



**Application Guide**  
**HVAC Equipment Design**  
**With HM / HD Series Duct Furnaces**



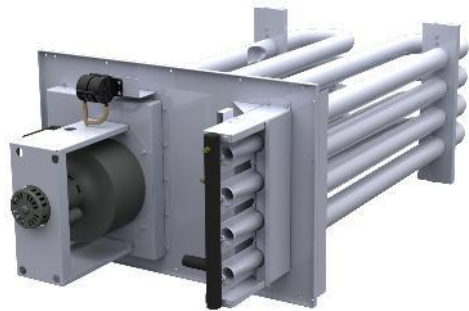
**ANSI Z83.8 (2009) - CSA 2.6M (2009) – Gas-Fired Duct Furnace**

# Indirect-fired Tubular Duct Furnaces

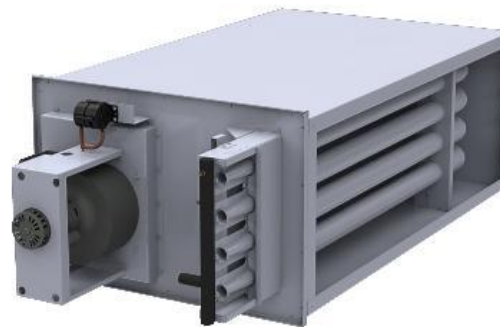
Inputs from 50,000 to 600,000 Btuh

Heat exchanger comprised of tube sheet & individual formed multi-pass tubes

Draft induced system with inshot style gas burners



HM Series A/B/D/G  
Heat Module  
  
ETL Recognized  
Component - ANSI Z83.8

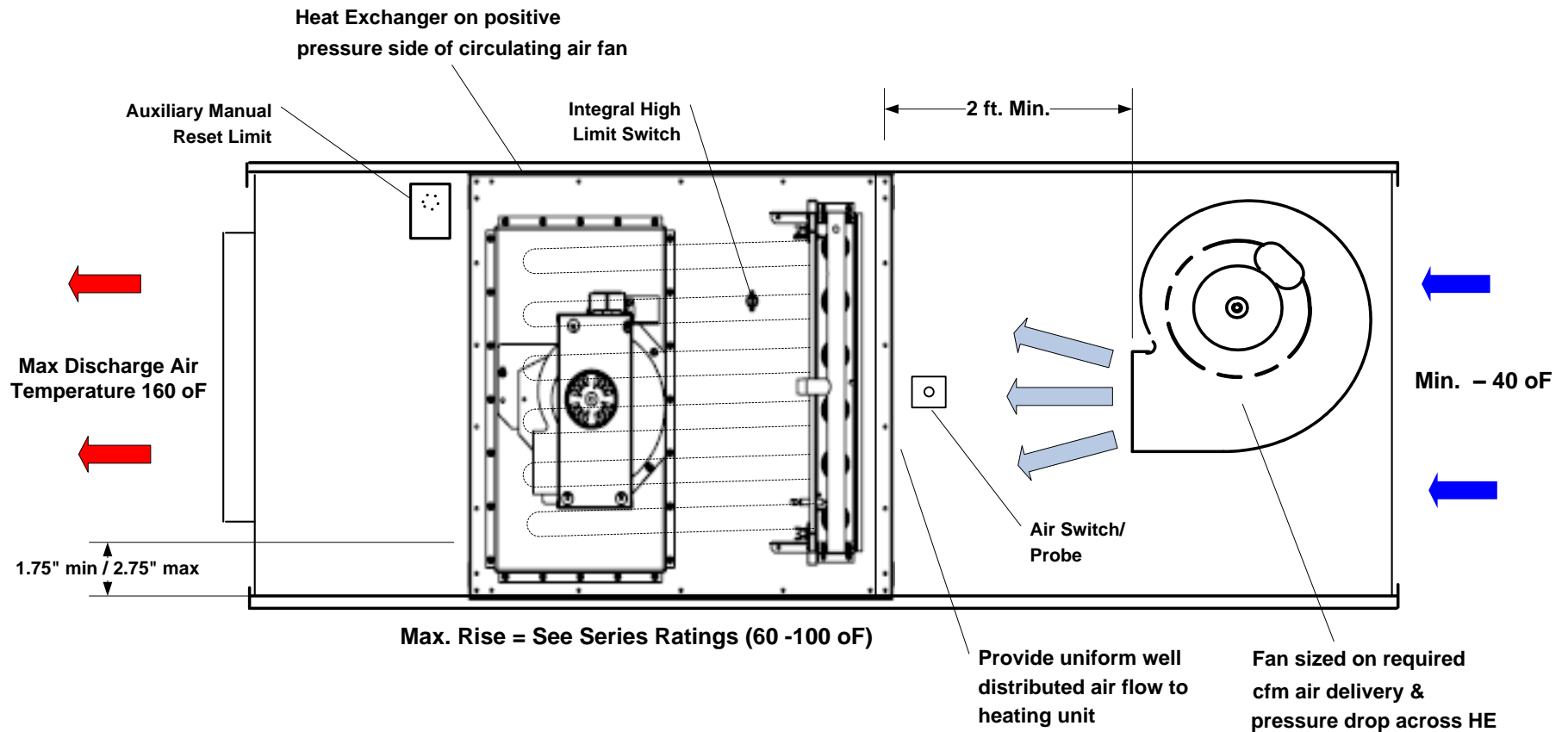


**Style C (OEM Insert)**  
HD Series A/B/D/G  
Duct Furnace with Un-insulated  
Air Side Wrapper  
  
ETL Listed - ANSI Z83.8 - Duct Furnace



**Style N**  
HD Series A/D/G  
Weatherproof Duct Furnace,  
Top Exhaust  
  
ETL Listed - ANSI Z83.8 - Duct Furnace

# Typical HD/HM Make-Up Air Application

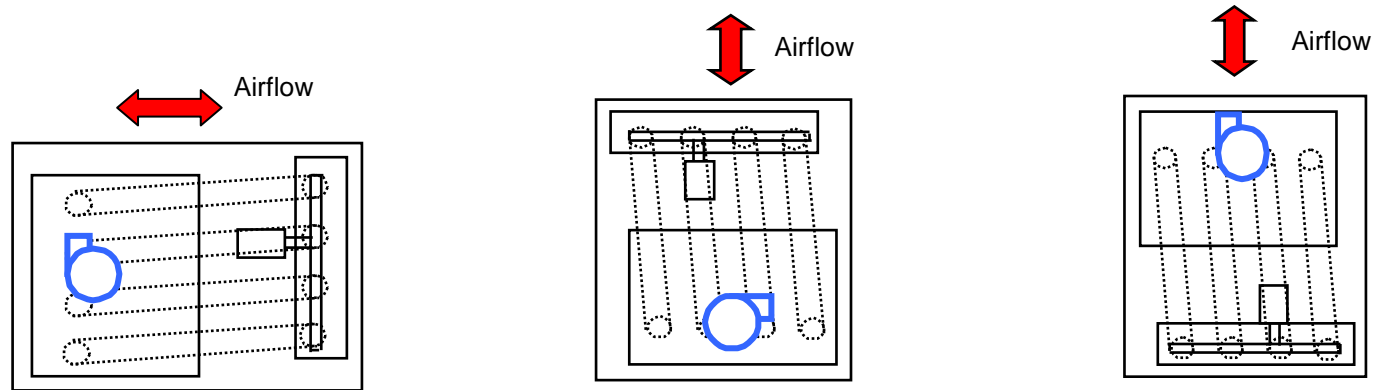


**HM Series heat exchangers typically employ an integral restriction form (dimple) in the heat exchanger tubes. Marking is provided on the heater indicating the proper mounting orientation**

**Heater configurations are available for any airflow scheme, to provide the proper orientation of the dimple form to allow drainage of condensate.**

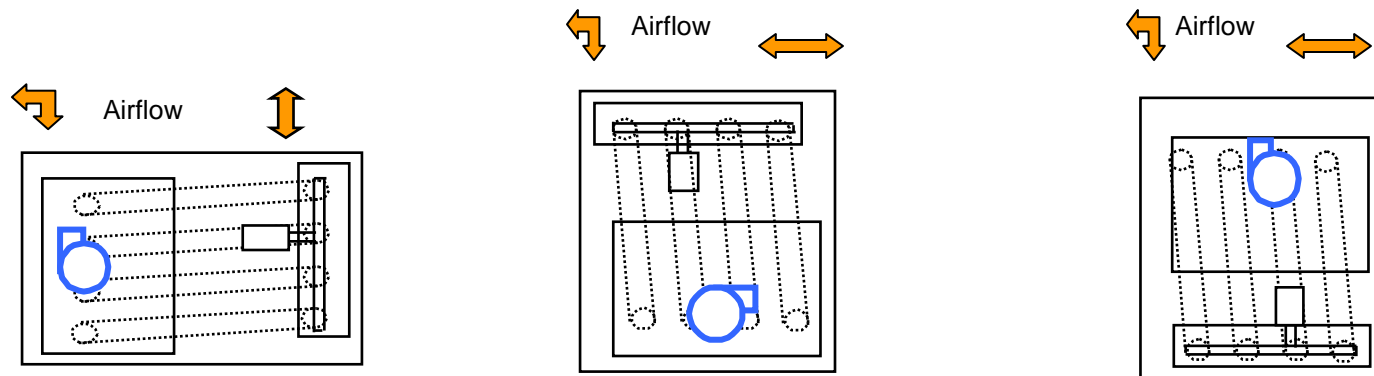
# Airflow Configurations

Airflow direction across heat exchanger affects maximum temperature rise @ 80% efficiency.



Preferred airflow direction provides for highest temperature rise @ rated efficiency

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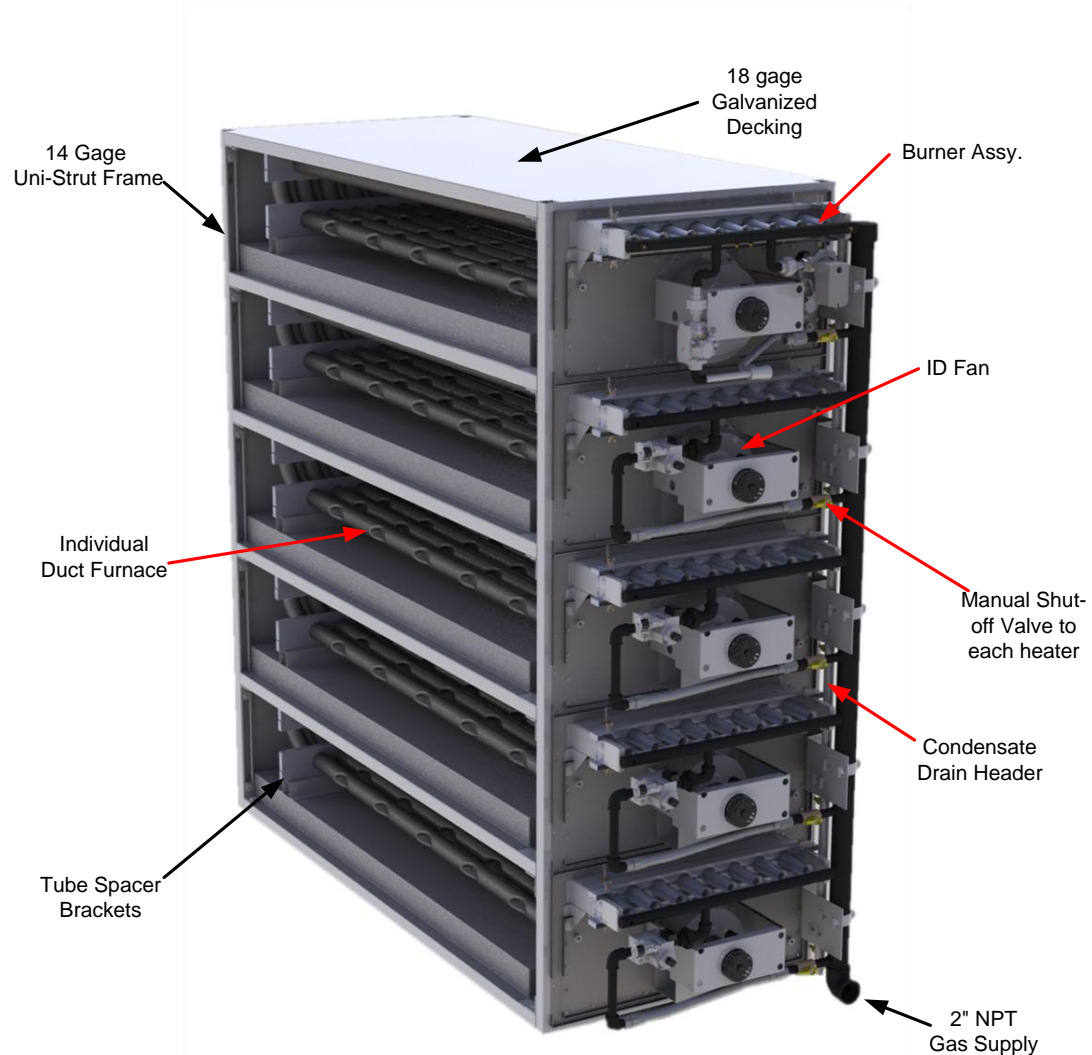


Airflow direction results in reduced maximum temperature rise @ rated efficiency. Maximum rise for these configurations is 60 °F.

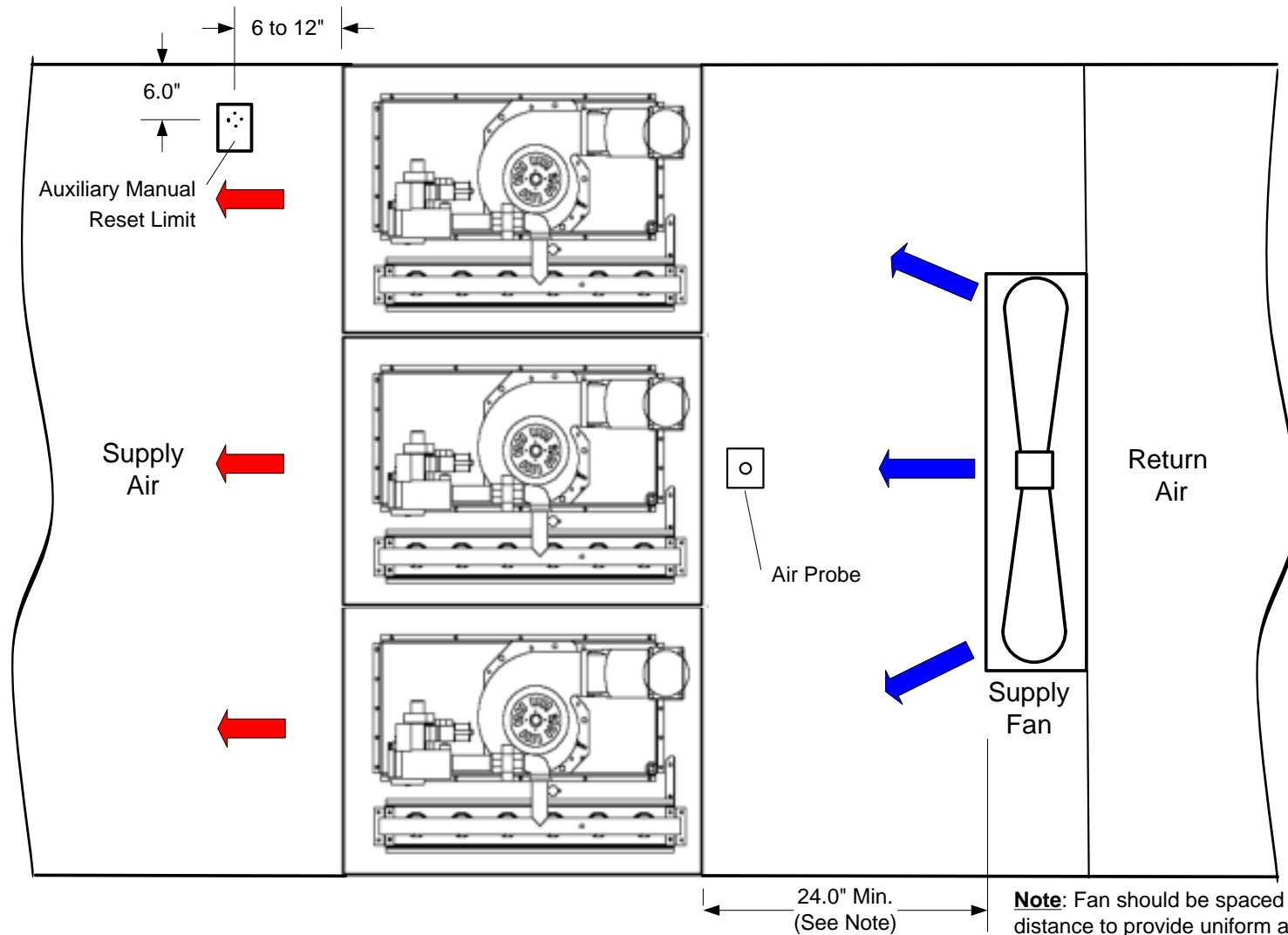
# Modular Rack Assembly

**Inputs from 500,000 to 5,000,000 Btuh**

**The Heatco modular duct furnace rack is an engineered, packaged assembly of multiple duct furnaces for application to high volume airflow systems.**



# HD Series Rack Assembly Application



**Note:** Fan should be spaced sufficient distance to provide uniform air flow over heat exchangers. If spacing is not available, provide air vanes or baffling to evenly distribute airflow.

## **Cabinet Design & Airflow**

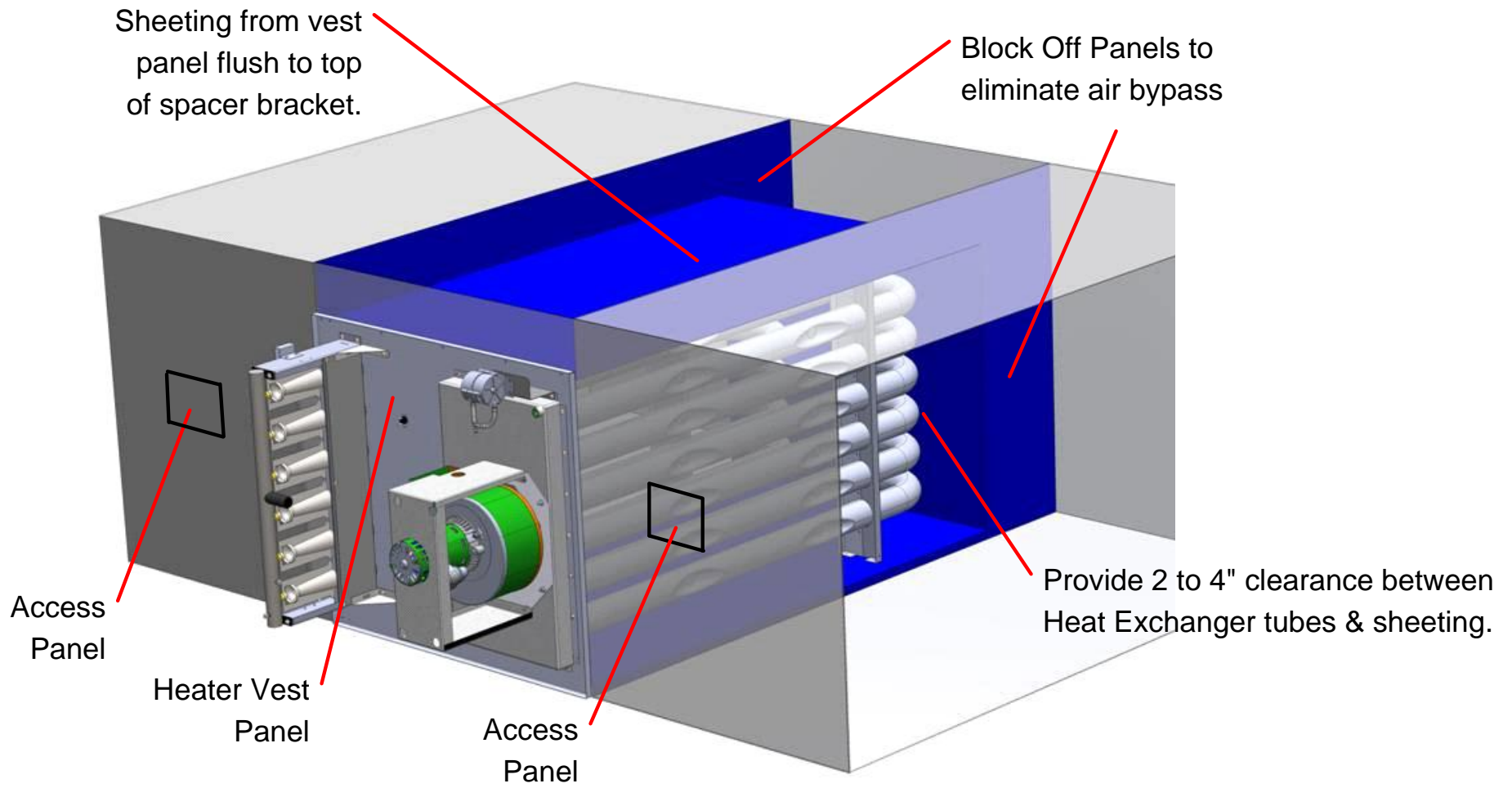
Duct furnace **MUST BE INSTALLED IN A NON-COMBUSTIBLE duct on the positive pressure side of the circulating air fan or blower.**

Duct furnace can be installed in products for Indoor or Outdoor Installation and downstream from refrigeration or cooling systems.

Poor Air distribution results in reduced performance and shortened heat exchanger life.

Heat exchanger must be properly sheeted to direct airflow over tubes and eliminate by-pass air for optimum performance.

If air tunnel opening is larger than heater profile, provide panels to block by-pass air and direct all airflow over heat exchanger.



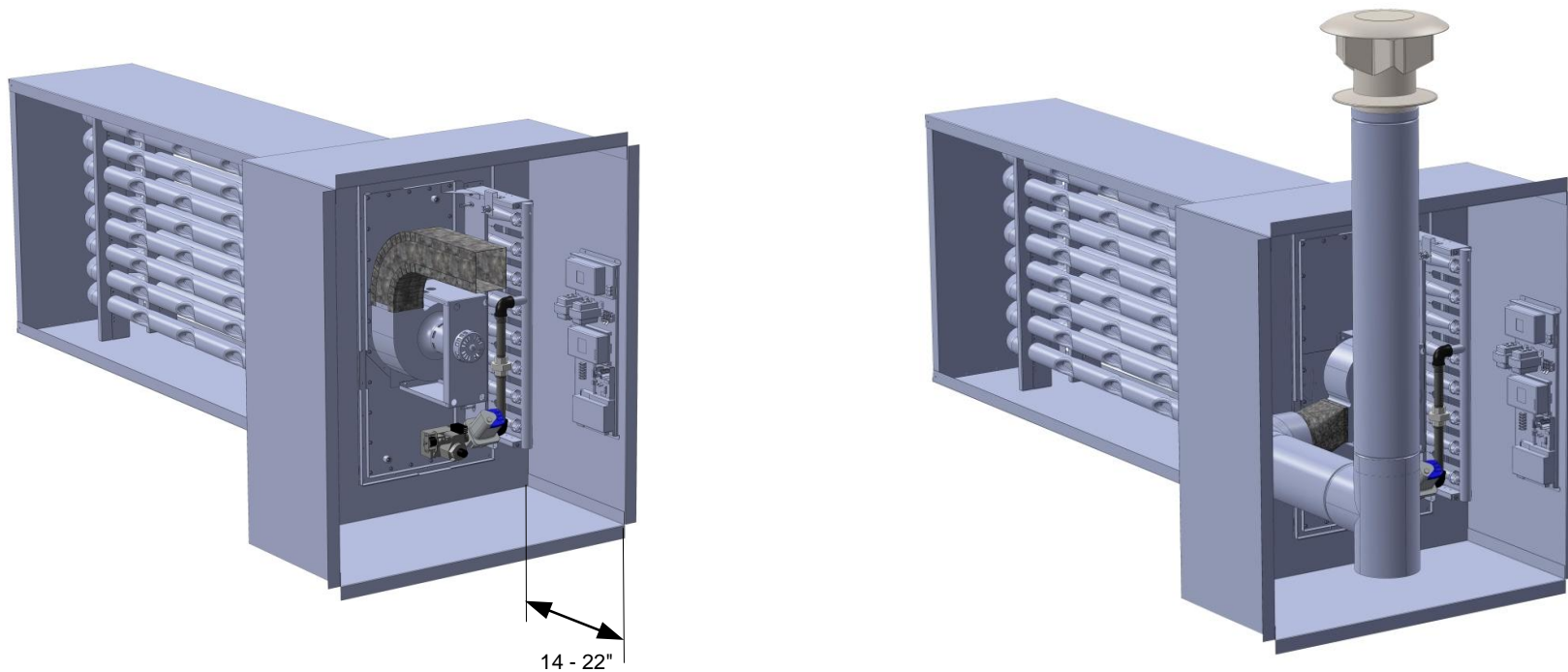
Provide removable access panels in cabinet immediately upstream. and downstream of duct furnace to allow for inspection of the heat exchanger



## Vestibule / Enclosure

Provide an enclosed vestibule area to house and protect gas controls, burner assemblies, induced draft fans and electrical controls.

Depending on furnace model and control system, the vestibule depth required will be 14 to 22 inches.



Access panels or doors to the vestibule area should be sized and located to provide easy access for adjustment, servicing and maintenance of gas and electrical controls.

Electrical control panels for HM and HD Series furnaces are shipped loose for customer mounting and connection.

Install control panel on non-heated surface and in an area with good ventilation air flow, away from heat sources and especially vent piping.

Do not mount electrical control panels where water may accumulate, especially on the vestibule base.



## **Combustion Air Supply**

**Provisions must be included to provide an ample supply of air to the vestibule area to provide ventilation and a supply of combustion air for the gas burners.**

Combustion process requires approximately 15 cu. ft. of air for every cu. ft. of gas burned

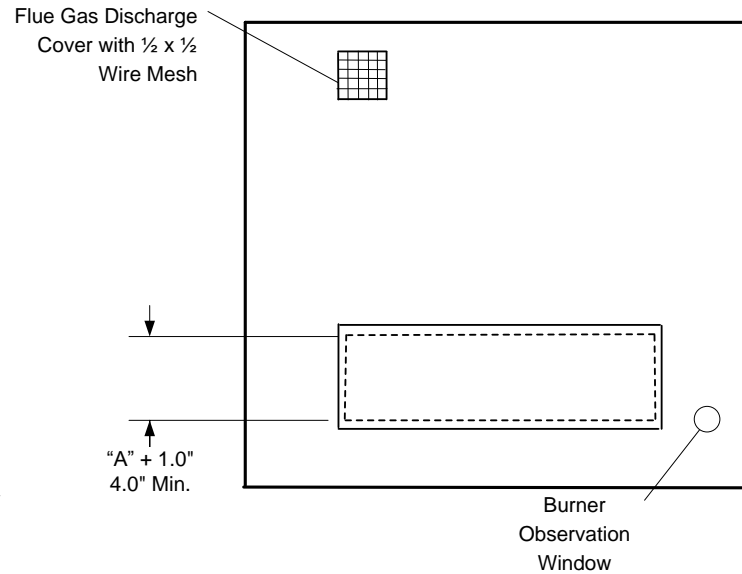
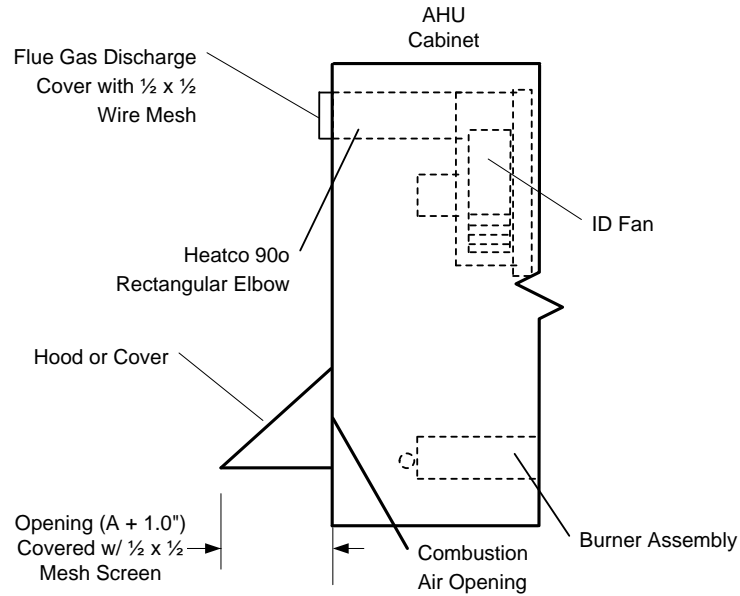
**Openings for combustion air must be provided in a panel or door (except separated combustion systems) with direct access to the vestibule area where the burners and draft inducer are located.**

Provide Combustion air openings in the cabinet sized to provide one (1) square inch of free area per every 4000 Btuh of heater maximum input rating.

Louvered openings may restrict free area up to 50%. If louvers are employed be sure the overall opening size is sufficient.

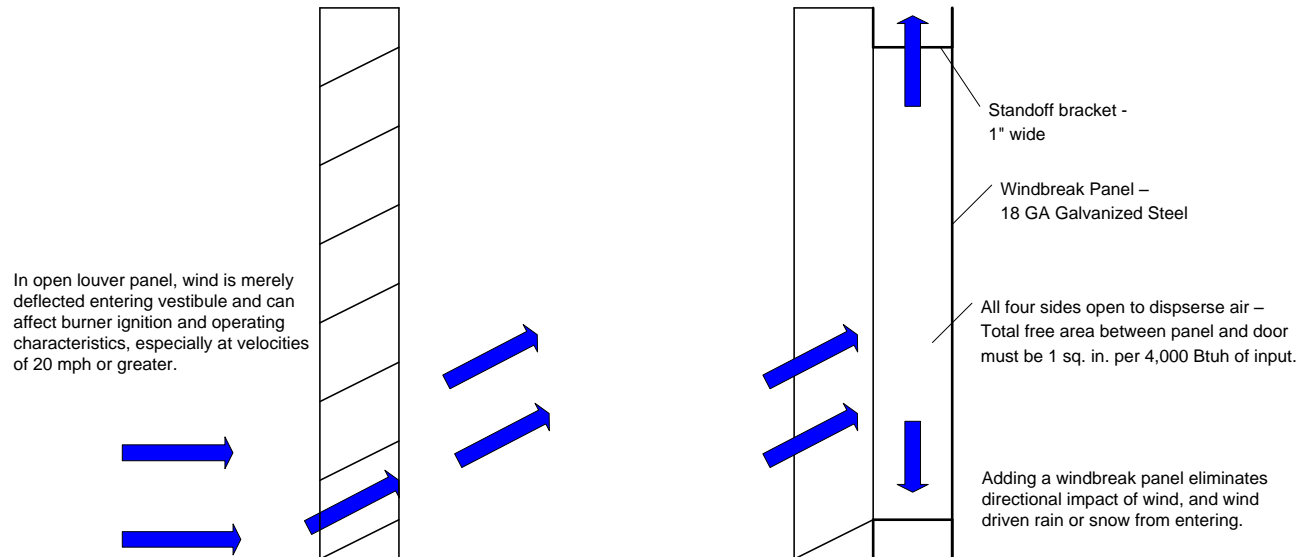
Locate combustion air openings to minimize the possibility of flue gas recirculation into combustion air supply.

# Combustion Air Hood / Rectangular Opening



# Louvered Combustion Air Openings

1.50 to 2.50" Spacing as required for free area



## Venting

**All duct furnaces must be connected to a venting system to convey flue gases outside of the heating unit and the heated space and away from combustion air inlet.**

The air handling unit manufacturer must provide a vent duct to exhaust flue gases outside of the unit.

This duct must be at least the same size (or cross-section) as the induced draft fan (ID Fan) outlet, however rectangular ducts **should not exceed 2 feet in length.**

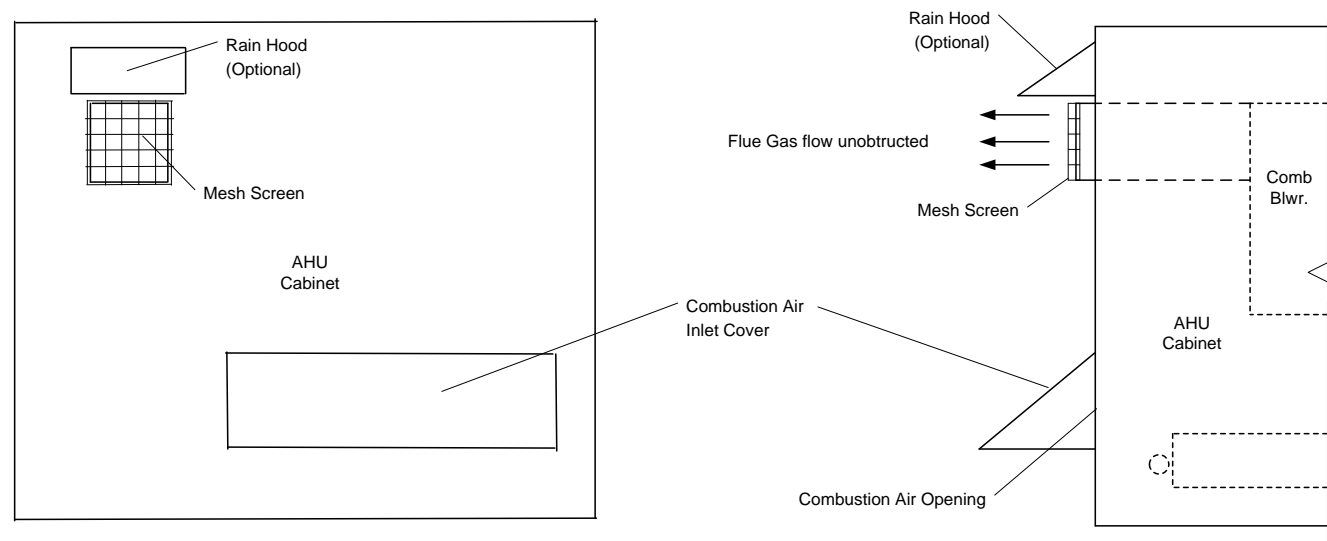
**Avoid sharp 90o bends or abrupt changes in direction** of the flue gas discharge at the ID Fan outlet. Use Heatco 90o rectangular elbow or rectangular to round fitting to transition from ID Fan outlet to vent pipe.

Minimize joints and length of vent duct in vestibule or cabinet to minimize heat build-up or possibility of flue gas leakage in vestibule.

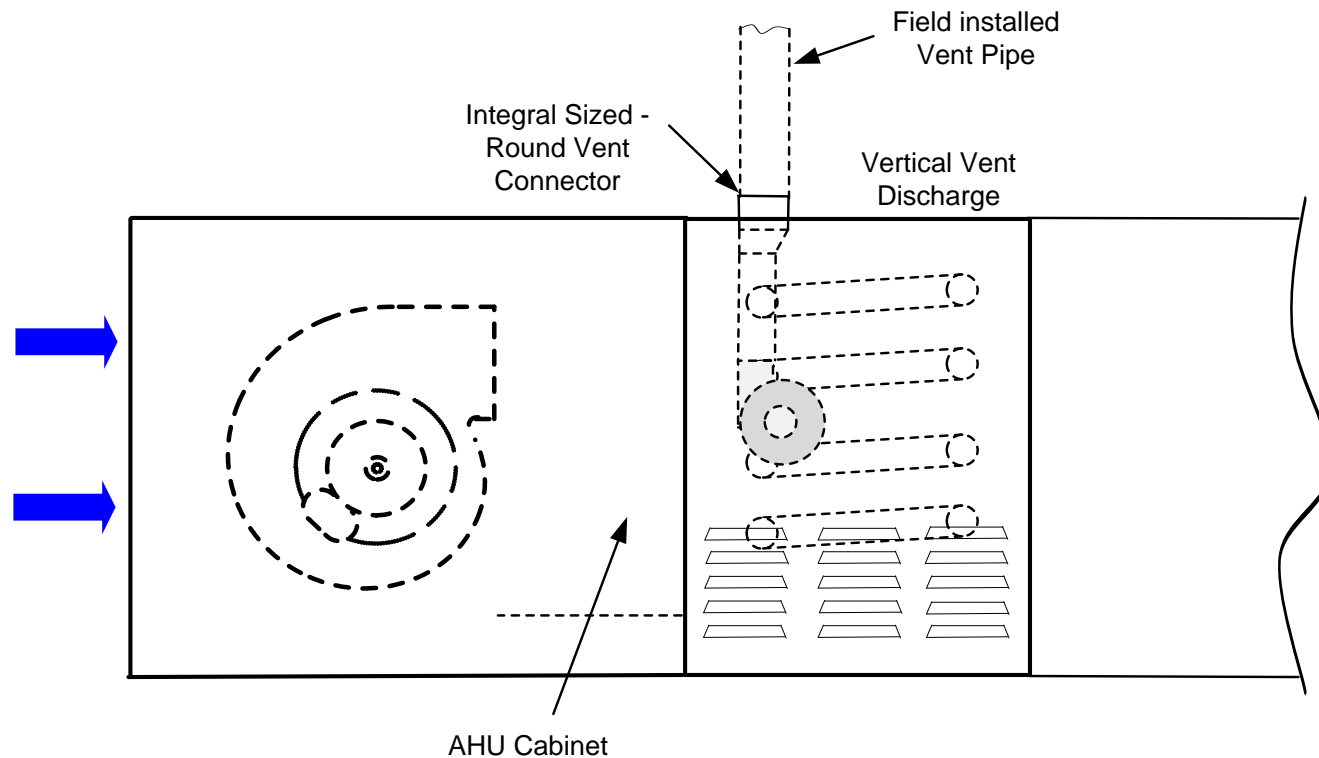
All joints in the vent connectors inside the vestibule must be sealed to prevent leakage of flue gases in the vestibule area and into the combustion air supplied to the burners.

Vent duct runs in vestibule or cabinet must be insulated. Be sure to provide sufficient clearance between vent duct and any heater operating controls. Type B vent pipe may be used in the vestibule area and does not need additional insulation.

For outdoor heating units, Vent discharge must be in the same pressure zone as the combustion air inlet opening to minimize affect of wind on combustion system



**For Indoor Category I or III installations, unit manufacturer must provide a point of connection for installation of vent pipe to the outdoors. This connection should be suitable for connection to round vent pipe.**



For indoor applications where rectangular fittings or ducts are used to exit cabinet, transition to round vent pipe immediately after exiting cabinet.

Round vent pipe must be sized in accordance with Table based on the input rating of the duct furnace (air heater).

### **Table – Round Vent Pipe Sizing**

<b><u>Input Rating (Btuh)</u></b>	<b><u>Input Rating (W)</u></b>	<b><u>Vent Pipe Dia.</u></b>
75,000 – 149,999	21,980 – 43,958	5 in. (126 mm)
150,000 – 400,000	43,960 – 117,228	6 in. (152 mm)
401,000 – 600,000	117,229 – 175,842	7 in. (178mm)



## **Fan Location & Circulating Airflow**

**Locate circulating air fan to provide uniform, well distributed air flow over the heat exchanger.**

**Circulating air fan should be located at least 24” from the heating section.**

The use of a diffuser or directional baffles may be necessary to provide well distributed air flow over the heat exchanger.

**Filters and filter racks should be located at least 36” from heating section.**

To insure proper fan sizing, determine pressure drop through gas heat section, based on design temperature rise and required airflow.

**A Circulating Airflow Proving Switch** should be provided as part of the installation to insure proper airflow over the heat exchanger. This switch prevents operations of burners if airflow is below minimum threshold.

## **Heater Condensation**

Indirect fired gas heaters will generate some condensate during modulating burner operation or when operated with a high percentage of outside air due to reduced flue gas temperature or colder heat exchanger surface temperatures.

**Flue gas condensate is corrosive, and operating heater in a continuous condensing mode, or accumulation of condensate, can lead to premature heat exchanger failure.**

For heaters located downstream of the cooling system, condensation in heat exchanger is likely during cooling operation. Even though this condensate is typically benign, damage can result from accumulation.

Therefore, steps must be taken to manage the disposal of condensate.

**A 1/4" NPT condensate drain connection** is provided in the flue box for furnaces with vertical or horizontal top mounted burner tray.

## **Condensate Disposal**

**Condensate drain lines must be connected if heating unit is equipped with modulating controls or if it is located downstream of cooling section.**

Condensate drain lines should be corrosion resistant. If Metal tubing is used, it must have corrosion resistance at least equal to that of 304 SS. Copper tubing is not suitable for flue gas condensate.

For furnaces with bottom mounted horizontal burner trays, condensate will drain from the open end of the heat exchanger tubes. A condensate collection pan should be installed at the base of the vest panel or cabinet vestibule.

Consult local plumbing codes regarding disposal of flue gas condensate as it will be a slightly acidic.

## Gas Supply and Piping

Installation of piping must conform with ANSI Z223.1 (NFPA 54) 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.

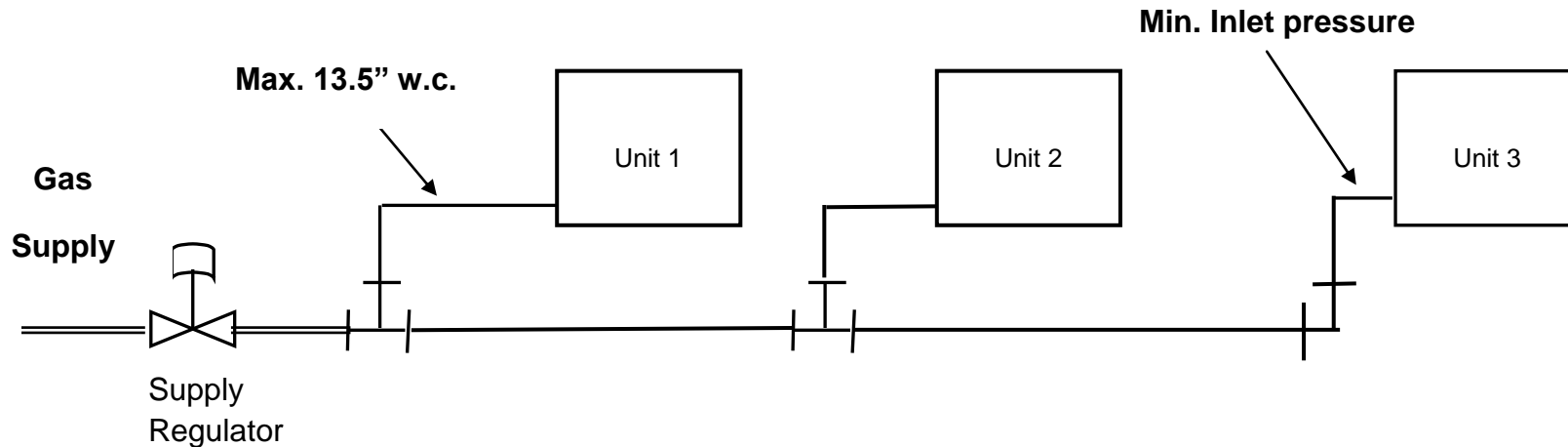
Use a pipe sealant **resistant to LP gases** on **gas** supply connections to heater.

**Properly support gas valve with back-up wrench**, during supply pipe installation to prevent loosening valve or damage to burner assembly or manifold.

Gas piping must be sized for the total Btu input of all units (heaters) serviced by a single supply.

The individual heat module inlet gas supply pipe connection size is  $\frac{3}{4}$ " 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.

For multiple heater installations, 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.



Individual duct furnace modules require a **minimum** inlet gas pressure as shown below.

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

## **Electrical Supply & Wiring**

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

The furnace 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.

Analog input circuits (0-10 VDC) are polarity sensitive. Reversed polarity results in system operation at minimum input after warm-up period.

Operating electrical controls are mounted to a panel, and for HM and HD OEM units, are shipped in a separate carton. Mounting locations should be selected to prevent exposing the controls to the following:

- Moisture, especially wind driven rain or snow
- Avoid mounting controls on or adjacent to surfaces that may be hot during heater operation – especially vent ducts or piping.

**Unit manufacturer must install and wire an Auxiliary High Limit in addition to previously mentioned circulating airflow proving switch.**

## **Heater Standard Operating and Safety Controls**

- **Primary safety direct spark ignition control with flame supervision and 100% safety shut-off, multiple ignition trials on call for heat, pre-purge and post-purge, auto reset on lockout after one (1) hour and diagnostic LED indicator.**
- **Primary control and gas control circuit is low voltage – 24 VAC. Transformer is mounted on each control panel.**
- **Combination gas control including redundant gas valves, pressure regulation and manual shut-off. Controls are listed to ANSI Standard Z21.85.**
- **Combustion Air pressure switch to monitor combustion air blower operation and blocked vent shut-off.**
- **Manual reset type rollout switch(es).**
- **Automatic reset high limit switch. (Note: Cycles burners on & off)**