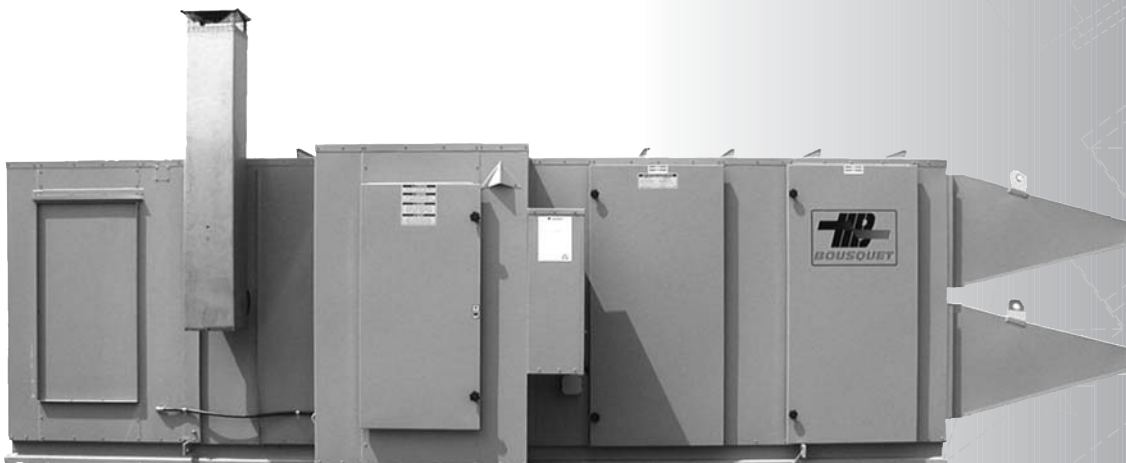


Indirect gas-fired air heater

SERIES HD



INSTALLATION AND SERVICE MANUAL

 **MANUFACTURED BY :**
BOUSQUET
BROTHERS LIMITED



WARNING

Improper installation, modification, adjustment or maintenance may cause damage, injury or death. Carefully read the installation, start-up and maintenance instructions before installing or servicing this unit

GAS ODOR

If gas odor is detected:

- 1: Open all windows;
- 2: Do not touch any switches;
- 3: Extinguish all open flames;
- 4: Immediately notify your gas supplier

WARNING

Using or storing fuel or any other flammable liquid or gas in open containers near this unit is dangerous.

INSTALLATION AND SERVICE MANUAL FOR THE INDIRECT GAS FIRED AIR HEATERS HD SERIES

PROJECT : _____

ADDRESS : _____

MODEL : _____

SERIAL NUMBER : _____

INSTALLER : _____

ADDRESS : _____

PHONE : _____

INSTALLATION DATE : _____

MANUFACTURER: BOUSQUET
ADDRESS: 2121 NOBEL, SAINTE-JULIE (QUEBEC) J3E 1Z9
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E-MAIL: bousquet@bousquet.ca
WEB SITE: www.bousquet.ca

**THIS INSTRUCTION MANUAL MUST ALWAYS BE AVAILABLE
AND KEPT WITH THE HEATER AT ALL TIMES.**

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CODES REGULATING INDIRECT GAS-FIRED AIR HEATERS

Indirect gas-fired air heater must be installed according to local installation code for gas equipment, and any provincial or state regulation applying to this category of equipment. All electrical installations must comply with Canadian electrical code C22.1, American code NFPA-70, and other local electrical applicable codes.

Any electrical installation to be done internally or externally to the heater must comply with the electrical wiring diagram supplied with the heater. For more information, refer to start-up instructions, operating sequence and adjustment instructions.

IMPORTANT

The minimum clearance between heater and any combustible material is :

Top	Sides and rear	Floor	Front / Access panels side	Vent connector
6 in.	6 in.	0 in.	42 in.	18 in.

Allow additional sufficient space on sides of the heater for maintenance.

For units installed indoors, it is mandatory to provide a sufficient amount of outside air for combustion in the mechanical room. Refer to CAN/CGA-B149 installation code for further information.

When required, for units installed indoors, it is mandatory to pipe gas piping purge and vent connections to the outdoor. These pipes must terminate with an elbow and a fine mesh screen in order to prevent blockage.

Depending on unit size, diameters of the flue gas connection vary between 6 and 12 inches. HD series combustion systems are designed to operate safely against a back pressure on 1/4" inch water column, with a double wall type PS chimney, either in a vertical arrangement (through the roof) or in a horizontal arrangement (through the wall), or a combination of both.

INSTALLATION INSTRUCTIONS

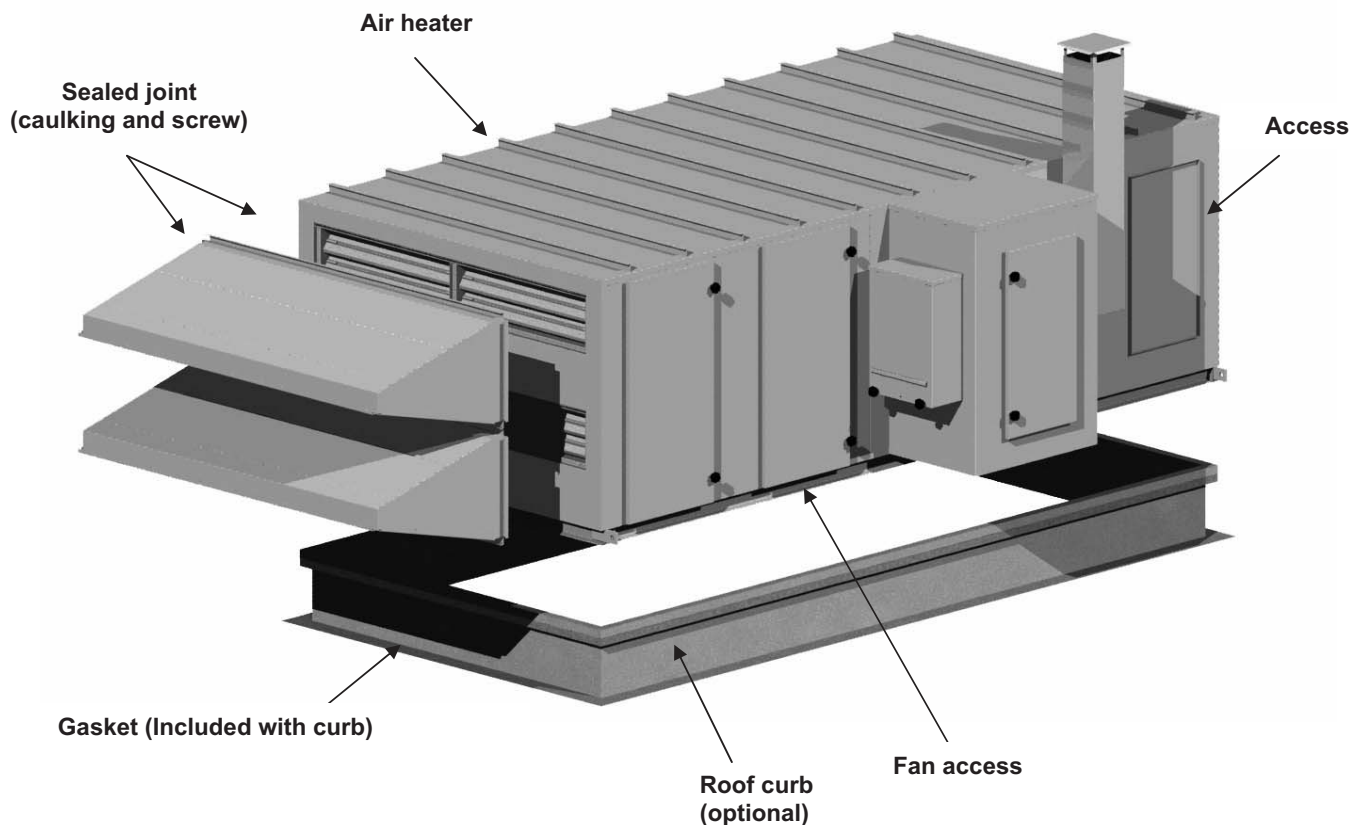
1) INSTALLATION

The air intake must be located and oriented in order to prevent infiltration of snow, rain and flammable toxic gas, as well as any other harmful material in the make-up air heater.

When the heater is hung over a work area, it must be installed at an adequate height. The installation of a service platform might be required.

When fire dampers are used in the ducts, they must be equipped with an electric switch wired to the safety control circuit of the unit in order to shut down the air heater when fire is detected in ducts. These electric switches must be wired to re-activate the safety circuit only when the fire dampers are completely opened.

In order to prevent any risk of freeze-up, the installer must install a minimal temperature detector if not supplied with the unit.



N.B.: It is recommended to mechanically fix the heater to the roof curb or supporting structure with screws or other appropriate fastening means.

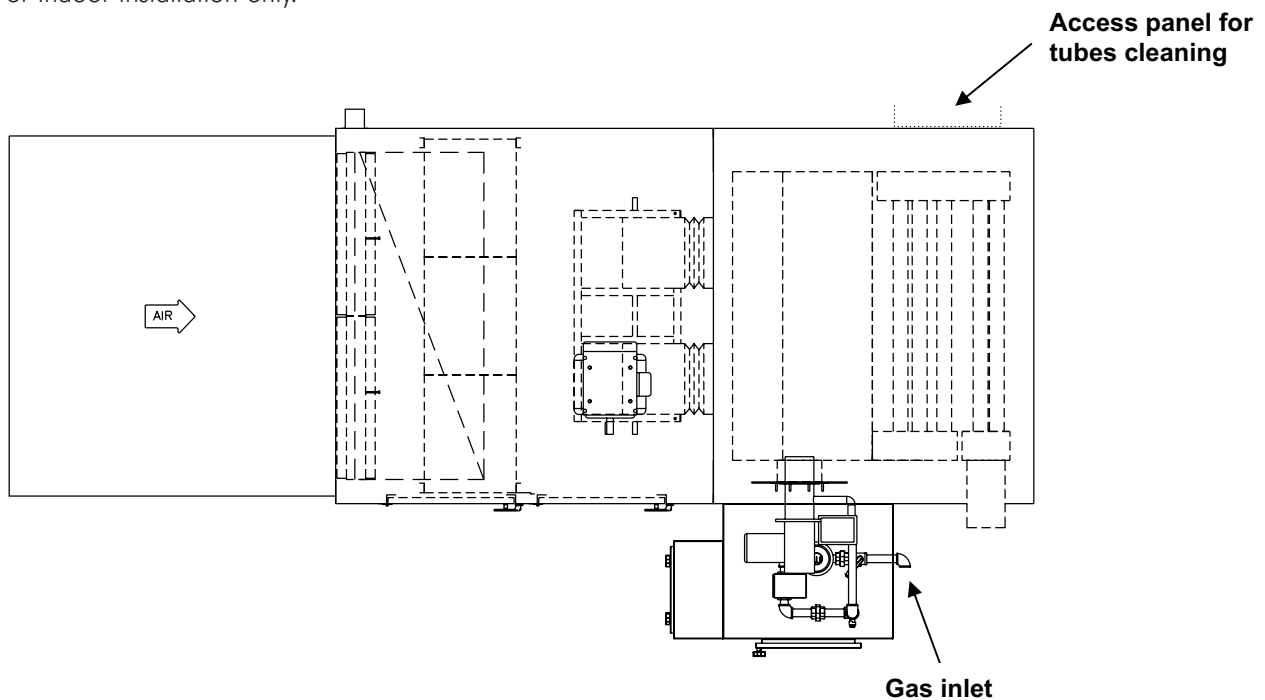
2) GAS PIPING CONNECTION

For units installed indoor, purge and vent connections must be piped individually towards the outdoor, as stated by CGA-B149 or other local codes in effect.

GAS CONNECTIONS PIPE SIZE (NPT) ^①		
HD MODEL	GAS CONNECTION Ø 1/2 PSIG (14 in. w.c.) ^②	
	inches	mm
20 to 75	1	25
85 to 200	1 1/2	38
250-350	2	51
400-500	3	76

VENT SIZES (Ø)				
HD MODEL	REGULATOR ^{③④}		PURGE VALVE ^③ (OPTIONNAL)	
	inches	mm	inches	mm
20 to 75	1/2	13	3/4	19
85 to 200	1/2	13	3/4	19
250-350	1/2	13	1	25
400-500	3/4	19	1 1/2	38

- ① This table should not be used to size the gas supply line.
- ② If gas pressure exceeds 1/2 psig (14 inches w.c.), a high pressure regulator must be installed at gas piping inlet. The regulator must be suitable for modulation in a ratio of 40:1, to properly regulate gas pressure at low fire.
- ③ The purge and regulator vents must be piped separately towards the outdoor.
- ④ For indoor installation only.



HEATER MAINTENANCE

CHECK LIST	MAINTENANCE FREQUENCY			
	WEEKLY	MONTHLY	1/2 YEAR	YEARLY
Check air filters - Replace them when necessary	●			
Check bearing lubrication and belts wear	●			
Ensure that no flammable material is stored near the heater	●			
Ensure that nothing obstructs the air inlet and outlet of the heater	●			
Check combustion and flame quality		●		
Check if fresh air damper opens completely			●	
Check that all safety controls are operational			●	
Check the operation of the high temperature limit thermostat				●
Ensure that there is no gas leaks in piping (fittings & valves).				●
Inspect all electrical connections				●
Ensure that blower and motor are firmly anchored				●
Inspect the flame detector and pilot igniters electrode; change if necessary				●
Clean burner fan wheel				●
Check burner installation and tighten screws and bolts if required				●

IMPORTANT

BEFORE START-UP AND AFTER 8 HOURS OF OPERATION

- Check bearings alignment and lubrication;
- Check bearings clamps;
- Check alignment belts tension;

AFTER 24 HOURS OF OPERATION

- Check belts tensions.

HEATER SHUTDOWN

A) EXTENDED SHUTDOWN

When the heater is shutdown for a long period of time, it is recommended to shut off gas and electric power.

Before turning on the heater after an extended shutdown, make sure all the air is purged from the gas piping, and that gas pressure is adequate. An inspection is recommended to make sure that everything is in order.

B) EMERGENCY SHUTDOWN

When the heater shuts down in emergency, main electrical disconnect should be turned OFF, and gas supply closed by shutting off the manual gas valve located in the supply gas line, out of the unit.

C) TURNING ON THE HEATER AFTER A FLAME FAILURE ALARM

After a flame failure alarm, perform the following checks:

FAN

1. Place main electrical disconnect to OFF position;
2. Check fan belts; replace or adjust if required;
3. Check filters conditions; replace if necessary;
4. Ensure that nothing obstructs the air inlet and outlet of the heater;
5. Ensure that nothing is restraining inlet or outlet dampers operation.

BURNER

1. Ensure that all gas supply hand valves are opened;
2. Check status of the flame safeguard relay (For problems, refer to troubleshooting section);
3. Check pilot flame rod and spark igniter;
4. Place main electrical disconnect to ON position;
5. Press the reset button of the flame safeguard relay;
6. Ensure that the blower motor is operating;
7. Ensure that the pilot ignites properly;
8. Fix all problems and repeat the start-up procedure.

START-UP INSTRUCTIONS

WARNING

The following information should only be used by a qualified technician for gas equipment installation (with qualification cards) with knowledge in electricity and ventilation.

WARNING

DO NOT SMOKE

During gas heater start-up

Recommended Tools

- Voltmeter
- Ammeter
- Air temperature reading device
- Tachometer (Fan & motor [rpm])
- Pressure gauge
 - (1x) 0 - 5 in. w.c.
 - (1x) 0 - 20 in. w.c.
- Combustion analyzer

START-UP INSTRUCTIONS

1) FAN ADJUSTMENT

- Check voltage of each phase at main electrical disconnect
- Check fan rotation and modify electrical connection if required
- Ensure that the contactor overload relays are set according to the full load amperage (FLA) as indicated on motor name plate
- Check alignment and belts tension ①
- When dampers are completely opened, with fan running, read amperage at each motor phase and check if it corresponds to the project design BHP, as shown on the heater technical name plate. Modify fan rotation if necessary.

2) BURNER ADJUSTMENT

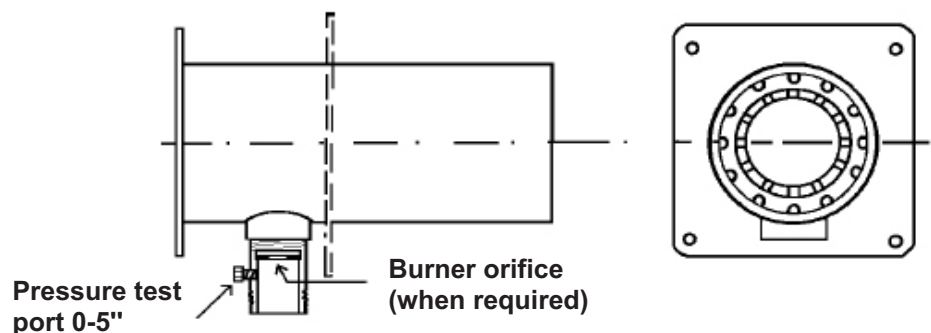
- Make sure that all vents are piped adequately.
- Install a pressure gauge (0-20 in. w.c.) on gas piping inlet on the test port located upstream of the low pressure regulator.
- Ensure that the gas inlet pressure complies with the following table:

HD MODEL	* NATURAL GAS	GAS INLET Ø - in.(mm)
20-30-35-40-50-55-65-75	MIN: 10 in. w.c. (pa) MAX: 14 in. w.c. (3484 pa)	1 in (25 mm)
85-100-125-150-175-200	MIN: 10 in. w.c. (pa) MAX: 14 in. w.c. (3484 pa)	1 1/2 in (38mm)
250-300-350	MIN: 12 in. w.c. (pa) MAX: 14 in. w.c. (3484 pa)	2 in (50 mm)
400-500	MIN: 12 in. w.c. (pa) MAX: 14 in. w.c. (3484 pa)	3 in (75 mm)

*** For gas other than natural, consult the manufacturer**

- Install the (0-5 in. w.c.) pressure gauge on the test port located at burner inlet, downstream of the modulating valve (butterfly valve) SEE FIGURE 2.1

FIGURE 2.1
BURNER PRESSURE
TEST PORT LOCATION
MODEL C

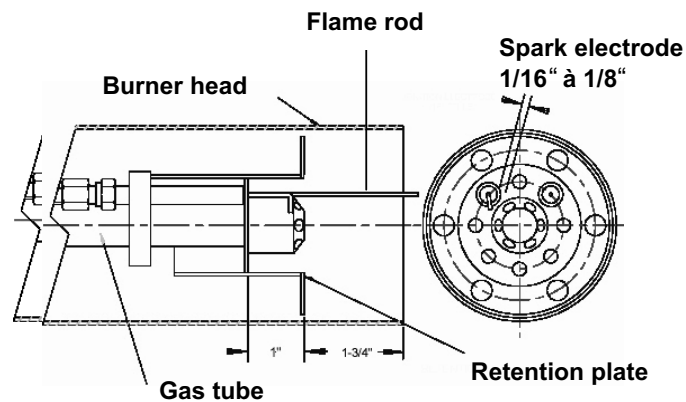


- Ensure that all the air is completely purged from gas piping.

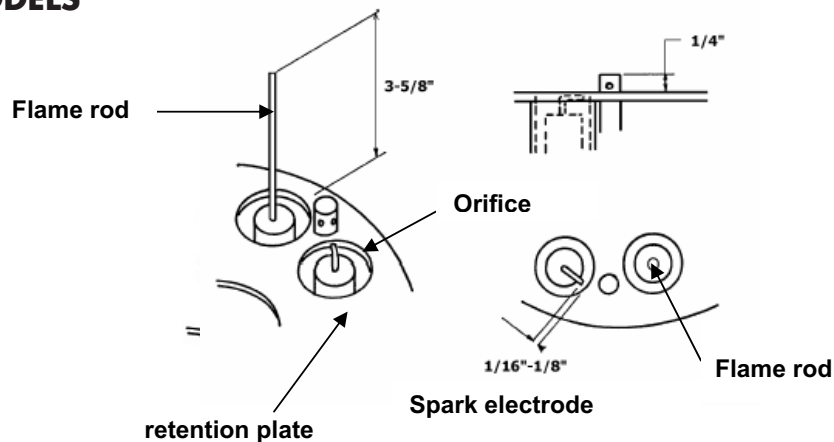
①: For this test, turn OFF the main electrical disconnect.

- Check burner fan rotation and modify electrical connections if required.
- Ensure that the contactor overload relays are set according to the full load amperage (FLA) as indicated on burner motor name plate.
- Check spark igniter electrode adjustment; check pilot flame rod adjustment.
- Spark ignition electrode must be positioned and oriented as shown in figure 2.2 and 2.3.

**FIGURE 2.2
C4 MODEL ONLY**



**FIGURE 2.3
C6 to C12 MODELS**



- The horizontal portion of the electrode must be aligned with the top face of the retention plate.
- Electrode gap must be adjusted between 1/16" and 1/8".
- For model C4, this gap is the distance between electrode tip and the burner nozzle. For burner models C6 to C12, the gap is the distance between the electrode tip and the edge of the orifice in the retention plate.

The flame detector illustrated is a flame rod. It could be replaced by a « UV » type flame detector. In that case, the UV tube must be placed in the same support used to install the flame rod.

PILOT ADJUSTMENT

- Turn ON main electrical disconnect, and turn control panel selector to BURNER position.
- Close the manual burner gas valve located upstream of the electric valves. Open pilot manual gas valve.
- Ensure that there is no heat demand to gas modulating valve (low fire position).
- Check pilot lighting sequence. Take a reading of the flame signal (5-10 VDC), and adjust the signal corresponding to gas pressure available, after the pilot pressure regulator, in order to get the optimum signal.

BURNER ADJUSTMENT

For the combustion test, It is recommended to use a (0-10 VDC) manual potentiometer to simulate full modulation range of the burner.

Step 1:

Run the burner to its maximum position (high fire). Adjust the burner capacity in accordance with table 1. This table is affixed on the unit at burner section.

Table 1 data correspond to the values established by the manufacturer during a factory test, and represents those for the required burner capacity.

These data correspond to the desired the pressure readings at main gas inlet connection and at burner, in order to get the right unit capacity.

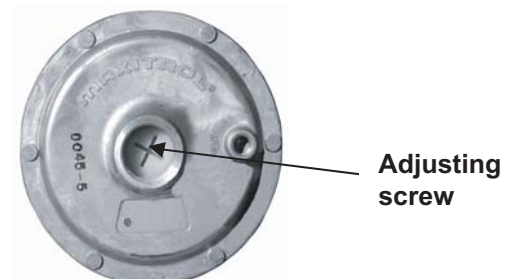
Calibration specified in **table 1** is obtained by adjusting the gas pressure regulator of the burner.

NOTE: Turning the adjustment screw clockwise \curvearrowright increases the gas pressure and burner capacity.
Turning the adjustment screw counter clockwise \curvearrowleft decreases the gas pressure and burner capacity.

TABLE 1

FACTORY FINAL ADJUSTMENTS	
Serial No:	
Inlet pressure - Stop:	
Inlet pressure - High fire:	
Pressure at burner - High fire:	

REGULATOR



Step 2:

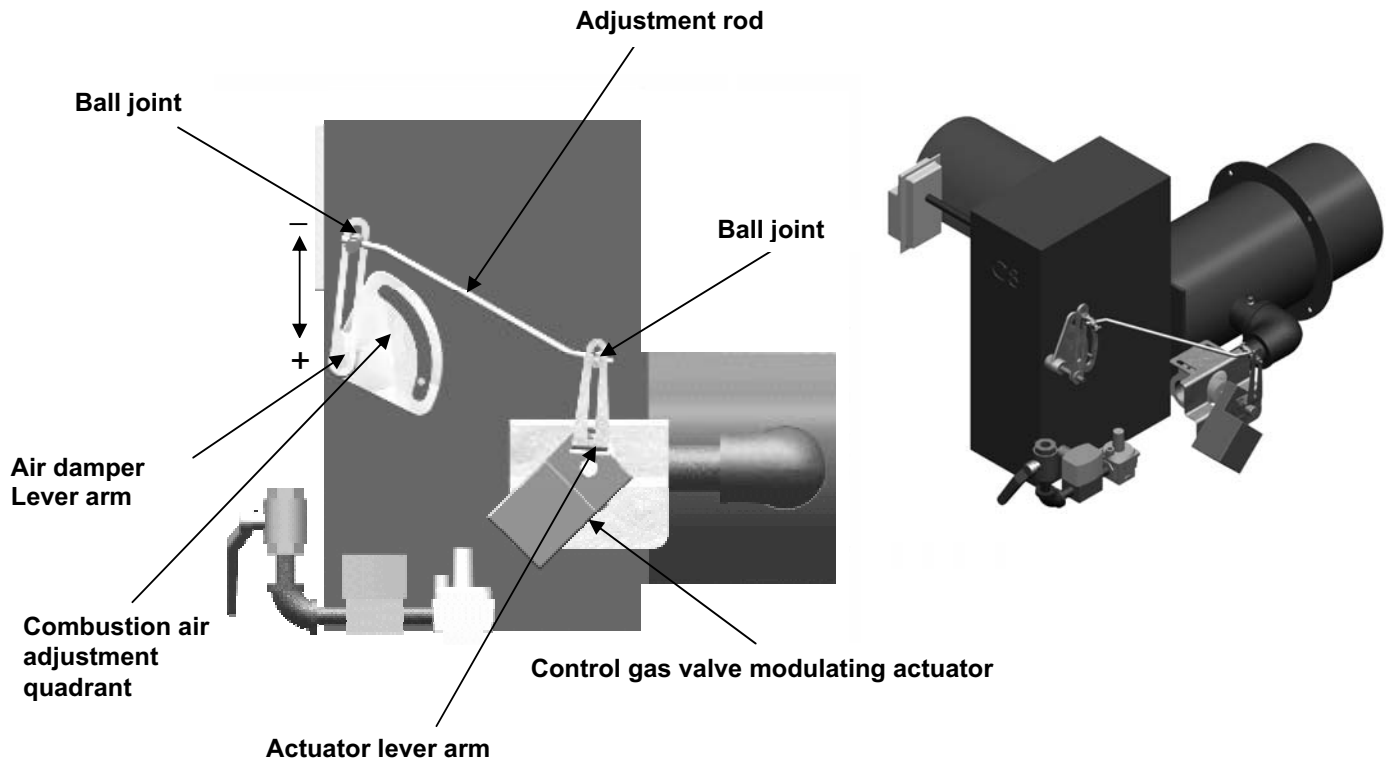
Take O_2 and CO readings. Ideally, O_2 , shall not exceed 5% at high fire, with CO not exceeding 0.04% (400 ppm).

If required, to increase or decrease O₂ concentration, proceed as follow:

HD 20 TO HD 350 MODELS (REFER TO FIGURE 2.4)

- Position burner at HIGH FIRE.
- Mark the actual position on the adjustment quadrant.
- Stop the burner.
- Unscrew adjustment rod ball joint.
- Slightly slide the ball joint in lever arm slot to the desired position. Mark the new position.
- Re-open gas and repeat high fire test.

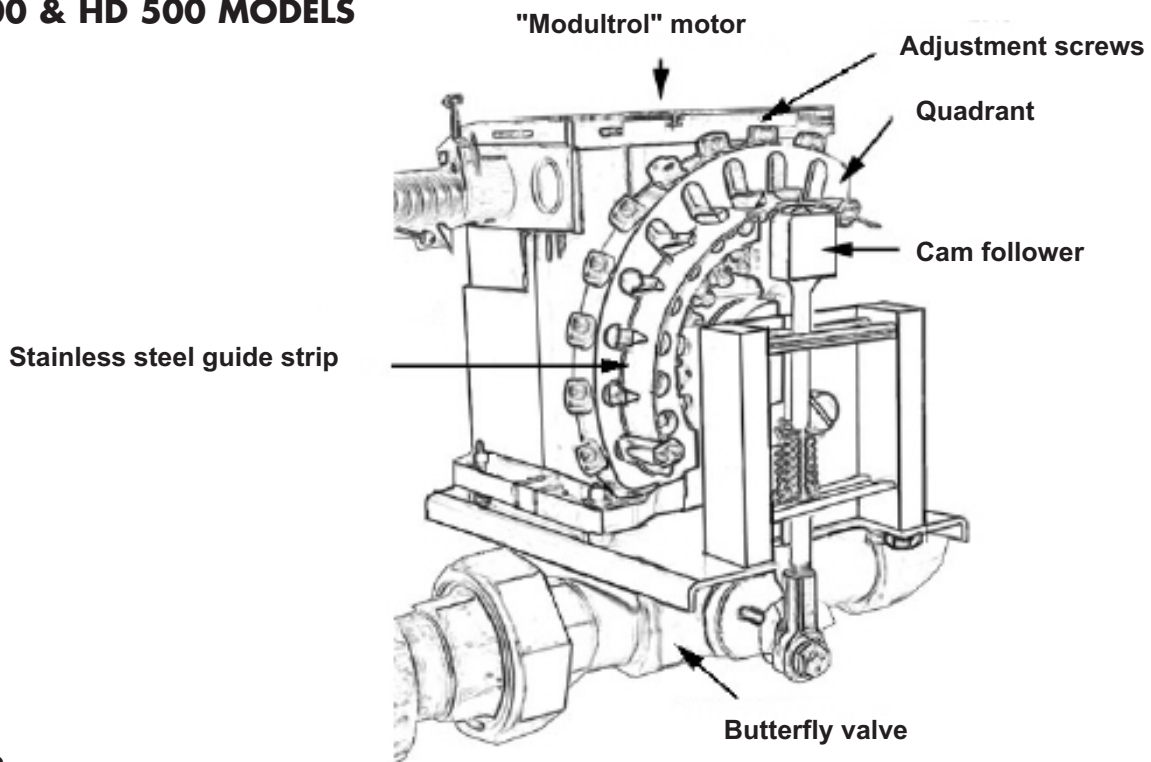
FIGURE 2.4
HD 20 TO HD 350 MODELS



HD 400 AND HD 500 MODELS (REFER TO FIGURE 2.5)

- Position burner at HIGH FIRE.
- Make adjustment with the help of the set screw inline with the "Cam Follower".
- By turning the screw clockwise ↻, gas flow increases, and O₂ decreases.
- By turning the screw counter-clockwise ↻, gas flow decreases, O₂ increases.

FIGURE 2.5
HD 400 & HD 500 MODELS



Step 3:

Run burner to LOW FIRE position. Take combustion readings and adjust in order to measure .04% CO (400 ppm) maximum.

NOTE: It is normal to have high O₂ reading. Mark the position.

Make adjustments for the complete range of modulation between both high and low fire marks.

Take combustion readings over all the modulation range of the burner. Don't forget to tighten all adjusting screws and to complete the start-up report.

WARNING

**Do not adjust burner flame only visually.
Using a combustion analyzer and combustion instruments is the only
recommended method to adequately adjust burner combustion.**

MODEL HD CONTROL SEQUENCE

(For indication purpose only)

STARTING UP THE FAN

1. Position selector (STOP/FAN/BURNER) to FAN position.
2. Fresh air intake damper opens.
3. The damper end switch closes.
4. Fan motor starter contactor is energized.
5. The fan is in operation.

STARTING UP THE BURNER

1. Position selector (STOP/FAN/BURNER) to BURNER
2. Burner combustion air fan starts.
3. Air combustion damper opens completely to perform a complete purge of the exchanger, and returns to closed position.
4. Pilot ignites. Pilot operation is proven when burner fan pressure switch and high temperature limit switch are closed.
5. The main burner operates and modulates according to an external signal (0-10 volts or 4-20 ma).
6. When demand for heating is satisfied, the post purge sequence maintains the burner in operation with the combustion air fully opened in order to evacuate all remaining flue gas from heat exchanger.
7. Burner stops and is now ready for a new heat demand.

TROUBLESHOOTING

1- FIREYE FLAME SAFEGARD RELAY

A) NORMAL OPERATING SEQUENCE

- The FIREYE flame safeguard relay includes five lights to indicate that the operating sequence is normal and also to indicate burner malfunction.

NORMAL OPERATING SEQUENCE

1. The (OPR CTRL) light is on when there is a heating demand and terminal 7 is energized.
2. The (AIR FLOW) light comes on when all safety devices as well as the low and high air pressure switches, and high temperature switch are closed and terminal 6 is energized.
3. The (PTFI) light is on during pilot ignition sequence.
4. The (FLAME) light is on only when flame safeguard relay detects a good flame signal and is not in alarm mode.
5. The (ALARM) light flashes when a malfunction is detected.

NOTES:

1. During an alarm, the ALARM light that corresponds to the malfunction flashes at 1 second intervals. The status of the other four lights indicates the type of malfunction (see table on next page).
2. Pressing down the reset button brings back the flame safeguard relay to its normal operating mode.

B) STATUS OF WARNING LIGHTS (FIREYE)

The table below lists the most common and important codes concerning unit operation.
(Refer to manufacturer for other codes not listed in this table).

(A COMPLETE TROUBLESHOOTING LIST IS PRESENTED ON PAGES 19 AND 20)

TROUBLE CODE	TROUBLE DESCRIPTION (ALARMS)	OPR CTRL	AIR FLOW	PTFI	FLAME	ALARM
6	FREQUENCY NOISE	●	○	○	●	*
7	PILOT FLAME FAILURE (PTFI)	○	●		●	*
19	BURNER FLAME FAILURE (MTFI)	○	○	●	●	*
21	OPEN AIR PRESSURE SWITCH	●	●	●	○	*
54	GROUND FAULT	○	○	○	●	*
55	FAULTY PROGRAMMER	○	○	●	○	*
56	FAULTY AMPLIFIER	●	○	○	○	*

LIGHTS:

- = OFF
- = ON
- * = FLASHING

NOTE: Refer to the normal operating sequence and service check list below to identify possible causes of problems.

The Honeywell S7800A keyboard module displays the following trouble codes which are the most important with regard to the operation of the heater. (Refer to the manufacturer for any code not listed below).

FIREYE AND HONEYWELL TROUBLESHOOTING CHECK LIST	
SYMPTÔMS	CORRECTIVE ACTION
<ul style="list-style-type: none"> ✓ The fan is stopped. ✓ The burner is off. ✓ Fresh damper is closed. 	<ol style="list-style-type: none"> 1. Turn ON main disconnect switch. 2. Check line voltage. 3. Check secondary circuit fuse (120 volts). 4. Check selector position on remote control panel; turn it to BURNER position. 5. If ALARM light of the flame safeguard relay (FIREYE or HONEYWELL) flashes, press the reset button. 6. Check adjustment of the overload relay of the fan motor; re-adjust if necessary. 7. Check freeze low temperature thermostat. Its contact opens approximately 300 seconds if supply air temperature remains below 42°F. To restart the heater, turn selector of the remote control panel to STOP, and then back to BURNER position. 8. Refer to the manufacturer.
<ul style="list-style-type: none"> ✓ The fan is stopped. ✓ The burner is off. ✓ Fresh damper is opened. 	<ol style="list-style-type: none"> 1. Ensure that fresh damper end switch is closed. 2. Refer to the manufacturer.
<ul style="list-style-type: none"> ✓ The fan is in operation. ✓ The burner is off. ✓ The flame safeguard relay is operating normally (No flashing lights) 	<ol style="list-style-type: none"> 1. Check if the auxiliary contact of the main fan motor starter works. 2. Check the position of the selector on the remote control panel; position it to BURNER. 3. Refer to the manufacturer.
<ul style="list-style-type: none"> ✓ Frequency noise CODE (6) FIREYE	<ol style="list-style-type: none"> 1. Check for a high voltage source close to the flame safeguard relay. 2. Check electrical wiring between building distribution panel and the heater. 3. Refer to the manufacturer.
<ul style="list-style-type: none"> ✓ Flame failure (PTFI) CODE (7) FIREYE CODE (28) HONEYWELL NOTE: The flame safeguard relay goes into alarm mode during the pilot ignition cycle.	<ol style="list-style-type: none"> 1. Check pilot gas supply. 2. Check pilot ignition transformer. 3. Check flame signal intensity (pilot only: it should range between 5 and 10 VDC for Fireye or between 3 and 5 VDC for Honeywell). 4. Check if manual and electric pilot gas supply valves are opened. 5. Check condition of the flame rod ceramic; replace if necessary. 6. Refer to the manufacturer. 7. Check the flame safeguard amplifier; replace if necessary.
<ul style="list-style-type: none"> ✓ Flame failure (MTFI) CODE (19) FIREYE CODE (17) HONEYWELL NOTE: The flame safeguard relay goes into alarm mode during the pilot ignition cycle.	<ol style="list-style-type: none"> 1. Check if a gas interruption has occurred during heater operation. 2. With burner in operation, check gas pressure at burner manifold. 3. Check flame signal intensity (pilot only: it should range between 5 and 10 VDC for Fireye or between 3 and 5 VDC for Honeywell over the entire modulation range). 4. Perform a combustion test. 5. Refer to the manufacturer.
<ul style="list-style-type: none"> ✓ Flame failure CODE (19) HONEYWELL NOTE: The flame safeguard relay goes into alarm mode during the burner ignition cycle.	<ol style="list-style-type: none"> 1. Check burner gas piping and burner electrical connections. 2. Check condition of the flame rod ceramic; replace if necessary 3. Check flame signal intensity (between 5 and 10 VDC for Fireye or between 3 and 5 VDC for Honeywell). 4. Perform a combustion test over the entire capacity range of.

NOTE: Refer to the normal operating sequence and service check list below to identify possible causes of problems.

The Honeywell S7800A keyboard module displays the following trouble codes which are the most important with regard to the operation of the heater. (Refer to the manufacturer for any code not listed below).

FIREYE AND HONEYWELL TROUBLESHOOTING CHECK LIST			
SYMPTÔMS	CORRECTIVE ACTION		
✓ Air pressure switch opened CODE (21) FIREYE CODE (32) HONEYWELL NOTE: While the heater is in operation, safety contact between 6 and 8 terminals for Fireye and 6 and 7 for Honeywell relay must be closed.	There are two safety devices connected in series between terminals 6 and 7 of the Honeywell flame safeguard, and 6 and 8 terminals for the Fireye flame safeguard relay.		
	A) Burner pressure switch The burner pressure switch proved that the burner is in operation. (Adjusted at 0.5" w.c.)	CORRECTIVE ACTION 1- Check burner fan rotation. 2- Check for obstruction in chimney. 3- Check for obstruction at combustion air intake. 4- Check sampling tubes of the pressure switch (installation and adjustment). 5- Replace pressure switch if defective. 6- Refer to manufacturer.	
	B) Safety high temperature limit switch (set at 160 °F) Its contacts are normally closed (N.C.) and open when air temperature exceeds 160°F downstream of the heat exchanger.	AT START-UP OR WHEN HEATER IS IN OPERATION 1. Check temperature upstream of the heater (Safety high temperature limit switch opens when air temperature exceeds 160°F). 2. Check burner modulation, all controls, and temperature control signal. 3. Check gas pressure at burner manifold for maximum fire" 4. If required, replace the temperature switch. 5. Refer to manufacturer.	
✓ Ground fault CODE (54) FIREYE	1. Check grounding of the heater frame and flame safeguard relay. 2. Check for ground default in electrical wiring between the heater and main distribution panel. 3. Refer to manufacturer.		
✓ Faulty programmer CODE (55) FIREYE	1. Replace the programmer. 2. Refer to manufacturer.		
✓ Faulty amplifier CODE (56) FIREYE	1. Replace amplifier. 2. Refer to manufacturer.		
✓ Voltage drop CODE (5) HONEYWELL	1. Check voltage at relay while heater is in operation. 2. Check relay electrical connections and installation 3. Refer to manufacturer.		
✓ Ground fault CODE (109) HONEYWELL	1. Check relay grounding. 2. Main current and neutral wires are inverted. 3. Refer to manufacturer.		

A350P TEMPERATURE CONTROLLER (OPTIONAL)

Calibration of the electronic proportional and integral temperature controller supplied as an option with the HD heater.

(Set point dial)

Adjust desired set point
with this dial

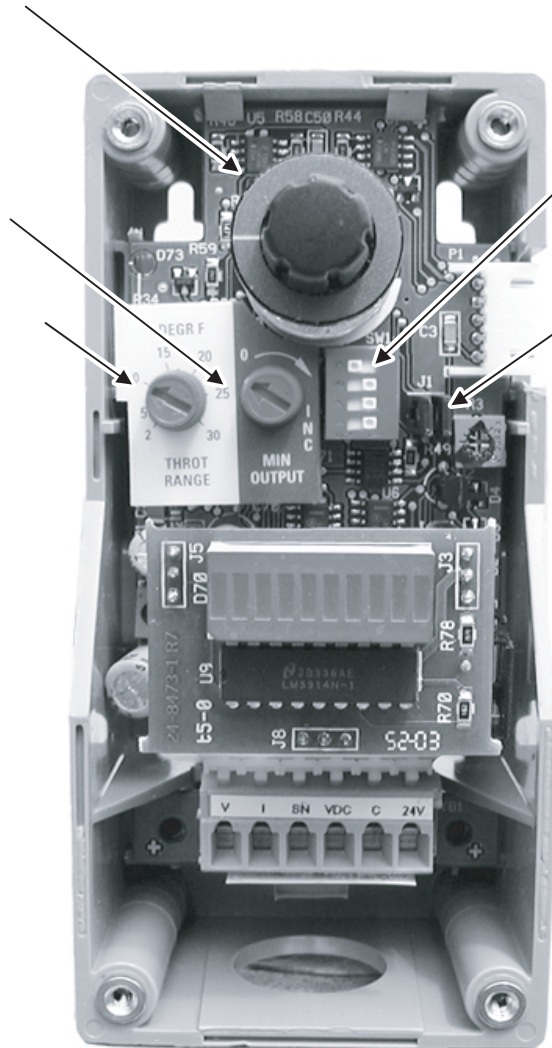
(Minimum output
potentiometer)
Adjust to 0%

(Throttling range
potentiometer)
Adjust to 10°F

(Integration DIP switch)
ON ←

DIP switch 4 (ON)
DIP switch 3 (OFF)
DIP switch 2 (OFF)
DIP switch 1 (OFF)

Operating mode jumper positions
(Reverse acting (RA) or direct acting (DA))
Place JUMPERS in vertical position
“Reverse Action”, which corresponds
to heating mode.





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