

INSTALLATION AND SERVICE MANUAL



HOT WATER HEATING BOILER HOT WATER SUPPLY BOILER MODELS: 250,000 BTU 500,000 BTU 750,000 BTU 1,000,000 BTU



WARRANTY

Factory warranty (shipped with boiler) does not apply to boilers improperly installed or improperly operated.

IMPORTANT: Consult and follow Building, Fire Regulation, and other Safety Codes that apply to this installation. Consult local gas utility company to authorize and inspect all gas connections and flue connections.

SPECIAL INSTRUCTIONS TO BOILER OWNER

NOTE: Retain this manual for future reference.

This manual supplies information for the installation, operation, and servicing of the boiler. **It is strongly recommended that this manual be reviewed completely before proceeding with an installation.** Factory warranty does not apply to boilers improperly installed or improperly operated. Experience has shown that improper installation or system design, rather than faulty equipment, is the cause of most operating problems. Upon receiving equipment, check for signs of shipping damage. Pay particular attention to parts accompanying the boiler, which may show signs of being hit or otherwise mishandled. Verify total number of pieces shown on packing slip with those actually received. In case there is damage or a shortage, immediately notify carrier.

WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

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.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

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

WARNING: Should over-heating occur or the gas supply fail to shut off, do not turn off or disconnect the electrical supply to the pump. Instead, shut off the gas supply at a location external to the appliance.

DO NOT USE THIS BOILER IF ANY PART HAS BEEN UNDER WATER. IMMEDIATELY CALL A QUALIFIED SERVICE TECHNICIAN TO INSPECT THE BOILER AND TO REPLACE ANY PART OF THE CONTROL SYSTEM AND ANY GAS CONTROL WHICH HAS BEEN UNDER WATER.

WARNING: Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electric shock, or other occurrences which may injure you or damage your property. Consult a qualified installer, service agent or the gas supplier for information or assistance.

WARNING: To minimize the possibility of serious personal injury, fire, damage to your boiler or improper operation, never violate the following safety rules:

- 1 Always keep the area around your boiler free of combustible materials, gasoline, and other flammable liquids and vapors.
- 2 Never cover your unit, lean anything against it, store trash or debris near it, stand on it, or in any way block the flow of fresh air to your boiler.

IMPORTANT: Operation of this boiler on low temperature systems requires special piping to insure correct operation. Consult low temperature system section for piping details.

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CODES

The equipment shall be installed in accordance with those installation regulations in force in the local area where the installation is to be made. These shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made. In the absence of such requirements, the installation shall conform to the latest edition of the National Fuel Gas Code, ANSI Z223.1. Where required by the authority having jurisdiction, the installation must conform to American Society for Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, No. (CSD-1). All boilers conform to the latest edition of the ASME Boiler and Pressure Vessel Code, Section IV. Where required by the authority having jurisdiction, the installation must comply with the Canadian Association Code, CAN/CGA-B149.1 and/or B149.2 and or local codes.

LOCATION OF BOILER

These boilers are suitable for indoor or outdoor installations. Venting options and configurations are illustrated in the venting section.

NOTE: If this boiler is installed above radiation level, it must be provided with a low water cutoff device at the time of boiler installation (optional, available from factory). The boiler must not be installed on carpeting.

NOTE: 250,000 BTU models may be installed in a closet. 500,000 through 1,000,000 BTU models may be installed in an alcove.

CAUTION: All installations in such locations must be vented to the outside in accordance with venting instructions.

INSTALLATION

1. Locate the unit so that if the water connections should leak, water damage will not occur. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the unit. The pan must not restrict combustion air flow. Under no circumstances is the manufacturer to be held liable for water damage in connection with this unit, or any of its components.

2. Indoor units must be installed so that the ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, control replacement, etc.)

3. Allow sufficient space in the back of boiler for servicing pipe connections, pump, and other auxiliary equipment, as well as the boiler.

4. The boiler must be placed on a level floor; combustible floor locations may be used.

5. Periodically check venting system. The boiler venting areas must never be obstructed and minimum clearances must be observed to prevent restriction of combustion and ventilation air. Keep appliance area clear and free of combustible and flammable materials and liquids.

The connection from the boiler vent to the stack must be as direct as possible.

CAUTION: The stack for conventional vented units should extend at least three feet above the highest point of the roof to insure proper venting. The stack should be provided with a weather cap of approved design.

NOTE: Provisions must be made to prevent contact of the vent pipe with combustible surfaces, in accordance with all codes and regulations.

CLEARANCES

Clearances for the boiler are based on the location and type of venting system used on the installation. Indoor models using the clearances in Table 1 may be vented with a conventional negative draft stack. The optional Thru-wall venting system will use Table 2 for clearances. All installations must leave adequate clearance for service.

Consult the venting section of the manual for specific installation instructions for each type of venting system you will be using. Thru-wall, Direct Vent, and Outdoor venting systems require special flue pipe and vent caps which must be supplied by the manufacturer.

**TABLE 1
INDOOR MODELS**

MODEL#	Clearances for Servicing				Clearances from Combustible Material			
	250	500	750	1000	250	500	750	1000
TOP	12"	16"	18"	24"	2"	3"	4"	5"
FRONT	24"	24"	24"	24"	2"	18"	18"	18"
BACK	24"	24"	24"	24"	2"	3"	4"	5"
SIDES	*	*	*	*	0*	0*	0*	0*
FLUE					6"	6"	6"	6"
HOT WATER PIPES					1"	1"	1"	1"

**Allow 24" on either left or right side for access to the back of boiler. Suitable for combustible floor installation.*

**TABLE 2
DIRECT VENT MODELS**

MODEL#	Clearances for Servicing				Clearances from Combustible Material			
	250	500	750	1000	250	500	750	1000
TOP	12"	16"	18"	24"	0"	0"	0"	0"
FRONT	24"	24"	24"	24"	0"	0"	0"	0"
BACK	24"	24"	24"	24"	0"	0"	0"	0"
SIDES	*	*	*	*	0*	0*	0*	0*
HOT WATER PIPES					1"	1"	1"	1"
VENT CAP					24"	24"	24"	24"

**Allow 24" on either left or right side for access to the back of boiler. Suitable for combustible floor installation.*

**TABLE 3
OUTDOOR MODELS**

MODEL#	Clearances for Servicing				Clearances from Combustible Material			
	250	500	750	1000	250	500	750	1000
TOP	12"	16"	18"	24"	0"	0"	0"	0"
FRONT	24"	24"	24"	24"	0"	0"	0"	0"
BACK	24"	24"	24"	24"	0"	0"	0"	0"
SIDES	*	*	*	*	0*	0*	0*	0*
HOT WATER PIPES					1"	1"	1"	1"
VENT CAP					24"	24"	24"	24"

**Allow 24" on either left or right side for access to the back of boiler. Suitable for combustible floor installation.*

COMBUSTION & VENTILATION AIR OPENING

For indoor installations with conventional negative draft stacks or the optional Thru-wall venting system, the boiler room must be provided with two openings to assure adequate combustion air and proper ventilation.

1. If air is taken directly from outside the building:
 - a. Combustion air opening, 1 square inch per 2,000 BTU input. This opening must be located approximately 6" from floor.
 - b. Ventilation air opening, 1 square inch per 2,000 BTU input. This opening must be located approximately 6" from the ceiling.
2. If air is taken from another interior space, each opening specified above should have a net free area of one square inch for each 1,000 BTU of input.

CAUTION: Under no circumstances should the equipment room ever be under a negative pressure. Particular care should be taken when exhaust fans, compressors, air handling units, etc. may rob air from the boiler. If negative air pressure exists, additional combustion air and ventilation must be provided.

The combustion air supply must be completely free of any chemical fumes which may be corrosive to the boiler. Common chemicals which must be avoided are fluorocarbons and other halogenated compounds, most commonly present as refrigerants or solvents, such as freon, trichlorethylene, perchlorethylene, chlorine, etc. These chemicals, when burned, form acids which quickly attack the copper tubes, headers, tube sheets, flue collectors, and boiler stack. The result is improper combustion and premature boiler failures.

Provisions for combustion and ventilation air must be in accordance with Section 5.3, Air Combustion and Ventilation, of the latest edition of the National Fuel Gas Code ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of local codes.

VENTING

IMPORTANT: This boiler is a high efficiency unit. It operates at an efficiency level which could yield a condensing condition. Care should be taken in providing the proper venting and employing the best principals of application and sizing. This boiler is listed as a Category II appliance when tested to the latest ANSI Standard.

A Category II boiler operates with a non-positive vent static pressure and with a flue loss less than 17 percent.

Common venting systems may be too large when an existing unit is removed. At the time of removal of an existing appliance, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

- a. Seal any unused opening in the common venting system.
- b. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other unsafe condition.
- c. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at a maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- d. Place in operation, the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

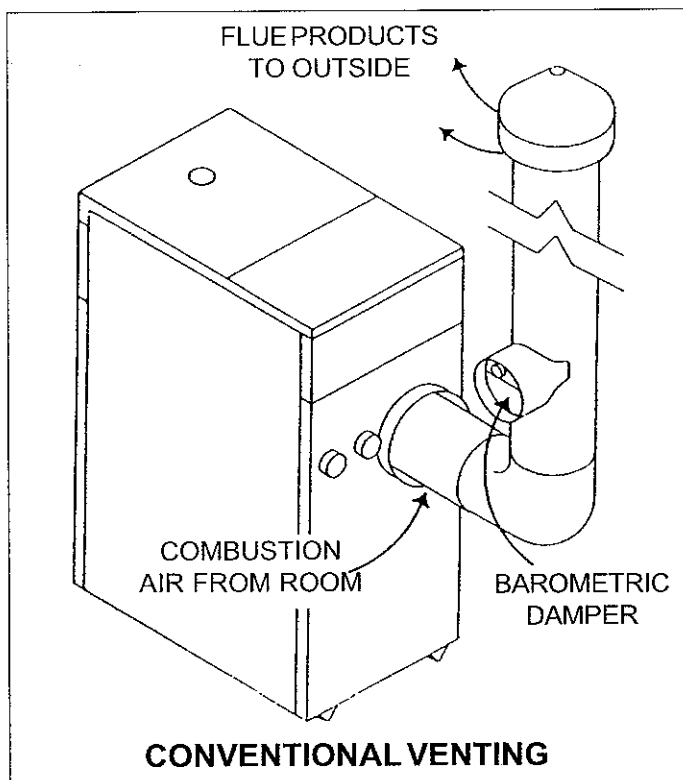
- e. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
- f. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and other gas burning appliances to their previous conditions of use.
- g. Any improper operation of the common venting system should be corrected so that the installation conforms with the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 in the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment.

VENTING CONVERSIONS

This boiler has four venting options. They are:

- A. Category II, negative draft venting
- B. Direct Vent
- C. Outdoor Venting
- D. Thru-Wall Venting

These letters are used as a model number suffix to indicate the installed venting option. These letters are used as a model number suffix to indicate the installed venting option. All boilers are shipped from the factory equipped for conventional venting. The model number has an A suffix. When any of the optional venting system kits are installed, a decal furnished in the kit, should be affixed to the boiler below the rating plate. This indicates that an approved venting conversion has been



installed.

The following is a detailed explanation of each venting system, its installation requirements, the components used, and part numbers for each.

CATEGORY II NEGATIVE DRAFT VENTING - SUFFIX A

This venting uses the natural buoyancy of the heated flue products to generate a negative draft in the flue. The negative draft must be within the range of 0.02 to 0.05 negative to insure proper operation. A barometric damper is furnished with each boiler and must be installed per the damper manufacturer's instructions. The damper is double acting and must be adjusted to maintain draft in the specified range. The vent material must be Category II double wall vent pipe or a Category II insulated vent pipe. Vent material must be listed by a nationally recognized test agency. A bell increaser, mounted directly on the boiler vent, is furnished with models 250, 500 and 750. This bell increases the boiler vent size by 1". The model 1000 does not use an increaser. The minimum flue pipe diameters for Category II, negative draft venting must be as follows:

#250	5" diameter
#500	7" diameter
#750	9" diameter
#1000	10" diameter

Flue pipe for models 750 and 100 must clear the water piping before it can extend vertically.

Vent material for a Category II vent may be purchased locally. Contact the manufacturer of the vent material if there is a question about the suitability of a vent material for application on a Category II vent system.

Adequate combustion and ventilation air must be supplied to the boiler room in accordance with the National Fuel Gas Code requirements (see Combustion and Ventilation Air Openings). For boilers connected to gas vents or chimneys, vent installations shall be in accordance with Part 7, Venting of Equipment, of the latest edition of National Fuel Gas Code ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of local building codes.

Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under a positive pressure.

The connection from the appliance vent to the stack must be made as direct as possible and the same diameter as the vent outlet. The vent must be installed to prevent accumulation of condensate and, have means provided for drainage of condensate. The horizontal breaching of a vent must have an upward slope of not less than 1/4 inch per foot (21mm/m) from the boiler to the vent terminal. The horizontal portions of the vent shall also be supported for the design and weight of the material employed to maintain clearances prevent physical damage and separation of joints.

The manufacturer recommends that vent sizing for single unit installations use the vent sizing chart in table 11-1 of the latest edition of the National Fuel Gas Code. The minimum and maximum BTU ratings in the FAN columns for double wall vents may be used to determine proper vent size for a unit's Category II vent. The combined vertical rise and horizontal run of the vent must have adequate BTU capacity to insure proper operation of the unit. Draft must be maintained within the range of 0.02 to 0.05 negative to insure proper operation. Minimum specified flue pipe diameters must not be reduced.

When combining vents from multiple Category II units, the manufacturer recommends that vent sizing of the common vent and connectors use the vent sizing chart in table 11-6 of the latest edition of the National Fuel Gas Code. The minimum and maximum BTU ratings in the FAN columns for double wall vents may be used to determine proper vent size for a unit's Category II vent. The combined vertical rise and horizontal run of the vent must have adequate BTU capacity to insure proper operation of the unit. Draft must be maintained within the range of 0.02 to 0.05 negative to insure proper operation. Minimum specified flue pipe diameters must not be reduced.

IMPORTANT: Examine the venting system at least once a year. Check all joints and vent pipe connections for tightness. Also check for corrosion or deterioration.

VENT TERMINATIONS

The vent terminal should be vertical and terminate outside the building at least 3' (0.9m) above the highest point of the roof. The vent cap should have a minimum clearance of 4' (1.2m) horizontally from and in no case above or below (unless a 4' (1.2m) horizontal distance is maintained) electric meters, gas meters, regulators and relief equipment. The distance of the vent terminal from adjacent public walkways adjacent buildings, openable windows and building openings must be consistent with the National Fuel Gas Code Z223.1 in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment.

CAUTION: The vent cap terminal must be sized adequately to evacuate the BTU's of the boilers in the flues.

DIRECT VENT - SUFFIX B

These installations utilize the boiler mounted blower to draw combustion air from outdoors and vent combustion products to the outdoors. They require a special double wall, combination air intake/flue pipe and a special vent cap. Both the double wall pipe and vent cap must be furnished by the boiler manufacturer in accordance with AGA/CGA requirements.

WARNING: No substitutions of flue pipe or vent cap material are allowed. Such substitutions would jeopardize the safety and health of inhabitants.

The total length of the direct vent system cannot exceed 20' (6.0m) in length. Each elbow used is equal to 5' (1.5m) of straight pipe. This will allow installation in one of the three following combinations of vent pipe and elbow(s).

1. 20' (6m) of straight intake/flue pipe.
2. 15' (4.5m) of straight intake/flue pipe with one elbow.
3. 10' (3.0m) of straight pipe with two elbows.

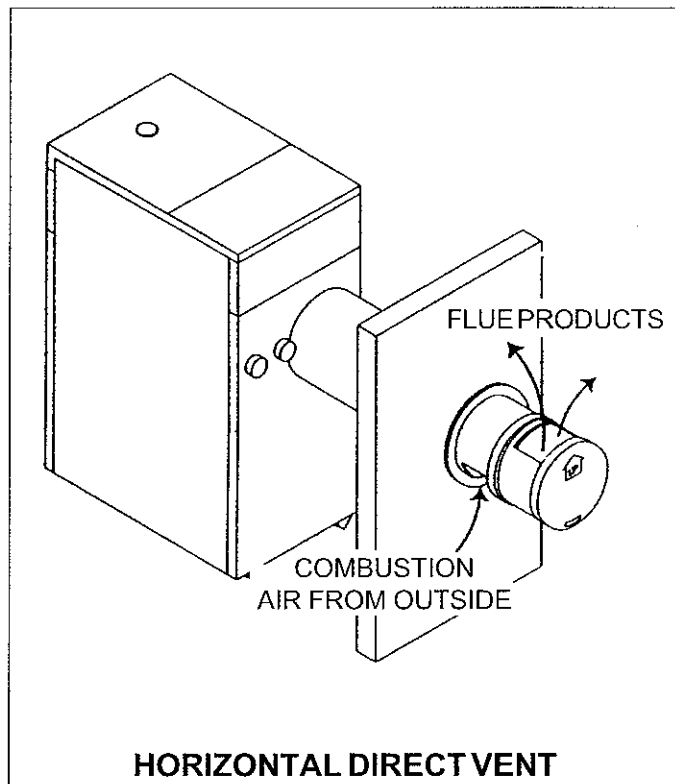
The vent cap is not considered in the overall length of the venting system. Flue pipe for Models 750 and 1000 must clear water piping before it can extend vertically.

Care must be taken during assembly that all joints are sealed properly and are airtight. Adhesive sealant is included with each flue pipe and fitting.

IMPORTANT: The bell increaser furnished with the boiler must be removed when installing the direct vent piping.

VENT TERMINAL

Direct vent boilers may be installed with either a horizontal side wall vent cap or a vertical roof top vent cap. You must use the correct vent cap for the location of the vent cap required on the job. The vent caps are not interchangeable in their mounting position. The vent cap must be mounted on the exterior of the building.

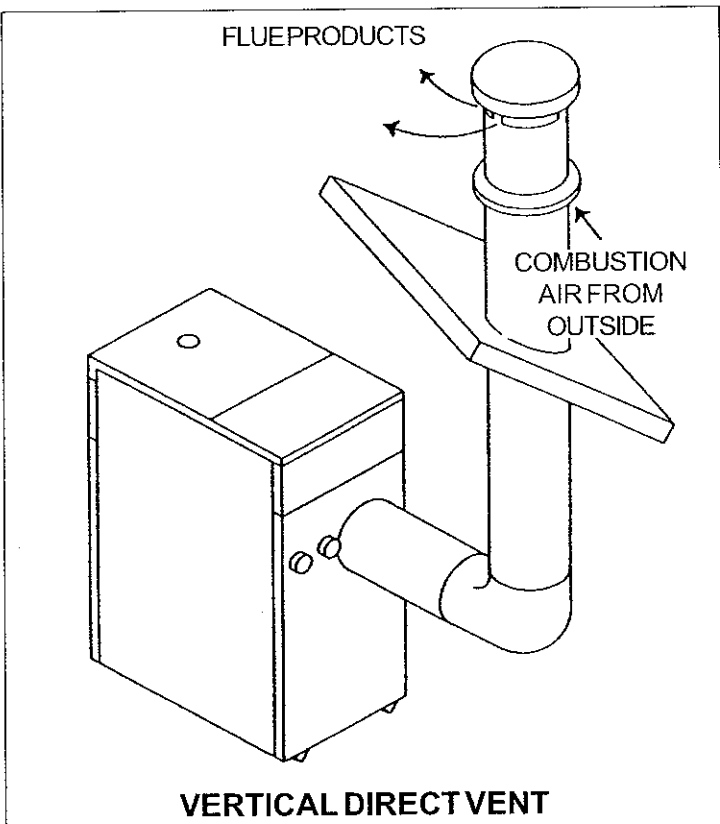


HORIZONTAL DIRECT VENT INSTALLATION

The horizontal side wall vent cap **MUST** be mounted on the exterior of the building. The vent cap cannot be installed in a well or below grade. The directional arrow on the end of the horizontal cap must be in a vertical position to prevent recirculation of flue products. The vent cap must be installed at least one foot (0.30m) above ground level and above normal snow levels. Combustion air supplied from outdoors must be free of particulate and chemical contaminants. To avoid a blocked flue condition, keep the vent cap clear of snow, ice, leaves, debris, etc.

Multiple horizontal direct vent caps **MUST NOT** be installed with one cap directly above another cap. This vertical spacing would allow the flue products from one cap to be pulled into the combustion air intake of the cap installed above. This type of installation can cause non warrantable problems with components and operation of the unit due to the recirculation of flue products. Multiple horizontal direct vent caps should be installed in the same horizontal plane with a 48" (1.2m) clearance from the side of one cap to the side of the adjacent cap(s). The vent terminal installation must be in accordance with local building codes or the latest edition of the National Fuel Gas Code ANSI Z223.1 in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment.

FLUEPRODUCTS



VERTICAL DIRECT VENT INSTALLATION

The vertical direct vent cap is designed for roof top mounting only. The air inlet opening on the vertical cap **MUST** be installed 12" (3.0m) above the roof line or above normal snow levels that might obstruct combustion air flow. This dimension is critical to the correct operation of the boiler and venting system and reduces the chance of blockage from snow. Multiple vertical direct vent caps require a 48" (1.2m) clearance between each cap to prevent recirculation of flue products. The vent terminal installation must be in accordance with local building codes or the latest edition of the National Fuel Gas Code ANSI Z223.1 in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment. Combustion air supplied from outdoors must be free of particulate and chemical contaminants.

VENT CLEARANCES

Care must be taken in the location of the vent cap on the exterior of the building. The flue gases will condense as they leave the vent cap. Therefore, the following clearances are very important.

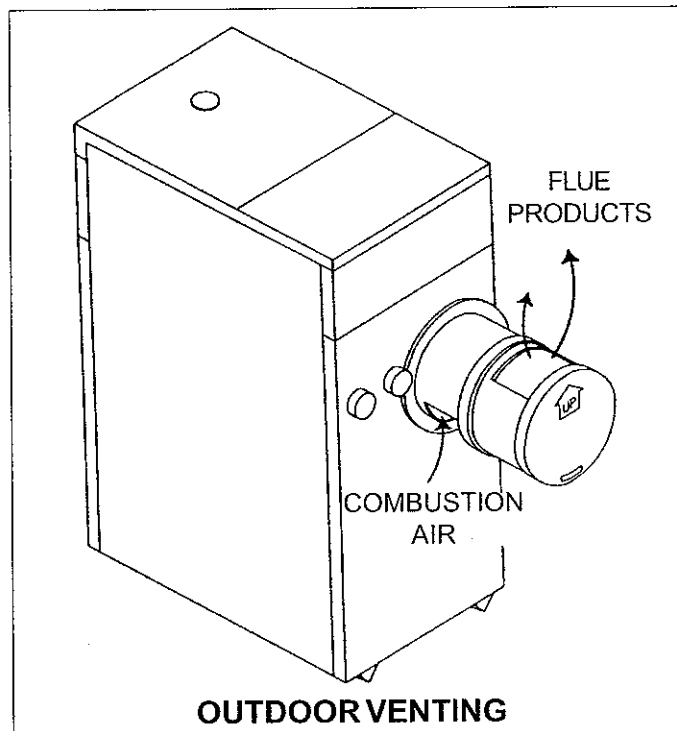
1. Do not locate the vent cap above any window, door, walkway or gravity air intake.
2. The vent cap shall terminate at least 4' (1.2m) below and 4' (1.2m) horizontally from any window, door, or gravity air inlet into any building.
3. The vent cap must terminate at least 10' (3.0m) from any forced air inlet.
4. Multiple Direct Vent installations require a 48" (1.2m) clearance between vent caps.
5. Use a 2'x2' (0.6m x 0.6m) rust resistant sheet metal backing plate against brick or masonry surfaces.

NOTE: During winter months check the vent cap and make sure no blockage occurs from build up of snow. Condensate can freeze on the exterior walls or on the vent cap. Frozen condensate on the vent cap, can result in a blocked flue condition. Some discoloration to the exterior of the building can be expected.

The part numbers for the vent materials are listed in the following table.

Piping	#250	#500	#750	#1000
Straight Section	DRH3700	DRH3701	DRH3702	DRH3703
Elbow	DRH3704	DRH3705	DRH3706	DRH3707
Vent Cap Vertical	DRH2733	DRH2734	DRH2735	DRH2736
Vent Cap Horizontal	DRH2737	DRH2738	DRH2739	
DRH2740				
Coupling	DRH2725	DRH2726	DRH2727	DRH2728

When installing a direct vent system, the suffix B decal furnished with the kit, should be affixed to the boiler below the rating plate.



OUTDOOR INSTALLATION-SUFFIX C

Outdoors models are self venting when installed with the factory supplied horizontal direct vent cap and require no additional vent piping. This special vent cap is provided by the boiler manufacturer in accordance with AGA/CGA requirements. It must be installed directly in the boiler in a horizontal position. Notching of the vent cap mounting flange may be necessary to clear outlet piping on some models. A windproof cabinet protects the unit from the weather.

Care must be taken when locating the outdoor unit because the flue gases discharged from the vent cap can condensate as they leave the cap. Improper location can result in damage to adjacent structures or building finish. For maximum efficiency and safety, the following precautions must be observed:

1. Outdoor models must be installed outdoors and must use the vent cap supplied by the manufacturer.
2. Periodically check venting system. The boiler's venting areas must never be obstructed in any way and minimum clearances must be observed to prevent restriction of combustion and ventilation air. Keep area clear and free of combustible and flammable materials.

3. Do not locate adjacent to any window, door walkway, or gravity air intake. The vent should be located 4 feet horizontally from such areas.
4. Install above grade level and above normal snow levels.
5. Locate boiler at least 10 feet (3.0m) away from any forced air inlet.
6. Adjacent brick or masonry surfaces must be protected with a rust resistant sheet metal plate.
7. Installation cannot be within 3 feet (0.9m) of any over hang.
8. Multiple Outdoor Vent installations require a 48" (1.2m) clearance between vent caps.
9. Do not install in locations where rain from building runoff or roof drains will spill onto the boiler.

NOTE: The condensate can freeze on the exterior walls or on the vent cap. Frozen condensate on the vent cap can result in a blocked flue condition. Some discoloration to exterior building surfaces can be expected.

The directional arrow on the horizontal vent cap must be in the vertical position to prevent recirculation of flue products. The vent cap must be mounted directly on the vent pipe of the boiler.

THE BELL INCREASER FURNISHED WITH THE BOILER SHOULD NOT BE USED WITH OUTDOOR VENTING.

A decal is furnished in the vent cap box. The decal referring to Vent Kit C should be affixed to the boiler below the rating plate.

WARNING: No substitutions of flue pipe or vent cap material are allowed. Such substitutions would jeopardize the safety and health of inhabitants.

The total length of the Thru-wall vent system cannot exceed 20' (6.0m) in length. Each elbow used is equal to 5' (1.5m) of straight pipe. This will allow installation in one of the three following combinations.

1. 20' (6.0m) of straight flue pipe.
2. 15' (4.5m) of straight flue pipe and one elbow.
3. 10' (3.0m) of straight pipe and two elbows.

The vent cap is not considered in the overall length of the venting system. Care must be taken during assembly to insure that all joints are sealed properly and are airtight. Adhesive sealant is included with each flue pipe and fitting.

The side wall vent termination must be furnished by the boiler manufacturer in accordance with AGA/CGA requirements.

The flue pipe, straight and elbows, are the same material used in the direct vent system. See the Direct Vent Suffix B schedule.

GASSUPPLY

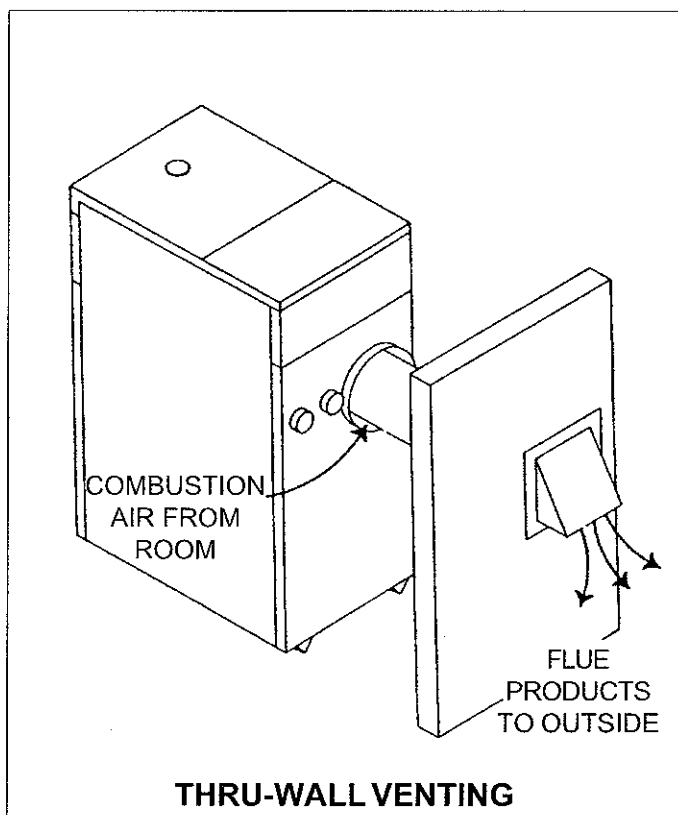
1. Before making gas hook-up, verify that the boiler is being supplied with same gas type as indicated on the data plate. These boilers are orificed for operation up to 2,000 feet altitude. In U.S., boilers derated 4% per 1,000 ft. above 2,000 ft. elevation. In Canada, derated 10% 2,000-4,500, over 4,500 ft. derate must be in accordance with local authorities. Consult factory for installations at higher elevations. Conversions authorized by factory personnel only. The rating plate will be marked to indicate high altitude rating of unit.
2. For the purpose of input adjustment, the inlet gas pressure, upstream of the gas valve and pressure regulator should be as follows:

TABLE 4

	Nat. Gas	LPG
Max. Allowable (Inches-water column)	10.5"	13"
Min. Allowable (Inches-water column)	7"	9"

GAS PRESSURE TEST

1. The boiler must be *disconnected* from the gas supply piping system during any pressure testing of that system at test pressure in **excess of 1/2 PSIG**.
The boiler must be isolated from the gas supply piping system by *closing* the manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than **0 PSIG**.
2. The boiler and its gas connection must be leak-tested before placing it in operation.
3. The gas pressure regulator supplied is for low pressure service. If upstream pressure exceeds 8 oz. (14" water column), an intermediate gas pressure regulator, of the lockup type, must be installed.
4. Install a union connection at inlet to the boiler manifold to permit servicing controls when necessary.
5. The gas line should be a separate line direct from meter, unless the existing gas line is of sufficient capacity. Verify pipe size with your gas supplier.



GAS CONNECTION

All gas connections must be made with a pipe joint compound resistant to action of liquified petroleum and natural gases. Table 5 indicates the proper size and length of standard black steel pipe to install from the gas meter to the boiler in single unit installations. Table 6 is used to size the gas line for multiple units in a mechanical room. The total BTU requirement of all units on the gas supply line and total equivalent length of pipe are used to determine gas line pipe size. Table 7 can be used to convert pipe fittings to equivalent lengths of straight pipe for total equivalent pipe length from meter for part numbers.

SINGLE UNIT INSTALLATIONS
TABLE 5
SUGGESTED GAS PIPE SIZE

BTU Input	DISTANCE FROM METER				
	0-50	51-100	101-200	201-300	301-500
250,000	1"	1"	1"	1"	2"
500,000	1"	1"	2"	2"	2"
750,000	1"	2"	2"	2"	3"
1,000,000	2"	2"	2"	3"	3"

For each elbow or tee, add equivalent of straight pipe to total length.
For multiple gas appliances, see the detailed gas pipe sizing chart below.

MULTIPLE UNIT INSTALLATION
TABLE 6
GAS PIPE SIZING CHART

Nominal Iron Pipe Size, Inches	Length of Pipe in Straight Feet														
	10	20	30	40	50	60	70	80	90	100	125	150	175	200	
3/4	369	256	205	174	155	141	128	121	113	106	95	86	79	74	
1	697	477	384	328	292	267	246	236	210	200	179	164	149	138	
1 1/4	1,400	974	789	677	595	543	502	472	441	410	369	333	308	287	
1 1/2	2,150	1,500	1,210	1,020	923	830	769	707	686	636	564	513	472	441	
2	4,100	2,820	2,260	1,950	1,720	1,560	1,440	1,330	1,250	1,180	1,100	974	871	820	
2 1/2	6,460	4,460	3,610	3,100	2,720	2,460	2,310	2,100	2,000	1,900	1,700	1,540	1,400	1,300	
3	11,200	7,900	6,400	5,400	4,870	4,410	4,000	3,800	3,540	3,330	3,000	2,720	2,500	2,340	
4	23,500	16,100	13,100	11,100	10,000	9,000	8,300	7,690	7,380	6,870	6,150	5,640	5,130	4,720	

Maximum capacity of pipe in thousands of BTU's per hr for gas pressures of 14" water column(0.5 PSIG) or less and a pressure drop pf 0.5 Inch Water Column (NAT GAS, 1025 BTU's per cubic foot of gas, based on 0.60 specific gravity gas.)

TABLE 7
FITTINGS TO EQUIVALENT STRAIGHT PIPE

Diameter Pipe	1/2"	1"	1 1/2"	2"	3"	4"	5"
Equivalent Length Straight Pipe	2'	2'	3'	4'	5'	10'	20'

Based on 0.5 inches of water column pressure drop.

SPECIAL NOTE: Gas pipe size is *larger than heater connection*.

NOTE: A trap (drip leg) should be provided in the inlet gas connection to the boiler. The gas pressure regulator is factory set at 4 inch water column for natural gas, and 7 inch water column for LPG. The maximum inlet gas pressure for LPG or natural gas must not exceed 14 inch water column.

	Nat. Gas	LPG
MANIFOLD GAS PRESSURE (Inches-water column)	4"	7"

A manual main gas shutoff valve is provided outside the jacket, upstream of the main gas valve. This gas shutoff is required by code and must not be removed.

CAUTION: Some leak test solutions, including soap and water, may cause corrosion. The gas line should be rinsed with water after testing.

BLEEDS AND VENTS

All bleeds and vents from valves and regulators are vented to the atmosphere, outside of the fan pressurized inner chamber. Local codes may require routing of these bleeds and vents to the atmosphere, outside of the building.

INLET & OUTLET WATER CONNECTIONS

For ease of service, install unions on inlet and outlet of boiler. The connection to the boiler marked "inlet" should be used for the return from the system. The connection marked "outlet" is to be connected to the supply side of the system.

RELIEF VALVE PIPING

Boiler is supplied with a pressure-relief valve, sized in accordance with ASME requirements. Each relief valve should be piped to a suitable floor drain. The discharge pipe from the relief valve should be conducted to a suitable place for disposal when relief occurs. No reducing coupling or other restriction can be installed in the discharge line. It is strongly recommended that this valve should be manually operated at least once a year.

JACKET DRAIN

This boiler is provided with a drain tube which should be directed to a convenient drain in the event that sweating occurs on start up. Liquid should not flow from the drain in normal operation. Low temperature systems require special piping to prevent condensation (see Low Water Temperature Systems).

ELECTRICAL REQUIREMENTS

The boiler is wired for 120 volts and must be electrically grounded in accordance with local codes, or in the absense of local codes, with the latest edition of the National Electrical Code ANSI/NFPA. When the unit is installed in Canada, it must conform to the CSA C22.1, Canadian Electrical Code, Part 1 and/or local Electrical Codes.

1. Water must be pumped continuously through the boiler when it is being fired.
2. Do not energize boiler or pump until system is full of water. Serious damage may result.
3. All wiring must be in accordance with all local, state or federal codes.
4. Provide circulating pump with proper overload protection.

TABLE 8

Model#	Fan	Controller	*Pump	Approximate Total Amps
250	.7	5	7	13
500	1.8	5	7	14
750	4.5	5	7	17
1000	4.5	5	7	17

**This pump for hot water supply boiler, only.*

WATER FLOW SWITCH

This unit is equipped with a factory installed water flow switch in the discharge piping. A minimum of 18 GPM is required to make the switch and turn off the low water flow light. This flow switch meets most code requirements for a low-water cutoff device on boilers requiring forced circulation for operation.

INITIAL START-UP

PLACING BOILER IN OPERATION

The Power-Fin boiler should be installed and tested by qualified personnel.

FILLING THE BOILER

Fill the system with water. To be sure that the boiler is not "airbound", open the relief valve. Leave the valve open until a steady flow of water is observed. Close the valve and complete filling the system.


FOR YOUR SAFETY READ BEFORE OPERATING

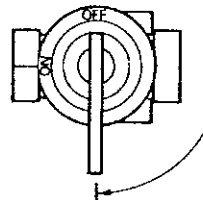
WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life!


- A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do NOT try to light the burner by hand.
- B. Before operating, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
- C. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

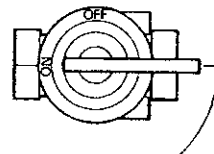
OPERATING INSTRUCTIONS

1. Stop! Read the safety information above on this page.
2. Set the thermostat to lowest setting.

3. Turn off all electrical power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burners. DO NOT try to light the burners by hand.
5. Turn the manual gas cock clockwise  to "OFF".




6. Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow the safety information on page one. If you don't smell gas go on next step.
7. Turn the manual gas cock counter clockwise  to "ON".



8. Turn on all electric power to appliance.
9. Set the thermostat to the desired setting.
10. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to the lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Turn manual gas cock clockwise  to "OFF".

WARNING: Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the appliance.

TEMPERATURE ADJUSTMENT (Domestic Hot Water Use)

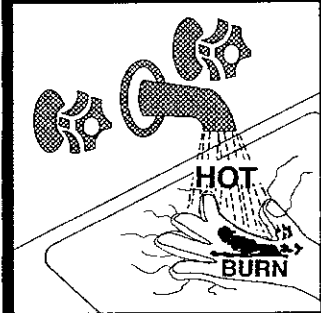
This unit has an adjustable thermostat to control water temperature. The thermostat is factory pre-set at approximately 125° F. Households with small children or invalids may require a 120° F or lower temperature setting to reduce risk of scald injury. Some states may require a lower temperature setting. Check with your gas supplier for local requirements governing the temperature setting. Remember, no water heating system will provide exact temperature at all times. Allow a few days of operation at this setting to determine the correct temperature setting consistent with your needs.

NOTE: (1) This water heater, when set at the lower temperature setting, is not capable of producing hot water of sufficient temperature for sanitizing purposes. (2) Higher stored water temperature increases the ability of the water heater to supply desired quantities of hot water, however remember **CAUTION:** Hotter water increases the risk of scald injury.

Incorrect piping of the cold water supply to the system may result in condensate formation on the heat exchanger and operational problems. See the typical installation drawings provided with the unit for correct piping. Higher water temperatures reduce condensate formation.

CAUTION: Setting the temperature selector dial higher provides hotter water, which increases the risk of scald injury.

⚠ DANGER



- Water temperature over 125°F can cause severe burns instantly or death from scalds.
- Children, disabled and elderly are at highest risk of being scalded.
- See instruction manual before setting temperature at heating appliance.
- Feel water before bathing or showering.
- If this appliance is used to produce water that could scald if too hot, such as domestic hot water use, adjust the outlet control (limit) or use temperature limiting valves to obtain a maximum water temperature of 125°F.

THERMOSTAT DIFFERENTIAL ADJUSTMENT

The operating thermostat is furnished with an adjustable differential. The differential setting is located on the body of the thermostat behind the jacket top. To adjust the differential turn off main power to the boiler. Remove the temperature adjustment knob by pulling forward. Remove the two thermostat mounting screws. Open the jacket top and remove the thermostat from the jacket top. The differential adjustment is located beside the temperature adjustment knob shaft. The differential adjustment can be made with a small screwdriver. Reinstall the thermostat and jacket top.

MANUAL RESET HIGH LIMIT (OPTIONAL)

The reset for the high limit is located at the outer edge of the temperature adjustment knob. The reset is a small red button that must be pushed in whenever the water temperature has exceeded the temperature setting of the high limit.

NOTE: The control will not reset until the water temperature has dropped below the set point of the high limit.

IGNITION SHUT-OFF SYSTEM

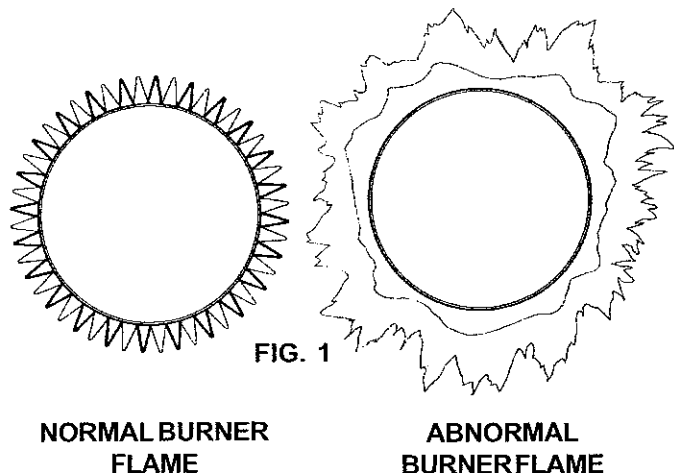
The Hot Surface Ignitor System has an internal self-check to control its operation. This self-checking process takes 15 to 60 seconds. During this period, the main gas valve will not open and main burner ignition will not occur.

To test this sequence of operation, turn boiler on and wait until main burner is on. Then turn manual gas valve to OFF. The control panel diagnostic light for flame failure will come on, followed by the low gas pressure light. Simultaneously, the main gas valve will close and main burner flame will go off. If the boiler fails to function in this manner, turn it off and consult a qualified service agent.

FLAME PATTERN

The correct burner flame pattern should have sharply defined blue tips as shown below. (Figure 1)

If flame pattern is pulsing, or if flame is yellow and lifting off the burner, check gas pressure and combustion air supply.



MAINTENANCE

1. Gaskets

The foam-type gasket material on the sheet metal of the jacket and heat exchanger section is very important. It assures an air-tight chamber that is necessary for proper burner operation. When cleaning, inspect all gaskets carefully. If they have been damaged or have deteriorated, replace with 1" x " one-sided adhesive foam rubber gasket with density of PVL-7. When replacing jacket part, be sure gasket makes a tight seal. Replacement gasket kits are available from your local distributor.

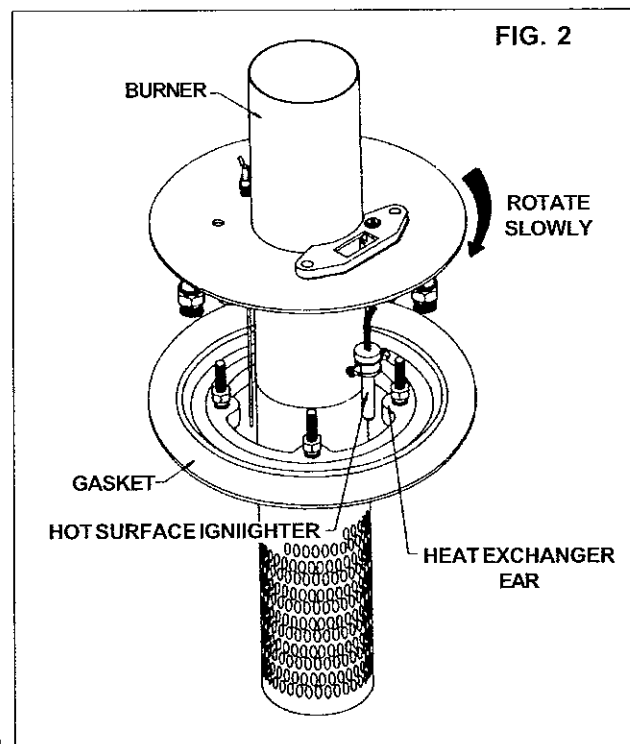
2. Burner Removal

IMPORTANT: The hot surface ignitor is very fragile and care must be taken to avoid breakage when removing the burner.

- Turn off main power to unit.
- Turn off gas supply.
- Remove both front and rear jacket top panels.
- Loosen gas train union dividing front and rear sections of the gas train.
- Remove the mounting screw that secures the orifice mount to the burner.
- With gas train union loose, lift up the front section of the gas train, away from the burner.
- Disconnect the hot surface ignitor power plug.
- Disconnect the flame rod sensor wire.
- Remove the 4 nuts that secure the burner.
- Carefully remove the burner assembly from the combustion chamber, rotate the burner slightly making sure not to bump the hot surface ignitor on the top header of the heat exchanger (Figure 2).

3. Burner Cleaning

The burner will require cleaning if the unit is exposed to particulate contaminated combustion air during operation (dust, dirt, concrete dust, dry wall dust, etc.) Non-combustible particulate matter will block the burner ports and cause a non-warrantable failure. A dust contaminated atmosphere will require burner cleaning on a 3 to 6 month schedule or more often, based on the severity of contamination. Follow burner removal and cleaning procedure.



After removing the burner, use a stiff bristle brush to clean the burner ports inside and out. Be sure to remove any foreign material that is in the burner. A water hose can be used to flush contaminants from the burner port area. Dry burner before firing unit. Check for any cracks, holes or deterioration. The burner **MUST** be replaced when there are holes in both the inner and outer perf material.

4. Heat Exchanger

- a. Remove the inner jacket top. Inspect gaskets (page 9).
- b. Remove the two front panels; the heat exchanger will be exposed. Inspect gaskets (see gasket section page 9).

For models prior to Ser. N. K865212, proceed to "c" below. For models after K865212, proceed to "g" below.

- c. Disconnect the inlet and outlet water pipe.
- d. Disconnect the two heat exchanger hold-down clips at the bottom of the heat exchanger.
- e. Disconnect the back plate (4) bolts.
- f. Remove the heat exchanger from the boiler.
- g. Inside the rear compartment, disconnect the inlet and the outlet water pipes by removing the (4) bolts on the heat exchanger flange and the (4) bolts holding the heat exchanger to the divider panel. Inspect the (2) flange gaskets (see gasket section above).
- h. Remove the heat exchanger from the boiler.

To clean the heat exchanger, remove the "V" baffles by removing the screws from the "V" baffle retainers. Be sure to replace the retainers on reassembly. Use a garden hose to wash soot and scale from the outside of the heat exchanger. Unbolt the top header to inspect the inside of the tubes. If cleaning is necessary, remove the bottom header so sediment and scale from cleaning will not accumulate in bottom header.

5. Flue Gas Passageway Cleaning

While the burner and heat exchanger are out, take a garden hose and wash the inner jacket thoroughly and make sure the boiler drain is not plugged. Clean the flue passageway. Check to see if there is any sign of deterioration or corrosion in the flue pipe; if there is, replace corroded parts. To reassemble boiler, follow the above instructions in reverse order. If boiler will not operate, call a qualified technician.

6. Operation/Diagnostic Lights

The control panel has ten lights which indicate sequence of operation and control sensed malfunctions. The operational lights indicate prepurge, trial for ignition, and main burner on. Diagnostic lights indicate low water flow, blocked flue, low gas pressure, high water temp, blocked drain, low air pressure, and flame failure.

WARNING: The ignition module **MUST** be removed from the control panel before trouble shooting any indicating lights or control components. Failure to remove the module could result in internal damage to the module which can dangerously alter the ignition sequence.

Lights which do not operate when energized should be replaced. All lights except trial for Ignition are 24 VAC. Trial for ignition is a 120 VAC light.

CAUTION: Do not attempt to troubleshoot or repair this boiler without proper test equipment. A VOLT-OHM-MICRO-AMP meter, a manometer, and a draft gauge are required for proper set-up, operation, and diagnostics.

7. Transformer

Check using a voltmeter on the secondary side, voltage should be 24 to 28 volts.

8. Flame Sensing Current

The ignition module supervises main burner flame with a flame rod. The flame current can be measured with a microamp meter installed in the pink wire from the module to the flame rod. Quick connect terminals are provided in the pink wire. The flame current must be greater than 0.5 microamps. Flame current should be steady and NOT exceed 4 microamps.

If your appliance is equipped with a low water cutoff, it should be periodically checked. Float types should be flushed occasionally.

The boiler area should be clear and free from combustible materials, gasoline and other flammable vapors and liquids. Care should be taken to assure that combustion and ventilation air openings remain clear and unobstructed.

9. Direct Vent Systems

The vent air intake system of direct vent units must be properly re-assembled and re-sealed per the installation instructions.

10. Combustion Air Fan

The combustion air fan should be checked and oiled every 6 months. Use non-detergent SAE 20 oil.

11. Water Circulating Pump

Inspect pump every 6 months and oil as necessary. Use non-detergent SAE 30 oil or lubricant specified by the pump manufacturer.

FREEZE PROTECTION

Although these boilers are AGA design-certified for outdoor installation; such installations are not recommended in areas where the danger of freezing exists unless proper freeze protection is provided. If equipment is installed in cold weather areas, the following precautions must be observed:

1. Pump Operation - MOST IMPORTANT - If system pump does not run continuously, then an additional pump **MUST** be installed to provide constant circulation through the boiler. This will help to prevent freezing.
2. A snow screen should be installed to prevent snow and ice accumulation around boiler.
3. If for any reason the boiler is to be shut off, you **MUST**:
 - a. Shut off gas supply.
 - b. Shut off water supply.
 - c. Shut off electrical supply.
 - d. Drain boiler.
 - e. Drain pump.

INSTALLATION OF AIR CONDITIONING SYSTEM

The boiler, when used with refrigeration system, shall be installed so that the chilled medium is piped in parallel with the heating boiler with appropriate valves to prevent the chilled medium from entering the boiler.

Install a duct coil downstream of cooling coil. When the hot water heating boiler is connected to a heating coil located in air handling units where they may be exposed to refrigerated air circulation, the boiler piping system must be equipped with flow control

valves or other automatic means to prevent gravity circulation of the boiler hot water during cooling cycle. The coil must be vented at the high point and the hot water from the boiler must enter the coil at this point. Due to the fast heating capacity of the boiler, it is not necessary to provide a ductstat to delay circulator operation. Also, omit thermal flow checks, as the boiler is cold when heating thermostat is satisfied. This provides greater economy over maintaining a standby heat. See Figure 3.

FIG. 3

TYPICAL INSTALLATION ON AIR CONDITIONING SYSTEM

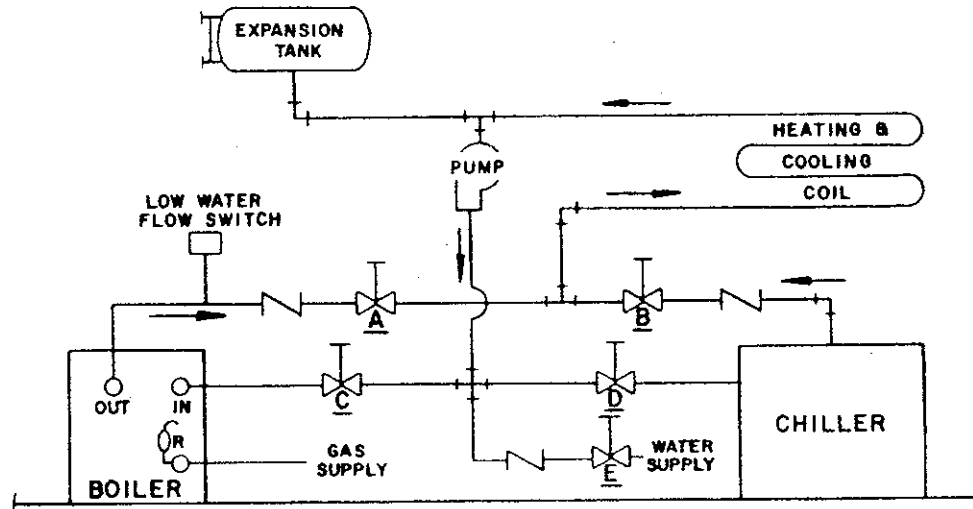


DIAGRAM NOTES:

1. Valves "D" and "C" may be manual or automatic—to suit.
2. Provide drain for relief valve "R" to safe place.

3. Close both "A" and "C" valves when running chiller.
4. Close both "B" and "D" valves when running boiler.
5. Water supply valve remains open at all times.

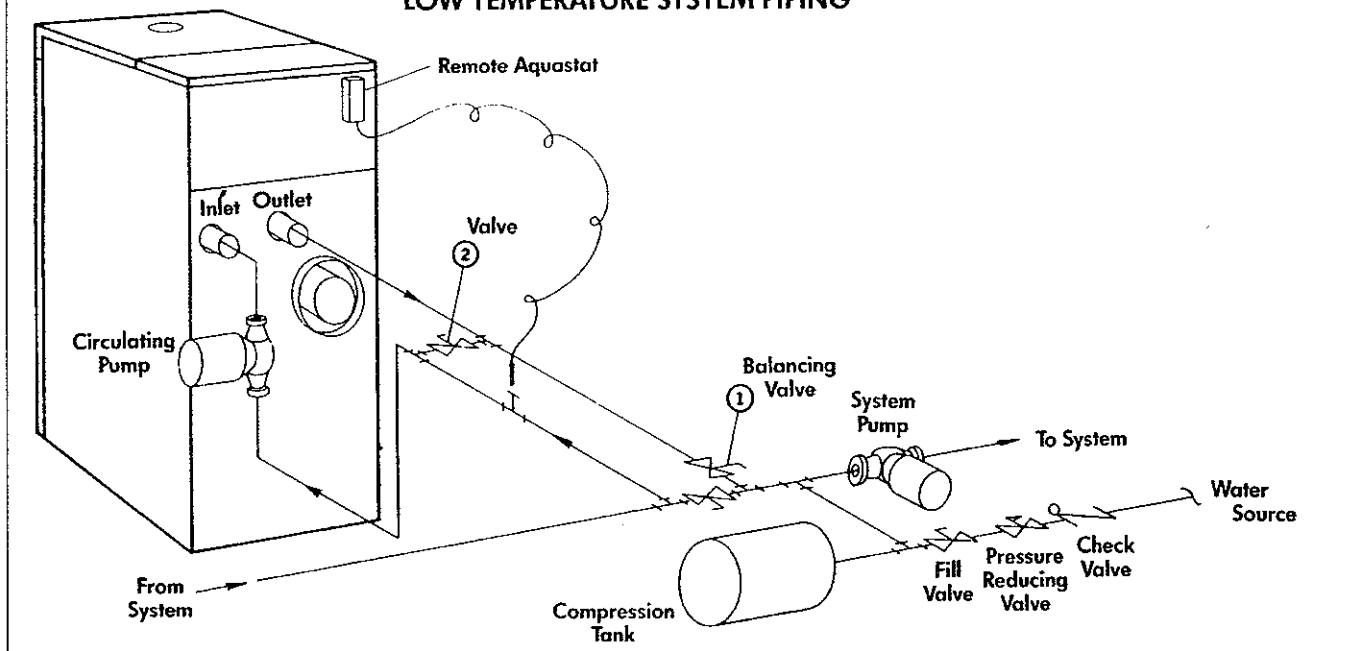
LOW WATER TEMPERATURE SYSTEMS

A number of hydronic boiler applications call for system water temperature operation in the range of 60° to 150° F. Several of the more typical of these applications are: Water Source Heat Pump Systems; Greenhouse Soil Heating and Irrigation Systems; Process or Manufacturing Operations; or Swimming Pool Heating.

Installations such as these, while increasingly common, often present problems resulting from boiler condensation, thermal stresses, and poor overall system efficiency. Our boilers are particularly adaptable to applications of this type for several reasons:

FIG. 4

LOW TEMPERATURE SYSTEM PIPING



1. This is an instantaneous boiler, requiring virtually no heat-up time, and having no temperature "overshoot". Result? High system efficiency!
2. Its unique construction prevents the transfer of heat exchanger thermal stresses to other boiler components - reducing wear and tear, while increasing equipment life expectancy.
3. Its compact, simple design and low boiler mass permits condensation-free operation to temperatures as low as 60° F.

The piping illustration and instructions in Figure 4 details a simple details a simple by-pass arrangement which will allow the system to be operated at any temperature above 60° F, without condensation forming in the boiler.

Condensation is prevented by simply regulating the flow balancing valve so as to maintain inlet water temperature at approximately 150°F, while allowing the system to operate at temperatures (as low as 60°F.) See Figure 4.

For Low Temperature Operation Proceed As Follows:

1. Select proper boiler size.
2. Set remote control aquastat at desired system temperature.
3. Start system and adjust balancing valve (1), slowly closing until inlet temperature to boiler is 150° F minimum.
4. If temperature to boiler exceeds 150°F, slowly close valve (2) until 150° F is maintained.

NOTE: Carefully following these instructions will permit the system circulating loop to operate at the desired temperature regardless of the higher boiler water temperature.

NOTE: Closed Loop Systems, may require an expansion tank, water feeder, air vents, and/or other components not furnished with the boiler.

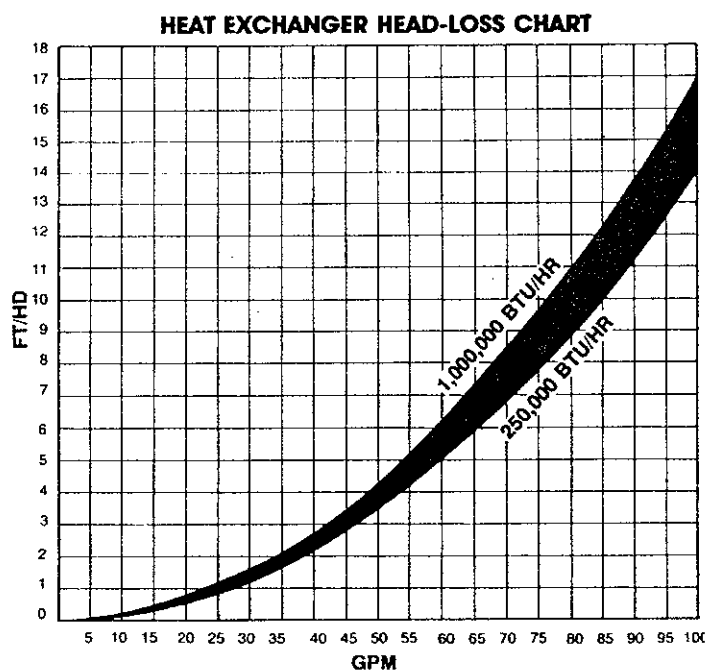
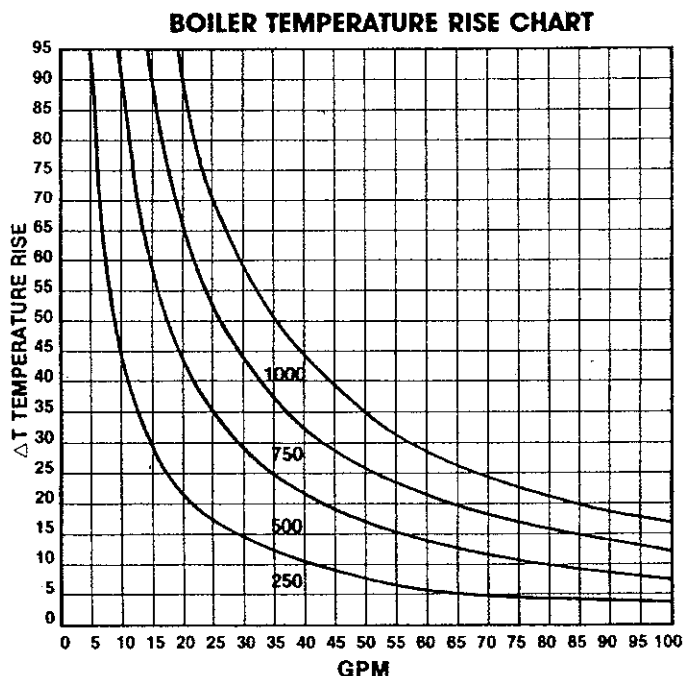
HEATING AND PERFORMANCE DATA

BOILER TEMPERATURE RISE

These boilers are generally capable of operating within the design flow rates for the building heating system. Should the flow rate of the system exceed the maximum flow rate through the boiler, an external boiler by-pass must be installed. This will prevent boiler damage.

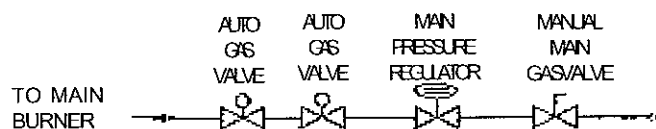
MAXIMUM BOILER FLOW RATES

250	100 GPM
500	100 GPM
750	100 GPM
1000	100 GPM

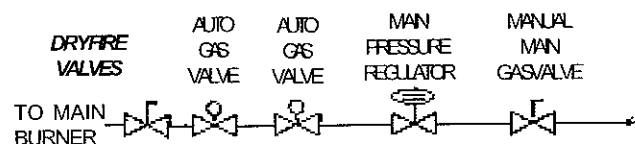


BOILER GAS TRAIN AND CONTROLS

STANDARD GAS TRAIN - USA MODELS



STANDARD GAS TRAIN - CANADIAN MODELS



NOTE: The boiler Gas Train and Controls Assembly have been tested under the American National Standard for Hot Water Boilers to meet minimum safety and performance criteria such as safe lighting, combustion and safety shutdown operation.

DOMESTIC HOT WATER SUPPLY BOILER

WATER VELOCITY CONTROL

IMPORTANT - To insure proper velocity through the heat exchanger, it is necessary to regulate the temperature rise across the heat exchanger from inlet to outlet. This must be done on initial installation and periodically rechecked. With the correct temperature rise across the heat exchanger, you may be assured of the proper velocity in the tubes and long life and economical operation from your hot water supply boiler. Excessive lime build-up in the tubes is a result of too little velocity through the tubes. Excessive pitting or erosion in the tubes is caused by too much velocity through the tubes. Care should be taken to measure temperature rise and maintain a velocity as follows:

1. The pump must run continuously.
2. With the pump running and the water heater off, the inlet and outlet thermometers should read the same temperature. If they do not, an adjustment must be made to your final calculation.
3. Turn the water heater on and allow time for the temperature to stabilize. Record the difference between the inlet and outlet temperatures. This difference will be the "temperature rise".
4. Compare the temperature rise on the heater with the required temperatures rise in Table 11. Should adjustment be needed, proceed as follows:

If the temperature rise is too high, the water velocity is too low. Check the following:

1. Check for restrictions in the outlet of the heater.
2. Be sure all valves are open between the heater and the tank.
3. Check the pump to be sure it is running properly and that the pump motor is running in the proper direction.
4. Be sure that the circulating pipes between the heater and storage tank are properly sized.

COMMON MANIFOLD SIZE FOR MULTIPLE POWER-FIN WATER HEATERS

Quantity Water Heaters	Manifold Pipe Size
1	2"
2	3"
3	3"
4	4"
5-6	5"
7-9	6"
10-16	8"

Table 10

This section applies only to those units used to supply domestic hot water usually in conjunction with a storage tank. The use of a proper pump size and the control of water velocity, as explained below, are important for correct operation of your hot water supply boiler.

If the temperature rise is too low, the water velocity is too high. Adjust as follows:

1. Slowly throttle the valve on the outlet side of the heater until the temperature rise is steady at the required temperature raise in the chart below.

REQUIRED TEMPERATURE RISE

Model	Temperature Rise F°
250	6
500	12
750	17
1000	23

Table 11

PUMP OPERATION

1. The Hot Water Supply Boiler must be connected with a properly sized, continuously running pump that circulates water between heater and storage tank.
2. Pump is sized to heater input and water hardness. Care should be taken that pump is sized correctly.

PUMP SPECIFICATIONS*

Model	Min. Pump Performance Water Hardness of 0-25 grains	
	GPM	Ft. Hd.
250	75	15
500	75	15.8
750	75	16.5
1000	75	17.3

Table 12

*The pump specification chart is based on heater to tank circulating loop of not more than 45 ft. (13.6m) of straight pipe plus the following fittings:

- 6-90° elbows
- 2 unions
- 2 ball valves
- 1 cold water tee

For longer distances and more fittings the pump may have to be resized. Manifold pipe size must be used as recommended for multiple units.

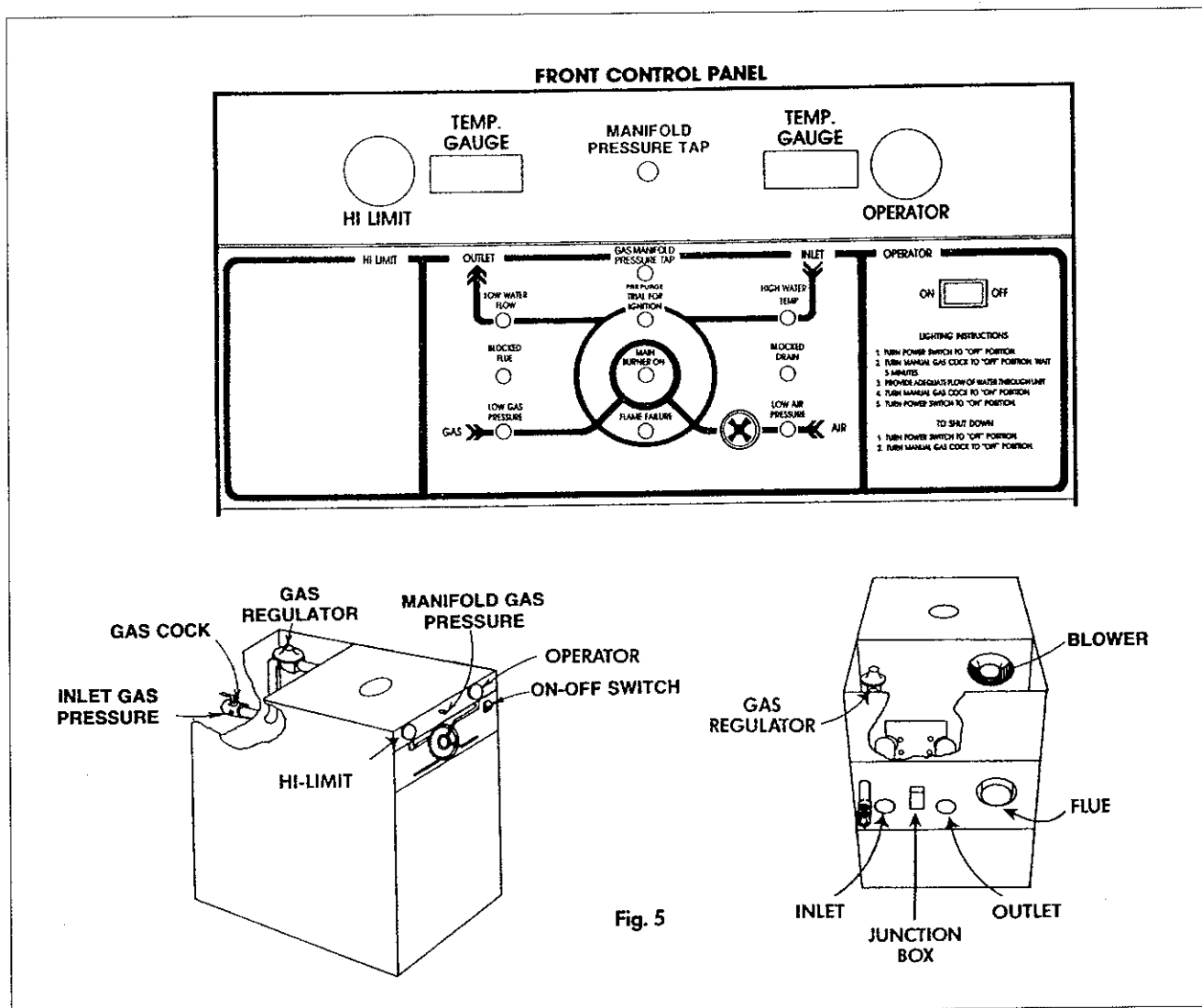
HEAT EXCHANGER

This is a highly sophisticated heat exchanger, designed to carry water in such a way that it generates a scouring action which keeps all interior surfaces free from a build-up of impurities. The straight-line, four-pass design of the tubes sends water into the headers at properly rated velocity. The configuration of the headers, in turn, creates a high degree of turbulence which is sufficient to keep all contaminants in motion and in suspension.

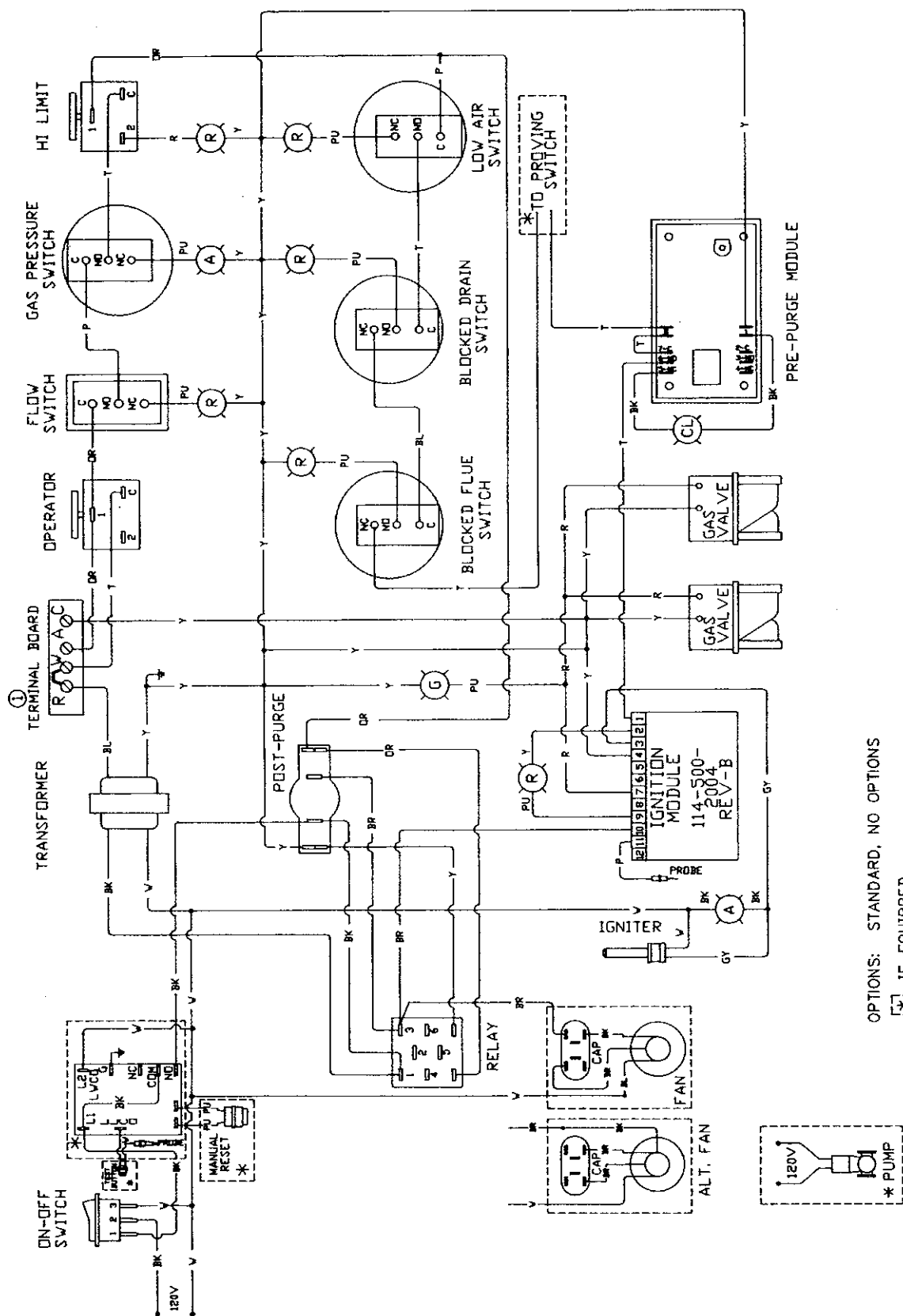
This "scouring action" provides greater cost savings for owners. Tubes are always able to transfer heat at peak efficiency. Every surface within this water containing section is of a non-ferrous material, providing clear, clean, rust-free hot water. Straight copper tubes - finned on the outside for maximum heat transfer - coated cast iron headers, and inspection covers make up an entirely rust-proof unit. On all models, bolted header inspection covers can be removed for field inspection and cleaning of copper tubes. Entire heat exchanger may be easily removed through the front of the unit.

CATHODIC PROTECTION

When cathodic protection devices are used in the storage tank, hydrogen gas can be produced when the system has not been used for a long time (generally, two weeks or more). To prevent injury, we recommend a hot water faucet be open for several minutes. **Hydrogen gas is extremely flammable.** If hydrogen is present, it will probably sound as though air is escaping through the hot water faucet. There should be no smoking or open flame near the faucet while it is open.



COLOR CODES	
BK	BLACK
BL	BLUE
GY	GRAY
G	GREEN
P	PINK
R	RED
T	TAN
W	WHITE
PU	PURPLE
Y	YELLOW
BR	BROWN
OR	ORANGE



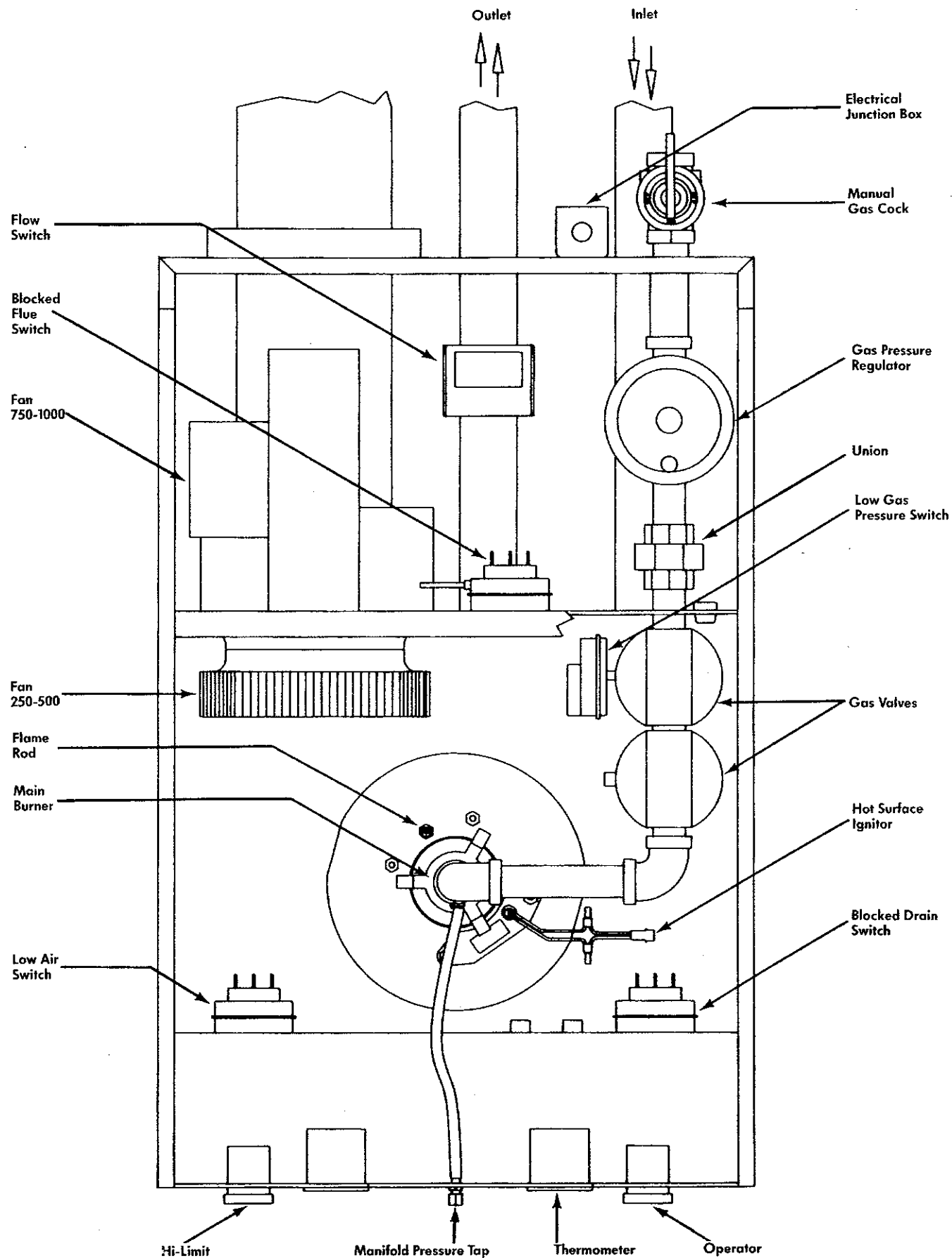
① REMOVE JUMPER BETWEEN R & V TO CONNECT - I.D. RESET, REMOTE OPERATOR OR MOD-U-PAK, ADDITIONAL CONTROL, ETC.

OPTIONS: STANDARD, NO OPTIONS

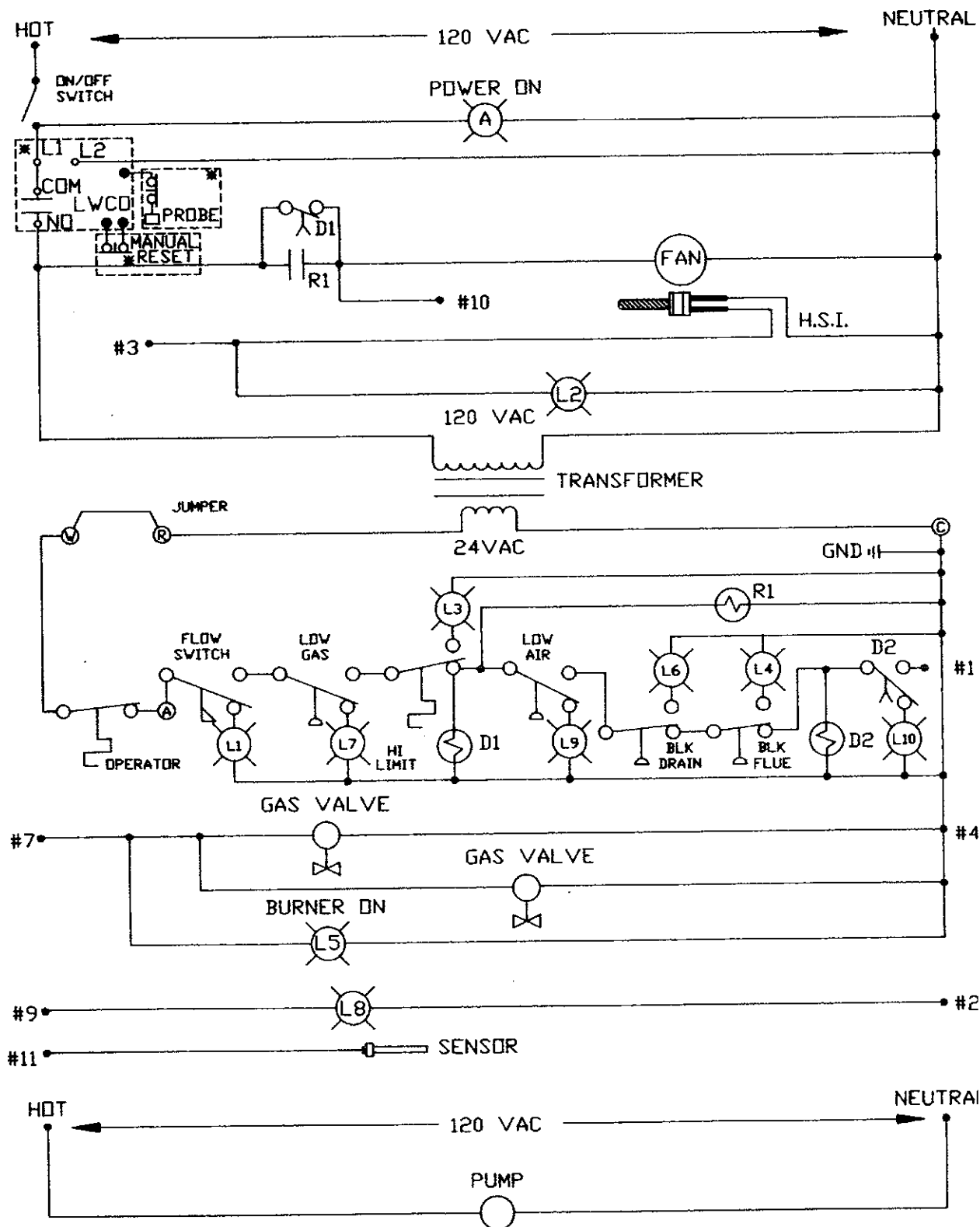
[*] IF EQUIPPED

REPRESENTATIVE WIRING DIAGRAM (STANDARD F-9 CONTROLS)

CONSULT FACTORY PACKAGED MATERIALS FOR YOUR SPECIFIC DIAGRAM



Component Location Diagram



Lamp Schedule

- L1 - Red - Low Water Flow
- L2 - Amber - Trial for Ignition
- L3 - Red - High Water Temperature
- L4 - Red - Blocked Flue
- L5 - Green - Burner On
- L6 - Red - Blocked Drain
- L7 - Amber - Low Gas Pressure
- L8 - Red - Flame Failure
- L9 - Red - Low Air Pressure
- L10 - Clear - Pre-Purge

NOTES:

1. #1 through #12 are connected on ignition module.
2. If any of the original wire as supplied with the appliance must be replaced, it must be replaced with type 150 C wire of its equivalent.
3. L3 was pre-purge prior to serial no. J877683.
4. D1 is Post-Purge Relay.
5. D2 is Pre-Purge Relay.
6. LWCO is Low Water Cut-Off (optional)
7. Ⓢ, Ⓜ, Ⓢ, and Ⓢ is Terminal Strip
- 18 for Remote Operator.

SITUATION	CORRECTIVE ACTION
NO POWER	<ul style="list-style-type: none"> · Check Circuit Breaker/Fuses · Check wiring to Power-Fin · Check ON/OFF Switch operation
UNIT NOT FIRING	<ul style="list-style-type: none"> · Check Mod-U-Pak or other external Energy Management System/Temperature Control · Insure Hi-Limit and Operator are adjusted above inlet water temperature · Check Control Panel Diagnostic Lights for indication of control problem · Check transformer output, should be 24 VAC with power on · If equipped, check operation of Low Water Cut Off
LOW GAS PRESSURE	<ul style="list-style-type: none"> · Turn Gas Cock handle to full on position · Check Gas Pressure and Gas Pipe Sizing · Insure that the Low Gas Pressure Switch vent hose is connected to the correct atmospheric vent barb
LOW WATER FLOW	<ul style="list-style-type: none"> · Make sure that the system is full of water · Insure that adequate pump and pipe size are installed · Check piping for restrictions · Check Flow Switch operation, switch needs 18GPM to function
LOW AIR PRESSURE	<ul style="list-style-type: none"> · Check operation of the combustion air fan · Check jacket for air leaks due to loose panels, seals, or shipping damage · Check wiring to fan, capacitor, and fan relay · Check line voltage, it should be at least 110VAC · Check wiring of Low Air Pressure Switch and insure that the vent hose has no leaks and is attached to the atmospheric vent barb
BLOCKED FLUE	<ul style="list-style-type: none"> · Check the vent cap for obstructions or restrictions · Insure that the vent terminal is adequately sized · Check wiring of the Blocked Flue Switch and make sure that the sensing tubes are properly positioned · Measure draft in flue, it should be a negative .02 to .05 while unit is firing · This switch can function during periods of high winds, it will auto-reset when conditions subside
BLOCKED DRAIN	<ul style="list-style-type: none"> · Check vent pipe and flue cap for restrictions or obstructions · Check drain hose for blockage · This switch can function during periods of high winds, it will auto-reset when condition subsides
HANGING ON TRIAL FOR IGNITION	<ul style="list-style-type: none"> · Check wiring and connections to the Hot Surface Ignitor, CAUTION 120VAC · Check operation of Hot Surface Ignitor on trial for ignition, It should glow red hot, If not, replace (<i>See manual for burner removal instructions</i>)
FLAME FAILURE	<ul style="list-style-type: none"> · Check Gas Pressure. There should be 4.0" W.C. pressure at the manifold pressure tap while unit is firing · Insure that the gas line thoroughly bled, air in the gas line may result in flame failure · Insure that the pink wire from the ignitor module to the flame rod is connected and there is no corrosion on the wiring terminals · Check the flame rod for position, cracks in the insulator, or oxidation on its surface. Remove surface oxidation with emory cloth · Reset controls by turning main power OFF, wait one minute, turn main power ON
HARD START	<ul style="list-style-type: none"> · Check Gas Pressure, while unit is firing there must be 7" W.C. minimum at the gas cock and 4" W.C. at manifold pressure tap. Adjust the unit pressure regulator to secure proper manifold pressure · Insure that gas supply piping, regulators, and meters are properly sized · Adjust air shutter (where provided) to balance gas/air mixture · Insure that adequate combustion and ventilation air are present. See Manual for requirements · Check flue size and performance by using a draft gauge. Draft should be a negative .03 to .05 while firing · A double acting barometric damper must be installed on each unit and adjusted to correct draft specifications

