



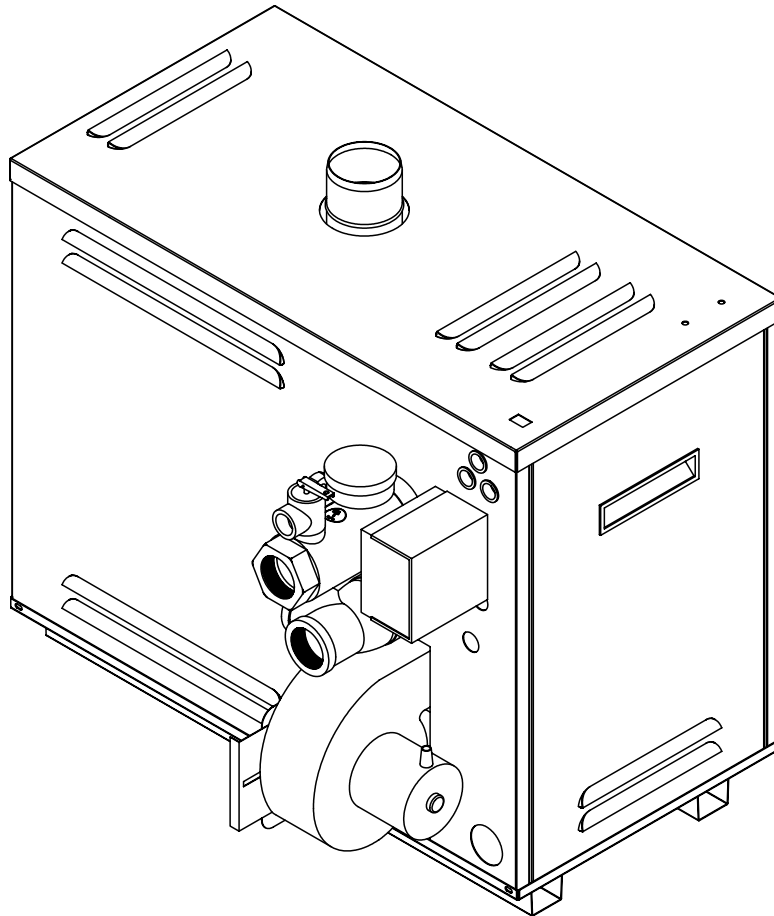
## INSTALLATION AND SERVICE MANUAL

# SC SERIES GAS BOILERS

FOR MODELS SC-35 TO SC-280

SEE REAR COVER FOR INDEX

This manual must only be used by a qualified heating installer,  
service technician or gas supplier.



See *Section 3.11* for Installer's Checklist

See *Section 4.3* for Service Checklist



Manufactured by

**Allied Engineering Company**

Division of E-Z-Rect Manufacturing Ltd.

Manufacturers of Gas and Electric Boilers, Stainless Steel Tanks, Heat Exchangers and Electric Boosters.

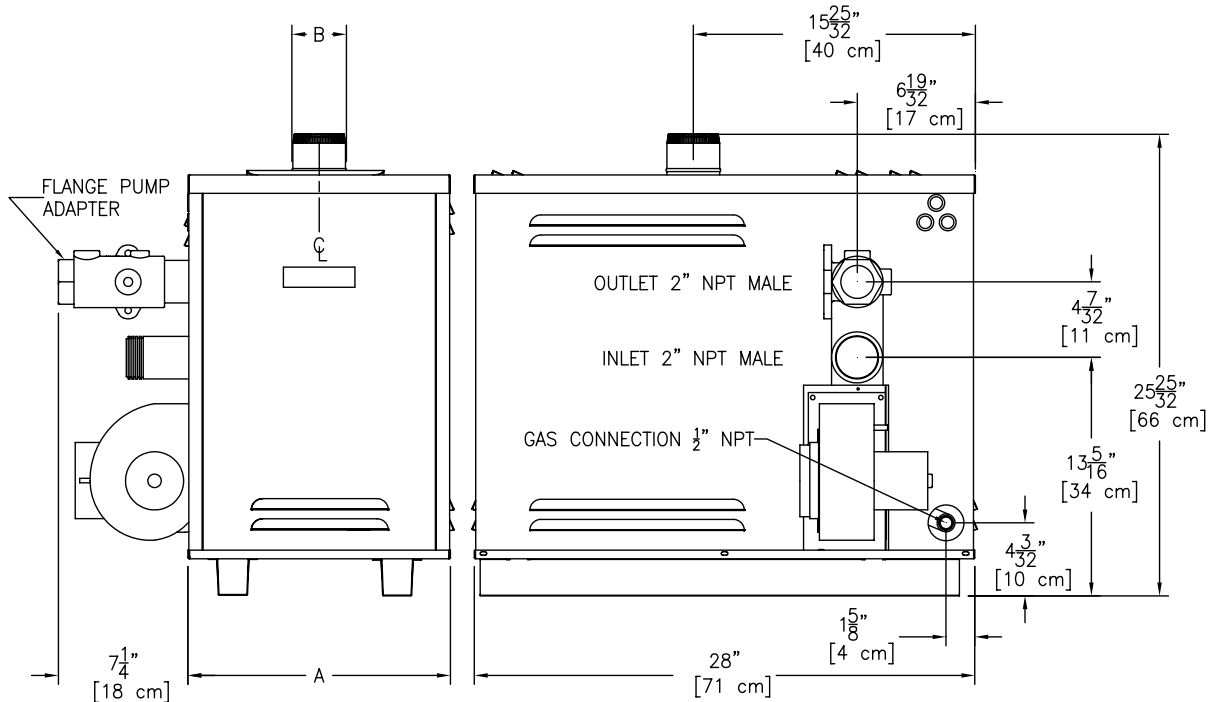
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Branches: Calgary • Edmonton • Toronto



# SC SERIES BOILERS

## DIMENSIONS AND SPECIFICATIONS



MODEL NUMBER	INPUT*		OUTPUT		DIM A		DIM B		SHIPPING WEIGHT	
	MBH	kW	MBH	kW	In	cm	in	cm	lb	kg
SC-35	35	10.3	30.2	8.9	8.7	22.1	3	7.6	166	75
SC-70	70	20.5	60.5	17.7	11.7	29.7	3	7.6	198	90
SC-105	105	30.8	90.9	26.6	14.7	37.3	3	7.6	230	104
SC-140	140	41.0	121.3	35.5	17.7	44.9	3	7.6	262	119
SC-175	175	51.3	151.6	44.4	20.7	52.5	4	10.2	294	133
SC-210	210	61.6	182.2	53.4	23.7	60.1	4	10.2	326	148
SC-245	245	71.8	212.8	62.3	26.7	67.8	4	10.2	362	164
SC-280	280	82.1	242.9	71.2	29.7	75.4	4	10.2	398	181

\* For altitudes above 2,000 feet, refer to section 4.7 to determine the appropriate Input derate or contact the factory.

Minimum clearances from boiler outer case to combustible material: Top 13" (33 cm), Right Side 1/2" (1.27 cm), Left Side 9" (22.9 cm), Rear 1/2" (1.27 cm), Front 2.5" (6.4 cm). A minimum service clearance of 18" (46 cm) is recommended for the front and left side. Approved for Combustible Floors (not directly on carpeting), Alcove & Closet installation.

### Model Number Suffixes:

"N" = Natural Gas

"HS" = Hot Surface Ignition

"P" = Propane

"PS" = Packaged Boiler

The Super Hot product improvement program may result in changes to the design and/or specifications being made without notice.

### Packaged Boiler Includes:

- Combination Gas Valve / Direct Ignition
- Temperature / Pressure Gauge
- Zone Control Board for 4 Zones c/w transformer
- Pressure Relief Valve 30 PSI
- Drain Valve 3/4" NPT
- Dual Aquastat
- Stainless Steel Burners Low NOx
- Hot Surface Ignition
- Air Differential Pressure Switches
- Super Hot Cast Iron Pump Adapter
- Combustion Air Blower / Fan
- Sidewall Vent Termination Cap
- 1 1/4" Circulator / Pump (mounted and wired)
- Expansion Tank
- Air Purger
- Automatic Air Vent
- Combination Fill Valve / Regulator
- Rated 86% AFUE



## ABOUT OUR MANUALS

Your *Super Hot* boiler has been provided with two manuals:

- *User's Information Manual* - This manual is intended for the **owner or user** of the boiler and provides information on routine operation and maintenance, and emergency shutdown.
- *Installation and Service Manual* - This manual must only be used by a **qualified heating installer, service technician or gas supplier**. Installation or service by anyone unqualified to do so may result in severe personal injury, death or substantial property damage.

Both manuals should be kept in the envelope provided and affixed adjacent to the boiler so that they are readily available for future reference.

## Lighting Instructions

## Section 1

This boiler is always equipped with an ignition device which automatically and directly lights the main burners (there is no pilot burner).

There are two possible ignition systems:

1. direct spark ignition with combination gas valve (equipped with gas control knob) and module.
2. hot surface ignition with combination gas valve (equipped with gas control knob) and module.

The lighting instructions shown in this section apply to both ignition systems. In addition, the lighting instructions have been printed on a label attached to the boiler. If you are unsure which type of gas valve or ignition system your boiler is equipped with, check the wiring diagram sticker on the boiler or contact the factory.

### WARNING

**Should boiler overheat, or the gas supply fail to shut off, do not turn off or disconnect the electrical supply to the circulating pump. Instead, shut off the gas supply at a location external to the boiler.**



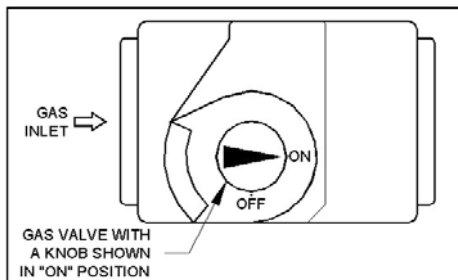
## FOR YOUR SAFETY READ BEFORE OPERATING

**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.
- 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.
  - C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
  - D. 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 label.
2. Turn off all electrical power to the appliance.
3. Set the room thermostat to lowest setting.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove control access panel.
6. Turn gas control knob clockwise ↻ to "OFF".
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
8. Turn gas control knob counterclockwise ↻ to "ON".
9. Replace control access panel.
10. Set room thermostat to desired setting.
11. Turn on all electrical power to the appliance.
12. 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. Turn off all electrical power to the appliance if service is to be performed.
2. Set the room thermostat to lowest setting.
3. Remove control access panel.
4. Turn gas control knob clockwise ↻ to "OFF". Do not force.
5. Replace control access panel.



## Installation Instructions

## Section 2

### 2.1 RECEIVING

**INSPECT SHIPMENT FOR POSSIBLE DAMAGE.** All goods are carefully manufactured, inspected, checked and packed by experienced workers. The manufacturer's responsibility ceases upon delivery of goods to the carrier in good condition. Any claims for damage and/or shortage in shipment or non-delivery must be filed immediately against the carrier by the consignee.

Use care when receiving and unpacking the boiler. Dropping the boiler may cause damage and prevent safe and proper operation.

### 2.2 INSTALLATION CODES AND REQUIREMENTS

All applicable national, provincial/state, and local codes, laws, regulations, and ordinances must be followed. They expand on and take precedence over any recommendations in this booklet. Authorities having jurisdiction shall be consulted before installations are made.

In **Canada**, the installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the *CAN/CSA B149 Installation Codes* (current edition). All electrical wiring and grounding must be in accordance with the *Canadian Electrical Code, CSA C22.1 Part 1* (current edition) and applicable local codes.

In the **United States of America**, the installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the *National Fuel Gas Code, ANSI Z223.1* (current edition). All electrical wiring and grounding must be in accordance with the *National Electrical Code, ANSI/NFPA 70* (current edition) and applicable local codes.

Where required by the authority having jurisdiction, follow the *Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1* (current edition).

If there is any conflict in the above requirements, the more stringent requirement applies.

The installation and service must also conform to the additional requirements in this manual. If there is any conflict with a requirement in this manual and a Code requirement, the Code requirement must be followed.

### 2.3 LOCATION

This boiler is intended for indoor installation only. Observe the following minimum clearances from the boiler to combustible materials:

Minimum Clearances to Combustible Materials											
Left Side with piping		Right Side without piping		Rear		Top		Front		Flue Pipe	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
9	229	0.5	12.7	0.5	12.7	13	330	2.5	64	2.5	64

- A minimum **service clearance of 18 in.** is recommended for the Front and Left Side (with piping).
- Maintain a clearance of 2-1/2" from the flue pipe in any direction to combustible materials.
- Allow ample space for the boiler water inlet and outlet connections, and the gas connection.
- Boiler must be installed on a stable and level foundation.
- The boilers can be installed on a combustible floor but must not be installed directly on carpeting.
- **A hot water boiler installed above radiation level, or as required by the authorities having jurisdiction, must be provided with a low water cutoff device at the time of boiler installation.**



- This boiler must be installed such that gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, condensate trap, control replacement, etc.).
- Structure through which venting will pass must be free and clear for opening (i.e. no hidden conduit, telephone cables or other obstructions).

### 2.4 GAS SERVICE PIPING

Make sure the gas on which the boiler will operate is the same as that specified on the boiler rating plate. Do not install the boiler if equipped for a different type gas. Consult your gas supplier to get gas information.

To prevent damage, care must be taken not to apply too much torque when attaching gas supply pipe to gas valve gas inlet. Use a wrench on the square ends of the gas valve to hold it when connecting the gas supply pipe.

The boiler and its gas connection must be leak tested before placing the boiler in operation. The gas controls furnished are suitable for a maximum operating gas pressure of 1/2 psi (14 inches water column).

The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (14 inches water column).

The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing at test pressures equal to or less than 1/2 psig (14 inches water column).

A manual main shut-off valve must be installed in the gas line outside the boiler jacket and as required in *Section 2.2*. The valve should be readily accessible for turning on and off.

A drip pocket or sediment trap must be installed in the gas supply line upstream of the gas controls and as close to the boiler as possible (example shown in Figure 3 in *Section 6*).

The pipe compound used should be resistant to the action of liquefied petroleum gases. Check for gas leaks in piping before placing the boiler in operation by using a soap and water solution. Also check the gas leaks of the joint between the gas valve outlet and manifold when the boiler is on. **DO NOT USE AN OPEN FLAME.**

#### INSTALLER MUST IDENTIFY EMERGENCY SHUT-OFF DEVICES.

All piping and fittings must be installed as per codes in *Section 2.2*.

### 2.5 CORROSIVE ATMOSPHERES

If a gas boiler is to be installed near a corrosive or potentially corrosive air supply, the boiler should be isolated from it and outside air should be supplied as recommended in *Section 2.6*.

Chemical vapors from products containing **chlorine** or **fluorine** must be avoided. Even though these chemicals may be safe to breathe, corrosive substances can become liberated when passed through a gas flame. Even at low concentrations, these chemicals can significantly contaminate the air supply and shorten the life of any gas-fired appliance. The following is a list of some of the products which should be avoided:

- bleaches and chlorinated cleaning products
- paints and sprays
- water softeners (calcium or sodium chloride)
- leaking refrigeration equipment
- freon from common aerosol dispensers



These chemicals are especially common near swimming pools, beauty shops, dry cleaning establishments, laundry areas, workshops, and garages. **The warranty is void when failure is due to corrosion.**

### 2.6 VENTING AND COMBUSTION AIR

**Definitions:** A **direct** vent system operates so that all air for combustion is obtained from the *outdoor atmosphere* and all flue gases are discharged to the outdoor atmosphere.

A **non-direct** vent system operates so that all air for combustion is obtained from the *boiler room* and all flue gases are discharged to the outdoor atmosphere.

This boiler is certified as a **Category III** appliance **only**. This boiler can be installed similar to a Direct Vent Appliance (with an inlet air duct and a venting duct) but it **shall have** the same air supply as a Category III appliance is required to have.

#### Combustion Air Supply

For a non-direct vent or direct vent installations, a sufficient air supply **MUST** be provided to the boiler room and to the boiler. Air opening(s) to the boiler room provide the air for combustion and ventilation and are always required. The air opening size and location (as well as other air supply considerations) must conform to *Section 2.2*.

The boiler room must never be under a negative pressure in all applications, including direct vent alike. **Always** provide air openings sized not only to the dimensions required for the total input of all fuel-fired appliances in the boiler space, but also to handle the air movement rate of any **exhaust fans** or **air movers** using air from the building or space.

The venting terminations must always be kept clear of obstructions (i.e. snow, ice, etc.). Louvers and grilles used in the air supply and ventilation system must conform to *Section 2.2* and should be kept clear of any dust, dirt, or debris, which will block proper airflow.

The responsibility of providing a suitable venting and air intake pipe of adequate draft capacity and in good usable condition is that of the gas fitter/installer. Interference with the air supply for the boiler shall be prohibited.

For boilers to be connected to gas vents or chimneys, vent sizing, installation and termination shall be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1 or Section 7, Venting Systems and Air Supply for Appliances, of the CAN/CSA B149, Installation Codes, and all applicable provisions of the local building codes. Contact local building or fire officials about restrictions and installation inspection in your area.

#### Air Intake System

When the boiler is installed as a direct vent system, ABS, PVC schedule 40 pipe, galvanized steel pipe, PVC pipe and CPVC pipe can be used for air intake pipe. The air intake pipe may be sealed using appropriate sealants.

#### Exhaust Vent System

This boiler is certified as Category III and requires stainless steel exhaust venting suitable for positive pressure. The following manufacturers offer components approved for use with this boiler:

- Flexmaster Canada Ltd.: Z-Vent
- Z-Flex U.S., Inc.: Z-Vent
- Heat-Fab Inc.: Saf-T-Vent
- Flex-L International Inc.: StaR-34
- Protech Systems, Inc.: FasNSeal™

The use of these manufacturers' venting systems for sidewall venting will require the vent terminal supplied by Allied Engineering Company. The vent terminal for vertical venting and these venting systems may be not supplied with this unit and should be obtained from the supplier of the venting system listed above.

## **Condensate Trap**

All boilers with vertical venting installations require a condensate drain and drain trap. Do not operate the boiler without installing this trap and filling with water.

The condensate drain should be installed as close to the boiler as possible and must be equipped with a drain trap. The drain tap should be formed by attaching 3/8" I.D. high temperature tubing, such as silicone, to the drain assembly, making a loop of approximately 4" diameter and securing it with a cord or tie wrap where the tube crosses over itself. Do not squash the tube or over-tighten it, see Figure 1. The loop must then be filled with water to form a liquid-filled trap. This trap allows condensate to drain while preventing exhaust gases from escaping.

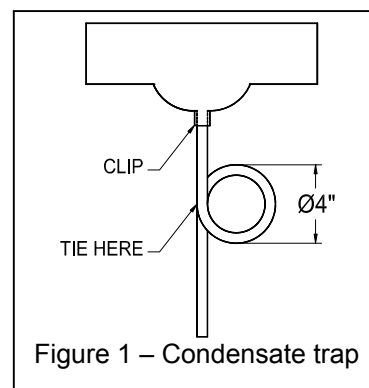


Figure 1 – Condensate trap

Periodic inspection and cleaning should be made of this assembly. Check for deterioration of the tubing and to ensure that the trap is filled with water. If the tube is plugged or appears to have excessive sediment in it, it should be removed from the condensate drain pipe, straightened out to clear the obstruction, reformed, filled with water and reinstalled as before. The drain should extend to a floor drain, condensate pump or to a plastic container which may require emptying periodically. Condensate disposal must be acceptable to the authority having jurisdiction.

## **Vent Terminal Information**

The minimum distance from the termination of a vent terminal to adjacent public walkways, adjacent buildings, openable windows and building openings shall be not less than those values specified in the *National Fuel Gas Code, ANSI Z223.1* and/or *CAN/CSA Installation Codes*.

Flue gas 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. Adjacent brick or masonry surfaces should be protected with a rust resistant sheet metal plate. To prevent discoloration and degradation of building materials by flue gases and flue gas condensation, ensure that the vent terminal is installed clear of nearby obstacles. In all cases, installation shall be in accordance with code.

For proper operation, the vent terminal must be kept free of snow, leaf dropping and other debris at all times to ensure that no blockage occurs. Do not terminate the vent in a window well, stairwell, alcove, courtyard, or other recessed area. The vent cannot terminate below grade and directly above a paved sidewalk or paved driveway that is located between two single-family dwellings and serves both dwellings. The vent shall not terminate underneath a veranda, porch, or deck unless the veranda, porch, or deck is fully open on a minimum of two sides beneath the floor and the distance between the top of the vent termination and the underside of the veranda, porch, or deck is greater than 1 foot (300 mm).

Do not locate the vent terminal directly under roof or deck overhangs to prevent icicles from forming. Vent terminal should not allow flue gas discharge towards neighbor's windows or where personal injury or property damage can occur.

It is highly recommended that the vent terminal be located where it will not be exposed to normal prevailing winds.

The vertical termination shall extend at least 3 feet (0.9 m) above the highest point where it passes through a roof of a building and at least 2 feet (0.6 m) higher than any portion of a building within a horizontal distance of 10 feet (3.0 m), or specified as local jurisdiction.

The vent terminal shall be located at least 3 feet from any building opening and above any forced air inlet located within 10 feet. And the vent terminal shall not be located within 6 feet (1.8 m) of a mechanical air supply inlet to any building.





Gas service meters: The vent terminal requires a clearance of 3 feet (0.9 m) and the air intake a clearance of 10 feet (3.0 m) from any *gas service regulator vent* outlet. Vents are prohibited above the gas meter assembly (not propane regulator vents) within 3 feet horizontally of the vertical center line of the regulator to a vertical distance of 15 feet (4.6 m).

The bottom of the vent terminal and the air intake shall be located at least 12 inches above grade plus height of the normal snow line.

Maintain a minimum clearance of 4 feet (1.2 m) below, 4 feet (1.2 m) horizontally from, or 1 foot (300 mm) above any door, window, or gravity air inlet into any building.

A 4 feet (1.2 m) horizontal clearance should be maintained from electric meters, gas meters, regulators and relief equipment and in no case above or below, unless a 4' horizontal distance is maintained.

The terminal shall not be less than 7 feet above grade where located adjacent to a public walkway and shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance of hazard or could be detrimental to the operation of regulators, relief valves, or other equipment.

## **Equivalent Vent/Air Intake Pipe Length and Diameter**

In order for the boiler to operate properly, the venting system, including air intake piping (if used), exhaust vent piping and terminations, must not be excessively restrictive. Use Table 1 to find exhaust vent and air intake pipe maximum and minimum equivalent length for a specified boiler model. The installation must be designed so that exhaust vent equivalent length is within the Max. and Min. range of "Exhaust Vent Equivalent Length". Similarly, Air Intake Pipe must be within the Max. and Min. range of "Air Intake Pipe Equivalent Length". Use the notes in Table 1 to calculate the equivalent length in feet for exhaust vent and air intake pipe.

Table 1. Equivalent Length of Venting System

<b>MODEL</b>	<b><i>Exhaust Vent Equivalent Length in Feet</i></b>				<b><i>Air Intake Pipe Equivalent Length in Feet</i></b>			
	3 inch diameter		4 inch diameter		3 inch diameter		4 inch diameter	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
SC-35	8	40			0	45		
SC-70	8	40			0	45		
SC-105	8	40			0	45		
SC-140	8	40			0	45		
SC-175			8	40			0	45
SC-210			8	40			0	45
SC-245			8	40			0	45
SC-280			8	40			0	45
<b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Calculate the Equivalent Length by measuring the total centerline length in feet and adding 6 feet for each 90-degree elbow used and adding 3 feet for each 45-degree elbow used. The calculated Equivalent Length must be within the Max. and Min. limits for the specified boiler model.</li> <li>2. The air inlet and exhaust vent must remain 3 inch diameter for SC-35 to SC-140, and 4 inch diameter for SC-175 to SC-280.</li> </ol>								



### Vent Installation

The boiler must be vented to the outdoors. Do not install the vent into a common venting system and do not install a vent damper, or similar device to the venting system or the boiler. Vent connectors serving the boiler must not be connected into any portion of mechanical draft systems operating under positive pressure. The venting can be installed as a direct vent system in which the air for combustion is obtained from the outdoor atmosphere directly or as a non-direct vent in which all air for combustion is obtained from the boiler room. The vent system will have a positive pressure in the flue requiring that all vent joints and seams be sealed gas-tight by following the vent manufacturer's instructions.

Follow the vent manufacturer's instructions for installation of the venting system, and firestop spacers, thimbles, caps, roof flashing, storm collar, supports, etc. The vent connector and firestop must provide correct spacing to combustible surfaces, as specified in the section 2.3. Venting is approved for combustible wall passage with a clearance of 2.5" from the flue pipe in any direction.

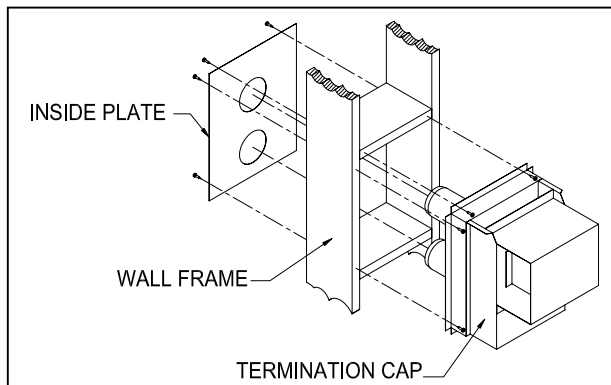


Figure 2. Side Termination Installation

Since the vent system will operate with a positive pressure in the exhaust vent pipe, it is critical that all joints be properly cleaned and thoroughly sealed as per the vent manufacturer's instructions. The exhaust may condensate in the vent with a longer vent length installation. The condensate of exhaust is acidic and can cause severe corrosion of ordinary venting materials. Boiler operation can be affected by restrictive vent and combustion air supply piping. Therefore, the venting system must completely conform to the requirements of Table 1. The specified minimum and maximum equivalent vent length listed for each boiler model must be followed.

For a sidewall venting installation with one horizontal run and a short vertical section as shown in Figures 3, 4 and 5, the exhaust venting run must slope downward at least  $\frac{1}{4}$  inch per foot from the beginning of horizontal run to the vent termination. There should be no sagging of the vent. This is to ensure that any condensate in the horizontal venting flows outside through the opening of the termination.

All horizontal runs for a vertical venting installation, as shown in Figures 6, 7 and 8, shall slope upward not less than  $\frac{1}{4}$  inch per foot. This is to ensure that any condensate in the venting flows back towards the boiler so that the condensate can be disposed of through the condensate disposal system installed on the venting horizontal section closest to the boiler. A condensation drain should be obtained from the supplier of the venting system.

The venting shall be supported as required by applicable code(s) so that its weight does not bear on the boiler. All vent pipes must be adequately supported with vent supports no less than five feet apart or as per the vent system manufacturer's instruction, and at smaller intervals if necessary to ensure that there are no sagging sections along the horizontal runs. Noncombustible pipe strap or hangers suitable for the weight can be used to support horizontal runs and maintain vent location.

Provide minimum 2.5 inches clearance from vent components to combustible materials. Use a wall thimble when penetrating a combustible wall.

Example venting configurations are shown in Figures 3 – 8. (Follow supplier's venting installation instructions for all installations shown)

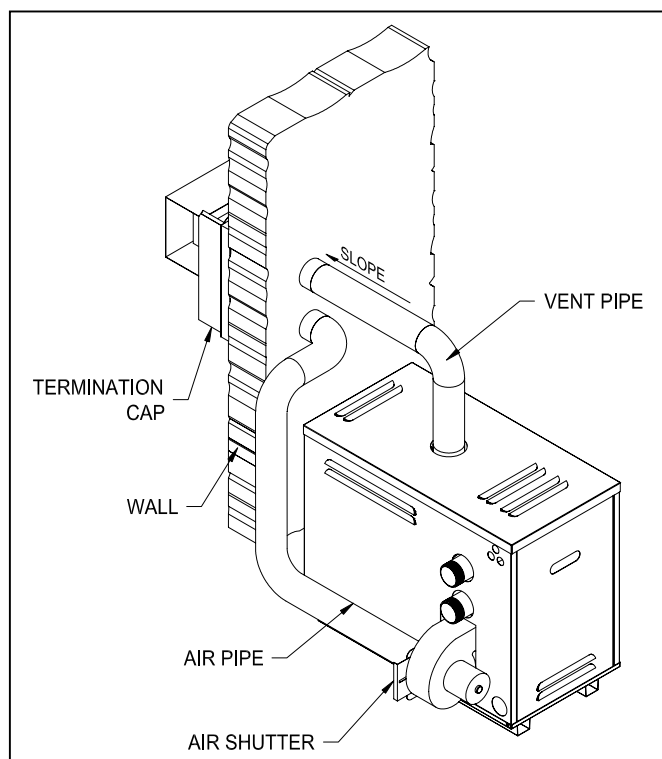


Figure 3 – Horizontal venting installed as a direct vent

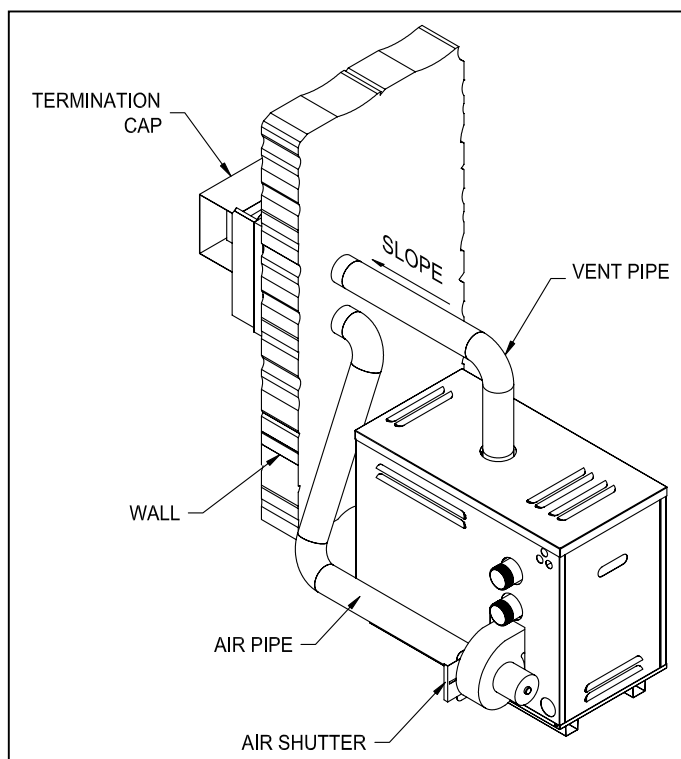


Figure 4 – Horizontal venting installed as a direct vent

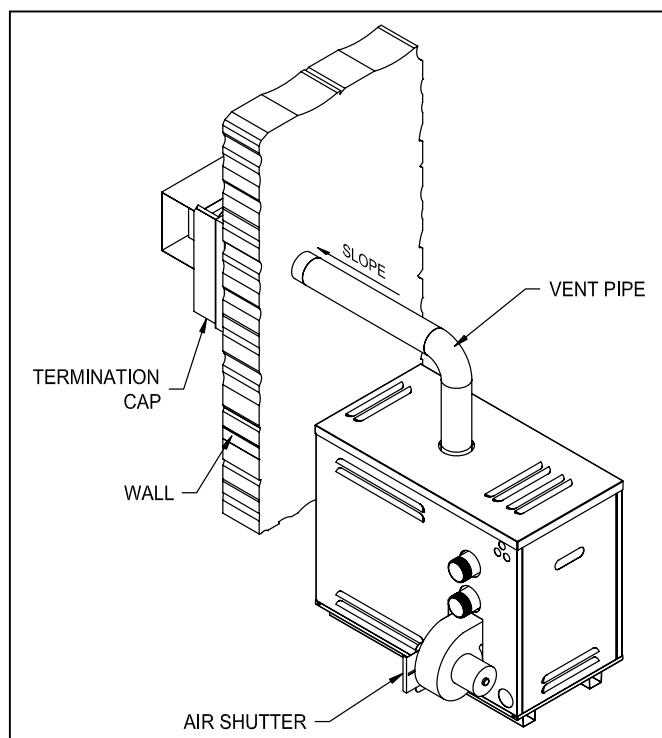


Figure 5 – Horizontal venting installed as non-direct vent

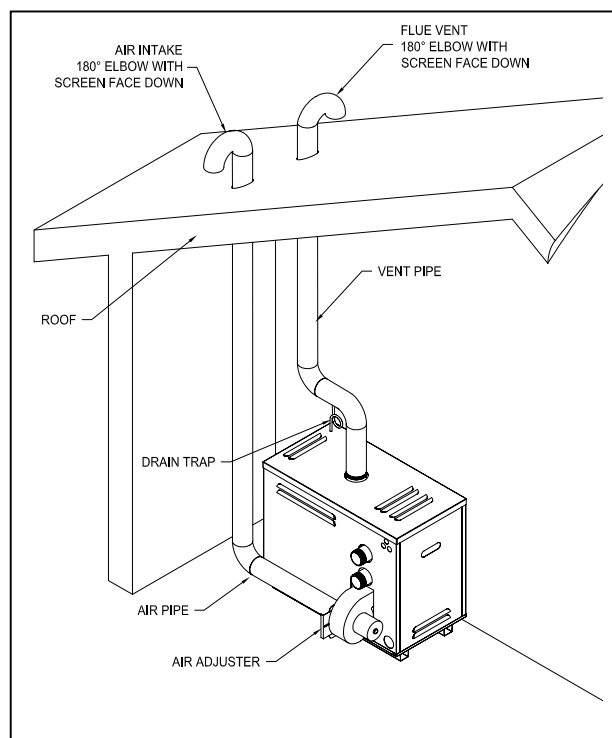


Figure 6 – Vertical venting installed as a direct vent

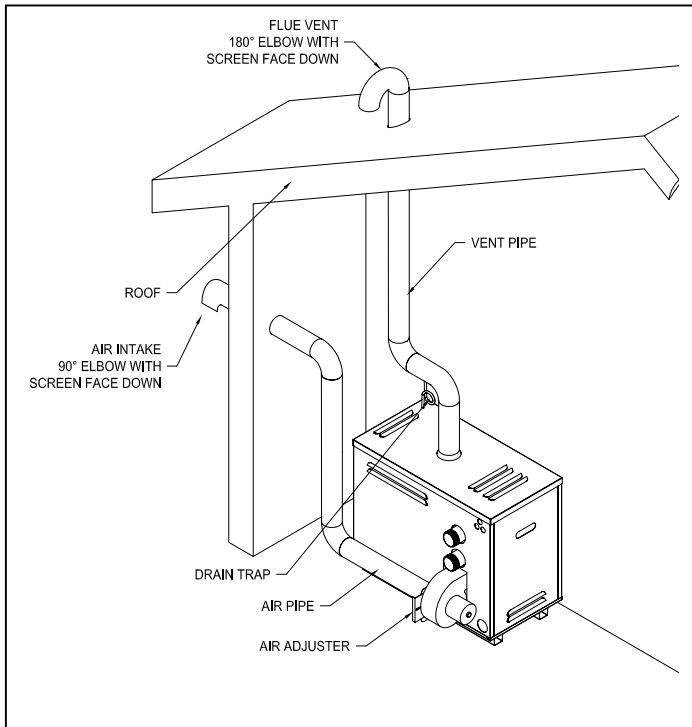


Figure 7 – Vertical venting installed as a direct vent

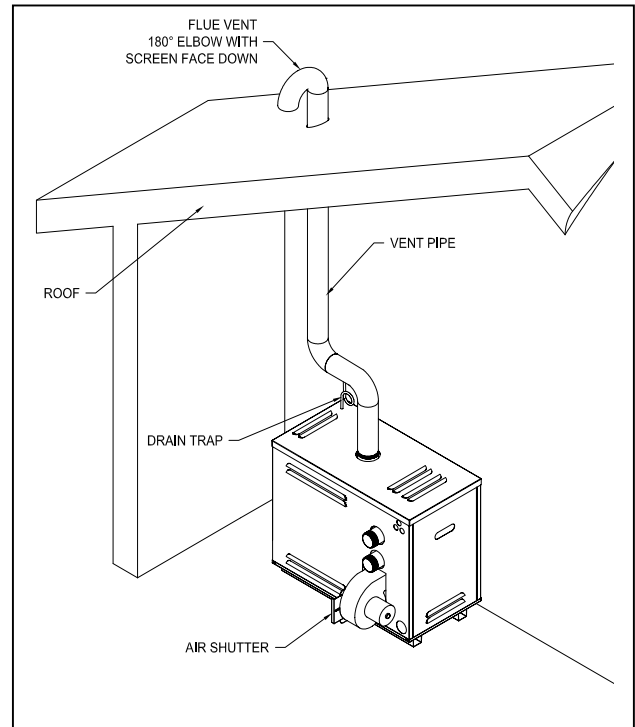


Figure 8 – Vertical venting installed as non-direct vent

## 2.7 WATER PIPING

The water piping system of a boiler connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

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

## 2.8 CORROSION PREVENTION (INTERNAL)

We specify the use of oxygen barrier tubing to protect the system and its components from corrosion. Chemical inhibitors are not recommended, as their improper use or maintenance can cause accelerated corrosion, resulting in premature failure of the boiler heat exchanger and/or system components. Corrosion is a preventable condition and is not covered by the *Super Hot* product warranty. Should your system include "non-oxygen-barrier-tubing" please contact the factory or your heating professional for recommendations.

## 2.9 SYSTEM OPERATING REQUIREMENTS

### WARNING

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

Avoid unnecessary replenishment of system water. It can allow oxygen to enter the system and cause serious corrosion problems. As well, minerals dissolved in the water supply will precipitate when heated; minerals preferentially deposit in the system and the heat exchanger. Do not draw water from the heating system for cleaning, flushing, etc.



*Super Hot* SC series boilers are designed for use in closed loop systems and are not intended for open systems, as in heating pool water or systems where water is constantly replenished. Operating the boiler in an open system will result in premature failure of the heat exchanger. *Super Hot* boilers may be used to heat water in open systems indirectly by installing a heat exchanger, such as the *Super Hot C-Coil*, to separate open and closed systems.

Heating systems with low temperature return water may cause flue gas moisture to condense on the boiler heat transfer surfaces, causing corrosion and restricting flue gas flow. Also, low temperature return water may overcool the flue gases, resulting in reduced vent suction. These are natural phenomena and are independent of the boiler design. As a guide to avoiding such corrosion and draft problems, it is imperative that the return water be not less than 135°F (57°C).

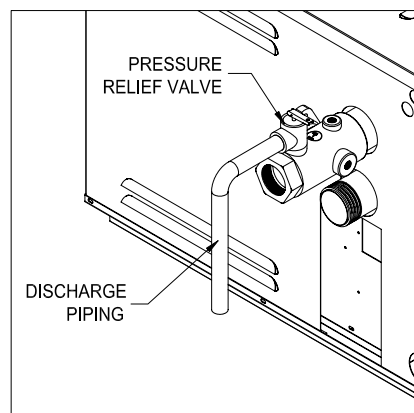
**THE BOILERS MUST ALWAYS BE USED WITH FORCED SYSTEM CIRCULATION.**

## 2.10 PRESSURE RELIEF VALVE

A pressure relief valve is supplied as standard equipment. The pressure relief valve is extra protection against damage that could be caused by malfunctioning controls or excessive water pressure. If a pressure relief valve is not used, the warranty is void.

The pressure relief valve should be installed on the boiler outlet with its spindle vertical. The connection between the boiler and the relief valve must have at least the area of the valve inlet.

A discharge pipe should be used. The discharge pipe outlet should be positioned over a suitable drain and so arranged that there will be no danger of being scalded. The discharge pipe must pitch down from the valve and should be no smaller than the outlet of the valve. The end of the discharge pipe should not be concealed or threaded and should be protected from freezing. Extensive runs, traps or bends could reduce the capacity of the pressure relief valve.



No valve of any type should be installed between the pressure relief valve and unit or in the discharge pipe. The pressure relief valve is a code requirement. Field installation of the relief valve must be consistent with the ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

Avoid contact with the hot water discharged to prevent personal injury.

## 2.11 ELECTRICAL WIRING

All electrical wiring must conform to the requirements in *Section 2.2*.

Run a separate circuit from the electrical service panel through a fused disconnect switch to the boiler. This boiler must be electrically bonded to ground in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the *National Electrical Code, ANSI/NFPA 70* (current edition) and and/or the *Canadian Electrical Code, CSA C22.1 Part 1* (current edition). Field wiring shall conform to *Section 2.2* and to the temperature limitations of Type T [63°F (35°C) rise] or better.

Make connections as shown in the wiring diagrams provided. For details of electrical wiring for different ignition controls, refer to wiring diagrams included in this manual on page 29 to 31.

**Startup Instructions****Section 3****3.1 PRE-STARTUP**

- a. Fill entire heating system with water and vent or purge air from system. Add water as needed to reach boiler operating pressure. Water should be of suitable quality. Do not use water with high hardness.
- b. Check that the venting condensate drain trap is filled with water.
- c. Check that the tubes tightly and correctly connect the air pressure switches with air chamber.
- d. Check for and repair any leaks in water piping.
- e. Check for proper installation of pressure relief valve and venting.
- f. Check that the electrical wiring matches the wiring diagram in this manual or on the boiler.
- g. Use a soap solution to check for leaks in gas piping from meter to gas manifold. Repair and retest any leaks found.
- h. Operate circulating pump and vent all radiation units and high points in system piping.

**3.2 STARTUP****WARNING**

The following instructions are intended as a guide for qualified persons. Before lighting the boiler, the pre-startup instructions of *Section 3.1* **MUST** be performed. If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

**WARNING**

Should boiler overheat, or the gas supply fail to shut off, do not turn off or disconnect the electrical supply to the boiler or circulating pump. Instead, shut off the gas supply at a location external to the boiler.

**a. Direct Spark Ignition Or Hot Surface Ignition**

This boiler does not have a pilot flame. It is equipped with a direct ignition device which automatically lights the main burner. Do not try to light the main burner by hand.

In the event of failure of any component, either the system will not operate or it will go into safety lockout.

- 1) Make sure the Gas Valve and all electrical power to the boiler are "OFF".
- 2) Set room thermostat to the lowest setting.
- 3) Connect a manometer at pressure tapping on downstream section of gas valve.
- 4) Wait five minutes to clear out any gas. If you smell gas, STOP! Follow the safety instructions provided in *Section 1.1* under WHAT TO DO IF YOU SMELL GAS. Remember that propane does not vent upward naturally.
- 5) Check the ignition control as follows:
  - a) Set room thermostat above room temperature to call for heat and turn power on for the boiler.
  - b) Watch/listen for spark or watch for hot surface to glow bright in the combustion chamber from the inspection hole in the front of boiler after 30 seconds pre-purge. If no flame is detected within 4 seconds, two or three retries will automatically occur after a 30 second inter-purge. If no flame is detected after three or four tries for ignition, all models will automatically lockout and restart the ignition sequence after one hour, or after the power is reset. However, if the lockout is caused by a blockage of the heat exchanger, venting or air inlet pipe, the controller



will not restart the ignition sequence and the boiler will be able to be put back into operation only by removing the blockage and resetting the electrical power to the controller.

- 6) Turn Gas Valve to ON. Main burner(s) should ignite. Check main burners and adjust the airflow, if necessary, as described in *Section 3.3 and 3.5*.
- 7) Check for gas leaks of the joint between the gas valve outlet and manifold.
- 8) Assure that all other gas appliances are turned off, including their pilot flames.
- 9) Check manifold pressure reading on the manometer and make necessary adjustments. Check burner input matches the rating plate input or is correctly derated for high altitude installations, as described in *Section 3.6 and 3.7*.
- 10) Return thermostat and controls to normal operating settings.

### **b) Sequence of Control System operation**

The sequence of control system operation is as shown in the following chart:

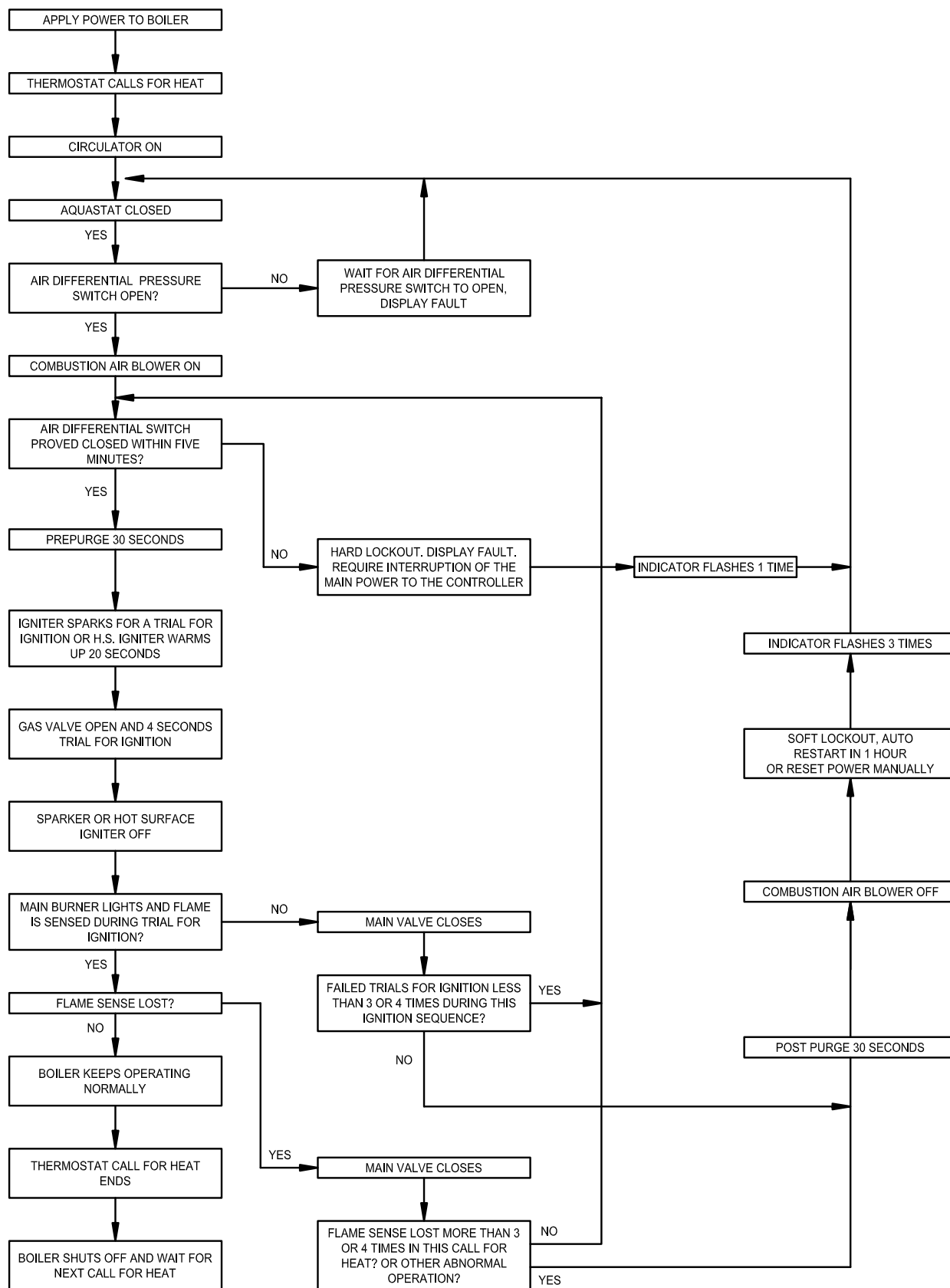


Chart 1: Operation Sequence for Spark and Hot Surface Ignition Control System.





### 3.3 CHECK BURNER SYSTEM

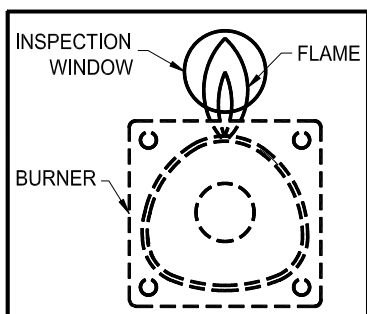
To maintain safe and efficient operation, examine the burner system regularly through the inspection window in the front of the boiler behind the door.

#### Check condition of burner system

It is possible for parts of the burners system to become plugged, cracked, eroded and/or dislodged resulting in unsafe operation.

#### Check for lifting

Flames should not lift excessively from the burner ports. The flames may lift slightly during ignition or when the burners are cold.



#### Check ignition and extinction

Ignition should flow quickly and smoothly across all the burners. Popping noises or explosions from the burners during ignition, extinction or abnormal burner operation indicates the need for service.

#### Check flame color

An extremely yellow flame, as seen on a burning candle or match, is an indication of incomplete combustion and is usually accompanied by the formation of soot and carbon monoxide (carbon monoxide is a lethal, colorless and odorless gas). If soot is allowed to accumulate, it will partially restrict free passage of products of combustion to the flue. Under typical operating conditions, the flame should have a distinct bright blue inner cone and a blue/light orange outer cone.

If any of the above problems are observed or the burner system does not operate properly, immediately take corrective measures following in section 1.1 and 1.3.

### 3.4 AQUASTAT ADJUSTMENT

The factory mounted aquastat controls main burner firing by sensing outlet water temperature. To set the temperature of this control, adjust the dial until indicator points to the temperature (setpoint) at which the gas valve will close. The gas valve will open at setpoint less the differential. The automatic reset safety high-limit aquastat is either fixed or, if adjustable, should be set a minimum of 20°F (10°C) above the setting of the aquastat.

### 3.5 AIR SWITCHES AND AIRFLOW ADJUSTMENT

The boiler is equipped with two differential air pressure switches:

1. **MINIMUM AIRFLOW (Red Light).** The first air pressure switch closes and the indicator is on when there is enough combustion air supplied to the boiler for safe operation. The Minimum Airflow switch senses positive combustion air differential pressures ( $\Delta P$ ) between the air chamber and burner venturi inlet. It acts as a safety device to prevent the boiler from firing when the airflow to the combustion chamber is too low. Low airflow can result in high levels of carbon monoxide, flashback and inefficient combustion. The minimum airflow switch is normally open and will close when the differential pressure of the air is above the switch's set-point. The actual airflow to make the boiler operate is slightly above the Minimum Airflow switch's set-point.
2. **OPTIMUM AIRFLOW (Red Light).** The second air pressure switch and indicator light allows the installer to easily adjust the blower to the optimum combustion airflow for any installation and venting configuration, and without the need of an inclined manometer or other such instrument. This switch only operates the indicator light and is only for the installer's use during setup. It is not a safety device and does not prevent the boiler from firing.

Both indicators are off when there is no call for heat. When there is a call for heat, the blower switches on and comes up to speed. If the Minimum Airflow switch senses enough airflow, it will close (red light ON) and allow the boiler to fire. Normally the Optimum Airflow switch will close (red light ON) but it may be on or off depending on operating conditions.

There are two tubes connecting the air pressure switches with the air chamber and burner inlet. The clear tube connected to the air chamber should be connected to the positive side (P1) of the switch and the red tube connected to the burner inlet should be connected to the negative side (P2) of the switch, as indicated on the pressure switch casing and as shown in Figure 9.

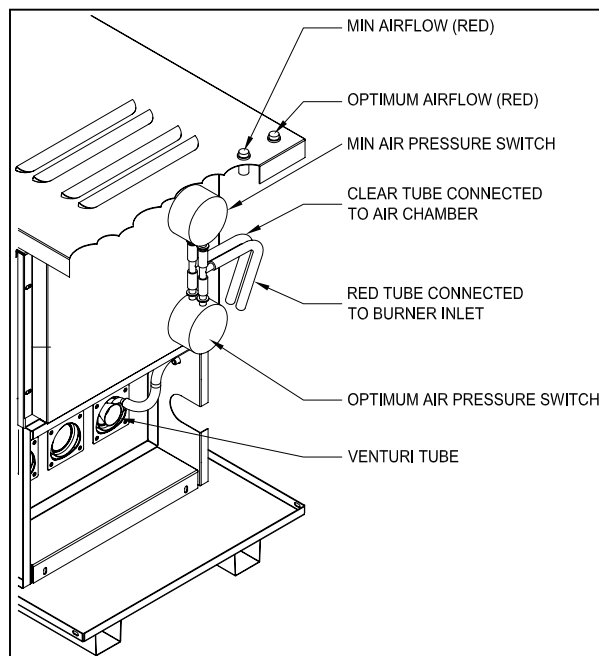


Figure 9 – Air differential pressure switch connections

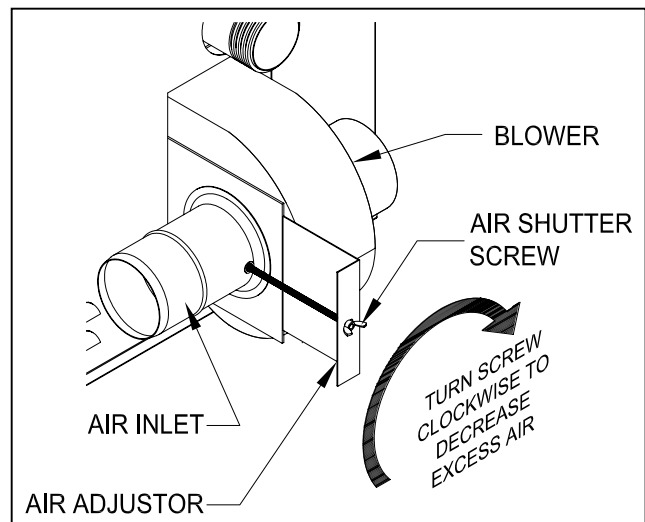


Figure 10 – Blower and air shutter

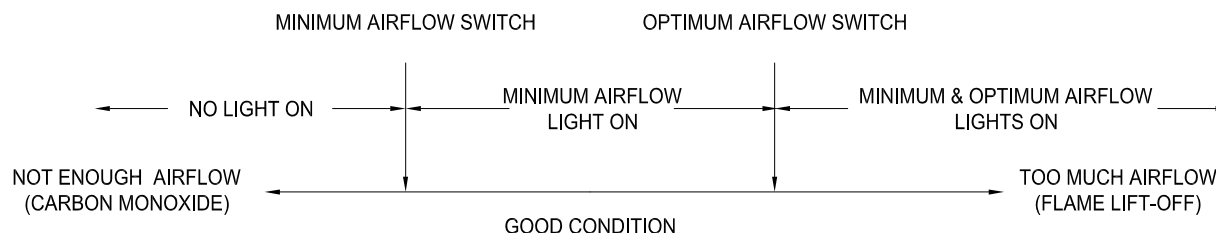


## Airflow Adjustment

After the boiler and its venting system have been installed, use the following procedure to adjust the boiler to the proper airflow:

- The airflow adjustment can only be done correctly when the boiler is hot.
- Turn gas valve off.
- Turn the air adjustor screw located on the blower inlet clockwise to slide the air adjustor closed. (Airflow adjustments are made by slowly turning the screw which slides the air adjustor located on the blower inlet to more open or more closed positions as shown in Figure 10.)
- Set room thermostat above room temperature to call for heat and turn on power to the boiler.
- The blower will start.
- Slowly** open the air adjustor to make the RED Minimum Airflow indicator light switch on. Continue to very **slowly** open the air adjustor until the RED Optimum Airflow light JUST switches on. Then immediately STOP moving the air adjustor. If the blower turns off before finishing the setting, the main electric power to the boiler has to be switched off and on to reset the controller.
- Turn the gas valve on. Reset the main electric power, if necessary. The boiler should ignite smoothly. The burner flames should be stable with no lift off or surges, and have a distinct bright blue "V"-shaped flame with a blue/light orange outer mantle.
- Let boiler run about 20 minutes, then slowly close the air adjustor to make the RED Optimum Airflow light switch off if it is still on. Shut boiler off and restart it immediately. Make sure that the boiler relights and the RED Minimum Airflow light switches on. The RED Optimum Airflow light may switch on or off and should be ignored. If the burner flames are not stable with lift off or surges, turn the screw clockwise a few turns to close the air adjustor and relight the boiler.
- Check the flame again. If the air adjustor is opened too much so the airflow is too high, ignition/flame failure may occur when the boiler is cold. The optimum operating condition of boiler should be the Minimum Airflow light switch ON and Optimum Airflow light switch OFF when the boiler is hot.

Too much airflow can result in inefficient combustion, flame lift off and ignition/flame failure. The Optimum Airflow switch is normally open and will close to turn the Optimum Airflow indicator light on when the actual airflow is above its set-point. The Minimum Airflow indicator light will always stay on when the boiler is firing. The indicator lights may be on or off during normal boiler operation. The status of the indicator lights for airflow is shown below.





### 3.6 GAS MANIFOLD PRESSURE

These boilers are factory equipped for operation at altitudes ranging from 0 to 2,000 feet above sea level. The designated manifold pressures for sea level application are as shown in the table below.

Model	Natural Gas	Propane
All Models for 0 to 2,000 feet altitude	3.5" W.C.	9" W.C.

Please note that the manifold pressure must be measured without referencing the gas valve venter to the air chamber (see *Manifold Pressure Adjustment* below). A 1/8" NPT tapping is provided on the gas valve for connecting a manometer to check this pressure. Both natural gas and propane models are furnished with gas valves which have a built in gas pressure regulator. If necessary, adjust to the proper value by removing cap and turning adjusting screw clockwise to increase manifold pressure or counterclockwise to decrease manifold pressure.

#### Use at Altitudes above 2000 feet

For altitudes above 2,000 feet above sea level, the input rating of the boiler must be reduced as shown in the table in *Section 3.7*.

In **Canada**, for boiler applications at altitudes in the range of 2000 to 4500 feet above sea level, the high altitude input rate must be achieved by changing the orifice size. The manifold pressure should be adjusted to the value as shown in the table above.

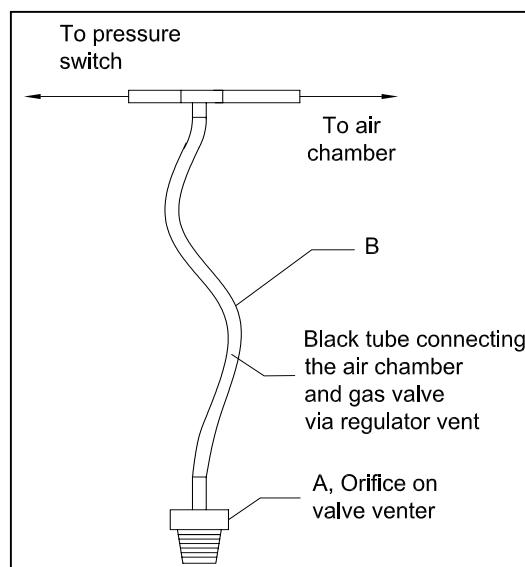
In **USA**, for boiler installations at altitudes above 2000 feet, the input rating of the boiler may be achieved by adjusting the manifold pressure or by changing orifice size.

The conversion of a boiler from sea level to high altitude must be performed by a qualified heating installer, service technician or gas supplier and in accordance with the requirements of Section 2.2 of this manual. A conversion data plate, indicating that the boiler has been converted for high altitude use, shall be attached adjacent to the rating plate. The correct conversion information must be entered on the conversion data plate by the installer.

After the boiler has been converted for high altitude use, the input must be verified following the input rate test as described in *Section 3.7*.

#### Manifold Pressure Adjustment

1. Adjust airflow as per section 3.5 of the manual
2. Ensure gas inlet pressure is set correctly
3. Connect a manometer to the gas valve outlet pressure tap
4. With the boiler running for few minutes, disconnect the tube B from the orifice on the gas valve venter and plug or clamp shut the end of tube B. The manometer should show the manifold pressure required on the rating plate or conversion data plate.
5. If the manifold pressure is not equal to the value required, remove the pressure regulator adjustment cap screw on the gas valve
6. Using a screwdriver turn the inner adjustment screw clockwise  $\curvearrowright$  to increase or counterclockwise  $\curvearrowleft$  to decrease it
7. Replace cap screw and tighten firmly
8. Reconnect tube B to the regulator vent orifice A.



### 3.7 CHECK INPUT & ORIFICES

**For safety, the input shown on rating plate must not be exceeded.** Check with the following table that the orifice size and input rate shown on your boiler rating plate match your application, i.e. boiler model, fuel type, and altitude. To adjust manifold pressure, follow the procedure described in *Section 3.6*. If the derated input rating for high altitude requires a change in orifice size, contact the boiler manufacturer.

FOR CANADA				
Model	Natural Gas		Propane	
	0 to 2,000 feet	2,000 to 4,500 feet	0 to 2,000 feet	2,000 to 4,500 feet
All	$\phi 7/64$ " orifice standard input	#36 orifice 10% derate input by adjusting manifold pressure	#50 orifice standard input	#51 orifice 10% derate input by adjusting manifold pressure

NOTE: For elevations above 4,500 feet reduce high altitude input 4% for each additional 1000 feet.  
Reference *Natural Gas and Propane Installation Code B149.1*, 3.22 High Altitude Installations

Example of High Altitude Derate

Boiler: SC-140

Altitude: 5,500 feet

Standard Input (0-2,000 ft) = 140,000 Btu/h

High Altitude Input (2000 to 4,500 ft) =  $140,000 \times 0.90 = 126,000$  Btu/h

% Reduction for additional 1000 ft =  $4\% \times 1 = 4\%$

Input at 5,500 ft = Derate High Altitude Input by 4%

=  $126,000 \text{ Btu/h} \times (1 - 0.04)$

=  $126,000 \text{ Btu/h} \times 0.96$

= 120,960 Btu/h

FOR UNITED STATES				
Model	Natural Gas		Propane	
	0 to 2,000 feet	Over 2,000 feet	0 to 2,000 feet	Over 2,000 feet
All	ϕ7/64" orifice standard input	Input must be reduced 4% for each 1000 feet above sea level. *	#50 orifice standard input	Input must be reduced 4% for each 1000 feet above sea level. *

\*Reference *National Fuel Gas Code ANSI Z223.1*, 8.1.2 High Altitude.

Example of High Altitude Derate

Boiler: SC-105

Altitude: 5,000 feet

Standard Input (0 to 2,000 ft) = 105,000 Btu/h (from page 2)

% Reduction for 5,000 ft = 4% x 5 = 20%

Input at 5,000 ft = Derate Standard Input by 20%

= 105,000 Btu/h x (1 - 0.20)

= 105,000 Btu/h x 0.80

= 84,000 Btu/h



Adjustments to the input rate can be made by varying the manifold pressure. Normally it should be adjusted no more than 0.1 inch w.c. for natural gas or 0.4 inch w.c. for propane from the manifold pressure specified on the rating plate for that altitude application.

## WARNING

**Exceeding the allowable input rate can produce dangerous concentrations of carbon monoxide, and cause the boiler to overheat resulting in severe personal injury, death or substantial property damage. Carbon monoxide is a lethal, colorless and odorless gas.**

### Input Rate Test

Consult gas company to determine the heating value of the gas supplied in Btu per cubic foot. Operate boiler for 15 minutes starting with all parts at room temperature and check input by clocking gas meter with all other gas appliances turned off, including their pilot flames. Use the following formula:

$$\text{INPUT (Btu/h)} = \frac{(3600) \times (\text{Heating Value of Gas}) \times (\text{Number of Cubic Feet Timed})}{\text{Seconds Clocked}}$$

To ensure accuracy for rating, clock enough cubic feet of gas so that there is at least one revolution of the test dial and the clocked time is at least 60 seconds.

## 3.8 CHECK OF CONTROLS

After the unit has been operated for a while, lower the aquastat setting below the setpoint or actual boiler water temperature and burner should shut off. Rotate the aquastat higher than setpoint and the main burner should ignite. Return the aquastat to its original setpoint and make sure boiler cycles normally. Repeat this type of check on the safety high-limit aquastat, thermostat and other system controls to ensure all work satisfactorily. If any of the safety or controls do not function, necessary corrections should be made immediately.

## 3.9 CHECK FOR GAS LEAKS

To identify gas leaks, smell for gas around boiler area and gas piping connections (See *Section 1.1*). To check a specific area, including the manifold joint connected to the gas valve, for leakage, spray a mixture of soap and water onto the suspected area – active bubbling indicates a gas leak. The gas leaks of the manifold joint connected to the gas valve outlet should be checked when the boiler is on. **DO NOT TEST FOR LEAKS WITH AN OPEN FLAME.** Gas leaks must be repaired immediately.

## 3.10 CHECK THE CONDENSATE DRAIN TUBE

Check that the tube loop is approximately 4" diameter. The water should fill the loop to form a liquid-filled trap and not be plugged with excessive sediment.



### 3.11 INSTALLER'S CHECKLIST

	Reference Section
<input type="checkbox"/> The information printed on the boiler rating plate matches the application (i.e. altitude and fuel type).	3.6
<input type="checkbox"/> All applicable electrical codes have been met.	2.2, 2.12
<input type="checkbox"/> Gas piping has been purged and checked for leaks with a soap solution, including the joint between the gas valve outlet and manifold when the boiler is on.	2.2, 2.4, 3.9
<input type="checkbox"/> System is filled with water and all air has been purged. Only oxygen barrier tubing has been used.	2.9, 2.10
<input type="checkbox"/> Tubes of air differential pressure switch are connected tightly and correctly.	3.5
<input type="checkbox"/> A manometer has been used to check the manifold pressure and gas supply pressure against requirements printed on boiler rating plate.	3.6
<input type="checkbox"/> Bypass or mixing valve has been used to prevent return water less than 135°F.	2.10
<input type="checkbox"/> All applicable venting codes have been met. Air openings sized to provide adequate supply air for combustion and ventilation and will not be blocked off.	2.2, 2.5, 2.6, 2.7
<input type="checkbox"/> Operate the boiler for 15 minutes, then clock and calculate Btu/h input rate. The input rate must not exceed that specified on the boiler rating plate. Clocked BTU/H Input Rate: _____	3.7
<input type="checkbox"/> Perform check of temperature controls: aquastat, high limit aquastat, and thermostat.	3.4, 3.8
<input type="checkbox"/> Test any other controls as specified by the manufacturer.	
<input type="checkbox"/> Visually inspect main burners to ensure proper flame operating characteristics and ignition/extinction is ok.	3.3
<input type="checkbox"/> Allow the boiler to cycle a few times to ensure functions are operating correctly.	
<input type="checkbox"/> Close main shut-off valve and check that burners flame extinguishes.	
<input type="checkbox"/> Clearly identify emergency shut-off devices and make the user or owner aware of their location and method of operation.	
<input type="checkbox"/> Fill in the contact information on the cover of the User's Information Manual and leave both manuals in the envelope adjacent to the boiler.	

#### NOTE: INSTALLER'S RESPONSIBILITY

*"Before leaving installations, installers shall ensure that an appliance, accessory, component, or equipment installed by them comply with the Code requirements, and the person initially activating the appliance shall ensure that the appliance is in safe working order."*

*CSA B149.1-00 Natural Gas and Propane Installation Code*

**Service & Maintenance Instructions****Section 4****4.1 SERVICE & MAINTENANCE INSTRUCTIONS****WARNING**

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

**WARNING**

If any part of this boiler has been under water, inspect the boiler and replace any part of the control system and any gas control which has been under water.

This boiler has been designed to provide years of trouble-free performance in normal installations. The owner or user should conduct a general external examination covering all items on the "User Checklist" at the beginning of each heating season and in mid-heating. In addition, the owner or user should have the boiler inspected by qualified service technician or gas supplier's service person at least **once every year** at the beginning of the heating season for continued safe operation. Note that some operating conditions may require more frequent inspections.

The qualified service technician or gas supplier's service person should follow the "Service Checklist". The "Service Checklist" must only be used by a qualified service technician or gas supplier's service person.

**Verify proper operation after servicing.**

**4.2 CLEANING PROCEDURE**

1. Shutdown the boiler as described in the lighting instructions in *Section 1.3*.
2. Inspect flue gas passages and burners for the presence of soot, rust or scale.
3. If necessary, use a wire brush and vacuum to clean and remove any blockages. Plugged burner ports must be cleared.
4. Replace any parts which have severely corroded or cracked.
5. Reassemble parts removed during cleaning as they were before, ensuring air tightness of flue gas passages.
6. Corrosion can be caused by low return water temperature or a contaminated air supply. Sooting can be caused by improper burner adjustment. Check and adjust as necessary.
7. Return boiler to operation following lighting instructions in *Section 1*.





### 4.3 SERVICE CHECKLIST

	Reference Section
<input type="checkbox"/> Do not store anything against the boiler or allow dirt or debris to accumulate in the area immediately surrounding the boiler. The flow of supply and exhaust air must not be obstructed.	2.5
<input type="checkbox"/> Check air openings are not restricted and complies with applicable code(s). Adequate supply air is necessary for combustion, flue gas dilution and ventilation.	2.2, 2.5, 2.6, 2.7
<input type="checkbox"/> Check all gasketed joints for leakage, and tighten bolts or replace gaskets if necessary.	
<input type="checkbox"/> When the boiler has operated for several minutes, check for leakage around boiler and along vent, and other areas susceptible to leakage.	
<input type="checkbox"/> Check externally the vent system for soot, rust scale or corrosion. Check for dislodged venting or possible leaks in venting ducts.	
<input type="checkbox"/> Inspect the flueways and terminal cap for the presence of soot, rust scale or blockage. The presence of soot, rust scale or corrosion indicates misadjustment. Clean the Terminal Cap Screen.	
<input type="checkbox"/> Inspect and, if necessary, clean the main burner. Check burners to see that they are not cracked or dislodged.	3.3, 4.2
<input type="checkbox"/> Visually check the main burner flames. A yellow flame caused by improper adjustment is always accompanied by formation of soot which, if allowed to continue, will partially restrict free passage of products of combustion to the flue.	3.3
<input type="checkbox"/> Check that gas piping is secured. Smell for gas leaks around boiler and gas piping connections. Gas leaks can also be checked for using a soap solution; do not use an open flame to check for leaks. Note: Propane is heavier than air and pools in a low area in the event of a leak.	3.9
<input type="checkbox"/> Inspect for leaks in the water piping and at water piping connections.	
<input type="checkbox"/> Circulating pumps used with hot water heating systems should be inspected for water leaks.	
<input type="checkbox"/> Check for weeping at pressure relief valve outlet during normal operation.	2.11
<input type="checkbox"/> Listen for unusual audible sounds in the boiler. Any audible sounds in the boiler system may be indications of scaling or lack of sufficient water flow and the system should be checked without delay. Scaling is due to improper maintenance. It is not the fault of the boiler. Scale damage is not covered by warranty.	2.10
<input type="checkbox"/> Check the temperature and pressure gauge and expansion tank pressure is within an acceptable range for the heating system.	
<input type="checkbox"/> Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids. Combustible materials, gasoline and other flammable vapors and liquids should not be stored in the area of the boiler.	
<input type="checkbox"/> Check should be made on ignition system, operation controls and safety shut-off valves for gas tightness.	
<input type="checkbox"/> Check the tubes connecting the air differential pressure switches with air chamber are correct, secured, and good condition.	3.5
<input type="checkbox"/> Check that the condensate drain tube is filled with water and not clogged.	2.7
<input type="checkbox"/> If applicable, inspect low water cutoff for proper operation.	2.3
<input type="checkbox"/> The emergency shut-off devices are identified and the owner is aware of their location and method of operation.	
<input type="checkbox"/> If applicable, periodically inspect the low water cutoff including flushing of float types.	



#### 4.4 CAUTION: WATER REPLENISHMENT

Avoid unnecessary replenishment of system water. It can allow oxygen to enter the system and cause serious corrosion problems. As well, an excessive amount of minerals may be deposited in the heat exchanger. Do not draw water from the heating system for cleaning, flushing, etc.

Any audible sounds in the boiler system may be indications of scaling or lack of sufficient water flow and the system should be checked without delay. Scaling is due to improper maintenance. It is not the fault of the boiler. Scale damage is not covered by warranty.

#### 4.5 REFRACTORY HANDLING PROCEDURE

##### WARNING

The mineral block and fiberglass wool used in this product are RCFs (Refractory Ceramic Fibers). RCFs pose a possible cancer hazard by inhalation and can cause respiratory, skin and eye irritation.

After mineral block has been fired, it will produce increased levels of nuisance dust and poses increased carcinogenic risk.

Follow the precautionary measures below before attempting service or access.

##### PRECAUTIONARY MEASURES:

- Avoid breathing fibers and contact with skin and eyes.
- Use a National Institute for Occupational Safety and Health (NIOSH) approved dust/mist respirator.
- Wear long-sleeved, loose fitting clothing, gloves and eye protection.
- Wash work clothes separately from other clothing. Rinse washer thoroughly.
- Operations such as sawing, blowing, tear out and spraying may generate airborne fiber concentration requiring additional protection.
- Use a vacuum with a HEPA filter for clean up.
- Dispose of all RCF scrap and dust in a closed airtight plastic bag.

##### FIRST AID MEASURES:

- Eye contact – Flush eyes with water to remove dust for at least 15 minutes. If irritation persists, seek immediate medical attention.
- Skin contact – Wash affected area gently with soap and warm water after handling.
- Difficulty breathing – Move to an area of clean fresh air. Seek immediate medical attention if difficulties persist.
- Ingestion – Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.

### Boiler Water Flow Data

### Section 5

Typical Water Flow Versus Pressure Drop Across Boiler

Model Number	20°F T.D.		30°F T.D.	
	U.S. GPM	P.D. FT.	U.S. GPM	P.D. FT.
SC-35	3.0	2.8	2.0	1.2
SC-70	6.0	2.8	4.0	1.2
SC-105	9.0	2.8	6.0	1.2
SC-140	12.0	2.8	8.0	1.2
SC-175	15.0	2.8	10.0	1.2
SC-210	18.0	2.8	12.0	1.2
SC-245	21.0	2.8	14.0	1.2
SC-280	24.0	2.8	16.0	1.2



## Replacement Parts

## Section 6

**NOTE:** To supply the correct part it is important that you state the boiler model number, serial number and type of gas when applicable.

Any part returned for replacement under standard company warranties must be properly tagged with Return Goods Authorization Form (R.G.A.), completely filled in with the boiler serial number, model number, etc., and shipped to the Company freight prepaid.

If determined defective by the Company and within warranty, the part will be returned in kind or equal substitution, freight collect. Credit will not be issued.

Refer to Figures 11 and 12 for replacement parts.

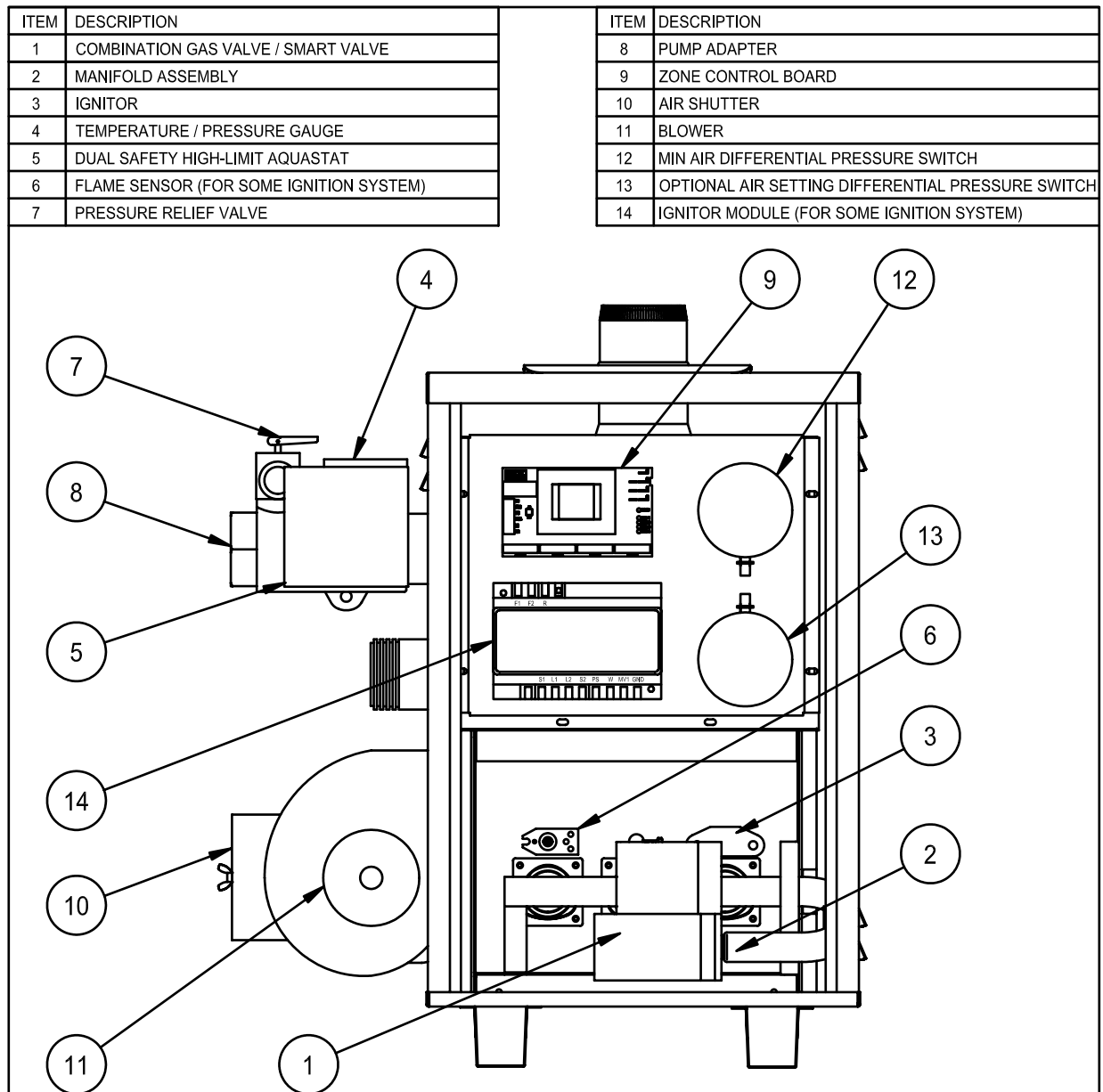


FIGURE 11 – TYPICAL LAYOUT FOR REPLACEMENT PARTS

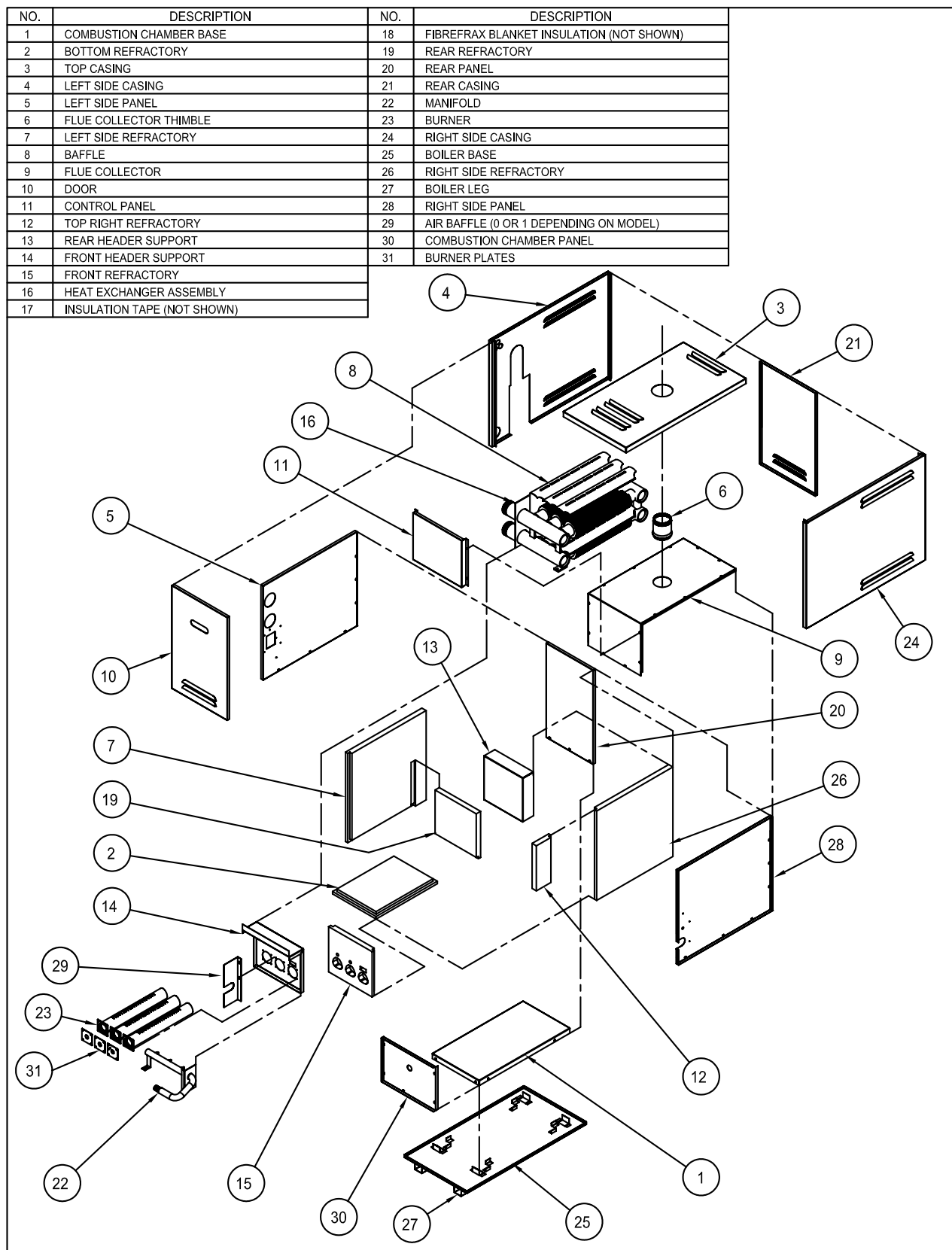


FIGURE 12 - GENERAL ASSEMBLY PARTS LIST

**Wiring Diagrams****Section 7****7.1 Simplified Wiring Instructions****IMPORTANT**

- Disconnect power source to boiler before wiring zone control board.
- All wiring must comply with applicable codes, ordinances and regulations.
- The non-replaceable fuse on the board will be blown if 240 Vac is connected to the board or if the 24 Vac system is even momentarily shorted out.

**A: Line Voltage Connections**

Connect 120 Vac, 60 Hz, single phase power to terminals L1(HOT) and L2(NEUTRAL). Strip wire ends to a maximum of 3/16" before inserting into terminal block. Tighten terminal screw clamps. Connect ground wire to ground screw "G" on the boiler control panel or a green colored screw.

**B: Zones**

Remove zone one plug-in terminal block. Connect 24 Vac thermostat leads to terminals TH1 and TH2 on plug-in terminal block. Connect normally closed zone valve 24 Vac motor leads to terminals ZV1 and ZV2. Connect zone valve "end switch" leads to terminals ES1 and ES2. Strip wire ends to a maximum of 3/16" before inserting into terminal block. Tighten terminal screw clamps. Re-insert plug-in terminal block into mating connector on Zone Control Board. Repeat for zones 2, 3, and 4 as required.

**C: Jumpers**

Jumpers J1 and J2 are factory set for a multi-zone installation.

**D: For Single zone Applications**

Install jumper J2 and connect 24 Vac thermostat leads to terminals TH1 and TH2 on Zone 1 plug-in terminal block.

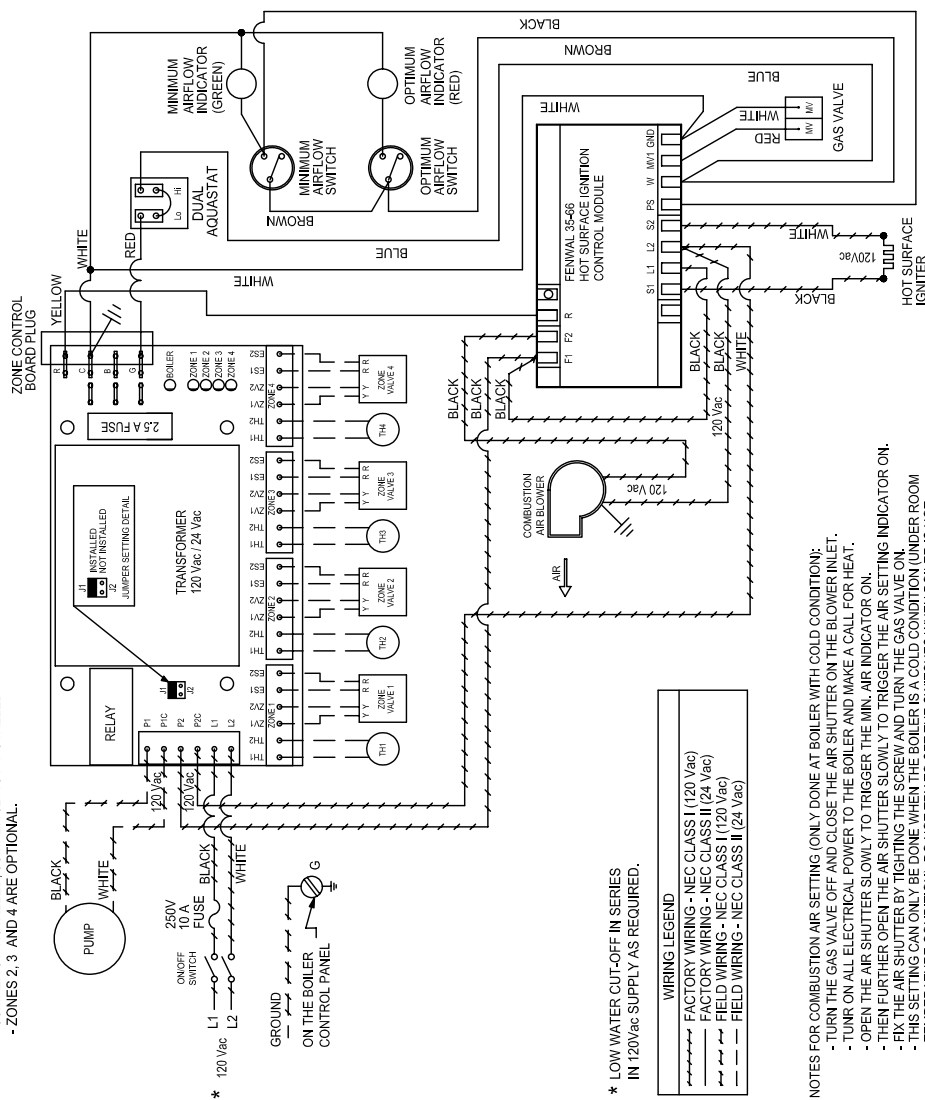
Manufactured exclusively by

**Allied Engineering Company**



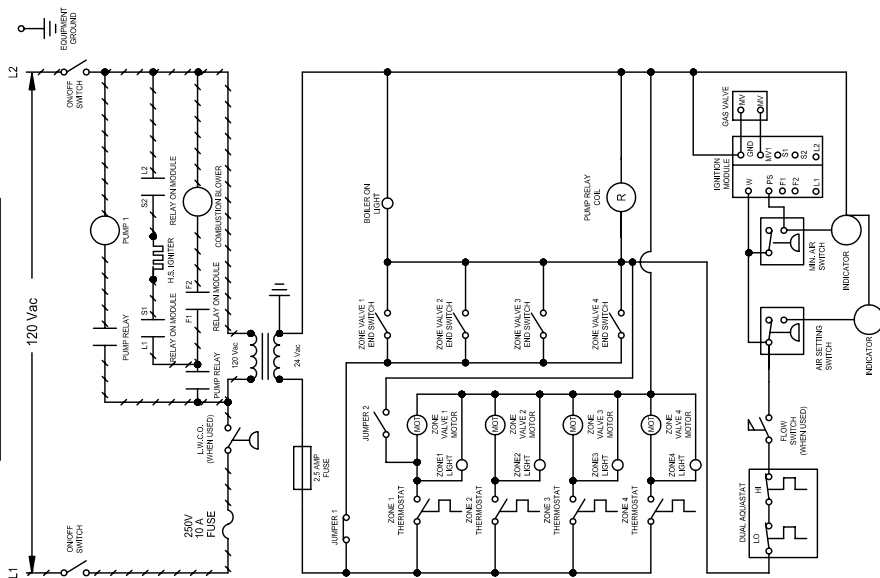
## SCHEMATIC WIRING DIAGRAM

- NOTES:
- WIRING IS 24 Vac UNLESS OTHERWISE SPECIFIED.
  - ZONE THERMOSTAT ACTIVATES ZONE VALVE, ZONE VALVE END SWITCH ACTIVATES PUMP(S) THROUGH RELAY AND BLOWER THROUGH MODULE.
  - AIR FLOW PRODUCED BY AIR BLOWER ACTIVATES THE MIN. AIR SWITCH.
  - MIN. AIR SWITCH ACTIVATES HOT SURFACE IGNITER AND GAS VALVE.
  - ZONE VALVES ARE IN THE NORMALLY CLOSED POSITION AND HAVE END SWITCHES.
  - JUMPER J1 INSTALLED, JUMPER J2 NOT INSTALLED.
  - ZONES 2, 3 AND 4 ARE OPTIONAL.



- NOTES FOR COMBUSTION AIR SETTING (ONLY DONE AT BOILER WITH COLD CONDITION):
- TURN THE GAS VALVE OFF AND CLOSE THE AIR SHUTTER ON THE BLOWER INLET.
  - TURN ON ALL ELECTRICAL POWER TO THE BOILER AND MAKE A CALL FOR HEAT.
  - OPEN THE AIR SHUTTER SLOWLY TO TRIGGER THE MIN. AIR INDICATOR ON.
  - THEN FURTHER OPEN THE AIR SHUTTER SLOWLY TO TRIGGER THE AIR SETTING INDICATOR ON.
  - FIX THE AIR SHUTTER BY TIGHTENING THE SCREW AND TURN THE GAS VALVE ON.
  - THIS SETTING CAN ONLY BE DONE WHEN THE BOILER IS A COLD CONDITION (UNDER ROOM TEMPERATURE CONDITION). DO NOT TRY TO SET THE SWITCHES WHEN BOILER IS HOT.

## LADDER WIRING DIAGRAM



### WARNING

ELECTRICAL SHOCK HAZARD. CAN CAUSE SEVERE INJURY OR DEATH. DISCONNECT POWER BEFORE INSTALLING AND/OR SERVICING.

### NOTES:

- ALL WIRING MUST BE INSTALLED IN ACCORDANCE WITH:
  - U.S.A. - N.E.C. ANS/NFPA 70 AND ANY OTHER NATIONAL, STATE, OR LOCAL CODE REQUIREMENTS
  - CANADA - C.E.C. C.S.A. C22.1 PART 1 AND ANY OTHER NATIONAL, PROVINCIAL, OR LOCAL CODE REQUIREMENTS
- IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE BOILER MUST BE REPLACED, TYPE 105°C WIRE OR ITS EQUIVALENT MUST BE USED.

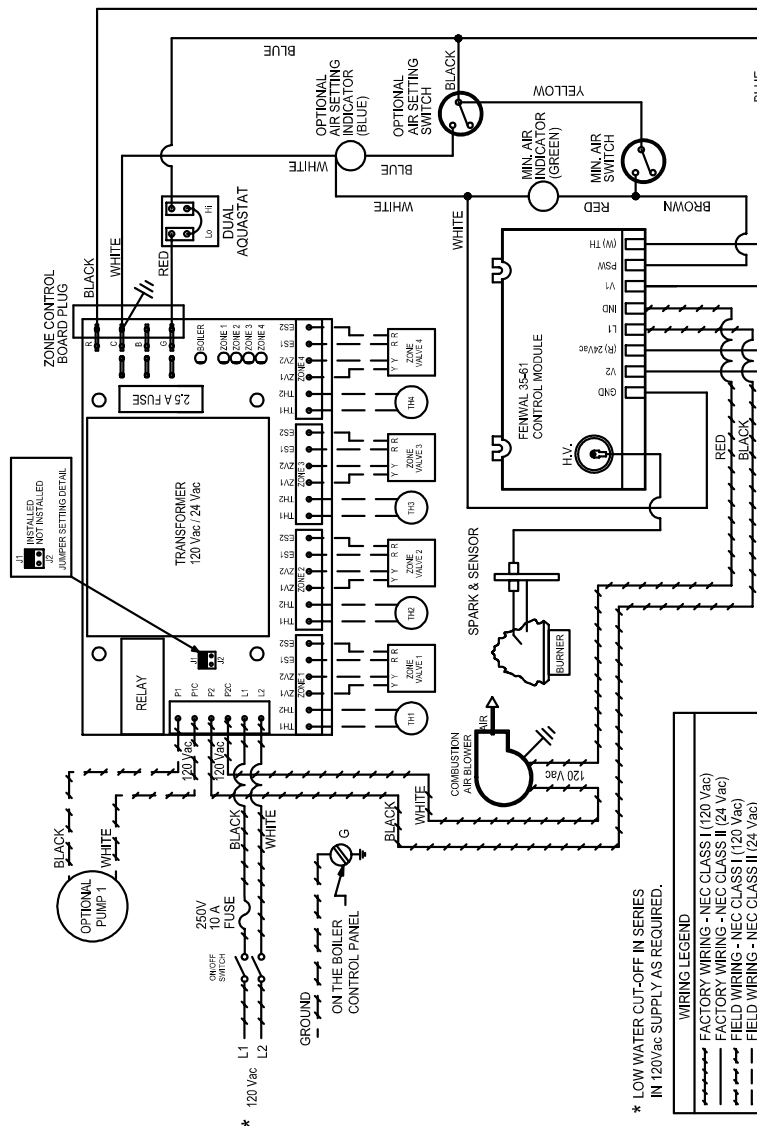
WIRING DIAGRAM FOR FORCED AIR BOILERS - FENWAL H.S. MODULE, W/ LOCAL SENSING & ZONE BOARD

SC-W-004-00



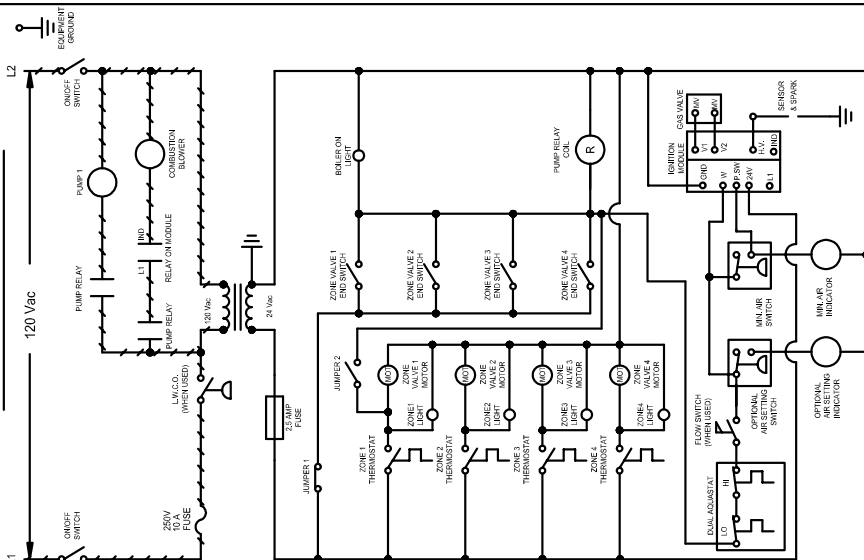
## SCHEMATIC WIRING DIAGRAM

- NOTES:
- WIRING IS 24 Vac UNLESS OTHERWISE SPECIFIED.
  - ZONE THERMOSTAT ACTIVATES ZONE VALVE, ZONE VALVE END SWITCH ACTIVATES PUMP(S) THROUGH RELAY AND BLOWER THROUGH MODULE.
  - AIR FLOW PRODUCED BY AIR BLOWER ACTIVATES THE MIN. AIR SWITCH.
  - MIN. AIR SWITCH ACTIVATES SPARK IGNITER AND GAS VALVE.
  - ZONE VALVES ARE IN THE NORMALLY CLOSED POSITION AND HAVE END SWITCHES.
  - JUMPER J1 INSTALLED, JUMPER J2 NOT INSTALLED.
  - ZONES 2, 3 AND 4 ARE OPTIONAL.



- NOTES FOR COMBUSTION AIR SETTING (ONLY DONE AT BOILER WITH COLD CONDITION):
- TURN THE GAS VALVE OFF AND CLOSE THE AIR SHUTTER ON THE BLOWER INLET.
  - TURN ON ALL ELECTRICAL POWER TO THE BOILER AND MAKE A CALL FOR HEAT.
  - OPEN THE AIR SHUTTER SLOWLY TO TRIGGER THE MIN. AIR INDICATOR ON.
  - THEN FURTHER OPEN THE AIR SHUTTER SLOWLY TO TRIGGER THE AIR SETTING INDICATOR ON.
  - FIX THE AIR SHUTTER BY TIGHTENING THE SCREW AND TURN THE GAS VALVE ON.
  - THIS SETTING CAN ONLY BE DONE WHEN THE BOILER IS A COLD CONDITION UNDER ROOM TEMPERATURE CONDITION; DO NOT TRY TO SET THE SWITCHES WHEN BOILER IS HOT.

## LADDER WIRING DIAGRAM



**WARNING** ELECTRICAL SHOCK HAZARD. CAN CAUSE SEVERE INJURY OR DEATH. DISCONNECT POWER BEFORE INSTALLING AND/OR SERVICING.

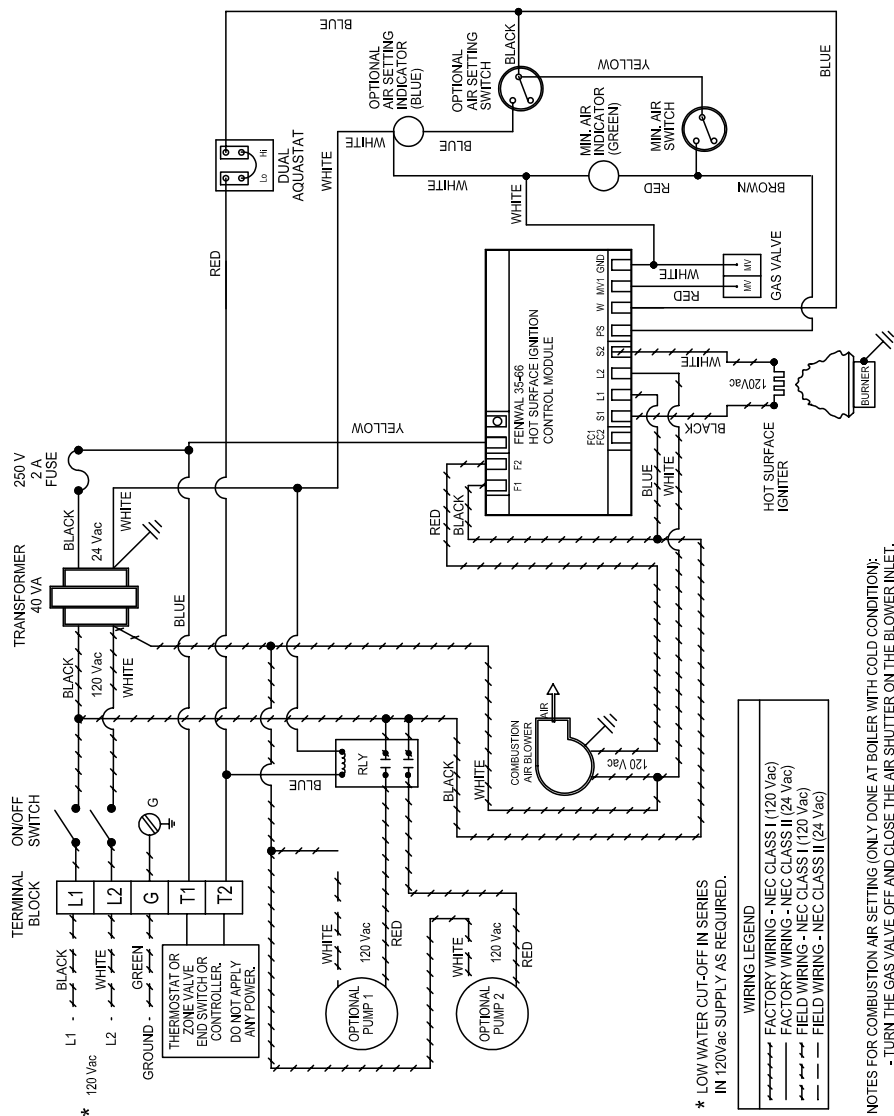
- NOTES:
- ALL WIRING MUST BE INSTALLED IN ACCORDANCE WITH:
    - U.S.A. - N.E.C. ANSINER 70 AND ANY OTHER NATIONAL, STATE, OR LOCAL CODE REQUIREMENTS
    - CANADA - C.E.C. C.S.A. C22.1 PART 1 AND ANY OTHER NATIONAL, PROVINCIAL OR LOCAL CODE REQUIREMENTS
  - IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE BOILER MUST BE REPLACED, TYPE 105°C WIRE OR ITS EQUIVALENT MUST BE USED.

## WIRING DIAGRAM FOR FORCED AIR BOILERS - FENWAL D.S. MODULE W/ LOCAL SENSING & ZONE BOARD

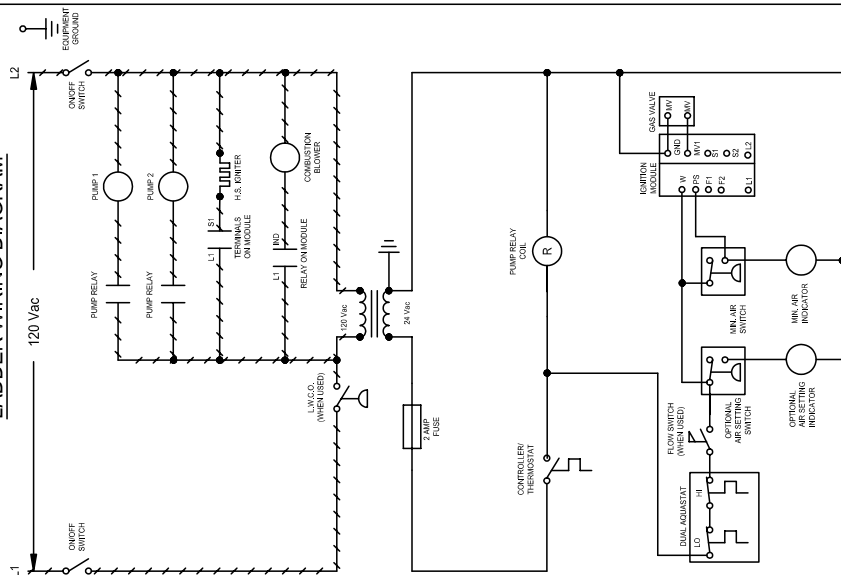
SC-W-002-00



## SCHEMATIC WIRING DIAGRAM



## LADDER WIRING DIAGRAM



**WARNING** ELECTRICAL SHOCK HAZARD. CAN CAUSE SEVERE INJURY OR DEATH. DISCONNECT POWER BEFORE INSTALLING AND/OR SERVICING.

- NOTES:**
- ALL WIRING MUST BE INSTALLED IN ACCORDANCE WITH:
    - U.S.A. - N.E.C. (ANSI/NFPA 70) AND ANY OTHER NATIONAL, STATE, OR LOCAL CODE REQUIREMENTS
    - CANADA - C.E.C. (C.S.A. C22.1 PART 1 AND ANY OTHER NATIONAL, PROVINCIAL OR LOCAL CODE REQUIREMENTS)
  - IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE BOILER MUST BE REPLACED, TYPE 105°C WIRE OR ITS EQUIVALENT MUST BE USED.

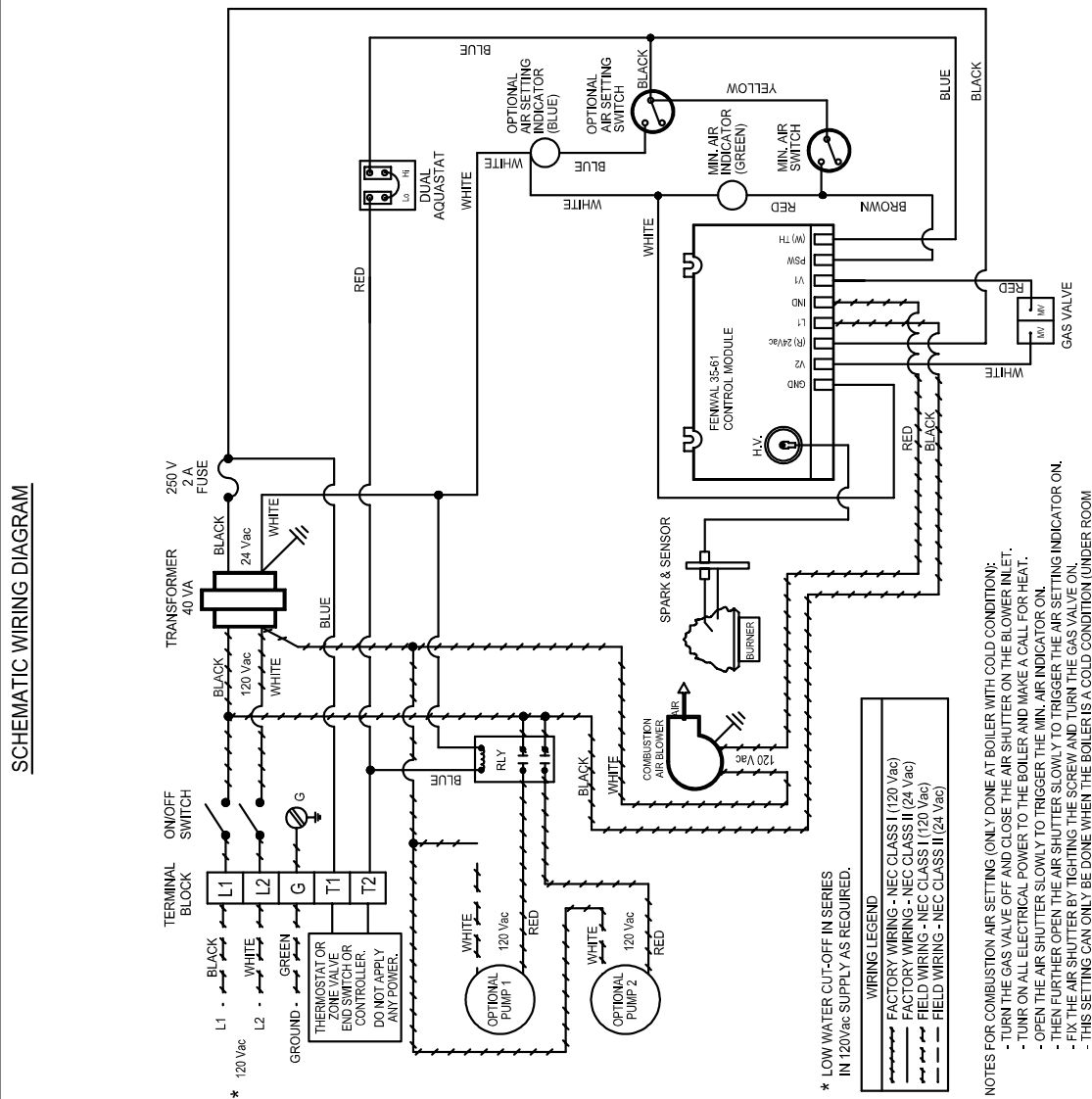
WIRING DIAGRAM FOR FORCED AIR BOILERS - FENWAL H. S. MODULE W/ LOCAL SENSING & TRANSFORMER

SC-W-009-00

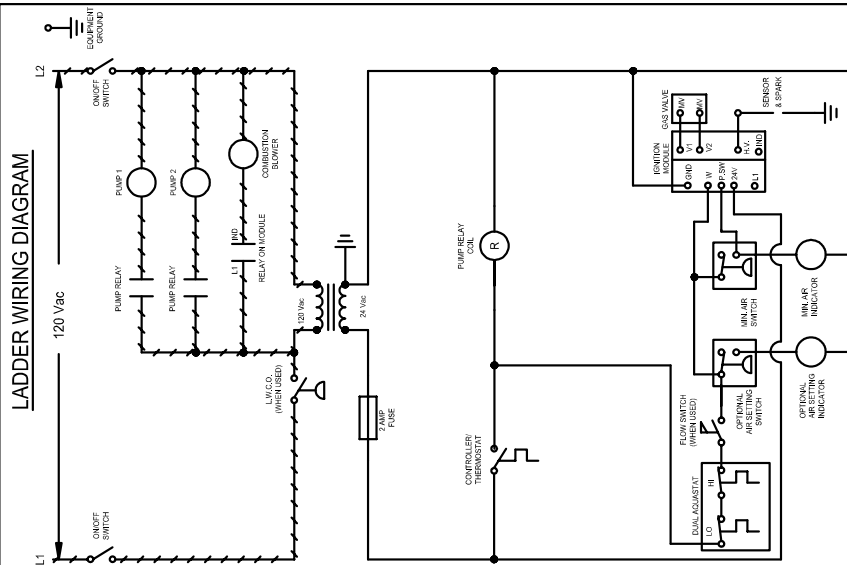




**SCHEMATIC WIRING DIAGRAM**



**LADDER WIRING DIAGRAM**



**WIRING DIAGRAM FOR FORCED AIR BOILERS - FENWAL D.S. MODULE W/ LOCAL SENSING & TRANSFORMER**

SC-W-007-00



## Troubleshooting Guide

## Section 8

### 8.1 Possible Causes and Solutions

Problem	Possible Cause	Solution
Boiler will not fire.	<ul style="list-style-type: none"> <li>No power.</li> </ul>	<ul style="list-style-type: none"> <li>Check power switches and wiring.</li> </ul>
	<ul style="list-style-type: none"> <li>No gas supply to boiler.</li> </ul>	<ul style="list-style-type: none"> <li>Check gas source and pressure.</li> </ul>
	<ul style="list-style-type: none"> <li>Gas supply pipes are not purged of air.</li> </ul>	<ul style="list-style-type: none"> <li>Purge gas line.</li> </ul>
	<ul style="list-style-type: none"> <li>No heat demand.</li> </ul>	<ul style="list-style-type: none"> <li>Check if thermostat setting is above room temperature and aquastat setting is above boiler water temperature.</li> </ul>
	<ul style="list-style-type: none"> <li>Flow switch or low water cut off.</li> </ul>	<ul style="list-style-type: none"> <li>Check pump capacity &amp; flow direction. Check for correct water levels and air locks.</li> </ul>
	<ul style="list-style-type: none"> <li>Gas valve failure (closed position).</li> </ul>	<ul style="list-style-type: none"> <li>Check gas valve and replace if necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Faulty wiring.</li> </ul>	<ul style="list-style-type: none"> <li>Check wiring of aquastats, zone valves, and thermostats for loose or broken wires and repair.</li> </ul>
	<ul style="list-style-type: none"> <li>Faulty aquastat, thermostat, or zone valve.</li> </ul>	<ul style="list-style-type: none"> <li>Check and replace if necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Pressure switch failure or airflow blockage in heat exchanger, venting, air inlet pipe or termination.</li> </ul>	<ul style="list-style-type: none"> <li>Check pressure switch and replace if necessary. Remove airflow blockages.</li> </ul>
	<ul style="list-style-type: none"> <li>Faulty controller or control wiring.</li> </ul>	<ul style="list-style-type: none"> <li>See "Control trouble troubleshooting".</li> </ul>
Boiler goes on and off at frequent intervals.	<ul style="list-style-type: none"> <li>Poor flow in boiler or circulator failure.</li> </ul>	<ul style="list-style-type: none"> <li>Check pump for proper capacity &amp; flow direction. Replace if necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Thermostat, heat anticipator, or aquastat set too low.</li> </ul>	<ul style="list-style-type: none"> <li>Check and adjust.</li> </ul>
	<ul style="list-style-type: none"> <li>Boiler oversized or insufficient radiation.</li> </ul>	<ul style="list-style-type: none"> <li>Check and adjust if necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Wrong type of thermostat or controller.</li> </ul>	<ul style="list-style-type: none"> <li>Check and replace if necessary.</li> </ul>
Boiler fires continuously.	<ul style="list-style-type: none"> <li>Gas valve failure (open position).</li> </ul>	<ul style="list-style-type: none"> <li>Check gas valve, replace if necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Faulty wiring.</li> </ul>	<ul style="list-style-type: none"> <li>Check wiring of aquastats, zone valves, and thermostats for short circuits or incorrect wiring.</li> </ul>
	<ul style="list-style-type: none"> <li>Faulty aquastat, zone valve or thermostat.</li> </ul>	<ul style="list-style-type: none"> <li>Check and replace if necessary.</li> </ul>
Rumbling and moaning sound in boiler.	<ul style="list-style-type: none"> <li>Boiler is overheated and safety high limit aquastat fails to cut out.</li> </ul>	<ul style="list-style-type: none"> <li>Check aquastats and adjust or replace if necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Improper wiring.</li> </ul>	<ul style="list-style-type: none"> <li>Check and correct.</li> </ul>
	<ul style="list-style-type: none"> <li>Foreign matter in heat exchanger.</li> </ul>	<ul style="list-style-type: none"> <li>Flush heat exchanger if necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Poor circulation.</li> </ul>	<ul style="list-style-type: none"> <li>Check pump for correct flow.</li> </ul>
	<ul style="list-style-type: none"> <li>Air trapped in heating system.</li> </ul>	<ul style="list-style-type: none"> <li>Purge air.</li> </ul>
Gas odor.	<ul style="list-style-type: none"> <li>Flue leaking.</li> </ul>	<ul style="list-style-type: none"> <li>Check venting and boiler if leaking.</li> </ul>
	<ul style="list-style-type: none"> <li>Insufficient combustion air to boiler.</li> </ul>	<ul style="list-style-type: none"> <li>Check combustion and ventilation air opening in boiler room meets installation code requirements, and air differential pressure if too low.</li> </ul>
	<ul style="list-style-type: none"> <li>Leak in gas system.</li> </ul>	<ul style="list-style-type: none"> <li>See "What to do if you smell gas" on cover. Have gas fitter test system and repair leaks.</li> </ul>
Flame flash back	<ul style="list-style-type: none"> <li>Burner cracked or eroded</li> </ul>	<ul style="list-style-type: none"> <li>Check &amp; replace if necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Not enough combustion air or wrong air switch setting</li> </ul>	<ul style="list-style-type: none"> <li>Adjust air shutter &amp; check air switch condition</li> </ul>
	<ul style="list-style-type: none"> <li>The vent or air inlet blocked</li> </ul>	<ul style="list-style-type: none"> <li>Check &amp; clean</li> </ul>



Problem	Possible Cause	Solution
Main burner will not light	• No spark or no hot surface glow.	• High voltage wiring is loose, broken or grounded. Repair wiring.
	• Ignition electrodes or H.S. are damaged.	• Replace electrodes or igniter.
	• Ignition electrodes improperly adjusted.	• Correct adjustment of electrode.
	• Faulty electronic ignition controller.	• Replace controller.
	• No gas.	• Confirm supply of gas to pilot and repair if necessary.
	• Gas supply pipes not purged of air.	• Purge gas line.
	• Air pressure switch is damaged.	• Replace air pressure switch.
	• Dirt or foreign material on the electrodes.	• Clean.
Spark or hot surface proves but flame failure after trial for ignition.	• Incorrect manifold pressure.	• Set manifold pressure to correct pressure.
	• Poor connections in wiring to flame sensor.	• Repair wiring.
	• Air differential pressure is set to high.	• Adjust the air shutter and set air differential pressure to correct pressure.
	• Ignition electrodes improperly adjusted.	• Correct adjustment of electrodes.
Burner starts but flame will not stay established.	• Ignition electrodes are wet, dirty or improperly adjusted (for electronic ignition only).	• Check, clean, change and/or adjust the electrodes.
	• Reversed polarity of power supply.	• Check the power supply polarity
	• Air differential pressure is too high.	• Adjust the air shutter and set air differential pressure to correct pressure.
	• Poor connections in wiring to flame sensor.	• Repair wiring.
Boiler carbonizes (forms soot) quickly.	• Incorrect orifice sizing.	• Check orifice and replace if necessary.
	• Inadequate combustion air.	• Check and adjust air differential pressure.
	• Dusty environment.	• Clean.
	• Low return water temperature.	• Adjust system.
	• Manifold pressure too high.	• Adjust manifold pressure.
Boiler overheats and system remains cold.	• Insufficient circulation.	• Check pump, clean and replace if necessary.
	• Air trapped in piping.	• Purge system.
	• Improper system wiring.	• Test and correct.
Boiler and heating system overheat.	• Faulty thermostat or controller.	• Check, adjust, and replace if necessary.
	• Faulty aquastat and/or safety high limit aquastat.	• Check, adjust, and replace if necessary.
	• Faulty wiring.	• Check wiring for short circuits and repair.

## 8.2 CONTROL TROUBLESHOOTING

### 8.2.1 Hot Surface and Direct Spark Ignition System with Fenwal Module

#### a) Fault Conditions of Hot Surface and Direct Spark Ignition System

Carefully note the red diagnostic indicator light located on the Fenwal Module. When a system failure occurs, the indicator light will show a series of quick flashes followed by a short pause between the series of quick flashes. Count the number of flashes that occur between the short no-flashing intervals. The failure code for the number of flashes and service checks are shown in following tables.



## Fenwal Module Fault Conditions:

LED Indication	Steady on	1 flash	2 flashes	3 flashes
Error Mode	Internal control failure	Air flow fault (hard lockout)	Flame with no call for heat	Ignition lockout (1 hour lockout)

The LED will flash on for ¼ second, then off for ¼ second during a fault condition. The pause between fault codes is 3 seconds.

## Troubleshooting Guides:

Symptom	Cause/Cure
1. Dead	<ul style="list-style-type: none"> <li>a. Miswired</li> <li>b. Transformer faulty</li> <li>c. Fuse/circuit breaker bad</li> <li>d. Bad control (check LED for steady on)</li> </ul>
2. Thermostat on – no blower	<ul style="list-style-type: none"> <li>a. Miswired</li> <li>b. Bad thermostat no voltage @ terminal W</li> <li>c. Bad control (check LED for steady on)</li> <li>d. Aquastat is not close</li> <li>e. Air different pressure switch is not open</li> </ul>
3. Pressure switch input okay but no trial for ignition after purge delay	<ul style="list-style-type: none"> <li>a. Miswired (check psw terminal voltage)</li> <li>b. Flame sense problem (existing flame-check LED – 2 flashes)</li> <li>c. Bad control (check voltage between L1 &amp; IND)</li> </ul>
4. Valve on, no ignition or spark	<ul style="list-style-type: none"> <li>a. Shorted electrode (spark system)</li> <li>b. Open HV cable (spark system)</li> <li>c. Defective hot surface ignitor (hot surface)</li> <li>d. Miswired</li> <li>e. Bad control</li> </ul>
5. Igniter or spark on, valve off	<ul style="list-style-type: none"> <li>a. Valve coil open</li> <li>b. Open valve wire</li> <li>c. Bad control (check voltage between V1 &amp; V2)</li> </ul>
6. Flame okay during TFI, no flame sense (after TFI)	<ul style="list-style-type: none"> <li>a. Bad electrode (spark)</li> <li>b. Bad S1 or HV wire (spark)</li> <li>c. Defective hot surface igniter (hot surface)</li> <li>d. Bad S1 wire (hot surface)</li> <li>e. Poor ground at burner</li> <li>f. Poor flame (check flame current)</li> </ul>
7. Flame with no call for heat	<ul style="list-style-type: none"> <li>a. Stuck valve (check LED for 2 flashes)</li> </ul>

### b). Flame Sensor Current Check

Flame current is the current which passes through the flame from the sensor to ground. The minimum flame current necessary to keep the system from lockout is 0.7 microamps (µA). To measure flame current, connect an analog DC microammeter to the FC- FC+ test pins on the module. The meter should read 0.7 µA or higher. If meter reads below “0”, meter leads are reversed. Disconnect power and reconnect meter leads for proper polarity.



NOTES

Section 9



NOTES

Section 9



NOTES

Section 10

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