



ISCF-1
May 2014
Supersedes September 2013

Installation and Service Manual

COUNTERFLO CF SERIES HEATERS GAS FIRING



WARNING **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.

Notice

Read These Instructions Before Installation

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SECTION I. – GENERAL INFORMATION

A. PURPOSE

The purpose of this manual is to present a guide for proper installation, maintenance, and operation of the Counterflo CF Series heaters, and to supplement, but not to replace, the services of qualified field service personnel to supervise the initial start-up and adjustment of the Counterflo unit. Persons without previous experience with large commercial and industrial equipment should not attempt the initial adjustment and checkout procedure which is essential before such installations may be considered as ready for operation. This manual should be made readily available to operating personnel as an aid in trouble-shooting and proper maintenance.

B. SHIPPING

Base Counterflo units are shipped with blower and burner sections assembled. Discharge air nozzles and/or discharge hoods, optional filter and/or damper sections, or other large optional accessories are assembled and shipped mounted and wired whenever possible within limitations of shipping and handling. Optional accessories shipped separately are shipped as assembled sections. Any wired accessories which have been disassembled for separate shipment require no additional conduit or wire for field reassembly. All wire leads will be tagged for ease of reconnection in the field.

Shipments are made F.O.B. Hastings, Nebraska, by truck. In either case, the unit is securely strapped, tied, and blocked to prevent shipping damage. All shipments are checked by an inspector before they are accepted by the carrier. Parts that are shipped unmounted are noted on the bill of lading. These parts, where feasible, are packaged and shipped with the units. Upon receipt of shipment, all units should be checked against the bill of lading to insure all items have been received. The units should be checked carefully for physical damage in the presence of the carrier's representative. If parts are missing or damage has occurred, a claim should be filed immediately with the carrier.

All Counterflo units are given a complete operations test and control circuit checkout before shipment. A copy of the flame test report and wiring diagram is included with each unit shipped. If correspondence with the factory is necessary, please provide the unit model and serial number.

C. STORAGE

If weatherproof equipment is not installed within 5 days after receipt, the equipment must be stored in a dry environment and free of rodents.

D. EQUIPMENT DESCRIPTION

The Counterflo heater is a rugged industrial grade space heater. Models are available for vertical upright mounting indoors, or outdoors, and horizontal mounting for indoor floors, ceiling suspension or rooftops.

1. Cabinet and Frame

Rugged channel iron frame and all aluminized steel cabinet surfaces are painted with heat and corrosion resistant industrial enamel. Standard unit includes three side return air screens. Burner end has a closure plate for motor access.

2. Blowers

Depending on heater size, there are two or three centrifugal, double width, double inlet, forward curved, class I industrial fans mounted on a one-piece shaft with self-aligning 200,000 hour prelubricated ball bearings. Blower wheels are statically and dynamically balanced. Fixed drives are standard on all units. A premium energy efficient open dripproof ball bearing squirrel cage induction T-frame motor is provided as standard for all voltages.

3. Burners

Standard burner is On-Off.

Gas (G) – Power type with pilot spark ignition and main burner pilot ignition for use with natural, manufactured, mixed, liquefied petroleum gas or liquefied gas/air mixture. Included in the manifold are main gas electric shut-off valve with linkage to combustion air damper, main and pilot gas pressure regulators for maximum inlet pressure of 1 PSIG, pilot gas-air mixer and pilot solenoid valve. Minimum standard entering gas pressure is 4 ounces.

4. Fuel and Electric Controls

Standard components for Counterflo Series heaters include a Nema 1 control box with electronic flame safeguard system and ignition transformer, motor starter, control transformer, high temperature limit switch, air flow switch, and gas electrical control system.

5. Control System

The standard On-Off control system is obtained with a single pole, single throw thermostat that closes upon a temperature drop below setpoint. Fan operation is intermittent. A detailed sequence of operation for standard gas-fired heaters is provided later in this manual. Thermostat is factory furnished for field mounting and wiring.

The optional control system for Hi-Lo-Off burner operation is obtained with a two-stage thermostat that closes in sequence on a temperature drop below setpoint. Fan operation is intermittent. The thermostat is factory furnished for field mounting and wiring.

The optional modulating control system has an On-Off thermostat as described above plus a modulating thermostat to control a modulating butterfly fuel valve. Fan operation is intermittent. Thermostats are factory furnished for field mounting and wiring.

6. Remote Control Panel (Optional)

The optional panel is furnished with a heavy duty toggle switch and three 115 volt signal lights as depicted in Figure 8. The switch controls the blower and the burner. The signal lights indicate supply blower operation (white light marked “blower”), burner operation (amber light marked “heating”), and safety lockout (red light marked “lockout”). Remote control panel lids are 16 gauge. Wiring box dimensions are 8” x 5” x 3-1/2” deep. All wiring is 14 AWG 16/30 stranded 105° thermoplastic or equivalent, color coded per corresponding wiring diagrams.

SECTION II. – INSTALLATION PROCEDURE

This equipment shall be installed and wired in accordance with regulations of the National Board of Fire Underwriters, National Electric Code, Gas Burning Appliance and Equipment, CGA B.149.1 & 2, applicable Provincial Regulations for the class, and local governing bodies which should be carefully followed in all cases. The following recommendations are not intended to supplant any requirements of federal, state, or local codes having jurisdiction. Authorities having jurisdiction should be consulted before installations are made. Local codes may require additional safety controls and/or interlocks.

The installer must identify the emergency shut-off devices after completion of the installation.

A. HANDLING THE EQUIPMENT

The Counterflo heater has been designed for rigging and handling through the use of special lifting lug hooks installed on the sides of the unit. See pages 5 & 6. As explained previously, the standard unit is designed for shipping in one piece. Optional accessories must be field mounted. Figure 1 depicts a typical Counterflo heater for vertical floor mounting.

When unloading and setting the heater, use the lifting lugs shipped along with unit or move the heater on rollers or suitable fork lift with proper capacity and fork length. Hooks, jacks, or chains must not be used around the casing, exhaust fan, or main control panel – “DO NOT LIFT UNIT USING COMBUSTION CHAMBER BRACKETS ON TOP OF COMBUSTION CHAMBER LIFTING LUGS.”

To be properly set, the Counterflo heater should be placed on a solid foundation and set exactly as detailed later.

During transit, unloading, and setting of the unit, bolts and nuts may have become loosened, particularly in the pillow block ball bearing assemblies in the fan section. It is recommended that all nuts and set screws be tightened. Turn fan shaft by hand to make certain that blower does not rub against blower housing, and that bearing lock rings are tight.

Open the cover on the electrical control box located near the middle on the side of the burner section. Box can be opened by turning main disconnect switch to the “off” position. Inspect all wire terminals and wiring terminations to ensure that all connections are tight.

B. POSITIONING THE HEATER

Locate the heater exactly level, making certain the minimum clearance is maintained between the heater, and any unprotected combustible material. The clearances are: 48” from main control panel located at the burner end, 18” at the rear, both sides and top. The exhaust stack clearance must be 18”. See page 9 for stack details. Units must be installed on non-combustible flooring.

For convenient access for maintenance, provide 24” clearance at the right side, as seen when facing the burner, and 36” at the rear. Position the heater, if practical, with the left hand side (as seen from burner end) next to any adjacent wall.

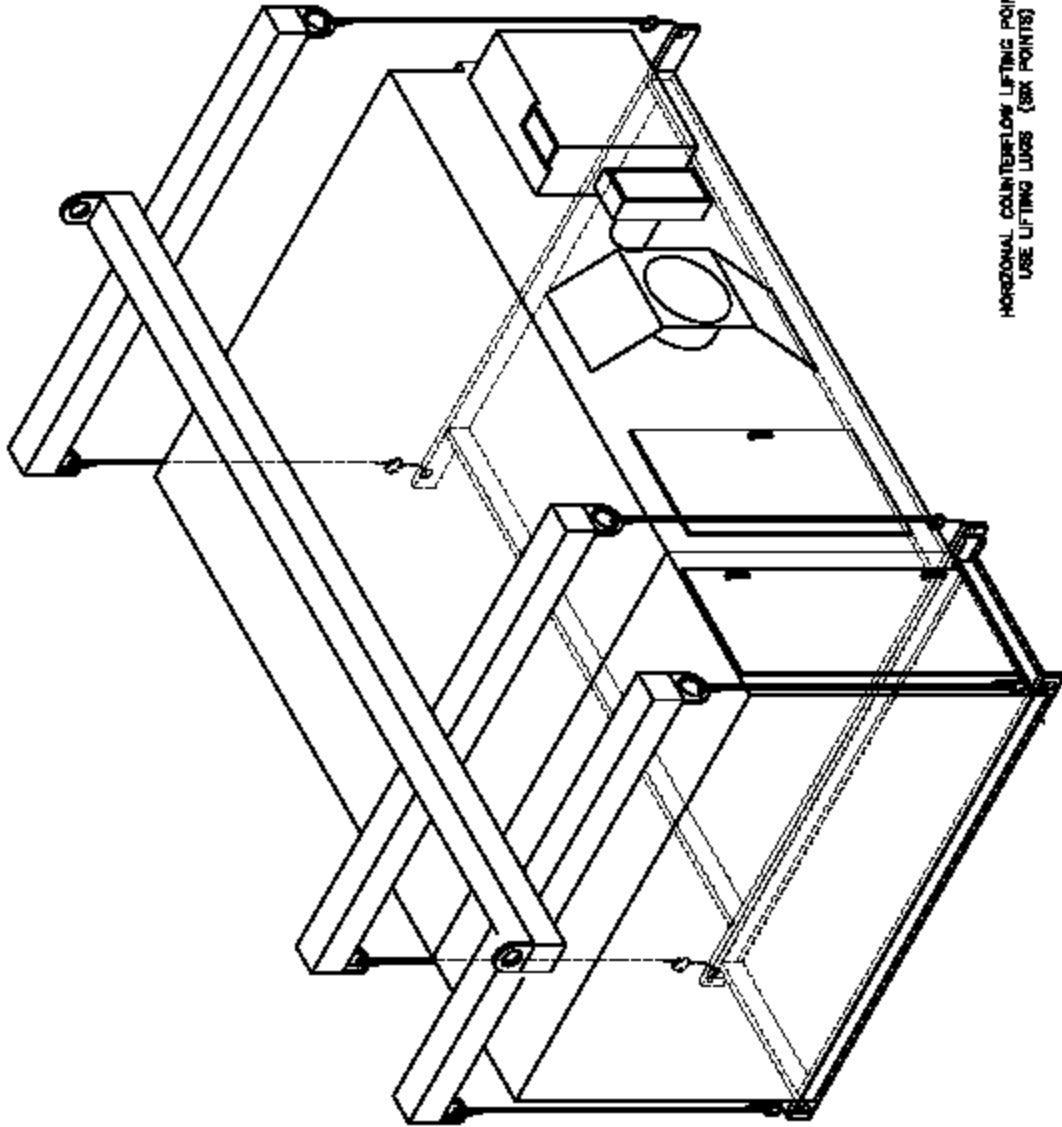
Special attention should be given to the exhaust duct connections, electrical power and control hookup points, and fuel connection points. This information should be cross-checked with the position of support beams and stand pipes to insure that clearance dimensions coincide with those of the unit.

The following recommendations are not intended to supplant requirements of federal, state or local codes having jurisdiction. All local authorities having jurisdiction should be consulted before the installation is made. The heater should be installed in accordance with the standard of the National Board of Fire Underwriters for the class and all wiring connections must conform to the National Electric Code.

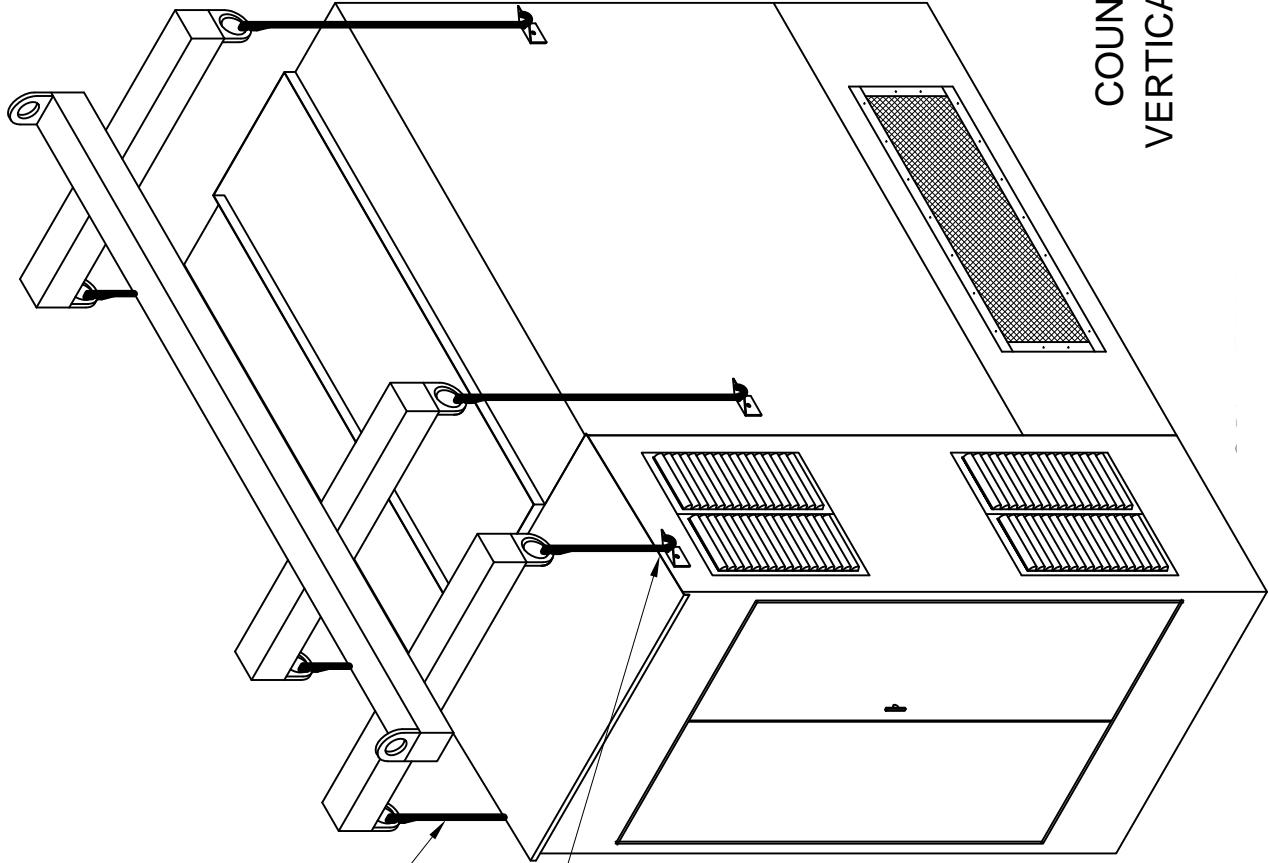
C. COMBUSTION AIR OPENINGS

When the heaters are installed in a separate heater room with fresh air and return air ducts running direct to the base of the heater, or when the plant is under a high negative pressure condition, provisions should be made for an outside source of combustion air. A conservative rule of thumb for estimating the inlet area required is 90 square inches per 1,000,000 BTU/HR heater output. The following table lists the recommended free area of vent opening in the outside wall for various heater sizes.

<u>HEATER SIZE MODEL</u>	<u>AREA OF COMBUSTION AIR INTAKE OPENING – SQ.INCHES</u>	<u>CONNECTING DUCT DIAMETER – INCHES</u>
20	18	6
25	22	6
40	36	7
50	45	8
75	68	9
100	90	11
125	113	12
150	135	13
175	158	14
200	180	14
225	202	16
250	225	18
275	248	18
300	270	19
325	292	20
350	315	20
400	360	22
450	405	24



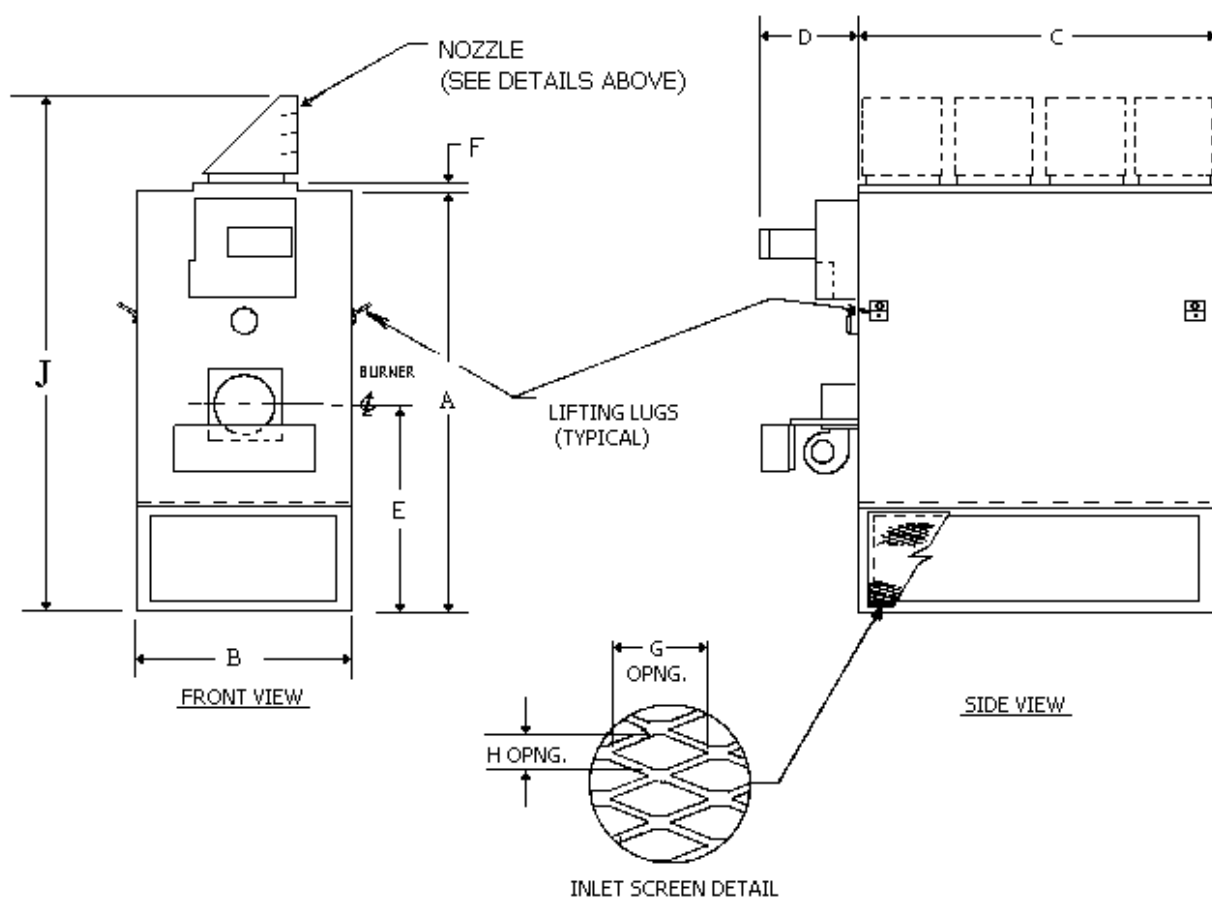
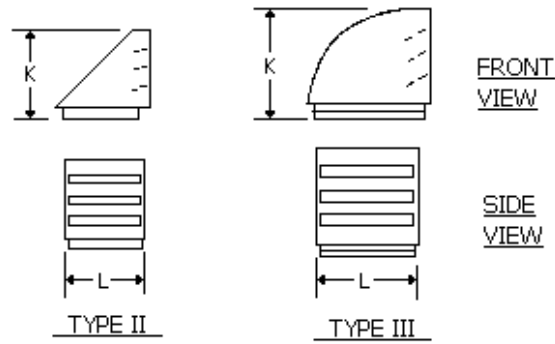
HORIZONTAL COUNTERBALANCE LIFTING POINTS
USE LIFTING LUGS (SEE POINTS)



THIS POINT IS FOR
LEVELING UNIT AND NOT
A WEIGHT BEARING LIFT POINT

COUNTERFLO 40/450
VERTICAL ARRANGEMENT

(LIFTING POINTS)



CF MODEL	DIMENSIONS IN INCHES											Qty. of Nozzles	Type of Hood/ Nozzle
	A	B	C	D	E	F	G	H	J	K	L		
40/55	88	33	52	22	50 ³ / ₄	2	1	5/16	104 ¹ / ₂	16 ³ / ₄	15 ¹ / ₄	3	II
60/85	94 ⁵ / ₈	39 ¹ / ₈	61 ¹ / ₈	22 ³ / ₄	49 ⁵ / ₈	1 ¹ / ₂	1	5/16	114 ¹ / ₈	18	17	3	II
100/125	98 ⁵ / ₈	44 ⁵ / ₈	70 ⁵ / ₈	21 ⁵ / ₈	51 ³ / ₄	2	1	5/16	118 ¹ / ₈	18	17	4	II
150/175	108	55 ⁵ / ₈	91 ¹ / ₈	25 ¹ / ₄	53	2	1	5/16	132 ¹ / ₂	22 ¹ / ₂	20	4	II
200/225/250	130 ³ / ₄	60 ⁵ / ₈	100	25 ¹ / ₂	72 ¹ / ₂	-	1	5/16	153 ¹ / ₄	22 ¹ / ₂	20	4	II
275/300/325	134	67 ⁵ / ₈	142 ¹ / ₂	29 ⁵ / ₈	88	1 ³ / ₈	2 - 11/16	1 - 1/16	164 - 11/16	29 - 5/16	29 ¹ / ₂	4	III
350/400/450	134	80	164	29 ⁵ / ₈	88	1 ³ / ₈	2 - 11/16	1 - 1/16	164 - 11/16	29 - 5/16	29 ¹ / ₂	5	III

Figure 1 – Typical Counterflo Heater for Vertical Upright Mounting

D. LOCATION OF ACCESSORIES

Where applicable, standard or optional accessories will be placed inside the fan section of the unit for shipment, and must be removed and installed by the mechanical or electrical contractor.

E. ELECTRICAL CONNECTIONS

All wiring must comply with all applicable local, state, provincial, and national electric codes. Since shipment of unit may require disassembly after factory flame test, reconnection of some electrical devices will be required in the field. Connect electrical wires (supplied in factory furnished conduit) to appropriate terminals. All leads are tagged to facilitate rewiring in the field. See wiring diagram provided with equipment. Complete all wiring to any optional accessories as shown on the electrical wiring diagram as required before applying voltage to the unit.

The total amperage of the main disconnect switch, blower motor, and control circuit transformer fusing is affected by the addition of 25% to the full load amps as required by the National Electric Code.

Check the supply voltage before energizing the unit. The maximum voltage variations should not exceed $\pm 10\%$. Phase voltage unbalance must not exceed 2%.

F. PIPING CONNECTIONS

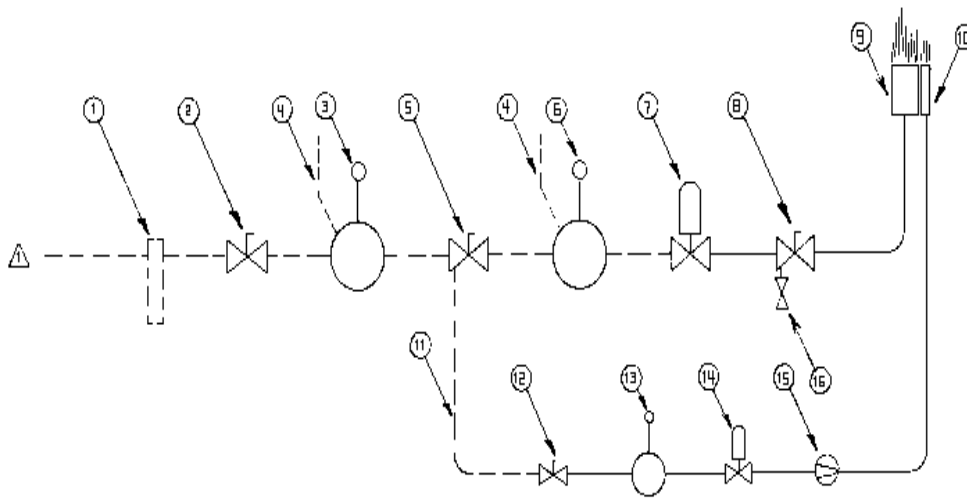
All gas piping connections are not shown in this manual because of the many manifold arrangements available due to approval code requirements and different types of modulation. All piping must comply with "Standards of National Board of Fire Underwriters" and all applicable local codes. Contact factory if exact piping dimensions are required. Protective pipe caps are furnished on manifolds for shipment from factory; these caps should be removed for installation.

Run correctly sized piping to unit. Install manual gas hand shut-off valve and gas pressure regulator. Please note that gas line pressure must be as shown on specification plate when unit is operating at full input.

1. Fuel piping – Gas Models

Figure 2 presents a table of gas piping sizes for varying flow rates. A typical On-Off gas piping manifold is shown in Figure 3. Gas burner connection will vary between 1" and 3" depending on the Counterflo model and type of gas.

On gas systems, vent pressure regulator(s) and vent valve (if included with unit) to outside of building. With vent pipe outside, install a proper vent cap and/or screen to prevent entrance of foreign material and plugging.



ITEM	DESCRIPTION	Furnished and Installed by Others		
		Furnished By Factory, Installed By Others	Factory Furnished And Installed	
1	Drip Leg			X
2	Main Gas High Pressure Hand Shut-Off Valve (If Required)		X	
3	Main Gas High Pressure Regulator (If Required)		X	
4	Vent Line Thru Roof To Outside Atmosphere			X
5	Main Gas Hand Shut-Off Valve		X	
6	Main Gas Pressure Regulator		X	
7	Safety Shut-Off Valve	X		
8	Manual Leak Test Hand Valve	X		
9	Main Gas Burner	X		
10	Leak Test Petcock W/ Plugged Test Connection	X		
11	Pilot Gas Supply Line			X
12	Pilot Gas Hand Valve	X		
13	Pilot Gas Pressure Regulator	X		
14	Pilot Gas Solenoid Valve	X		
15	Needle Valve (If Required)	X		
16	Pilot Gas Burner	X		

△ To Natural Gas Or Propane Fuel Supply.

Figure 3 – Typical On-Off Gas Piping For Counterflo Heaters (1/2# Inlet Pressure)

Length of Pipe (Equiv. Ft.)	GAS FLOW CAPACITY (CFH)							
	Iron Pipe Size (IPS) Inches							
	1	1-1/4	1-1/2	2	3	4	6	8
50	244	537	832	1680	5018	8464	22472	41518
100	173	380	588	1188	3549	5986	15894	29364
150	141	310	480	970	2896	4885	12972	23965
200	122	268	416	840	2509	4232	11238	20760
250	109	240	372	751	2244	3785	10050	18567
300	99	219	339	685	2047	3454	8170	16943
400	86	189	294	594	1774	2992	7945	14679
500	77	169	263	531	1587	2677	7108	13132
1000	54	119	185	375	1121	1891	5022	9279
1500	44	97	151	306	915	1544	4101	7577
2000	38	84	131	265	793	1338	3554	6567

Figure 2 – Gas Flow Capacity for Piping of Different Sizes and Lengths

G. EXHAUST DUCT CONNECTION

Installation of exhaust stack must comply with regulations of the National Board of Fire Underwriters and local governing bodies.

The exhaust stack, exhaust stack connector, exhaust stack support and miscellaneous items related to the exhaust stack are to be supplied and installed by others. **Exhaust stack located inside the building must be positive pressure vent.**

Connect the exhaust stack to the heater breeching box and run stack through roof as shown in Figure 7. Avoid use of long horizontal exhaust pipe runs; the exhaust fan has ample capacity for venting the heater, but cannot perform satisfactorily against strong back drafts or excessive stack resistance.

Heaters are not approved for use with Type L Vent in Canada.

H. OPTIONAL REMOTE CONTROL PANEL INSTALLATION

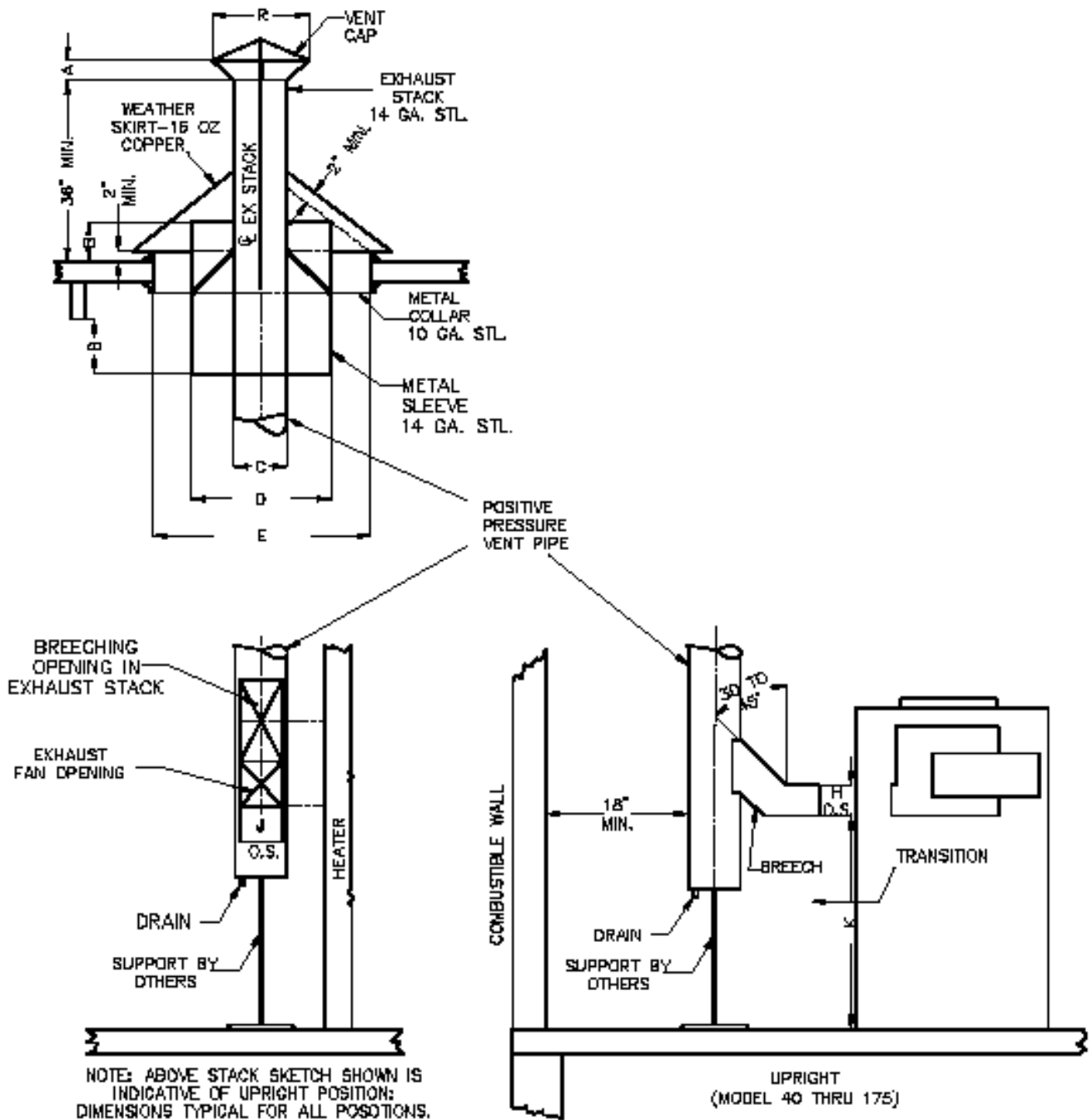
1. Refer to Figure 8 for guidelines.
2. All wiring must comply with applicable electric codes.
3. Align box with spirit level.
4. If box is to be surface mounted, three (3) mounting holes in back of box are recommended, one in each top corner and one at bottom center. If mounting holes are to be located in side of box as shown, four (4) holes are recommended, two at top and two at bottom.
5. If wiring box is to be recessed, install so that open edge of box will be flush with finish wall. Install optional flush mounting wall plate. Examine wiring box and control panel for clearance before providing conduit hole(s).
6. Control panel is furnished with components wired to coded terminal strip. Installer to connect numbered terminal blocks on remote control panel to corresponding terminal block(s) in master control panel on unit.
7. Use proper wire sizing practices when running wires for the remote control panel.

SECTION III. – PRE-START INSPECTION

A pre-start inspection is extremely important and should be completed with greatest attention given to detail. This will insure against possible unit damage on start-up and will save valuable analysis time in the event malfunctions occur on start-up and check-out.

A. PROCEDURE

1. Check to see that all factory installed pipe plugs have been removed.
2. Check supply voltage against unit voltage.



MODEL	A	B	C	D	D ¹	E	E ¹	H	J	K	R	S
40/55	4"	8"	8"	13"	13"	18"	18"	6-1/2"	3-3/4"	69-1/4"	16"	7-3/8"
60/85	5"	10"	10"	16"	18"	22"	26"	7 5/8"	4-3/8"	72-1/16"	20"	8-5/16"
100/125	5 ⁵ / ₁₆ "	10 ¹¹ / ₁₆ "	10 ¹¹ / ₁₆ "	16 ¹¹ / ₁₆ "	18 ¹¹ / ₁₆ "	22 ¹¹ / ₁₆ "	26 ¹¹ / ₁₆ "	9-1/4"	5-1/4"	73-1/16"	20 ¹¹ / ₁₆ "	9-1/2"
150/175	6"	12"	12"	18"	20"	24"	28"	9-11/16"	5"	80-1/4"	24"	13-9/16"

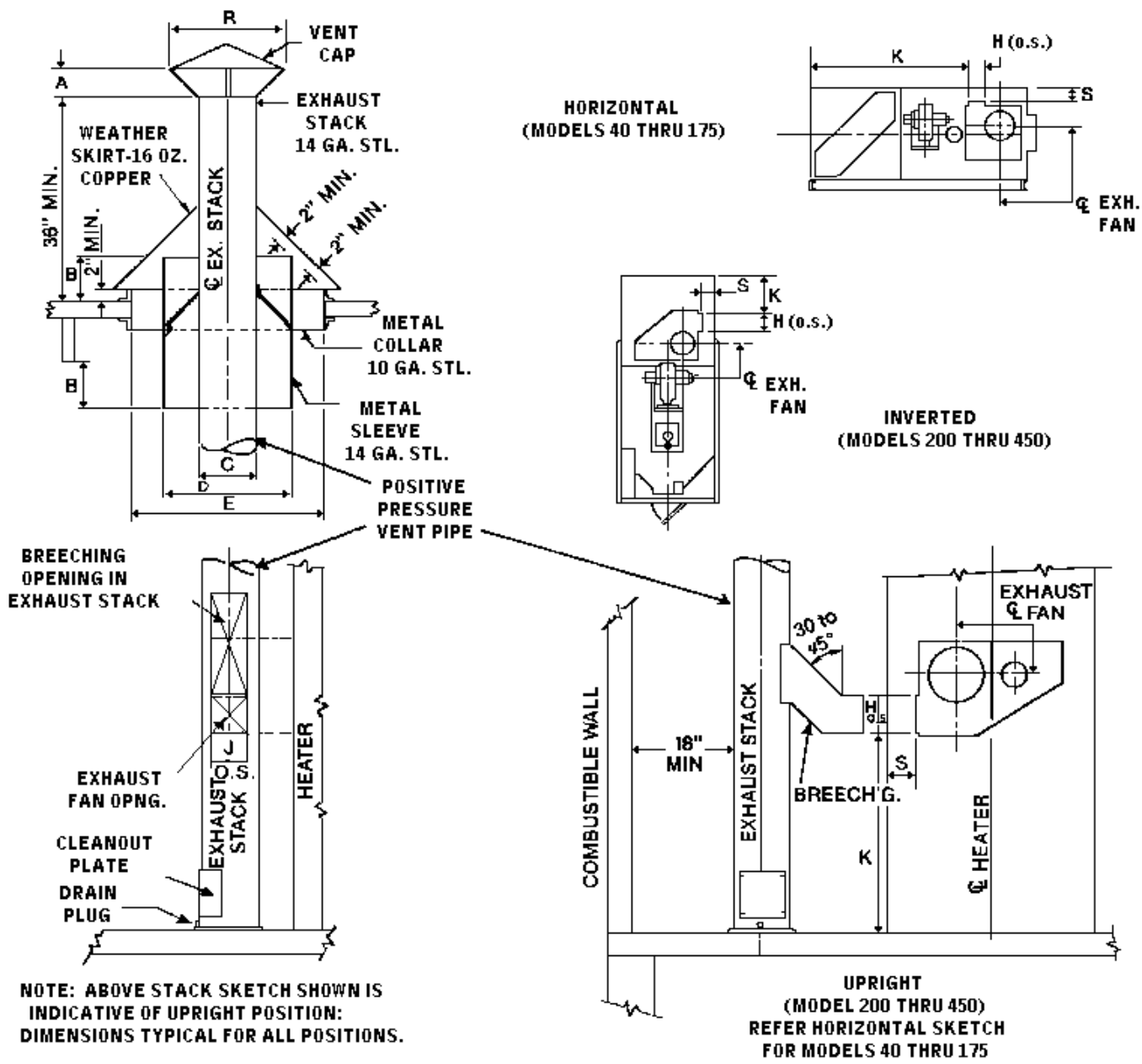
Note: Use D¹ and E¹ for orders with FM approval.

Note: Interior flue vent must be suited for positive pressure venting.

Note: Avoid 90° elbows or sweeping elbows if at all possible by using two 45° elbows.

Note: Refer to Section G on page 10 of Service/Installation Manual

Figure 7 – Exhaust Details for Counterflo Heaters (Model 40 thru 175)



MODEL	A	B	C	D	D ¹	E	E ¹	H	J	K	R	S
200/250	6"	12"	12"	18"	20"	24"	28"	9-11/16"	5"	23-1/8"	24"	9-5/8"
275/325	10-1/2"	16"	16"	22"	24"	28"	32"	11-5/16"	5-5/8"	33"	37-1/4"	6-3/8"
350/450	14"	18"	18"	24"	26"	30"	34"	11-5/16"	5-5/8"	33"	48"	9-1/4"

- Note: Use D¹ and E¹ for orders with FM approval.
- Note: Interior flue vent must be suited for positive pressure venting.
- Note: Avoid 90° elbows or sweeping elbows if at all possible by using two 45° elbows.
- Note: Refer to Section G on page 10 of Service/Installation Manual.

Figure 7 – Exhaust Details for Counterflo Heaters (Model 200 thru 450)

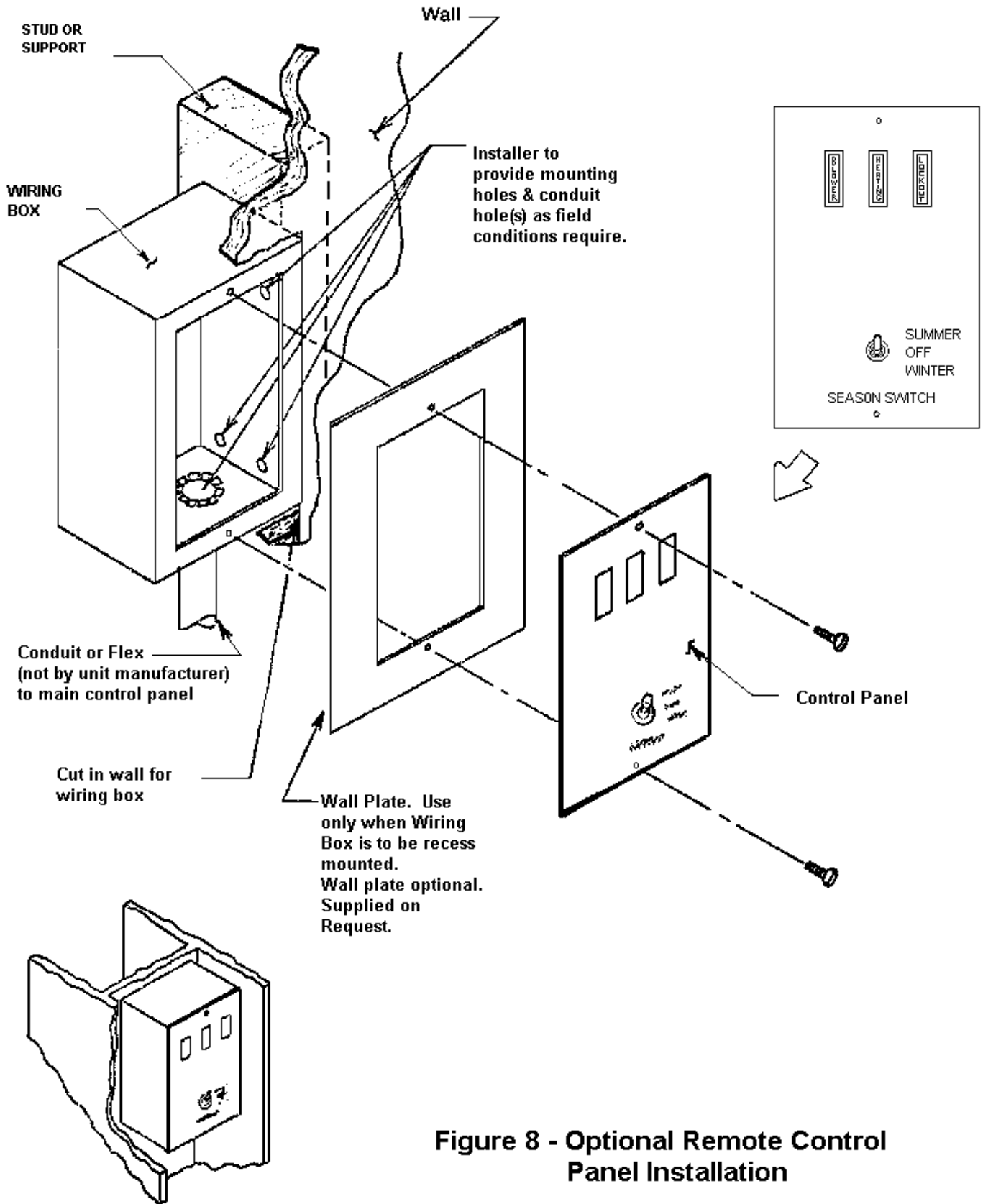


Figure 8 - Optional Remote Control Panel Installation

3. Check all electrical connections in the main control panel.
4. Check that all fuses are installed and that fuse sizing agrees with the fuse chart affixed on the inside of the main control panel door.
5. Check to see if all gas connections are tight and that all joints have been properly sealed.
6. Check positioning of flame rod, and spark rod. Make sure the combustion air fan is fastened securely to motor shaft.
7. Check for cracks in refractory around the blast tube. This inspection requires close observation with the aid of a good flashlight. Even a tiny crack can cause a positive pressure within the combustion chamber and result in faulty burner operation.
8. Check fan supply area to insure freedom of shaft rotation and proper belt tension. Check to see that blowers are tight on shaft and turn freely without rubbing the blower housing. The motor and shaft should turn readily by hand pull of the belts. Properly adjusted belts can be easily depressed about one inch. Make sure the fan shaft pillow block bearing locking collars are tight and main fan bearings have been lubricated.
9. Lubricate main fan bearing with a high grade lithium base grease. Perform at least every quarter (three months) or schedule according to equipment use.
10. Check fan motor to insure that pulleys are secure and drive belts are tight.

NOTE: Do not start the burner unless the main blower access plate or screen is secured in place.

Belt Cross Section (marked on belt)	Motor Pulley Pitch Diameter	Deflection Force	
		Minimum	Maximum
A	3.0" – 3.6"	2.62 lbs.	3.25 lbs.
	3.8" – 4.8"	3 lbs.	4 lbs.
	5.0" – 7.0"	3.25 lbs.	5 lbs.
B	3.4" – 4.2"	3 lbs.	5 lbs.
	4.4" – 5.6"	4 lbs.	5.87 lbs.
	5.8" – 8.6"	5.25 lbs	7.87 lbs.

11. Check all areas for cleanliness.

SECTION IV. – START-UP

All safety and operating controls have been checked during the factory test period; however, it is advisable to complete a similar check when first operating the unit. Before attempting any service work, make sure all electrical switches are open and manual valves are closed.

A. PROCEDURE – Caution: Always wear proper protective gear with face shield while operating these units.

1. Precheck:
 - a. The high limit should be set for 200° F. The fan control should be set at 120° F on high and 90° F on low. Note that fan operation is intermittent.

- b. Combustion air and exhaust air proving switches are factory set for 0.2" to 0.4" W.C.
 - c. Recheck all set screws on motor sheave and fan sheave. Check alignment of belt(s) and pulley(s). Run blower for a few minutes and adjust motor take-up if necessary. Motor is mounted on an adjustable base shown on Figure 9. Do not over-tighten belt(s) since excessive tension will reduce belt life and cause excessive load on bearings. After initial start, allow the belts a few days' running time to become seated in pulley grooves, then readjust as necessary. Do not roll belts over grooves or sheaves as this will result in permanent belt damage.
2. With the unit main control panel under lock out tag out procedure applied and with the (first-supply) manual gas valve being closed, remove the plug from the (first) electrical safety shutoff valve on the inlet side (in some cases a plugged tee is installed). Open the (first-supply) manual valve to purge air from the gas line. Caution: use an electronic combustible gas indicator as air is purged. Do not depend on sensing the odor of gas to determine if the gas line is purged. Refer to NFPA-54 (2012 edition or later) on procedures for proper gas purging.
 3. Close main disconnect switch.
 4. Push reset button on unit programming controller while power is on.
 5. The On-Off burner switch on the master control panel will operate the burner and exhauster blowers.
 6. All three phase motors were properly phased during factory testing. If rotation is reversed, interrupt main power supply and interchange any two of the incoming power leads. Reestablish power and recheck fan operation.
 7. On three phase units, the starter contacts should pull in and hold quietly without "clatter". If they do not operate quietly, check immediately for proper line voltage. Even temporary low voltage at start-up will cause constant operating trouble and must be corrected before the Counterflo heater is placed in service.
 8. Open manual hand valves. After manual valves have been opened, burner should ignite automatically if thermostat is in control circuit.
 9. The burner assembly for gas Counterflo heaters generally requires readjustment of the flame test settings for proper operation under actual field conditions. The most accurate guides to proper burner adjustment are:

WARNING: Never be within the swing radius of the access door when making flame observations through the peephole. Always wear proper protective gear with face shield while operating these units.

- a. Proper flame travel within the stainless steel combustion chamber differs from the pattern usually desired for a refractory lined furnace. Never adjust the burner to produce a short "bushy" flame concentrated in the front end of chamber as shown in Figure 10A. Such a flame concentrates heat release in the front end of the chamber and creates a short circuit between the burner and economizer tube section which results in high stack temperature. Figure 10B illustrates a flame that is much too long and will cause over-heating of the rear wall. A correct flame should be fairly vigorous, free of smoky haze, and should barely

impinge on the rear wall of the chamber. Figure 10C illustrates proper flame travel. This long steady flame provides adequate time for complete combustion and balanced heat release to all surfaces of the chamber. Typical draft conditions are noted in Figure 11 for firing at full rate capacity. Adjust to field conditions when necessary.

- b. Stack temperature, CO₂, O₂, CO and percentage of excess air percentage content of the flue gasses.
- c. Proper flame signal from the flame rod sensor, (4-10VDC).

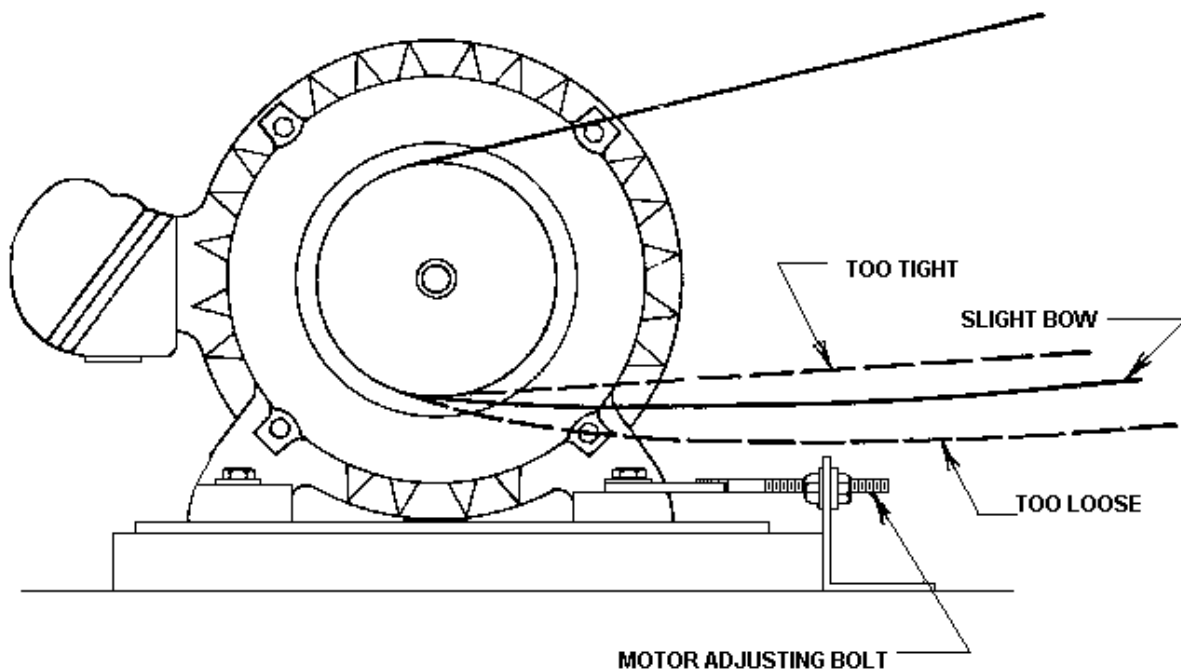


Figure 9 - Motor Adjustment Diagram for Counterflo Heaters

10. Burner Start-UP

Open the air louver on the air inlet to approximately the one-quarter open position. Open the manual gas valve slowly, burner will ignite. Allow motorized safety shut-off valve to open valve until gas pressure on the gauge is approximately 4 ounces w.c. (**See spec plate for factory differential pressure setting. Use "U" tube manometer**). Observe flame conditions and combustion readings from combustion analyzer. If gas flame has yellow or yellow tip appearance, open combustion air louver wider until flame appears short and hard.

Adjust gas pressure regulator on burner to the unit name plate operating pressure rating while firing with the manual gas cock in the wide open position. Read gas meter serving burner, input should be approximately that stated on the burner name plate. If not, readjust regulator to obtain rated input. NOTE: Check to see if other appliances are on before reading meter.

When the gas input rate is established, air adjustments may be made. The final air setting should produce a flue gas analysis of between 8½% and 9½ % CO₂., and 5.5% to 6.5% O₂ with 0 ppm to 10 ppm of CO and 23% to 30% excess air.

Your local gas utility may aid you in making burner adjustments if you do not have the proper instruments.

Start and stop burner several times to insure proper operation. Check for proper functioning of high limit and operating control. Burner is now ready for normal operation.

COUNTERFLO / AFX FLAME TEST REPORT

Model No. _____ Configuration No. _____ Ser. No. _____

Date: _____ Assembled By _____ Tested By _____

Approvals and/or Label No. _____

MOTOR OPERATING DATA

	Blower		Exhauster		Burner	
	Nameplate	As Read	Nameplate	As read	Nameplate	As Read
MFG.						
MODEL/CAT NO.						
HP						
RPM						
VOLT						
AMP						
PHASE						

FAN OPERATION

Main Fan

Design Speed _____ RPM Drive Fixed _____ Variable _____
 As Read _____ RPM

Exhauster

Design Speed _____ RPM Drive Fixed _____ Variable _____
 As Read _____ RPM

BURNER OPERATION

MFG. HASTINGS MAXON OTHER _____

MODEL _____

FUEL TYPE NG or LP

DESIGN INLET PRESSURE _____ " W.C./PSI AS TESTED _____ : W.C./PSI

BURNER (High Fire) OPERATING DIFF. PRESSURE (7" W.C. MAX) AS TESTED _____ " W.C.

FLAME SAFETY D.C. Volt Reading (High Fire) _____ (Low Fire) _____

STACK TEMPERATURE _____ °F COMBUSTION TEST (Attach Comb Text Printout)

DRAFT IN COMB CHAMBER (Hot) _____ " W.C. STACK _____ " W.C.

DIELECTRIC TEST

- 1-30V @ 600V for 1 Sec.
- 31-120V @ 1500V for 1 Sec.
- 121-250V @ 1800V for 1 Sec.
- 215-600V @ 2400V for 1 Sec.

Control Set Point

HIGH LIMIT (HL)	_____	OVERRIDING TIMER (OT)	_____
AUXILIARY HIGH LIMIT (AX)	_____	AIR PROVING SWITCH (AP)	_____
BONNET FAN SWITCH (BF)	_____	CLOGGED FILTER/BLOCKED INTAKE (CS)	_____
LOW LIMIT (LL)	_____	COMBUSTION AIR SWITCH (CA)	_____
OUTSIDE AIR CONTROL (AT)	_____	DRAFT SWITCH (DS)	_____
MODULATING DISCHARGE CONTROL (MD)	_____	LOW GAS PRESSURE SWITCH (LG)	_____
MODULATING LO LIMIT CONTROL (ML)	_____	HIGH GAS PRESSURE SWITCH (HG)	_____
DELAY TIMER (DT)	_____	ROOM STAT (RT)	_____

Modulating Damper Wired to Unit/Adjusted

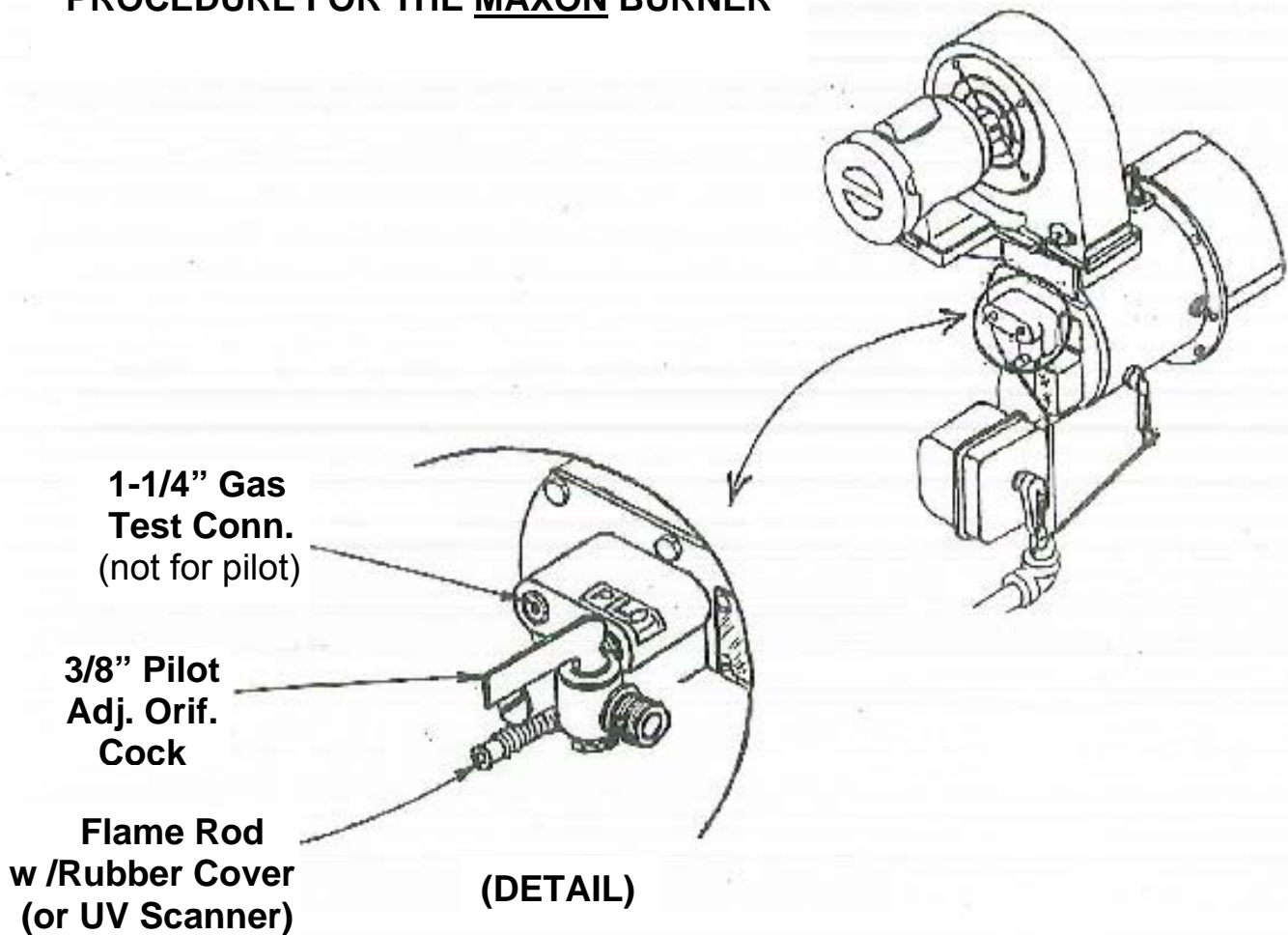
	Yes	No		Yes	No
Fresh Air	_____	_____	Discharge Air	_____	_____
Return air	_____	_____	Other	_____	_____

Operation and Inspection

This unit has been tested and inspected to insure that: (1) Fabrication, wiring, quality and location of all materials agree with Hastings HVAC Standard. (2) Bearings, sheaves, belts, and motors have proper alignment, lubrication and adjustment. (3) Controls, valves and programmers have proper sequence of operation and setting. (Limit, pressure and fan switches, thermostats, regulators, timers, microampere generation, pre and post purge, etc.)

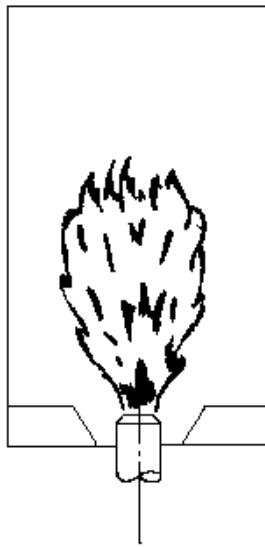
COMMENTS

**HASTINGS COUNTERFLO
OPERATING PRESSURE SETTING
PROCEDURE FOR THE MAXON BURNER**

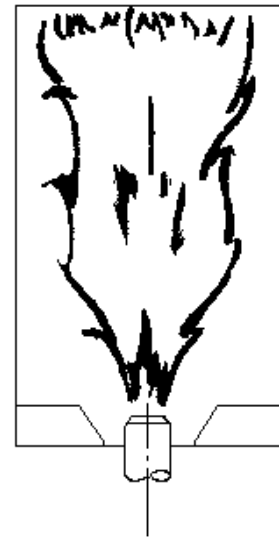


ATTACH ONE SIDE OF THE FLUID MANOMETER TO THE "1/4 IN. GAS CONN." ON THE MAXON BURNER. ATTACH THE OTHER SIDE OF THE MANOMETER TO A 1/4" X 7" TUBING WHICH IS INSERTED THROUGH THE SMALL OBSERVATION PORT OF THE COMBUSTION CHAMBER. THIS WILL YIELD A DIFFERENTIAL PRESSURE.

AFTER THE BURNER HAS BEEN RUNNING FOR 15 TO 20 MINUTES SET THE OPERATING PRESSURE TO HASTINGS SPECIFIED PRESSURE LISTED ON THE NAME PLATE OF THE HASTINGS UNIT WHILE IN THE HIGH FIRE MODE.



A. Flame Too Short



B. Flame Too Long



C. Proper Flame

Figure 10 - Flame Patterns

COUNTERFLO MODEL #	FULL RATED MBH OUTPUT	EXHAUSTER RPM GAS	CHAMBER PRESSURE (Neg. "W.C.)*	BREECHING PRESSURE (Neg. "W.C.)
			GAS	GAS
40	400	1400	.15	.055
55	550	1500	.15	.38
60	600	1300	.25	.60
85	850	2030	.15	.50
100	1000	1500	.20	.75
125	1250	1900	.45	.90
150	1500	1640	.50	1.10
175	1750	1875	.70	1.25
200	2000	1800	.55	1.40
225	2250	2000	.60	1.48
250	2500	2000	.65	1.50
275	2750	1635	.60	2.00
300	3000	1635	.65	2.00
325	3250	1635	.60	2.00
350	3500	1850	.50	2.00
400	4000	1850	.50	2.00
450	4500	1850	.30	2.00

Note: Values shown are those obtained when firing at full rated output.

*Note: Minimum chamber over-fired draft pressure .15" w.c.

Figure 11 – Typical Draft Conditions for Counterflo Heaters

12. The typical sequence of operation for an On-Off gas-fired unit is as follows:
 - a. Closing fused disconnect switch (FD) will energize 115 volt control circuit through control transformer (T2).
 - b. The On-Off burner switch (XB) on the master control panel will operate the blower. Unit burner operation is controlled by the On-Off thermostat (RT). Blower motor (M1) will operate through blower motor starter (1M) if starter overloads are all operational and bonnet temperature is above bonnet fan switch set point. The bonnet fan switch will remain in the electrical circuit after burner shutdown until blower has cooled heat exchanger to a temperature below the setpoint of the control.
 - c. After continuous flame has been established, ignition transformer and pilot valve drop out of circuit.
 - d. If safety shutdown should occur upon failure to ignite pilot, failure to light the main burner flame, or loss of flame while main burner is firing, the internal lockout switch will trip and lockout the protectorelay.

SECTION V. -- MAINTENANCE SCHEDULE AND LUBRICATION REQUIREMENTS

A. MAINTENANCE SCHEDULE – **Caution: Always wear proper protective gear with face shield while operating these units.**

Weekly

1. Check that fan belts are tight and sheaves are lined up.
2. Check gas pressure at burner.

Monthly

1. Check all valves, piping and connections for gas leaks.
2. Check combustion air louver settings as outlined in burner start-up procedures.
3. Remove pilot assembly and check spark electrode, flame rod settings, and pilot head.
4. Repeat control system check-out.

Quarterly

1. Check limit control to insure operation.
2. Check stack condition and stack connection, supports and draft.
3. Lubricate exhaust pillow block ball bearing units with a good grade of ball bearing grease.
4. Filters must be replaced at regular intervals with filters of same type, number, and size.

Yearly

1. Remove rear access plate and clean out economizer tubes. (Place receptacle to collect soot as the swirlers are pulled out. Do not operate fans while access plate is off as considerable soot may be blown into surrounding area.) Be sure gasket is properly seated when replacing the access plate.
2. Inspect refractory around burner. If cracked or damaged, repair or replace.
3. Clean exhauster fan wheels.
4. Remove burner drawer assembly, inspect nozzle and electrode tips, and remove any carbon deposits. Clean all parts before reassembling.
5. Lubricate burner motor.
6. Lubricate fan motor and main fan bearings as directed by motor and bearing manufacturer and inspect fan motor wiring for loose connections.
7. Check all control settings as outlined.
8. Clean gas pressure regulator.
9. Turn main disconnect switch to “off” and open control box. Make sure controls are free from dust and grease. Check and clean relay and starter contacts, and inspect for loose wiring. Do not use file, sandpaper, or other abrasives to clean contacts – clean with notebook or heavy wrapping paper, not newspaper.

NOTE: Keep screened air intakes clear of obstructions at all times – failure to do so will result in equipment damage.

B. LUBRICATION INSTRUCTIONS

<u>ITEM</u>	<u>Manufacturer</u>	<u>Bearing Type</u>	<u>Recommendation</u>
All 3 phase fan motors (1 HP to 100 HP) ODP or TEFC	U.S. or equal	Single row ball bearings	Note #1
Fractional HP exhauster motors, single phase, ODP or TEFC	Century, G.E., or equal	Sealed ball bearings	Lubrication Not Required
Fractional HP burner motors and oil pump motors, single phase, ODP or TEFC	Century, G.E. or equal	Sealed ball bearings	Lubrication Not Required
Fan shaft bearings	Linkbelt or equal	Self-aligning bearings, resilient mounted	Note #2

NOTES

1. Remove top and bottom grease plugs. Install lubrication fitting in place of top plug. Annually flush with lithium base grease, consistency #2, until clean grease is discharged from bottom hole. Run motor with drain plug removed until grease stops flowing from drain. Reinstall drain plug.
2. Apply a high grade of lithium base grease with a #2 consistency at least every quarter (3 months) or schedule according to equipment use. Wipe off excess grease from bearings.

C. TESTING OF CONTROLS AND SAFETY DEVICES – **Caution: Always wear proper protective gear with face shield while operating these units.**

The Safety and Operating Controls shall be periodically tested to maintain the safe operation of the furnace. Items to be tested include; High Limit, Gas/Oil Safety Shut-off Valves, Thermostats, Air Proving Switches and Flame Safeguards.

Thermostat:

1. Observe the cut-in and cut-out points of the thermostat.
2. Adjust the set point down until the load contacts open, compare this to the room temperature.

Air Proving Switch:

1. Turn unit on and set Thermostat to call for heat.
2. With heater in operation, manually trip the Blower Motor Overload Relay, to shut off blower motor.
3. The burner should shut off, and the unit should go into a Safety Shutdown.
4. Reset Blower Motor Overload Relay and Flame Safety.
5. Refer to the Air Proving Manufacturers' Installation and Maintenance Manual for further information.

Flame Safeguard:

1. Turn unit on and set thermostat to call for heat.
2. With heater in operation, simulate flame failure manually closing fuel shut off valves.

3. Measure the failure response time, (time between flame absence and shutting of safety shut-off valve). It should be less than 2-3 seconds.
4. The unit should go into a safety shutdown.
5. Reset Flame Safety and open manual shut off valves.
6. Refer to the Flame Safety Manufacturers' Installation and Maintenance Manual for further information.

Safety Shut-Off Valves:

1. Close the Manual Leak Test Hand Valve located down stream from the Second Safety shut-off valve.
2. Remove plug, and install rubber hose on the Leak Test Petcock, place the other end of hose in a bucket of water.
3. To check down stream Safety Shut-off Valve for leakage, open the up stream Safety Shut-off Valve manually or electrically, check for bubbles in water.
4. To check up stream Safety Shut-off Valve, open the down stream Safety Shut-off Valve (manually or electrically) and check for bubbles in water.
5. Bubbles observed in this test indicate one or both Safety Shut-off Valves are leaking and require repair or replacement.
6. Refer to the Safety Shut-off Valve Manufacturers' Installation and Maintenance Manual for further information.

High Limit:

1. Prior to placing the unit in operation, jumper the Air Proving Switch and manually trip Blower Motor Overload Relay.
2. Turn unit on and set Thermostat to call for heat.
3. Burner should light and when discharge temperature reaches the limit set point, the burner should shut down. This should occur within 10 minutes maximum.
4. Reset Motor Overload Relay and remove jumpers on Air Proving Switch.
5. Refer to the High Limit Manufacturers' Installation and Maintenance Manual for further information.

Cover Plates, Enclosures and Guards

WARNING: All Cover Plates, Enclosures and Guards must be maintained in place at all times, except during Maintenance and Servicing.

SECTION VI. – TROUBLESHOOTING

A. TROUBLESHOOTING GAS-FIRED UNITS

1. If blower fails to operate, check to see if:
 - a. Main disconnect switch or circuit breaker is closed.
 - b. All main fuses (if disconnect switch used) are in line.
 - c. Control transformer is supplying 115 volts to control circuit.
 - d. Burner switch in master control panel is "on".
 - e. High limit control is in circuit (manual reset switch).
 - f. Magnetic motor starter is in circuit (manual reset starter).
 - g. There are any loose wires or connections in blower circuit at either terminal block or control components.
 - h. Bonnet fan switch is in electrical circuit (burner must be operative).

Also check the following optional controls, if used, to see if:

- a. Main gas cock is open – units equipped with manual reset low gas pressure switch must have gas at switch for proper switch operation..
 - b. Low gas pressure switch in circuit (manual reset switch).
 - c. High gas pressure switch in circuit (manual reset switch).
2. If exhauster or combustion air fans fail to operate, check to see if:
 - a. Burner switch in master control panel is “on”.
 - b. Room thermostat is operational and ambient space temperature is not above thermostat set point.
 - c. High limit switch is in electrical circuit.
 - d. Programming relay is functioning properly.
 - e. Exhauster/burner starters, or relays if required, are operational and the fuses that protect them functional.
 3. If pilot fails to light, check to see if:
 - a. Proper exhaust air/combustion air is being sensed by exhauster/burner air flow switches.
 - b. Ignition system is operational.
 - c. Programming relay is functioning properly.
 4. If main flame is not established, check to see if:
 - a. Pilot has been established.
 - b. Flame detector is sensing pilot.
 - c. Programming relay is functioning properly.

B. GENERAL TROUBLESHOOTING TIPS

1. If blower operates and burner fails to operate, check to see if:
 - a. Programming relay is in safety lockout.
 - b. Ignition transformer is functioning properly.
 - c. Flame rod wire and spark ignition wire have loose connections and/or reversed wires.
 - d. Any electrode insulators are cracked; replace as required.
 - e. Pilot gas valve is open and that pilot has been lit (purge pilot gas line to eliminate any air).
 - f. A three to four microamp or 4-10 VDC reading of pilot is being attained.
 - g. Main gas valve(s) is open.
2. If burner ignites, but modulating valve fails to open, check to see if:
 - a. Motor and controller and/or thermostat are wired properly.
 - b. Discharge temperature controller or modulating room thermostat (if butterfly system is being used) is in electrical control circuit.
3. Any optional electrical items that are ordered can be the cause of nuisance shutdowns; check these items for proper operation if failure occurs. Check the supplemental control sheet with each unit for optional component service.

At this point, all common causes of trouble have been covered and one or more of the remedies suggested should have corrected the malfunction. However, if the unit still does not function properly, notify the nearest Hastings HVAC Field Service Engineer at 1-800-228-4243 or 4270.

WARNINGS:

WHEN UNIT IS NOT USED FOR AN EXTENDED PERIOD OF TIME ALL GAS MANUAL VALVES SHOULD BE CLOSED TO PREVENT LEAKAGE. AFTER THE UNIT HAS BEEN SHUTDOWN FOR AN EXTENDED AMOUNT OF TIME, ALL GAS MANUAL VALVES SHOULD BE OPENED AND THE UNIT SHOULD BE STARTED IN A NORMAL MANNER.

IN CASE OF EMERGENCY, THE FURNACE IS REQUIRED TO BE SHUTDOWN. DISCONNECT THE MAIN ELECTRICAL POWER SUPPLY AND CLOSE ALL GAS MANUAL VALVES.

NEVER BURN GARBAGE OR PAPER IN THE HEATING SYSTEM, AND NEVER LEAVE PAPER OR RAGS AROUND THE UNIT.

DO NOT TAMPER WITH UNIT OR CONTROLS – CALL YOUR SERVICE MAN.

For Service Parts and Technical Assistance call:
Hastings HVAC Service Co. at (800) 228-4243 or (800) 228-4270

Service Agent : Name _____

Address _____

Phone # _____



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