



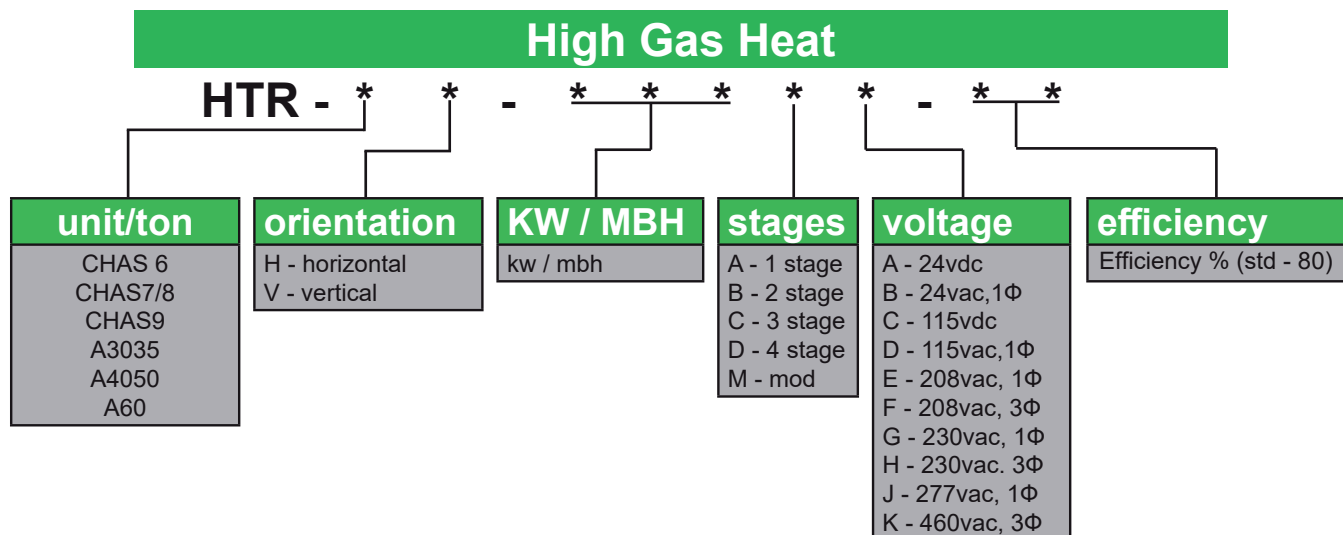
High Heat Box
O/M manual

Table of Contents

PART NUMBERING AND DESCRIPTIONS	3
GENERAL INSTRUCTIONS	4-5
INSTALLATION, OPERATING & SAFETY	6
HEATER CONDENSATE & CONDENSATE DISPOSAL	7-8
AIR-FLOW CONFIGURATION	9
CONTROLLER NAVIGATION	10-11
SETPOINT TABLE	12
APPENDIX A (Heatco. Model Number Identification)	13-14
APPENDIX B (Heatco. Application Guide)	15-33

HIGH HEAT BOX DESCRIPTION

iAIRE's High Heat Box rooftop packages are designed to supply air flow in vertical or horizontal duct configuration, and to fit on pre-installed curbs. They offer total low cost of ownership by providing 80% efficient gas heaters, ranging from 400,000 BTUH to 1,000,000 BTUH input, and a temperature rise up to 100 F, with low installed costs, low maintenance costs, and high reliability.



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.

GENERAL INSTRUCTIONS

An iAIRE's operation is a function of the options and control packages that the iAIRE unit is equipped with.

RECEIVING / INSPECTION

Check part # of iAIRE unit to ensure it is what was ordered. Verify voltage/phases match.

At the time of delivery the iAIRE unit should be visually inspected for possible damage. If any damage is found it should be reported immediately to the last courier company, preferably in writing. iAIRE recommends leaving the iAIRE unit in its shipping packaging until the time of installation.

Standard Operating and Safety Controls When working on iAIRE or other HVAC units observe precautions in the literature, tags and labels attached to the units, and any other safety precautions that may apply.

Follow all local, national and industry electrical codes when installing these units and accessories.

Primary safety control

Direct spark ignition with flame supervision and 100% safety shut-off, multiple ignition trials on call for heat, pre-purge and post-purge and auto reset on lockout after one (1) hour. Diagnostic LED.

Primary control and gas control circuit is low voltage – 24 VAC. Transformer is mounted on each control panel.

Combustion air pressure switch

Monitor induced draft fan operation and blocked vent shut-off.

Manual reset type rollout switch(es)

Shut-off gas in event of flame rollout.

Automatic reset high limit switch

Cycles burners on & off on temperature in low airflow conditions.

Combination gas control

Redundant gas valves, pressure regulation and manual shut-off. Controls are listed to ANSI Standard Z21.85.

ROOFTOP INSTALLATION

Verify the unit is the correct part # and voltage.

Check the HHB weight listed in this packet to determine if building structure reinforcements are required.

See the lifting and rigging section of this packet for instructions on setting the HHB.

RIGGING / LIFTING

Rig and place the HVAC unit per the instructions provided by the HVAC manufacturer (for mated applications only)

Inspect the HHB unit for transportation damage. File any claim with the transportation company.

The HHB unit weight is included in this packet. Check the lifting devices for capacity constraints.

Control Systems

SN - On/Off Operation

Single Stage operation at rated maximum input and single speed induced draft fan. Single stage thermostat or controller located in conditioned space. Heater cycles on and off to maintain space temperature.

TN - Two-Stage Operation

High / Low fire operation with two-stage gas valve and single speed induced draft fan. Two stage thermostat or controller located in conditioned space. Heater operates at 100% or 55% of maximum input depending on thermostat position.

TS - Two-stage Operation

High / Low fire operation with two speed induced draft fan control. Programmed Low fire start cycle. Operates at low fire for 90 seconds after initial call for heat, then high or low fire depending on thermostat position. During normal operation at high fire operation (100%) system operates with high speed ID Fan or low fire operation (55%) with low speed ID fan for improved operating efficiency during low fire operation. Two stage thermostat or controller located in conditioned space.

Electrical Supply

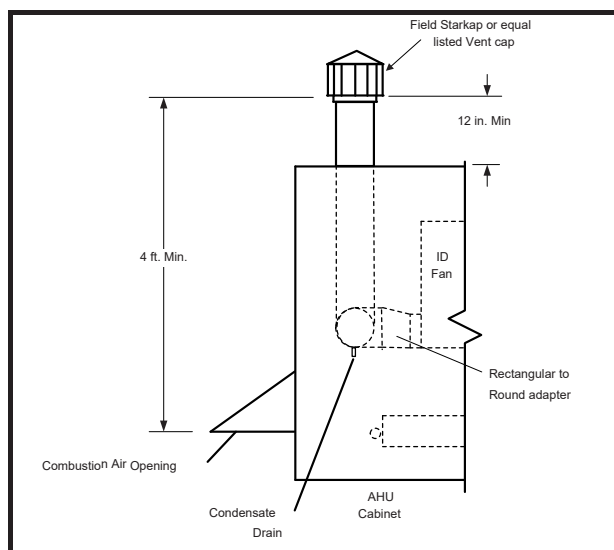
The furnace control system requires both line voltage and low voltage circuits with correct polarity, and clean neutral and ground. Line voltage readings between L1 and Neutral as well as L1 and Ground should be within +/- 3 volts.

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.

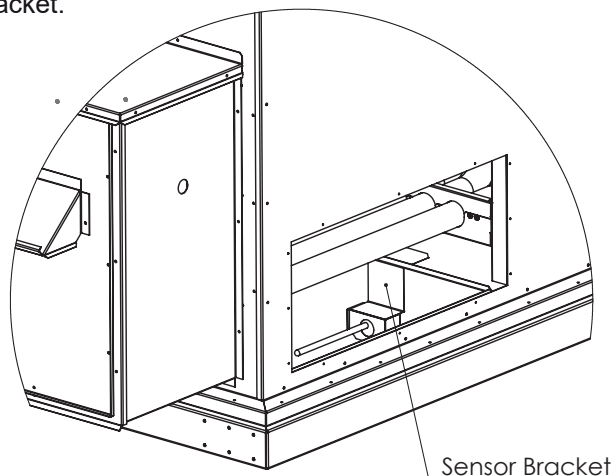
The air handling unit will be provided with a vent duct to exhaust flue gases outside of the unit.

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.



How to Install DAT Sensor & Sensor Bracket

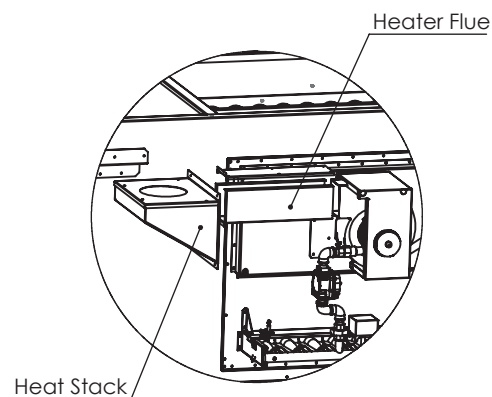
1. Remove access panels (Horz supply opening) to reach heater compartment.
2. Place Sensor Bracket 10" from the edge of access panel under direct air-flow stream.
3. Screw bracket properly in position.
4. Attach Sensor-53 in designated opening on the bracket.



How to install Flue

Attach Flue assembly over the opening of the Induced Draft Fan, and make sure it is locked in place. Place the Heat Stack over the Flue opening, and attach it to the control box.

NOTE: Heat Stack/Flue assembly might have to be disassembled to access filter compartment in some units.



Control Box (Enclosure)

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

Install control panel (with Nema 3R Enclosure) 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.

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.

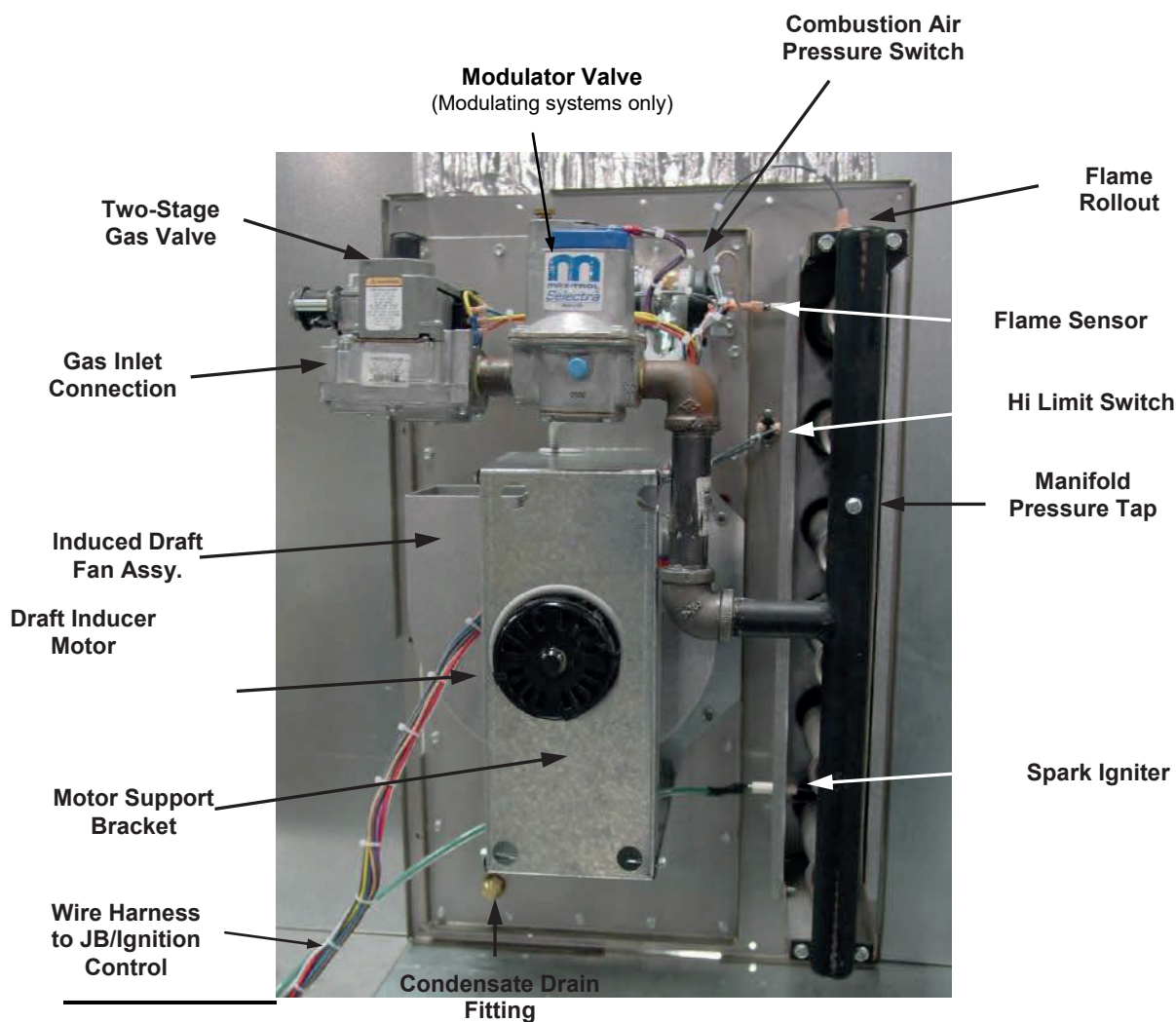
WARNING !

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.

Operating & Safety Instructions

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.

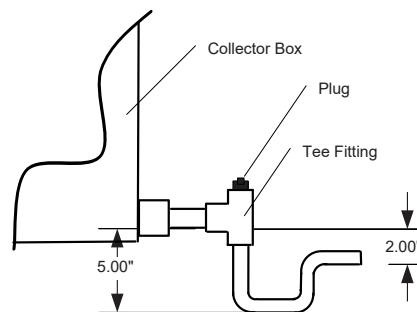
Figure - Furnace Component Identification



Condensate Drains

Heating units located downstream of a refrigeration system or a cooling coil will typically experience condensation during operation of the air conditioning. Heat exchanger surfaces may be cooled below the dew point temperature of the moist ambient air inside the heat exchanger resulting in condensation of water vapor in the heat exchanger and flue collector(s). This condensate is not harmful to the heat exchanger provided it is drained continuously. **A 1/4" NPT condensate drain connection** is provided in the flue box for duct furnaces with vertical or horizontal top mounted burner tray, to remove condensate from heat exchanger. **Condensate drain lines must be connected.** Condensate drain lines should have corrosion resistance at least equal to that of 304 SS.

Heat exchangers are under negative pressure and a P-trap should be provided as shown in figure below. The use of a “Tee” fitting allows for cleaning the trap. Use plug in cleanout opening.



In furnace modules with bottom mounted horizontal burner, condensate will drain from the open end of the tubes. A condensate collection pan which attaches to the burner assembly is available as an option.

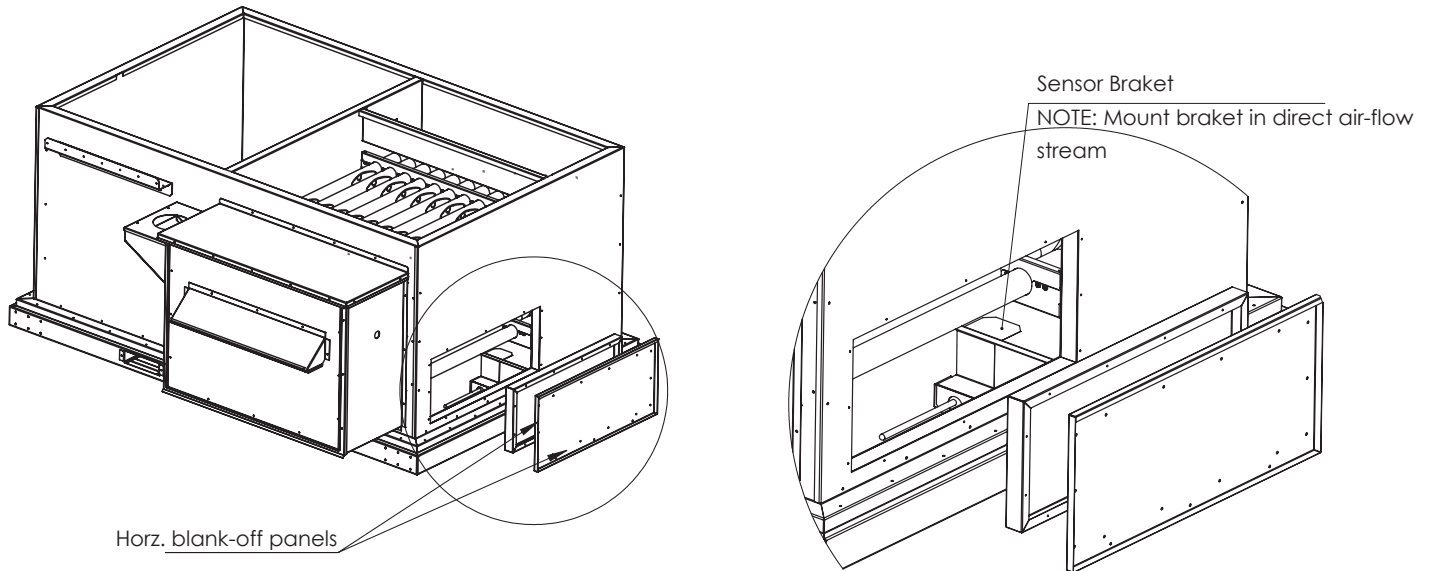
Additionally, condensation may form on surfaces such as the furnace vestibule panel (header plate) in contact with the conditioned air. Depending on operating conditions, condensate may collect in the lower vestibule pan. Provisions should be made to drain and remove this condensate as well, if such operating conditions exist.

Typically, condensation does not occur in mid-efficiency furnaces during heating operation. However, in applications with modulating controls or with 100% make-up air, some condensation may occur in the heating cycle. In these applications, connection of the drain line is required to prevent condensate buildup and possible heat exchanger damage. **Flue gas condensate is corrosive and may result in shortened heat exchanger life.** Use corrosion resistant metal tubing. Copper tubing is not suitable for flue gas condensate.

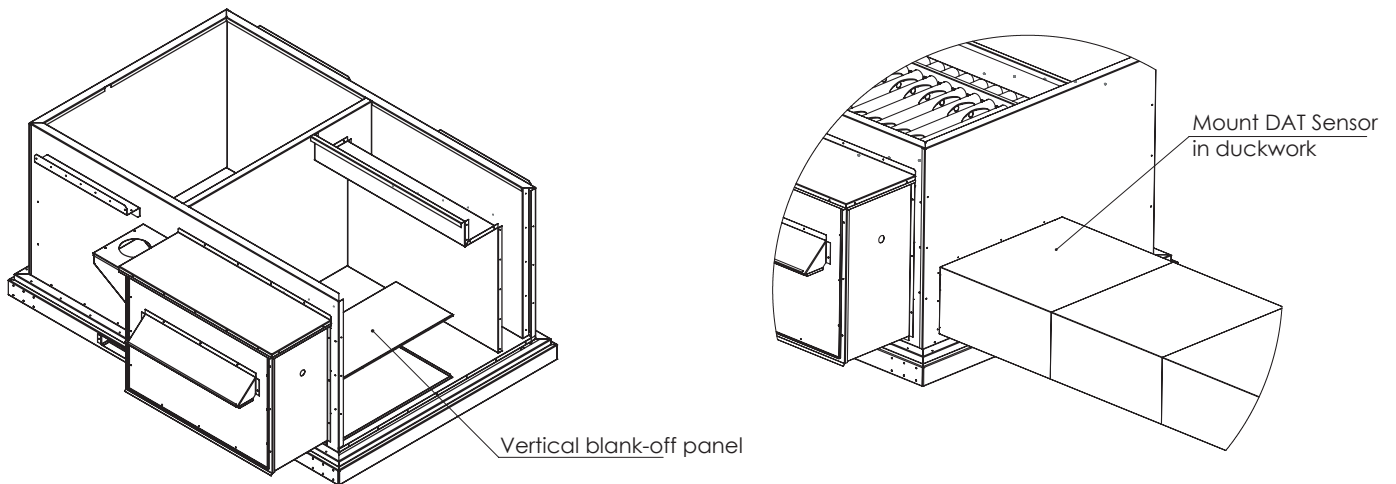
Disposal of condensate is subject to local codes and ordinances. Some municipalities require that the acidic condensate produced be neutralized before being discharged into the sanitary sewer. A condensate neutralizer kit is available. When neutralizer kits are provided they should be installed where they are readily accessible for inspection and maintenance

Air Flow Configuration

Vertical - supply units should include a *Sensor 53*, a sensor bracket, and two blank off panels for horizontal supply opening.



Horizontal - supply units should include a 15ft liquid pipe conduit, fittings for the conduit, a Nema 3R Enclosure box, a DAT Sensor, and a blank off panel for vertical supply openings must be installed.



Nema 3R Enclosure Box

SETPOINTS MENU

HEAT SETPOINT

RANGE: 60 F_90 F
DEFAULT: 75 F

DAT SETPOINT

RANGE: 000 F_100 F
DEFAULT: 070 F

NOTE: (DAT MODE ONLY) Temperature unit is trying to control to when in Discharge air mode (DAT).

CONFIGURATION MENU

MOD GAIN

RANGE: -20_20
DEFAULT: 03

NOTE: % Modulating reheat signal = (((Act temp - setpoint temp)+ Reheat Offset)/Reheat Gain) * Reheat Multiplier.

MOD OFFSET

RANGE: -10_10
DEFAULT: 01

NOTE: % Modulating reheat signal = (((Act temp - setpoint temp)+ Reheat Offset)/Reheat Gain) * Reheat Multiplier.

MOD MULTIPLYER

RANGE: 0.1_1
DEFAULT: 01

GAS HEAT MIN

RANGE: 00%_100%
DEFAULT: 00%

GAS HEAT MAX

RANGE: 00%_100%
DEFAULT: 100%

MOD HEAT WAIT

RANGE: 000S_300S
DEFAULT: 100%

REHEAT GAIN

RANGE: -20_20
DEFAULT: 01

NOTE: This is not used for modulating gas heat.

REHEAT MULTIPLIER

RANGE: 0.1_1
DEFAULT: 0.8

NOTE: This is not used for modulating gas heat.

REHEAT MIN

RANGE: 01%_100%
DEFAULT: 01%

NOTE: This is not used for modulating gas heat.

REHEAT MAX

RANGE: 01%_100%
DEFAULT: 75%

NOTE: This is not used for modulating gas heat.

REHEAT OFFSET

RANGE: -10_10
DEFAULT: 01

NOTE: This is not used for modulating gas heat.

Setpoint Chart

Once you have identified the application being used, please use the following chart to set up you iAire Controller Setpoints.

Setpoint	Standard Exchangers				High High Heat Exchangers	
Control Type	SPACE	DAT	ERV SPACE	ERV DAT	SPACE	DAT
Heat 1 On Delay	060s	060s	TBD	000s	0	0
Heat 1 Off Delay	005s	005s	TBD	000s	0	0
Heat 2 On Delay	005s	005s	TBD	150s	200	200
Heat 2 Off Delay	000s	000s	TBD	000s	0	0
Heat 1 On Offset	EXACT	EXACT	TBD	+04	1	2
Heat 1 Off Offset	+04	+04	TBD	+06	5	5
Heat 2 On Offset	-02	-02	TBD	-06	-5	-8
Heat 2 Off Offset	+02	+02	TBD	+02	EXACT	-3
# of Heat Stages	1	1	TBD	2	2	2
Mod Heat Config	Gas 1	Gas 1	TBD	Gas 2	Gas 2	Gas 2
Config Heat Type	Mod Heat	Mod Heat	TBD	Mod Heat	Mod Heat	Mod Heat
Mod Heat Min	0	0	TBD	0	0	0
Mod Heat Max	100	100	TBD	100	100	100
Mod Heat Gain	4	4	TBD	4	4	4
Mod Heat Offset	0	0	TBD	0	0	0
Mod Heat Multiplier	1	1	TBD	1	1	1
Min Heat %	0%	0%	TBD	0%	0%	0%
Max Heat %	100%	100%	TBD	100%	100%	100%
DAT Max	110F	110F	TBD	90F	98F	98F
Wait Time	030s	030s	TBD	000s	010s	000s

APPENDIX A (Heatco. Model Number Identification)

Heater Model Number Identification

Example: *HM T 125 CS 76 J 24 MB 1 N R7 S XX*

HM = Tubular Duct Module

A = 2.25" OD Tube/2 Pass

Input Rating

100 = 1,000,000

120 = 1,200,000

125 = 1,250,000*

Tube Material (Wall Thickness)

SS = 409 Stainless Steel (.042 min)

CS = 304 Stainless Steel (.042 min)

Tube Insertion Length = 76"

Configuration = J

Number of Tubes = 24 Tubes

Firing Mode

MR = Modulating (10:1)

MV = (15:1)

(Available for Natural Gas Only)

Options

XX = None

Job Site Elevation

S = 0 to 2000'

H = 2001 to 6999' (Specify Elevation)

Y = Above 7000' (Consult Factory)

Design Temp. Rise (°F)

R7 = 20F to 65F Rise (HMT 125)

R8 = 20F to 70F Rise (HMT 120)

R9 = 30F to 90F Rise (HMT 100)

Fuel Type

N = Natural Gas

L = Propane*

Power

1 = System/Inducer Voltage 115 VAC

APPENDIX B (Heatco. Application Guide)



Application Guide

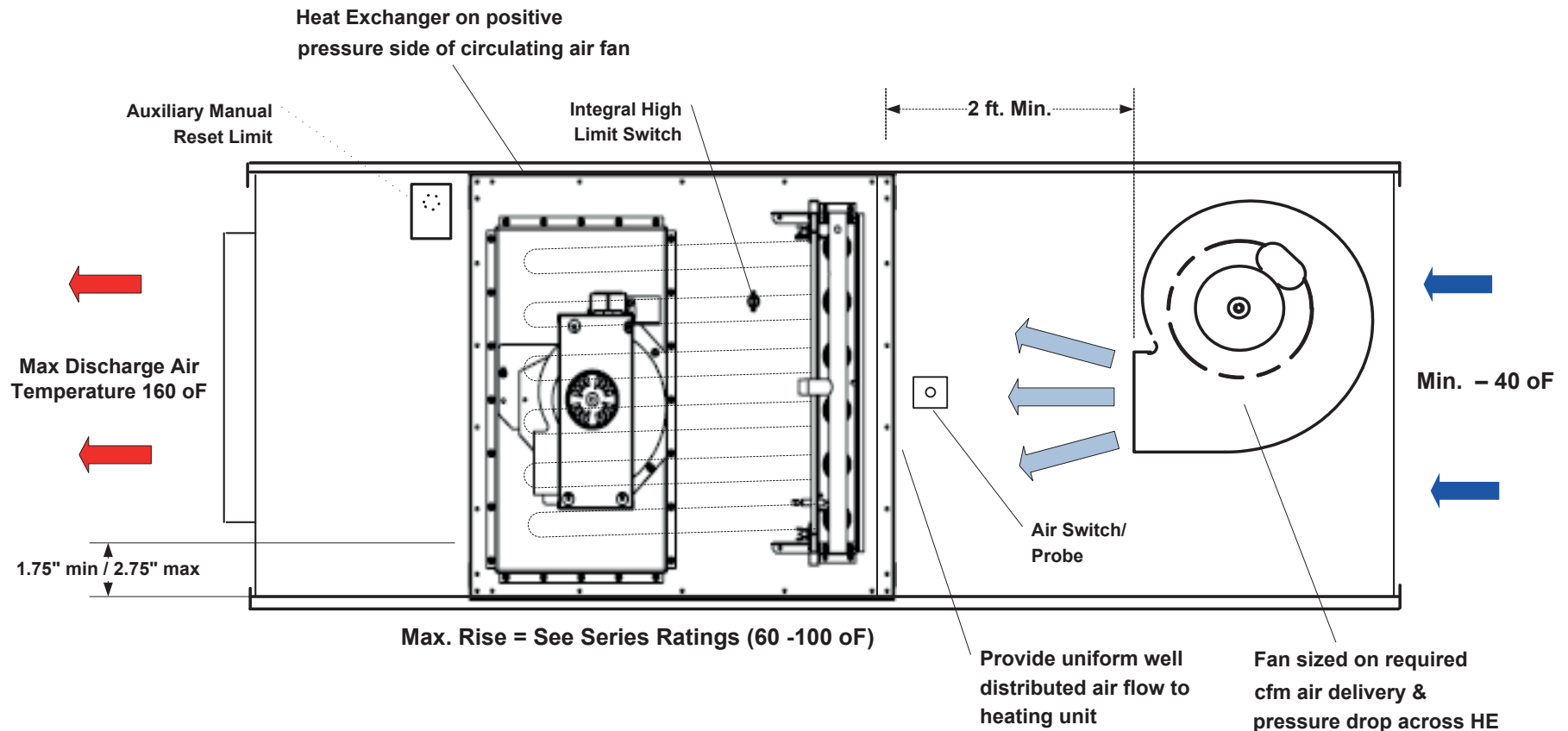
HVAC Equipment Design

With HM / HD Series Duct Furnaces



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

Typical HD/HM Make-Up Air Application

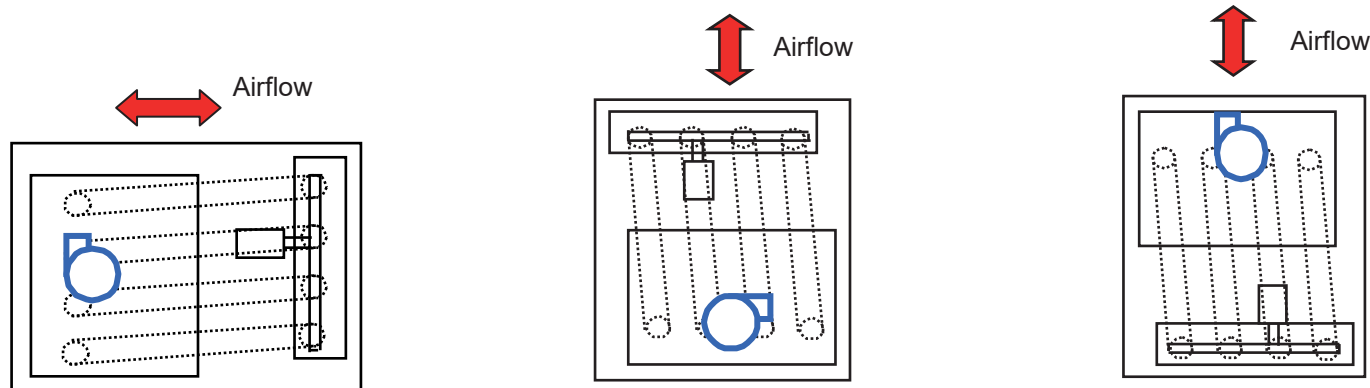


HM Series heat exchangers typically employ an integral restriction form (dimple) in the heat exchanger tubes. Marking is provided on the heater indicating the proper mounting orientation

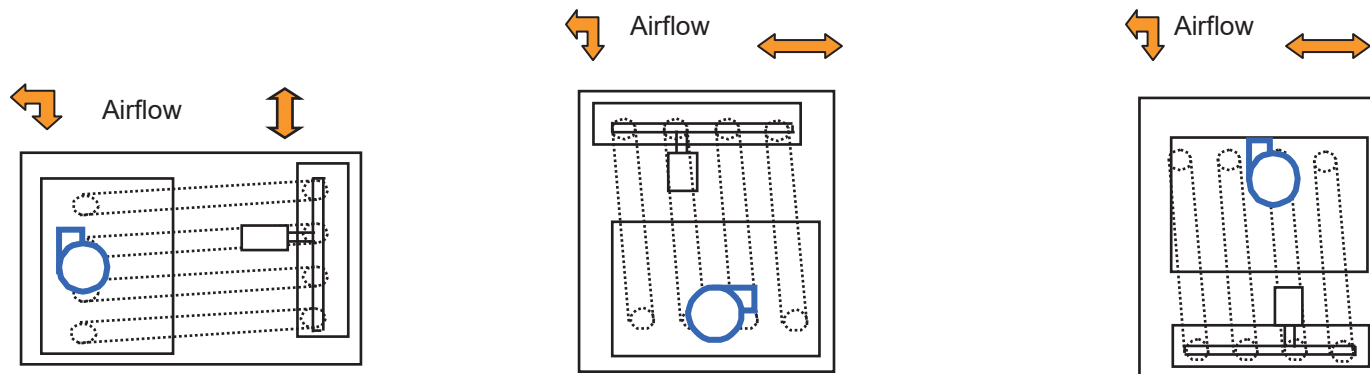
Heater configurations are available for any airflow scheme, to provide the proper orientation of the dimple form to allow drainage of condensate.

Airflow Configurations

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



Preferred airflow direction provides for highest temperature rise @ rated efficiency



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

Cabinet Design & Airflow

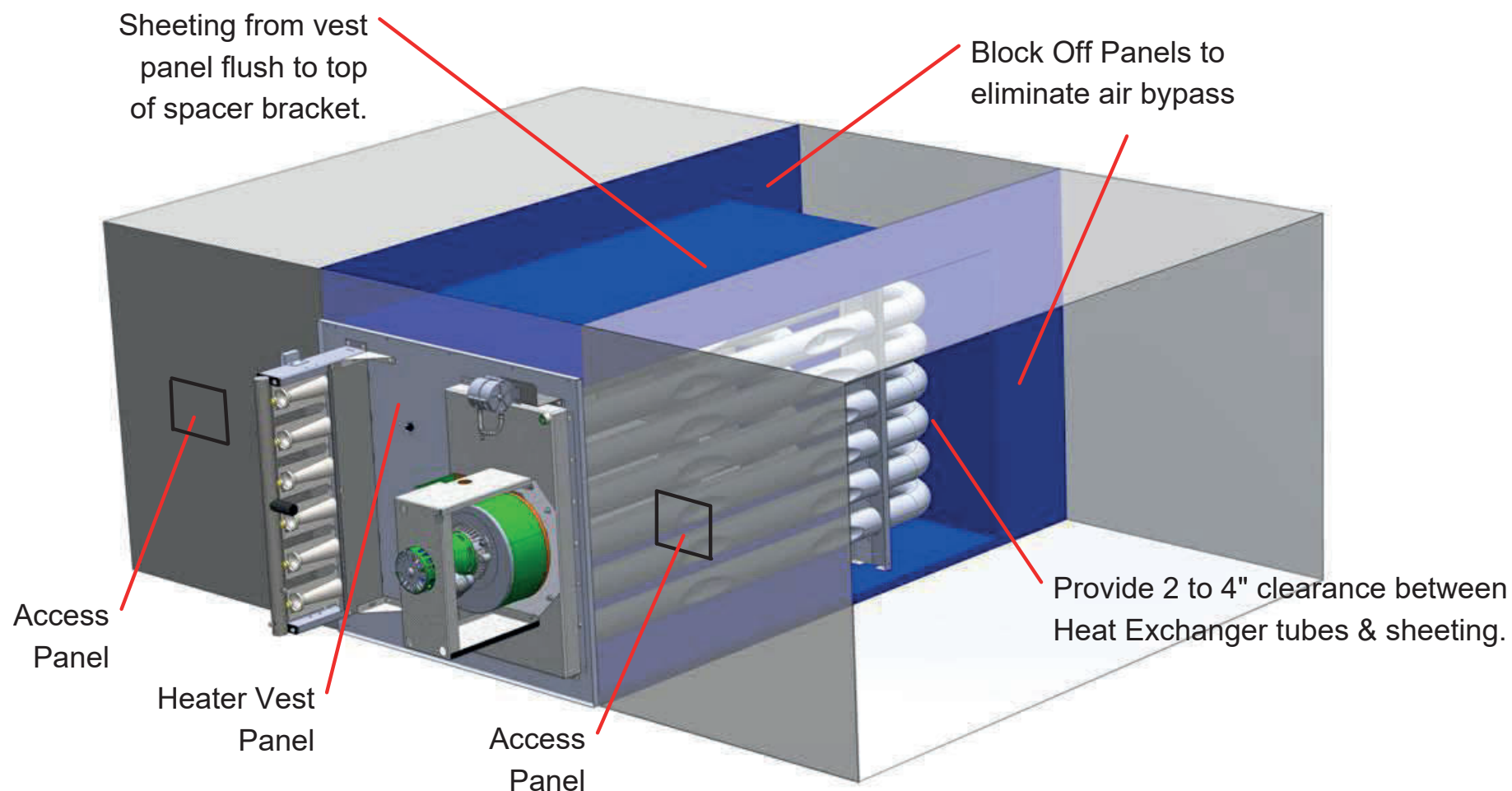
Duct furnace **MUST BE INSTALLED IN A NON-COMBUSTIBLE duct on the positive pressure side of the circulating air fan or blower.**

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.

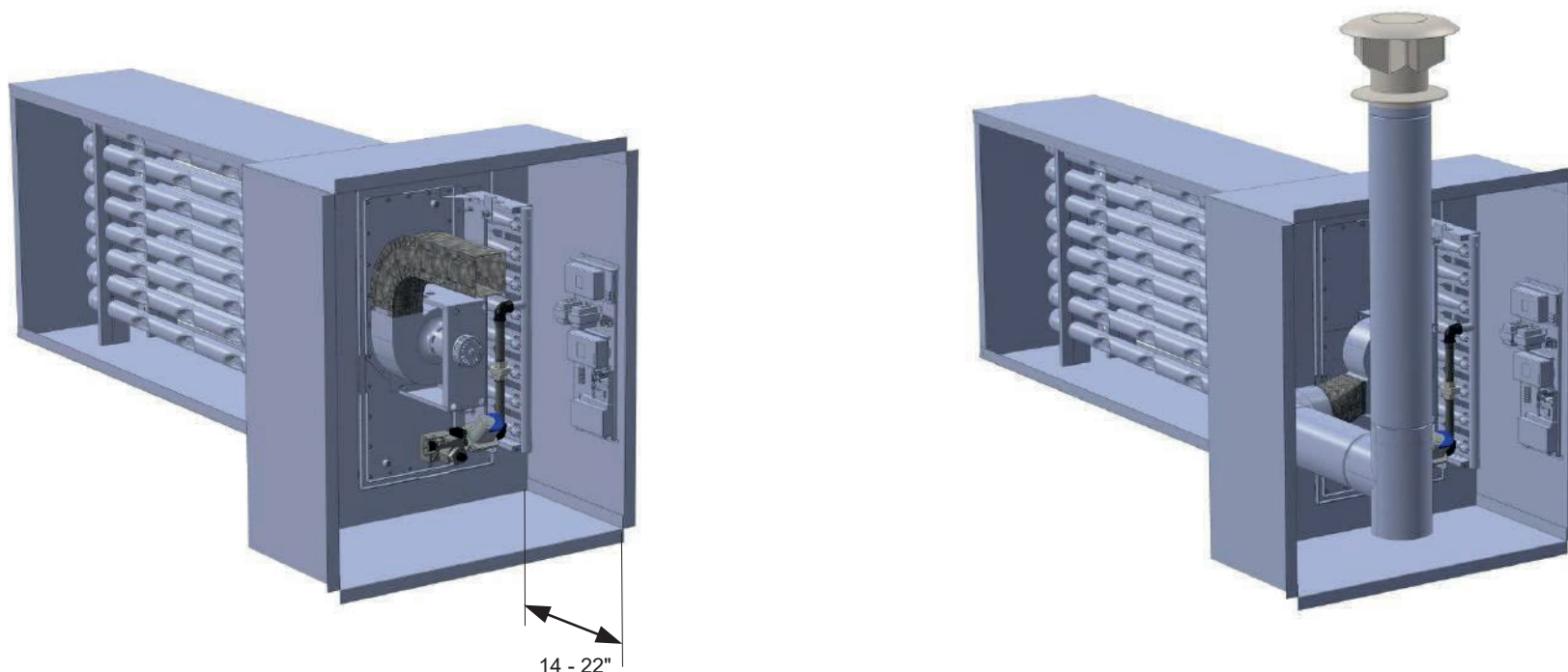


Provide removable access panels in cabinet immediately upstream. and downstream of duct furnace to allow for inspection of the heat exchanger

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

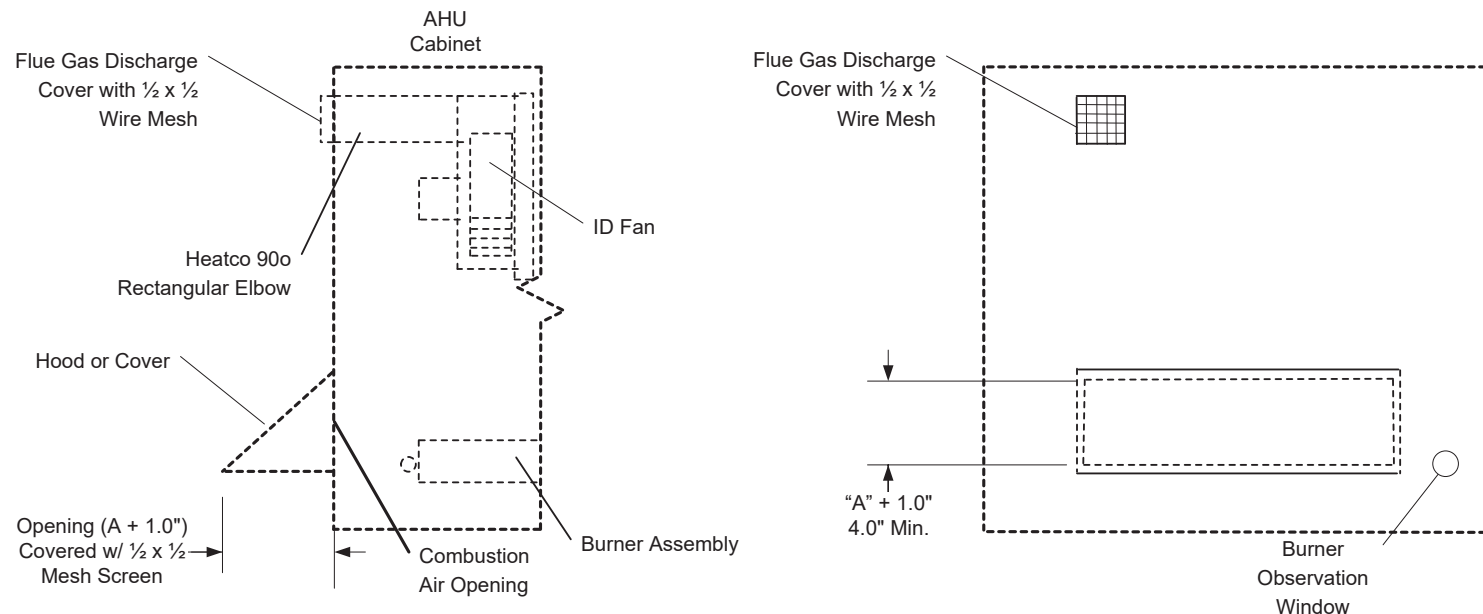
Openings for combustion air must be provided in a panel or door (except separated combustion systems) with direct access to the vestibule area where the burners and draft inducer are located.

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.

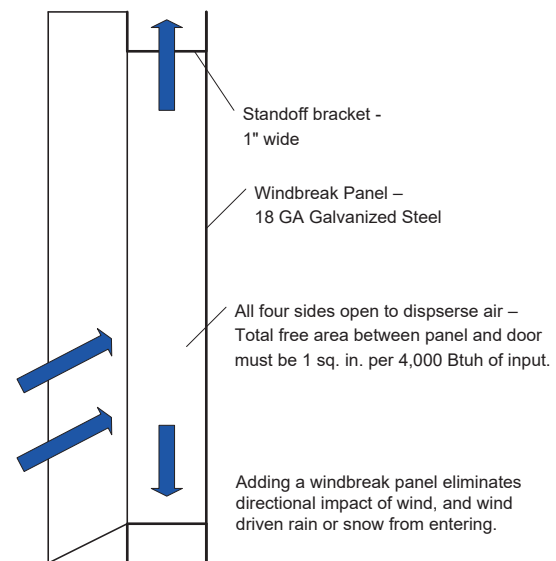
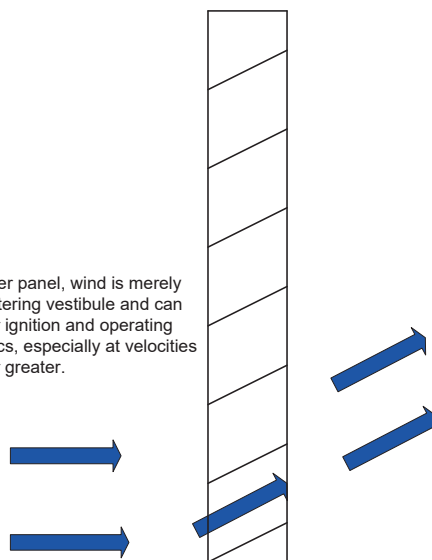
Combustion Air Hood / Rectangular Opening



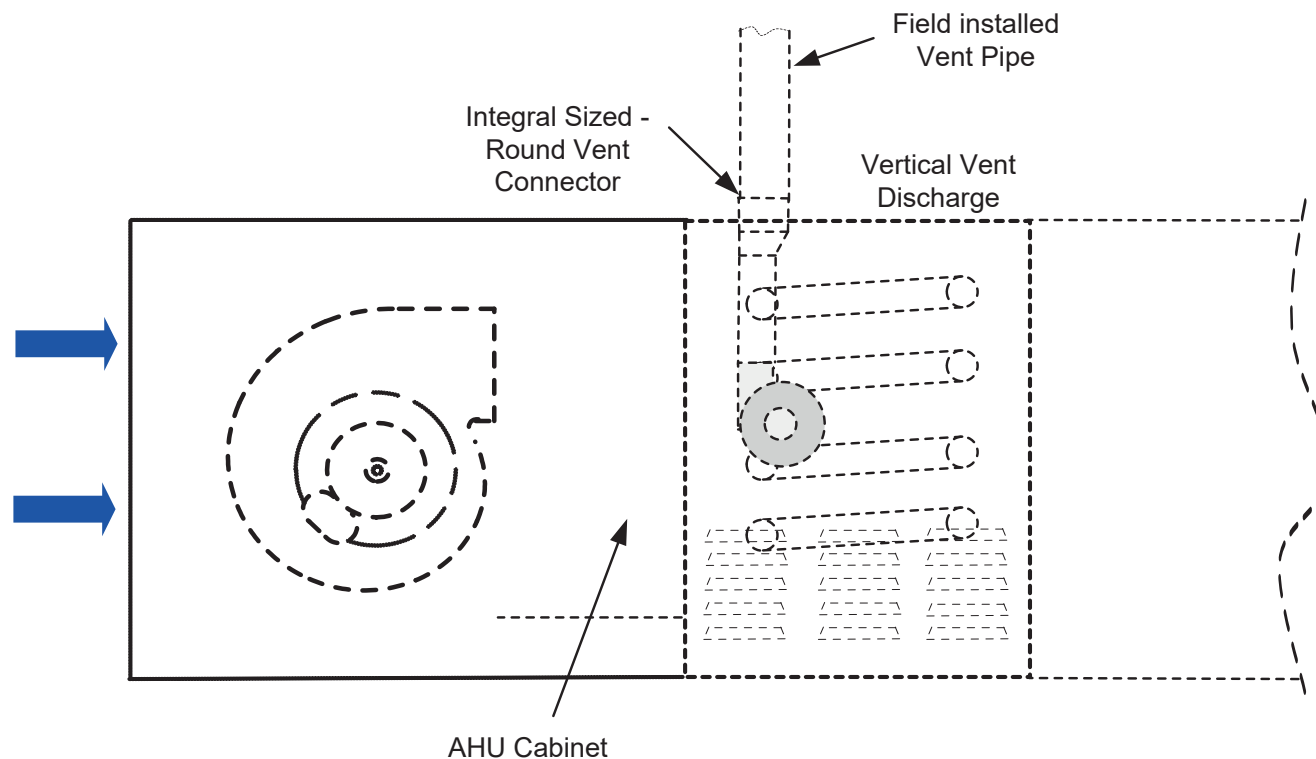
Louvered Combustion Air Openings

1.50 to 2.50"
Spacing as required for free area

In open louver panel, wind is merely deflected entering vestibule and can affect burner ignition and operating characteristics, especially at velocities of 20 mph or greater.



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

<u>Input Rating (Btuh)</u>	<u>Input Rating (W)</u>	<u>Vent Pipe Dia.</u>
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.

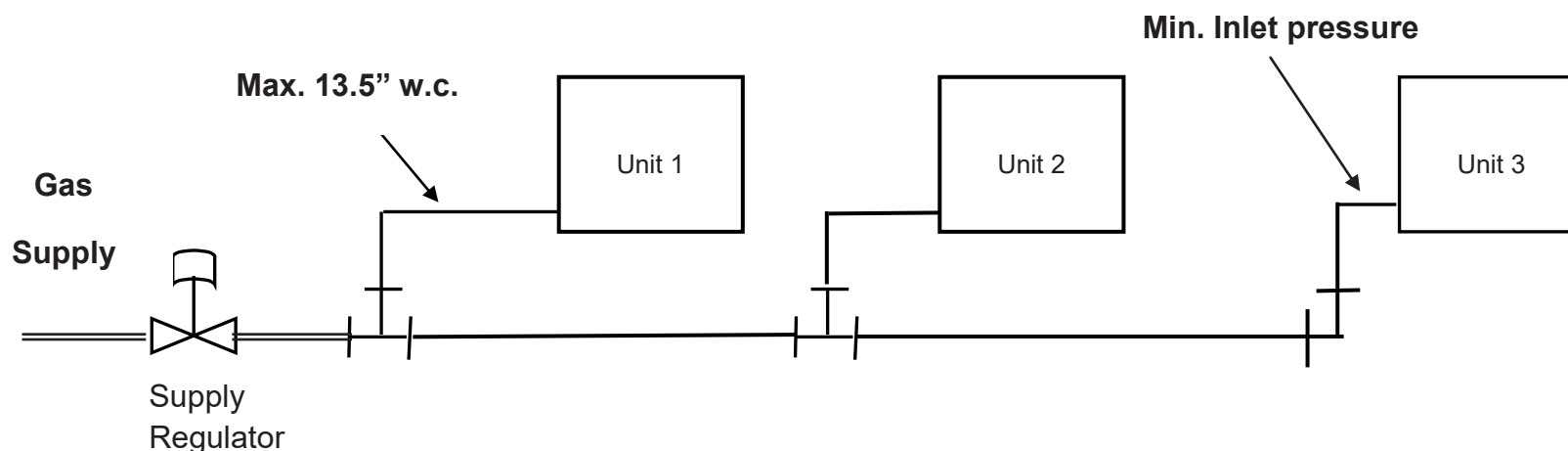
Use a pipe sealant **resistant to LP gases** on gas supply connections to heater.

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>
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.

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)**