table 1-Vent Sizing

<u>Models</u>	<u>Input Rating (Btuh)</u>	<u>Input Rating (W)</u>	<u>Vent Pipe Dia.</u>
HM(D,G) 050-175; HHG050-160	50,000 – 175,000	14653 – 51287	5 in. (126 mm)
HMG200-400, HMD200; HHG200-360	200,000 – 400,000	58614 – 117228	6 in. (152 mm)
HM(A,B)150-400; HHA150-400	150,000 – 400,000	43960 – 117228	6 in. (152 mm)
HM(A,B)450-600; HHA500; HHG440	440,000 – 600,000	131881 – 175842	7 in. (178mm)

2. Maximize the height of the vertical run of vent pipe. A minimum of **five (5) feet** (1.5m) of vertical pipe is required. The top of the vent pipe must extend at least **two (2) feet** (0.61m) above the highest point on the roof. (Use Listed Type B vent for external runs).
3. An approved weatherproof vent cap must be installed to the vent termination.
4. Horizontal runs should be pitched upward **¼” per foot** (21mm/m) and should be supported at **3 foot** (1m) maximum intervals.
5. Design vent pipe runs to minimize the use of elbows. Each 90o elbow is equivalent to **5 feet** (1.5m) to **7 feet** (2.13m) of straight vent pipe run depending on pipe diameter.
6. Vent pipe should not be run through unheated spaces. If such runs cannot be avoided, insulate vent pipe to prevent condensation inside vent pipe. Insulation should be a minimum of **½”** (12.7mm) thick, foil faced material suitable for temperatures up to 500 oF.
7. Dampers must not be used in vent piping runs. Spillage of flue gases into the occupied space could result.
8. Vent connectors serving Category 1 heaters must not be connected into any portion of a mechanical draft system operating under positive pressure.

Figure 6 – Indoor Vertical Venting



Horizontally Vented Duct Furnaces -Category III

Vent pressures in horizontally vented furnaces are positive and therefore are classified as **Category III** venting systems in accordance with ANSI standards. **Use only Category III vent materials listed to UL1738 / ULC S636 for vent pipe and fittings.**

All field installed vent pipe and fittings must be from the same manufacturer. DO NOT intermix vent system parts from different vent manufacturers. Follow instruction provided with approved venting materials used.

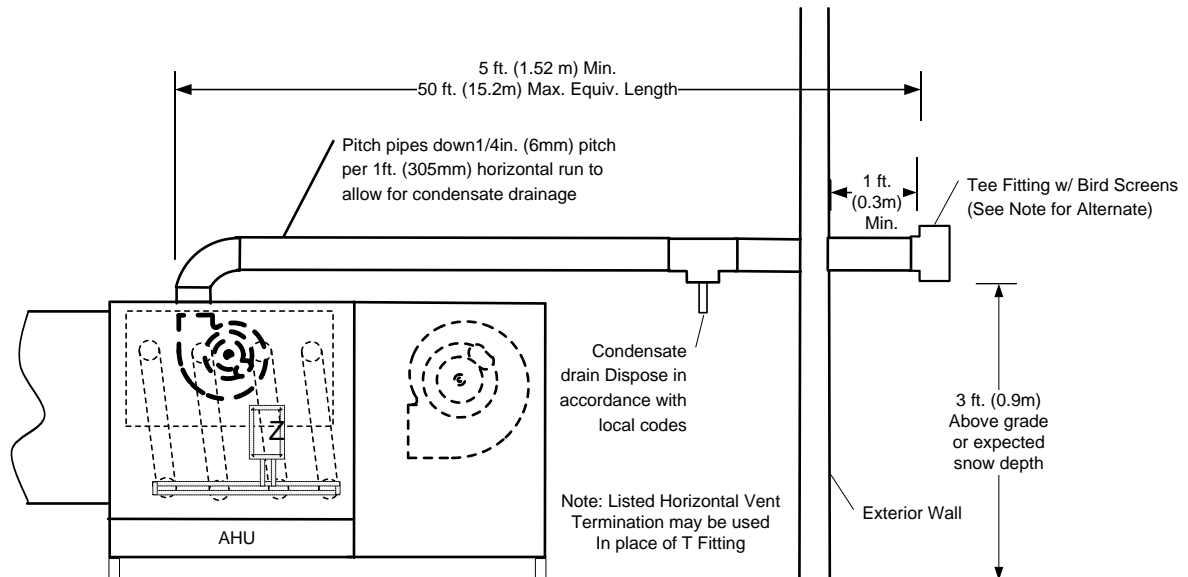
All vent pipe joints must be sealed to prevent leakage into the heated space. Follow instruction provided with approved venting materials used. See Table 1 for proper sizing of vent pipe diameter.

The total equivalent length of vent pipe must not exceed **50 ft. (15.25m)**. Equivalent length of 5 or 6 inch 90o elbows is 5 ft. (1.5 m), and for a 7 inch 90o elbow is 7 feet (2.13 m). 45o Elbows are half of the equivalent length of 90o.

The vent system must also be installed to prevent collection of condensate. Pitch horizontal pipe runs downward **¼ in. per foot (21mm per meter)** toward the outlet to permit condensate drainage. Insulate vent pipe exposed to cold air or routed through unheated areas. Insulate vent pipe runs longer than **10 ft. (3m)**. Insulation should be a minimum of **½ in. (12mm)** thick foil faced material suitable for temperatures up to 500 oF. Maintain **6in. (152mm)** clearance between vent pipe and combustible materials.

A Tee Fitting termination or Vent Cap listed for horizontal venting must be provided. Vent cap inlet diameter must be same as the required vent pipe diameter. The vent terminal must be at least **12 in. (305mm)** from the exterior wall that it passes through to prevent degradation of building material by flue gases. The vent terminal must be located at least **3 ft. (1m)** above grade, or in snow areas, above snow line to prevent blockage. Additionally, the vent terminal must be installed with a minimum horizontal clearance of **4 ft. (1.2m)** from electric meters, gas meters, regulators or relief equipment.

Figure 7 – Indoor Horizontal Venting



EACH FURNACE MODULE MUST HAVE ITS OWN INDIVIDUAL VENT PIPE AND TERMINAL. Do not connect vent system from horizontally vented units to other vent systems or a chimney.

Through the wall vents shall not terminate over public walkways, or over an area where condensate or vapor could create a nuisance or hazard.

Separated Combustion Systems

HM and HH duct furnace modules may be applied to systems for operation in separated combustion systems. The module must be mounted with the burner section in a reasonably airtight vestibule compartment, as these systems provide combustion air from outside the heated space and vent the products of combustion outdoors. Additionally the heating unit must include the following:

- 1.) An observation window to permit observation of ignition and main burner flame during operation and servicing.
- 2.) Openings into the vestibule for attachment of inlet air supply pipe and vent pipe, sized for the Btuh (W) input rating.
- 3.) Approved vent terminals on both the supply air inlet and flue gas exhaust. **NOTE: The inlet and outlet terminals must be located in the same pressure zone to provide for safe appliance operation.**
- 4.) Instructions covering installation and operation for the separated combustion system must be included in the equipment manufacturer's Installation and Operation Manual.

Proper installation of air inlet and flue gas exhaust piping are essential to proper operation of the heat module. Inlet air pipe must be same size as vent pipe based on input ratings. See Figures 8 and 9 for recommended installation.

Separated combustion systems may not be common vented. Each heater must have its own individual air supply and flue gas exhaust vent

Figure 8 – Vertical Venting

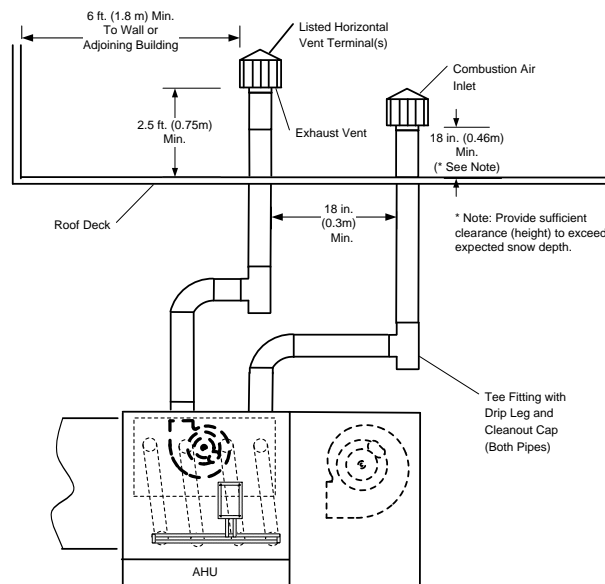
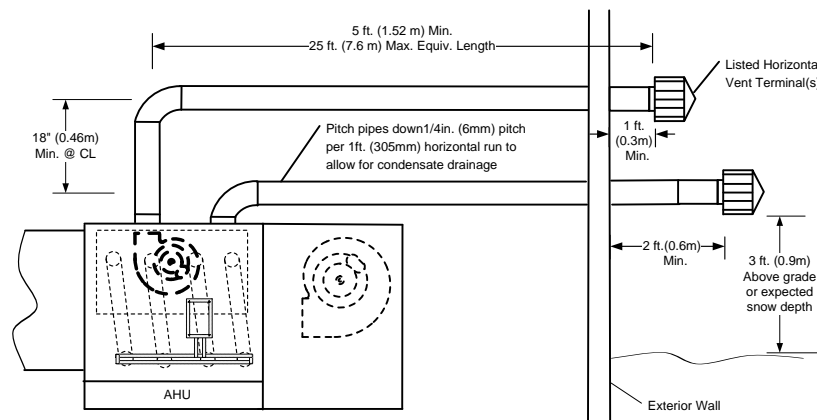


Figure 9 – Horizontal Venting- Separated Combustion



Be sure that the vent cap used for horizontal venting applications is approved for horizontal application.

For multiple heater installations provide independent air supply and vent to each heating unit

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.

Operating & Safety Instructions

Wiring diagram and Sequence of Operation are included in this information package for the specific control system provided on the heater module. Refer to these documents before attempting to place heater in service.

1. This furnace module does not have a pilot. 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 heater gas valve. Smell around the unit area for gas. DO NOT attempt to place heater in operation until source of gas leak is identified and corrected.
3. Use only hand force to push and turn the gas control knob to the "ON" position. NEVER use tools. If knob does not operate by hand, replace gas valve prior to starting the unit. Forcing or attempting to repair the gas valve may result in fire or explosion.

Start-up

1. Turn thermostat or temperature controller to its lowest setting
2. Turn off gas supply at the manual shut-off valve
3. Turn off power to the unit at the disconnect switch.
4. Remove access panel or open door to unit vestibule housing the gas heater.
5. Move gas control knob to "Off" position.
6. Install a tapped fitting for attachment to a manometer, or other gauge suitable for 14.0" w.c., in the inlet pressure tap, and for 10.0" w.c., in the manifold pressure tap.
7. Wait 5 minutes for any gas to clear out. If you smell gas, see Step 2 above and correct leak. If you don't smell gas or have corrected any leaks, go to the next step.
8. Turn gas control knob to "On" position
9. Open all manual gas valves
10. Turn power on at disconnect switch
11. Set thermostat or controller to its highest position to initiate call for heat and maintain operation of unit.*
12. Draft inducer will run for a 15 to 30 second pre-purge period (See Sequence of Operation provided)
13. At the end of the pre-purge the direct spark will be energized and gas valve will open
14. Burners ignite.

Failure to Ignite

1. On the initial start-up, or after furnace has been off long periods of time, the first ignition trial may be unsuccessful due to need to purge air from manifold at start-up.
2. If ignition does not occur on the first trial, the gas and spark are shut-off by the ignition control and the control enters an inter-purge period of 15 seconds, during which the draft inducer continues to run.
3. At the end of the inter-purge period, another trial for ignition will be initiated.
4. Control will initiate up to three ignition trials on a call for heat before lockout of control occurs.
5. Control can be brought out of lockout by turning thermostat or controller to its lowest position and waiting 5 seconds and then turning back up to call for heat. Controls provided will automatically reset after one hour and initiate a call for heat.

Manifold Pressure Adjustment

A pressure tap is provided in each furnace module manifold for measuring the gas manifold pressure. Manifold pressure must be checked at start-up and during any service or maintenance. All control systems require a **manifold pressure of 3.40 to 3.50 in. w.c. at maximum input on Natural Gas**, and 10.0 in. w.c. on Propane Gas at rated input. See **Fig. 10** for Gas Valve adjustment locations.

For two stage and modulating control applications, verify proper low fire adjustments as outlined in the "Sequence of Operation" sheet provided in the instruction package.

Figure 10A – Honeywell VR8305Q Gas Valve

2nd Stage (Hi Fire) Manifold Pressure Adjustment (3/32" Allen Key)

1st Stage (Lo Fire) Manifold Pressure Adjustment

Electrical Connection Block

1/8" NPT Inlet Pressure Tap

Manual Shut-off Control Knob

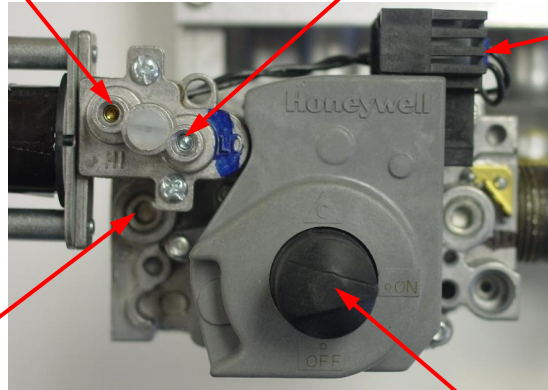


Figure 10B – White Rodgers 36H Gas Valve

1/8" NPT Inlet Pressure Tap

Manual Shut-off

Electrical Connection Block

Manifold Pressure Adjustment Remove Brass cap and adjust with plastic screw

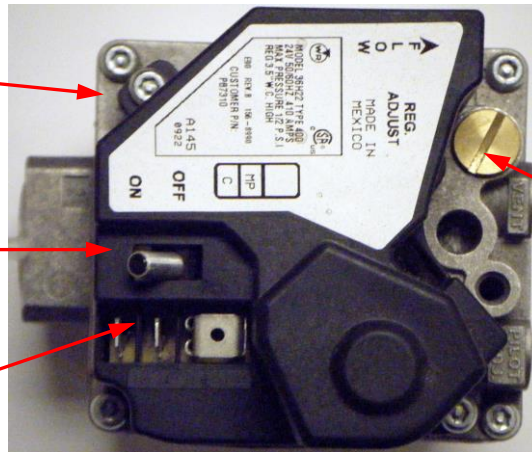
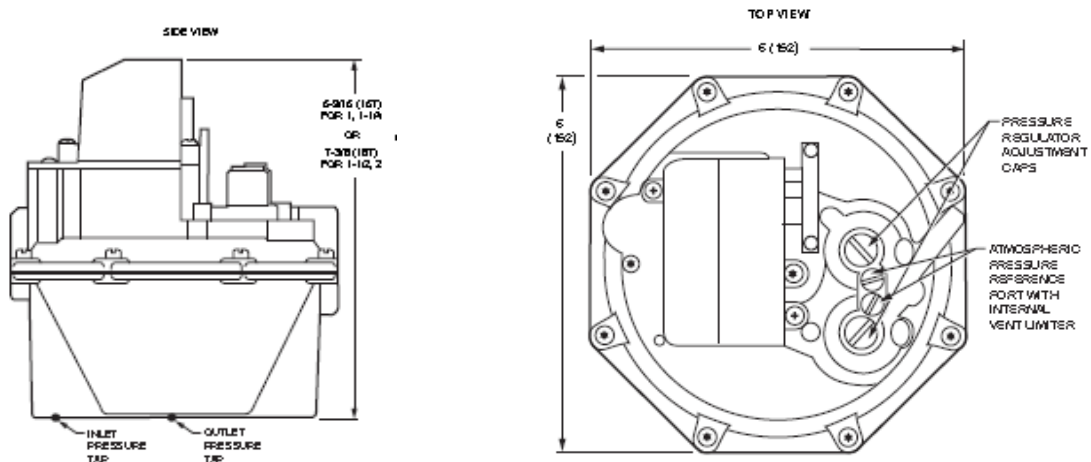


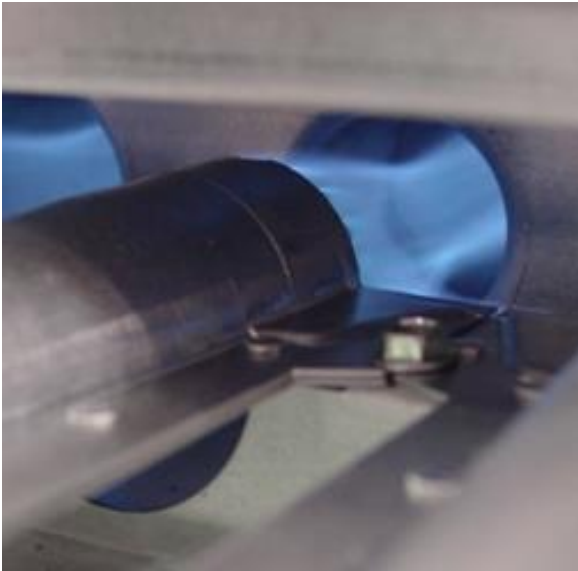
Figure 10C – Honeywell V8944 Gas Valve



Burner Flames

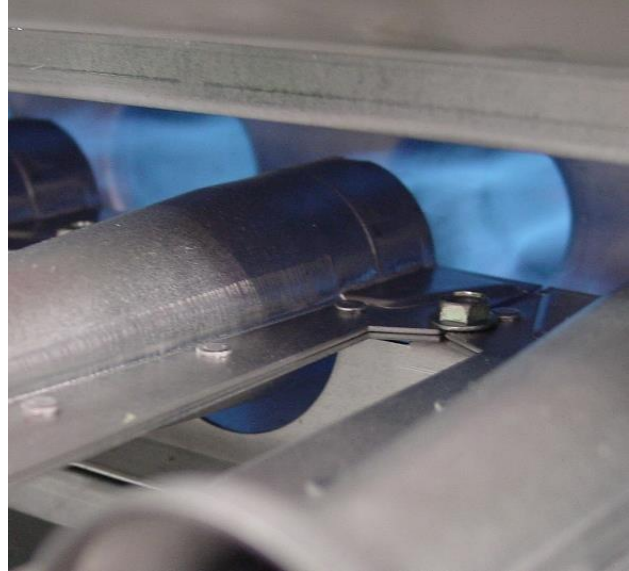
Prior to completing the start-up, check the appearance of the main burner flame. See Figures below for flame characteristics of properly adjusted Natural gas systems.

Figure 11A



Burner Flame @ Start-up 1.2" w.c. Manifold
Pressure Draft Inducer – High Speed

Figure 11B



Burner Flame @ High Fire 3.5" w.c. Manifold
Pressure Draft Inducer – High Speed

1. The burner flame should be predominately blue in color and well defined and centered at the tube entry as shown in Figures above. Distorted flame or yellow tipping of natural gas flame, or a long yellow flame on propane, may be caused by lint and dirt accumulation inside burner or at burner ports, at air inlet between burner and manifold pipe, or debris in the main burner orifice. Soft brush or vacuum clean affected areas.
2. Poorly defined, substantially yellow flames, or flames that appear lazy, indicate poor air supply to burners or excessive burner input. Verify gas supply type and manifold pressure with rating plate.
3. Poor air supply can be caused by obstructions or blockage in heat exchanger tubes or vent discharge pipe. Inspect and clean as necessary by to eliminate blockage. Vacuum any dirt or loose debris. Clean heat exchanger tubes with stiff brush. Poor flame characteristics can also be caused by undersized combustion air openings or flue gas recirculation into combustion air supply. Increase air opening size or re-direct flue products to prevent re-circulation.
4. Reduced air delivery can also be the result of fan blade slippage, dirt accumulation the fan blade or low voltage to draft inducer motor. Inspect draft fan assembly and be sure fan blade is secure to motor shaft. Check line voltage to heater.

Shutdown

1. Set thermostat or controller to lowest setting.
2. Turn off electrical supply to unit at disconnect switch.
3. Turn off manual gas supply.
4. Disconnect manifold and inlet pressure taps and re-install pipe plugs
5. Replace vestibule access panel or close door.

Normal Operation

1. Turn on electrical supply to unit at disconnect switch
2. Turn on manual gas supply
3. Set Thermostat or Temperature controller to desired temperature.
4. Information outlining the normal Sequence of Operation and Wiring Diagram for the control system supplied with the furnace model is enclosed with this instruction.

Operating & Safety Controls

Combustion Air Pressure Switch

An air pressure switch is provided as part of the control system to verify airflow through induced draft fan (ID fan) by monitoring the difference in pressure between the ID Fan and the atmosphere. If sufficient negative pressure is not present, indicating lack of proper air movement through heat exchanger, the switch opens shutting off gas supply through the ignition control module. On units with two speed draft inducer operation, a dual air pressure switch is used, monitoring high and low speed pressures. The air pressure switches have fixed settings and are not adjustable.

Rollout Switch (Manual Reset)

The duct furnace is equipped with manual reset rollout switch(es) in the event of burner flame rollout. The switch will open on temperature rise and shut-off gas supply through the ignition control module. Flame rollout can be caused by insufficient airflow for the burner firing rate (high gas pressure), blockage of the vent system or in the heat exchanger. The duct furnace should not be placed back in operation until the cause of rollout condition is identified. The rollout switch can be reset by pressing the button on the top of the switch.

Primary High Limit Switch

To prevent operation of the duct furnace under low airflow conditions the unit is equipped with a fixed temperature high limit switch mounted on the vestibule panel. This switch will shut off gas to the heater through the ignition control module before the air temperature reaches 250 °F. Reduced airflow may be caused by restrictions upstream or downstream of the circulating air blower, such as dirty or blocked filters or restriction of the air inlet or outlet to the unit. The high limit switch will shut-off the gas when the temperature reaches its set point and then automatically reset when the temperature drops to 30°F below the set point, initiating a furnace ignition. The furnace will continue to cycle on limit until the cause of the reduced air flow is corrected.

Ignition Control Module

Ignition control modules are available having a number of different operating functions. Refer to Sequence of Operation and Control Diagnostic data sheets provided in the instruction package for a detailed description of the control features, operation and troubleshooting for the model control installed.

Maintenance

Duct Furnace Inspection

Turn off all electrical power to the unit before inspection and servicing.

1. The duct furnace should be inspected annually by a qualified service agency. The condition of the burners, heat exchanger, draft inducer, vent system, operating controls and wiring should be determined. Check for obvious signs of deterioration, accumulation of dirt and debris and any heat or water related damage. Any damaged or deteriorated parts should be replaced before the unit is put back into service.
2. Clean burners, heat exchanger, induced draft fan and vent ducts as outlined on Page 12.
3. Check Heat Exchanger for cracks. If any are present, replace heat exchanger before putting unit back into service.
4. Check the attachment point of the duct furnace to the cabinet to verify that they are air tight.
5. Check the automatic gas valve to insure that the gas valve seat is not leaking
6. Check wiring connections to be sure they are secure and inspect wiring for any deterioration.
7. Label all wires prior to disconnection when servicing unit. Wiring errors can cause improper or dangerous operation. Verify proper operation after servicing.

CAUTION !

If any of the original wiring needs to be replaced it must be replaced with wiring materials suitable for 105°C.

Duct Furnace Operation Check

1. Turn on power to the unit and set thermostat or heat controller to call for heat, allowing duct furnace to operate.
2. Check for proper start-up and ignition as outlined in Start-up on Page 10.
3. Check the appearance of the burner flame (See Figure 11A and 11B on Page 12).
4. Be sure circulating air fan is operating and verify proper airflow through duct furnace
5. Return thermostat or heat controller to normal setting.



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