



INSTALLATION AND OPERATOR'S MANUAL

COAL GUN™ BOILER – OUTDOOR VERSION

Models: S130 OBE • S260 OBE



IMPORTANT: IN ORDER TO ACHIEVE SAFE AND SATISFACTORY RESULTS FROM YOUR ALTERNATE HEATING SYSTEMS BOILER, READ SAFETY RULES AND INSTRUCTIONS CAREFULLY BEFORE INSTALLING AND OPERATING. ALL INSTALLATIONS MUST BE IN ACCORDANCE WITH STATE AND LOCAL CODES. SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE.



Your Alternate Heating Systems Boiler is capable of generating very hot temperatures. Boiler temperatures and flames in the ignition box area are capable of causing ignition or explosion of explosive or flammable products or explosion of the boiler itself if maximum safe water temperature is exceeded. Maximum safe water temperature is 210° Fahrenheit. Flammable or explosive products must never be stored in the same room or in the vicinity of a boiler, and the boiler water temperature must never be allowed to exceed 210° Fahrenheit.

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Record Model and Serial Number Below:

Model:
Serial Number:
Date of Purchase:

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Coal Gun boilers are
optionally available with the
ASME H stamp.

It is the customer's
responsibility to determine
whether the boiler must
include the stamp to satisfy
local code requirements.



Coal Gun boilers bearing
the mark seen at right are
thereby designated as
compliant.

The Coal Gun™ has
undergone thorough testing
and is certified to the
Underwriter's Laboratories
test standard 5253-2009 and
Canadian Test Standard:
CSA B366.1-2011



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Introduction

The purpose of this manual is to assist you in the installation, operation and maintenance of your new boiler in order to achieve the best performance possible. The boiler unit shall be installed by a qualified and experienced boiler installation technician who has a thorough knowledge of hydronic heating systems and boilers and will comply with all requirements of AHS. Should your installation require a steam boiler, it is even more important that experienced personnel be consulted to ensure that the necessary safety controls are installed and properly wired.

Read the entire instruction manual carefully and understand it thoroughly before installing or operating this unit. Save these instructions and review them periodically to refresh your memory regarding safe operating practices and routine maintenance required.

All Alternate Heating Systems Boilers can be supplied with the ASME “H” stamp and National Board number for an additional fee when requested prior to purchase. Alternate Heating Systems boilers are built to rigid quality control standards. You can be assured of receiving a high quality product.

Boiler Installation

BOILER LOCATION

Coal Boilers radiate heat from multiple surfaces. This heat can be dangerous if the boiler is improperly installed. The boiler must stand on a noncombustible material such as brick, stone tile or concrete. NEVER place a boiler directly on a wood floor. The noncombustible material upon which the boiler stands should extend at least 12 inches beyond the base of the boiler in the rear and on the sides. The boiler **must be installed outdoors only**. We recommend installing the unit a minimum distance of 25 feet from any buildings, depending on local building codes.

Boiler Foundation

If the area is unstable or stays wet throughout the year, you may have to improve the soil by removing some of the soil and, then, adding a good layer gravel and even raising the elevation. A concrete pad of 4" – 6" inches thick should then be used.

Most of the time the boiler can be placed on six cement blocks evenly spaced under the two cabinet support rails. The cement blocks should be no less than 24 inches wide, 24 inches long, and at least 3 inches thick.

The dimensions of the concrete pad can be found in Appendix A for both S130OBE and S260OBE.



RIGGING AND POSITIONING OF BOILER

Do not attempt to move or off-load the boiler without the aid of a crane or lift. Outdoor Coal Guns must be lifted from the bottom with forks. You can pick the unit up from any side. There are rails that run long ways under the unit for support, there are hole cut in these rails to allow forks to go through. When choosing the equipment to move and/or position the boiler, always be sure of the load rating on the equipment prior to use.

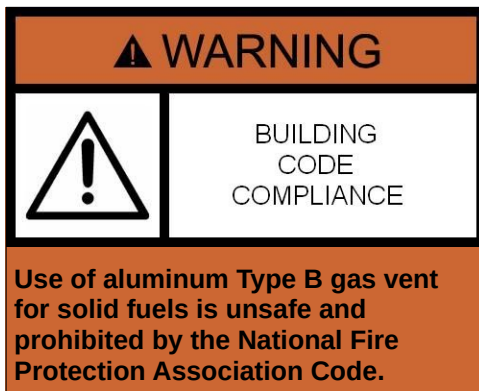
AHS suggests that professional movers should be used in any unpredictable situation. This is to prevent damage to the product, property, and to eliminate the potential for bodily injury.

Once the boiler is on the floor level where it will be installed, the unit may be rolled on pipe.

The boiler must be placed on a concrete slab or other rigid pad of non-combustible material with sufficient strength to adequately support the boiler, including its contents of water. Level the boiler after it has been positioned.

Before proceeding with installation, inquire with local building officials to ensure that the installation is in compliance with all building, plumbing and electrical codes.

A qualified technician experienced in boiler installations is recommended for the installation of this unit. Wiring on the boiler must be properly grounded.



CLEARANCES REQUIRED FOR SAFETY AND OPERATION

It is important to provide sufficient clearance around the boiler for convenient servicing, loading and ash removal. The recommended minimums for Outdoor Coal Gun boilers when measured from the exterior of the boiler are:

- **Rear:** 36 inches to the rear (end of boiler with fan assembly)
- **Right Side:** 10 feet to the right (hopper side) may need more room depending on how you plan on loading the hopper.
- **Left side:** 6 feet (flue side)
- **Front:** 36 inches, (end of boiler with sight tube)

It is the customer's responsibility to determine whether the installation complies with local code or insurance company requirements. Refer to Appendix A: Boiler Specification Diagrams for exterior dimensions of the various models.

GENERAL CHIMNEY INTRODUCTION

One of the most important considerations in installing a coal burning boiler is the type of chimney that will be used. The condition and construction of the chimney is important for providing sufficient draft. The Outdoor Coal Gun produces its own draft during the on cycle, and during the off cycle. Because of this it is not

necessary to have conventional draft during the off cycle.

NOTE: For insurance and building code compliance check with your local building inspector and insurance agent.

Draft

The amount of draft is critical to the operation of any solid fuel burning boiler. The S130OBE and the S260OBE need a draft of -.04 to -.08 inches of water column. Typically a chimney creates the draft during the off-cycle, but on the Outdoor Coal Gun's we use the draft motor to create the draft. This eliminates the need of a tall chimney.

You must verify the draft of the boiler during off-cycle. You will need a manometer to check the draft. Do this after installation is completely finished. Fire the boiler, wait until the unit reaches the temperature limit and goes to off-cycle. Remove the Sight Tube Cover from the front of the boiler. With a heavy pair of gloves hold the Sight Tube Flap tight against the boiler. Insert the probe of the manometer in to the Sight Tube Flap Bypass hole. Rotate the Bypass hole so that it closes against the probe. If the draft is more than -0.06 or less than -0.02 adjust the off-cycle fan speed accordingly. See Fan Speed section in this manual for more information.

A device called a manometer is used in describing the technical performance of a chimney. A manometer is an instrument used for measuring the pressure of liquids and gases. An analog manometer consists of a glass tube filled with a liquid and mounted in front of a measuring scale against which the liquid level can be measured. If a manometer were connected to a leak-free chimney with a leak-free connection, then the draft in the chimney should exert enough pressure (or pull) against the water in the manometer to cause it to move at least 0.04 inches in the tube.



Dwyer Manometer



Note: Manually operated draft dampers must not be used with the Coal Gun

CHIMNEY REQUIREMENTS

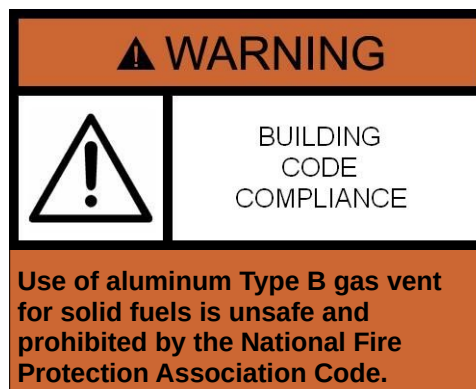
This unit must be installed into a chimney approved for use with solid-fuel appliances. In the U.S., it must be connected to a prefabricated chimney complying with the requirements for Type HT chimneys in the Standard for Chimneys, Factory-Built, Residential Type and Building Heating Appliances, UL 103.

In Canada, this unit is to be used with prefabricated chimneys tested and listed to the high temperature (650 degrees C) chimney standard, ULC S-629, or with a code approved masonry chimney.

When venting your Coal Gun boiler using a prefabricated chimney, be sure to contact local building code authorities, and to follow the

manufacturer's instructions exactly. Use only the manufacturer's parts; do not use makeshift installation techniques. All prefabricated chimneys must be tested to either the U.S. or Canadian high-temperature standards, UL 103 or ULC-629.

Your manufactured chimney may contain more parts than is shown in the subsequent diagrams. Include all required items in your installation. A chimney cap (A) serves to keep rain and snow from entering the chimney. An approved Class A chimney (B) is required for the Coal Gun Stoker boiler. Manufactured chimneys may feature a built in "twist lock" at each joint, but a Joint Band (J) is still normally required to secure pipe at the joint.



Chimney Connection

The boiler must be connected to a listed type HT prefabricated that is 6 inches in diameter and 36 inches long. For connecting pipe, 24 gauge stainless steel is the minimum requirement. Stainless steel is recommended for durability, preferably 300 series (304 or 316). The minimum flue diameter for an S130OBE is 6 inches and an S260OBE is 6 inches.

The recommended method for connecting the boiler to the chimney is as follows: Use a 6 inch diameter stove pipe to connect to the insulated flue pipe from the top of the boiler. This pipe will go on the inside of the opening of the exhaust flange. The stovepipe is 24 inches long. Connect it to the insulated stovepipe by sliding the non-insulated pipe around the inner pipe of the insulated stovepipe.

There is a flue pipe bracket bolted in the cabinet, on which the insulated flue pipe will rest. Seal the stovepipe to boiler connection with 100% silicone.

Seal around the insulated flue pipe where it comes through the roof as a weather seal with 100% silicone.

Stovepipe to
Boiler



Connection



Single Wall to Insulated Stovepipe Connection



Silicone Seal where Insulated Flue Pipe comes through the Roof

IN CASE OF CHIMNEY FIRE

1. Call the fire department. (In the event the fire is out before they get there, you will want them to inspect the structure and make sure there is no latent damage or hazard.)
2. Shut the boiler down by turning the main power off.
3. If you have a chimney fire, use a chemical flare type fire extinguisher. If you don't have an extinguisher, go to step 4.
4. Using a water hose, wet down the area of the roof surrounding the chimney. Do not wet the chimney itself or try to put water down the flue as it will very likely damage the flue tiles.
5. Contact a chimney professional to inspect your chimney for damages.

IN CASE OF RUNAWAY FIRE

1. Shut the boiler down by disconnecting power.
2. Be sure the draft inducer is off and/or make sure the barometric damper opens. (Excessive draft can cause a runaway fire.)

3. Maintain continued circulation of boiler water to remove heat from the boiler and if boiler is equipped with a domestic coil run hot water.

COMBUSTION AIR SUPPLY

It is important to make provision for adequate supply of combustion air.

Coal burns best when the combustion air is brought up through the fire. So, the Coal Gun needs combustion air to enter the cabinet, then into the ash area, from there it is pulled up through the fire.

There is a provision to allow air into the ash area along the side of the ash area in the cabinet you will find a “knock-out”. There is an inner and outer. Remove the inner knock-out, which will provide enough combustion air for the S130OBE. For the S260OBE remove both inner and outer knock-outs.

The airflow through the system and out the chimney means that air must enter the cabinet. You will cut a hole in the floor of the cabinet for the piping and electric power supply which will allow air into the cabinet.

BOILER PIPING FOR HYDRONIC SYSTEMS

Normal operating temperature for the Coal Gun is 180° F. This allows for optimum operation and less fly ash accumulation on heat exchange surfaces. Water returning to the boiler from zones should be about 160° F. After initial startup, return water temperatures should generally be greater than 140° F. If your system design results in water returning to the boiler too cold, incorporate a mixing valve to bring water temperatures back up to acceptable temperatures.

Note: Hydronic distribution and system design are ultimately the responsibility of the customer or installer.

Due to the design requirements of the various Coal Gun™ models, the tapings are not always in the same location on each boiler model. Appendix A: Boiler Specification Diagrams provides detailed

information on how each model should be connected. The washout plugs in the bottom of the unit are a requirement of the ASME boiler code and must be closed before filling the unit with water.

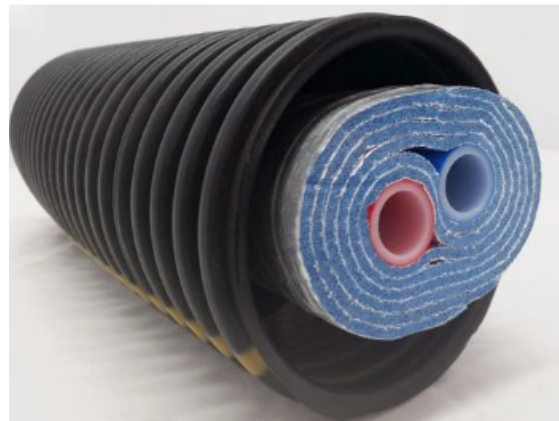
Note: Be sure to close all ports in the unit before filling the unit with water.

The tapping on the opposite side of the boiler from the tapping used for the return has been plugged at the factory.

Underground Piping and Ditch

The insulated pipe used to transfer the water to and from your Coal Gun is a very important part. If not done correctly or if done with uninsulated pipe will result in great energy loss! Your climate and the distance must be considered when selecting an insulated pipe for your system. Choose an insulated pipe with the least amount of heat loss!

The underground insulated tubing for your Outdoor Coal Guns must have at least two pipes running from each building, one supply and one return. Each pipe must be oxygen barrier PEX and be at least 1” in diameter and rated for 180F and 100psi continuous flow. You will also need 12-2 UF electric wire with ground that is underground rated. You will also need a single pair 24ga thermostat wire, for the dump limit. When you order the underground insulated pipe most manufactures can run the electrical wires in the outer corrugated pipe which makes it safer and easier for installation.



Insulated underground PEX Piping

Dig a ditch that is at least 24" deep and 8-12 inches wide. A slight slope in the ditch to drain water away from the insulated piping and out of the bottom of the trench is ideal. If the electrical is not pre-installed in the piping place the electrical wires in the ditch first and cover them with 6 inches of dirt or crushed stone.

Note: If the underground insulated piping is running under a driveway, the depth of the ditch needs to be increased to at least 3 feet.

The PEX tubing and the wiring should extend at least 3 feet out of the trench at both the boiler and at the building. To prevent water from coming in the building seal the hole around the insulated piping.

Cutting hole in Cabinet Floor

The cabinet floor of the boiler will need to at least an 8" x 8" hole cut through it. This can be done with a saw-zall with a metal blade or with a cutting disc on a grinder. The location of this hole is determined by you, but Appendix..... shows the best location.

Plumbing Connections at the Boiler

The Outdoor Coal Gun has a 1.5 FNPT inch supply fitting and a 1.5 FNPT return fitting. The supply fitting is located on the top of the boiler, above the draft fan. The return fitting is located at the bottom rear of the boiler, below where the hopper connects to the boiler.

Circulator pumps and expansion tanks can be installed in the boiler's cabinet but due to space restrictions we recommend installing these in the heated building.

We recommend installing a boiler drain and a ball-valve on both the supply line and the return line.

If a Low Water Cutoff is to be used install it in the supply line. Be sure it is not installed lower than the top of the boiler's water jacket.

Piping the Boiler in Parallel with another Boiler

The Coal Gun™ may be connected to a heating system supplied by one or more boilers that are already in place. There are many possible configurations that allow for an existing boiler to function as a backup to the Coal Gun™. For sample illustrations of multiple boiler configurations, see Appendix I.

A minimum of 1" diameter pipe should be used for this connection on the model S130. In any event, the pipe size must be determined by taking into account the distance involved and flow required.

Checklist: When the Boiler is Added to an Existing System

- ✓ Operate the (gas, oil, electric) boiler periodically to ensure that it will operate satisfactorily when needed.
- ✓ Do not relocate or bypass any of the safety controls in the original (gas, oil, electric) boiler installation.
- ✓ The operation of the gas boiler must be verified for acceptable operation before and after installation of the add-on appliance by a gas fitter who is recognized by the regulatory authority.
- ✓ Do not connect to any chimney or vent serving a gas appliance.
- ✓ The installation should comply with requirements of CAN/CSA-B365, and changes to the installation should comply with CSA B139 (for oil-fired), C22.1 (for electric), or CAN/CGA-B149.1 or CAN/CGA-B149.2 (for gas-fired).

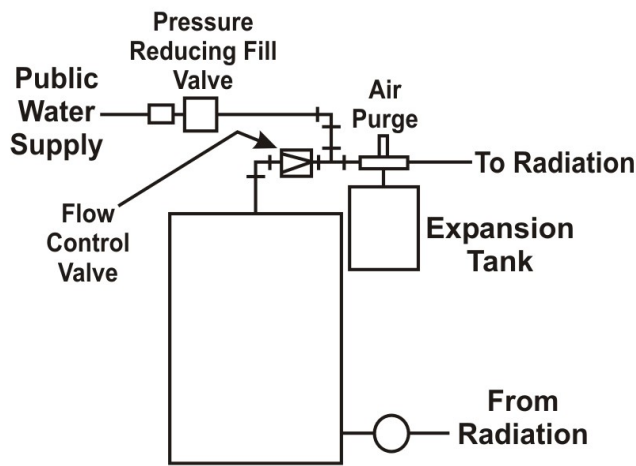
Pressure Relief Valve

The pressure relief valve is factory installed into a fitting on top the boiler. A length of copper pipe must be connected to the pressure relief valve, continuing to a point 6" from the floor. Extending the pipe to the floor is a requirement of building codes. It reduces the likelihood that a release of

boiler pressure would scald anyone standing near the boiler.

Pressure Reducing Auto Fill

It is required to provide for a make up water supply using a pressure regulating valve and backflow prevention valve in the feed water line of your primary boiler.



Pressure regulating valve and backflow prevention valve configuration

Expansion Tank

⚠ CAUTION

⚠

PROVIDE ADEQUATE EXPANSION TANK

It is very important to provide adequate expansion tank capacity based on the total volume of water in the system, particularly when the Coal Gun™ is added to an existing boiler.

It is very important to provide adequate expansion tank capacity based on the total volume of water in the system. This is particularly true if the Coal Gun™ is added to an existing boiler. Check the chart to determine the water capacity of the Coal Gun™ installed. If you are adding a Coal Gun to your system, most likely the expansion tank or air cushion tank installed originally is not adequate for the additional water volume added to the system with the Coal Gun™.

Low Water Cutoff

⚠ CAUTION

⚠

LOW WATER CUT-OFF REQUIREMENT

Some states require that all hydronic heating systems have a low-water cut-off control.

Many states require that all hydronic heating systems have a low-water cut-off control. Even if your state and local codes don't require this, it is still highly recommended. In cases where this control is required it should be located in a “T” placed in the supply riser just above the tapping in the boiler.

BOILER CONDITIONER / SEALANT

AHS provides two bottles of Boiler Conditioner/Sealant with the purchase of your boiler. When filling your boiler with water for the first time, mix contents of each bottle with 2 gallons of warm water. Pour into any suitable boiler opening. Replace plug, fill and pressurize the boiler. An MSDS is available upon request.

FORCED HOT AIR SYSTEMS (WATER TO AIR COIL IN DUCT)

The Coal Gun™ boiler may be easily adapted to any forced hot air heating system by installing a heat exchange coil in the hot air supply duct. The size and type of coil or heat exchanger required may be established after several factors are determined. These factors include: the heat output required (BTUH), the capacity of the existing fan blower (CFM) and the size of the duct or plenum where the coil will be installed. Sizing of the air coil will be the responsibility of customer and/or installer.

The coil creates increased resistance to air flow, so this factor must be considered when determining the final airflow. Design water temperature is usually 180° F, and a desirable output air temperature is 115° - 125° F. The coil is connected in the same manner as

in other types of radiation heating equipment. The thermostat can be wired to engage both the fan blower and the circulator pump.

If a hole was cut in existing ducting to install the coil, the opening should be closed tightly with a metal cover and sealed with duct tape.

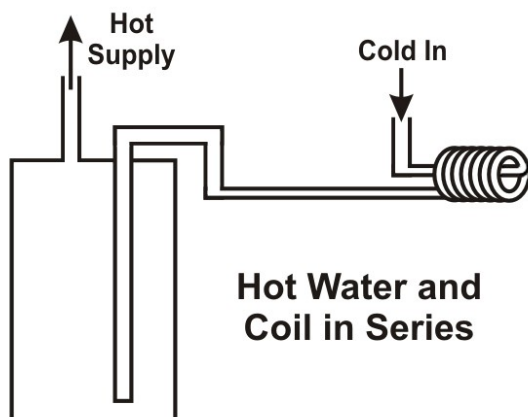
DOMESTIC HOT WATER COIL PIPING

Remote Domestic Hot Water Coil

Since the Outdoor Coal Gun is not in the building being heated it is best to use a remote domestic water coil. We recommend using at least a 200,000 btu/hr plate heat exchanger. Be sure it is made of Stainless Steel and is brazed with copper. The plumbing of these will be the same as with a direct hot water coil.

Direct Hot Water Coil

The Coal Gun™ may be fitted with a domestic hot water coil, which threads into a 4" tapping in the boiler. Multiple coils can be installed into larger boilers, the total number dependent on the size of the boiler and the number of fittings made available at time of manufacture. There are three methods for plumbing the domestic coil. One way is to connect the coil in series with an existing hot water heater.

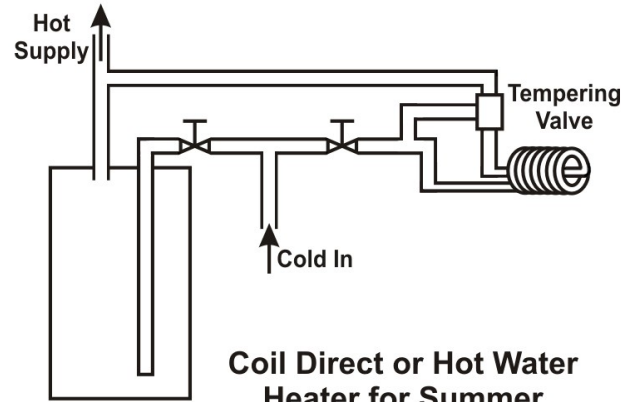


**Hot Water and
Coil in Series**

Plumbing – Coil in Series

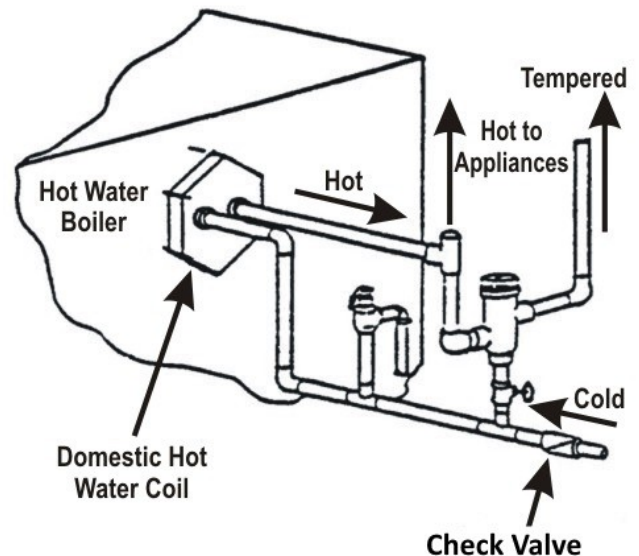
A second method of plumbing the domestic coil is to connect the coil in parallel with an existing water heater so that the conventional water heater may be used when the Coal Gun™ is not being fired

(for example in the summer). The diagram that follows indicates how this can be done.



Plumbing – Coil in Parallel

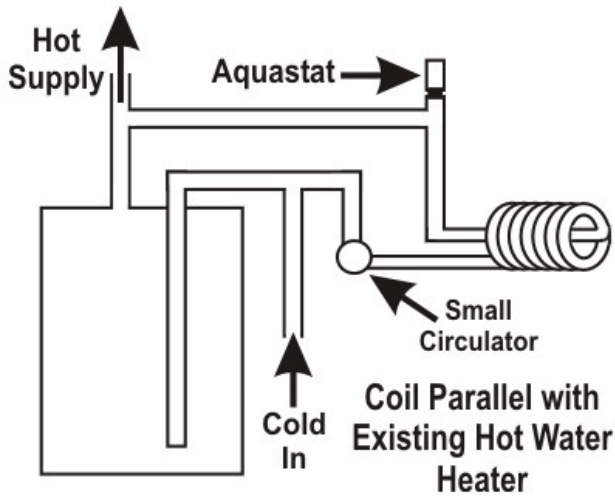
⚠ CAUTION	
	SCALD HAZARD
In installations where the coil discharges directly into the hot water distribution system a tempering valve must be included to limit the temperature of the water at the faucet to a safe level.	



Tempering valve

The third method of plumbing the domestic coil uses a small pump to circulate water continuously between the coil and existing hot water heater. It is also necessary to include a tempering valve or temperature controller on the supply side of the

storage tank/water heater to prevent super-heated water from reaching the domestic hot water tank and, ultimately, the faucets.



Plumbing – Coil with circulator

ELECTRICAL CONNECTIONS IN THE COAL GUN™

All hydronic Coal Guns are prewired to maintain boiler water temperature at approximately 180° F.

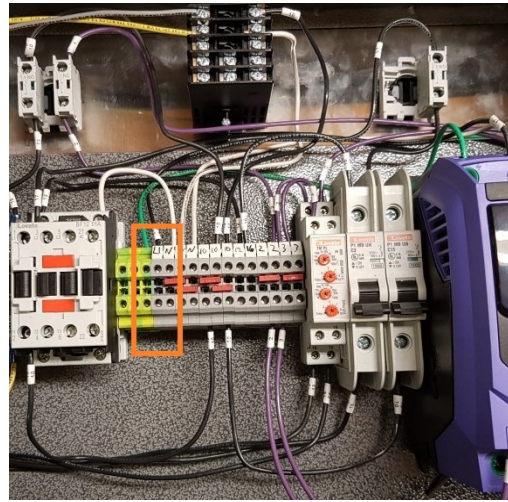
S130/S260 Power Requirements

The S130OBE and S260OBE Coal Guns require a dedicated power circuit of 120 volts, 20 ampere.

Power Connections

Power connections are made inside the large enclosure for the controls. A photo of the area where connections are made (outlined in orange) follows.

1. Before making connections, use a multimeter to verify correct wiring and voltage on your wiring circuit providing power to the Coal Gun.
2. Turn off circuit breaker or otherwise disconnect power to the circuit.
3. Attach your neutral conductor to any terminal labeled “N”.
4. Attach your line providing power to the terminal labeled “L1”.
5. Attach your ground conductor to the green terminal.



Terminal Detail for Power Connections

CONTROLS

Aquastat Controls

Coal Guns for hydronic heating have no provision for control wiring connections to building thermostats. As stated previously, the boilers are designed and wired to maintain water temperature. The control scheme for Coal Gun boilers requires that building thermostats control distribution of the hot water, usually by circulator pumps, zone valves, or both.

Hydronic Coal Guns are supplied with dual aquastats. The R-W terminals on the dual aquastat are intended to be used to control a circulator for high water temperature over-ride situations, sometimes known as a “dump limit.” If these terminals are used to directly power a zone, the maximum current draw is 3 amps.

Note: it is required that a dump zone be utilized to protect from over heat circumstances. An additional section, dedicated to dump zones, is included later in this manual.

The Coal Gun is provided with a high limit control, a combination operating limit control, which activates the draft fan, a dump zone control, and an electronic ash temperature monitoring control. It is very important to follow the guidelines listed here for proper operation of the boiler.

The operating limit is designed to maintain boiler temperature under normal operating conditions by turning the draft fan on and off. The range for this control is from 150° F to 180° F. The normal factory setting is 180° F. It has a fixed differential of 10°F

The dump zone temperature control is designed to operate one or more heat zones to prevent high boiler temperatures from occurring during low load conditions. **This setting should be set 20° F above the operating limit setting with a maximum setting of 200° F.** Also refer to the dump zone wiring instructions for specific use applications. See Appendix H for example dump zone wiring applications.

Thermal Ash Monitor Settings

The Thermal Ash Monitoring Control is factory set to 130° F. When reading the digital readout, PV refers to the process variable, or actual ash temperature reading. SV refers to the set point variable, or the temperature set point of the control, which is the reference point for governing the grate operation. Another important setting on the control is referred to as hysteresis. This value represents the offset in degrees between the set point variable (SV) and grate operation. The factory setting for hysteresis is 2° F. Based on factory settings, when the temperature of the ash drops to 2° F below the reading indicated at SV, there will be a call for the grates to cycle on, operating until ash temperature climbs to the SV value. Whether the grates will be actually observed to be running at this time will depend on the position of the Grate Switch, whether the induction fan is running, and where the timers are at in their cycle. The Grate Switch and Grate Timers are described a bit later.

The setting of the Thermal Ash Monitoring Control is the preferred way to keep the height of the fire set correctly in the Coal Gun. The lower your set point (SV), the higher the position of the fire will be in the burn pot. This is because the fire must necessarily be further from the thermocouple based sensor in order to reach the lower ash temperature on the monitor. The optimum setting is the one that

gives you the best balance of efficiency and performance. A Coal Gun under moderate demand that has been actively firing for 10 minutes or more should have a relatively small cone of black coal in the center of the burn pot, with vigorously burning coal all around the circumference of the burn pot surrounding it. The photo below illustrates acceptable fire positioning.



Coal Gun Fire Position

In addition to a higher position for the fire, a lower setting on the Thermal Ash Monitoring Control will also mean deeper ash under the fire and more opportunity for coal to burn completely before dropping into the ash tub. There will also be less likelihood that you will experience coal gas building up and lighting off suddenly in the boiler. The main downside is greater likelihood that the fire will go out during an extended period of low demand. Deeper ash can also mean lower peak airflow and therefore, typically lower peak output. When you have high demand, raising the setting can increase peak output, but may also lead to some unburned coal dropping into the ash pan. If you have adjusted this control and it is already set 10° F or more above or below the factory settings, limit adjustments to a

maximum of 5° at a time, and let the boiler operate at the new setting for 48 hours before observation and readjustment. The most important observations are the position of the fire in the burn pot and ash quality. For the latter, you want to see less unburned coal. Keep in mind that coal quality will play a role in obtaining good ash quality.

To adjust the temperature setting of the Digital Controller simply use its up and down arrows.

Grate Switch & Ash Removal

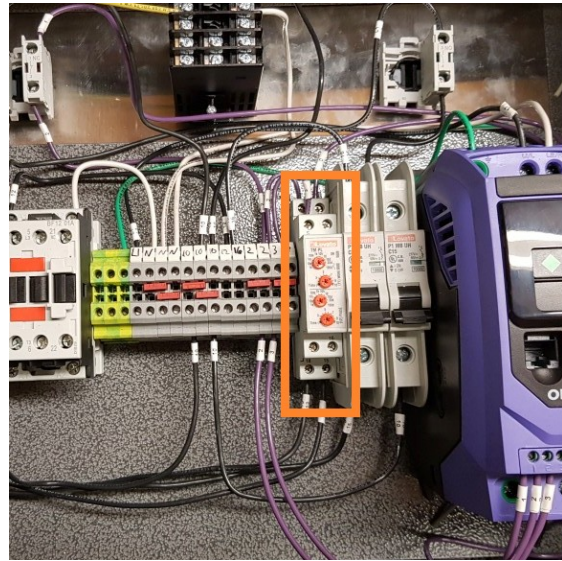
The Grate Switch offers two modes Start and Run, in addition to an OFF position. In **Start** the fan is allowed to run but the grate is kept off. You will put the boiler in this mode to start the fire. Once the PV temperature of the digital controller is higher than the SV temperature turn the switch to Run. In **Run** the grate motor is allowed to run. The Thermal Ash Control system will automatically remove the ash as needed. The system will only operate when the draft fan is running. This control also reduces the likelihood of unburned coal being dumped into the ash pan. Ash removal takes place when the ash temperature has dropped below the SV value on the controller which allows the grate motor to cycle. The Thermal Ash Temperature monitoring control incorporates a digital process controller for operating the coal grate motor based on ash temperature in the grate area. It maintains active monitoring of grate temperature.



Switches and Digital Controller for Thermal Ash Control

Grate Timer and Settings

The grate interval timer consists of a Lovato timer located inside the control box. This allows fine tuning of grate motor run time. There is both a “Work” time and a “Pause” time. The Work time limits the maximum run time. The Pause time enforces a minimum off cycle. The interval timers engage when the digital temperature controller is calling for grate operation.



Grate Timer

Keep in mind that most Coal Gun boilers will not require adjustment of the internal, grate interval timer. Your boiler's factory settings on the internal timers are already quite adequate for most situations. Rarely, it may be necessary to adjust the timer to adapt the boiler to conditions like unusually low or high demand or poor quality coal. Even under such circumstances, adjusting the temperature setting on the grate control, easily accessed on the front panel of the control box, is normally sufficient. The following instructions should only be consulted if adjusting the Thermal Ash Monitoring Control is insufficient to getting good results.

The Grate Timer consists of a Work section and a Pause Section with two orange dials in each. The upper dials in each section allow you to select the span of seconds, minutes, or hours. The lower dials in each section select the duration or a percentage of the span selected by the upper dial. For example if the upper dial is set to the span of 10min and the

lower dial is set at 5 then it will time out around five minutes. A stop watch must be used to be sure that the change is made accurately. The **Pause** timer should always be set equal to or higher than the **Work** timer. Usually setting the Pause timer 2 to 3 times longer than the on timer is appropriate.

If the timers were adjusted incorrectly and need to be reset, use these parameters:

The **factory setting** for the **Work time** is as follows: The upper dial is set at 1-10min and the lower dial is set at 1.

The **factory setting** for the **Pause time** is as follows: The upper dial is set at 1-10min and the lower dial is set at 3.

When adjusting the timer cycles, be sure that you are able to observe the boiler's operation every hour or two for eight hours. Be sure to limit each adjustment to a change of no more than 45 seconds per grate operation cycle. All adjustments must be checked with a stop watch to ensure correct timing. Always allow 48 hours for the boiler to acclimate to the adjustment made previously before making another 45 second adjustment. CAUTION if the timer is adjusted to keep the grate motor off too long, it will cause the fire to travel towards the hopper, triggering the heat sensor, which will turn off the boiler. The same can happen if the grate switch is left off too long.

In circumstances that include high demand, the boiler may be able to produce more heat through a modest timer adjustment. Increase the **Work time** value by turning up its lower dial to 2. Allow 48 hours for the boiler to acclimate to the change. If more adjustment is needed please call Alternate Heating Systems.

If the coal ash has a high percentage of unburned coal reducing the run time of the grate may help. It is not advisable to make adjustments unless the problem is persistent. To adjust the run time of the grate, turn down the set value of the **Work time** to 30 seconds by turning its upper dial to 1min and its lower dial to 5. Allow the boiler to acclimate for 48 hours. If the coal ash still contains a large percentage

of unburned coal after 48 hours, turn down the set value of the **Pause timer** 30 seconds with its lower dial, (shorten by 30sec by moving the lower dial halfway to the next lowest number). When demand on the boiler increases inspect the boiler twice daily to ensure the grate is removing enough ash to allow the boiler to keep up with demand and to also make sure that the fire is not burning into the hopper.

Never make adjustments to the grate interval timer that would inhibit the grate motor from running less than 30 seconds every 10 minutes.

The power switches are located on the front of the control panel. The "Main" switch will shut off all power to the unit.



Thermostat Connection

Hydronic Coal Guns do not require a connection to a building thermostat for operational purposes. The boiler water temperature is controlled by the aquastats.

BOILER DUMP ZONE APPLICATIONS

Unlike oil or gas fired boilers, solid fuel boilers will still produce some additional heat after the call for heat has ended. This will cause the boiler temperature to rise if no zones are calling for heat. It is possible to see temperature rise 30° F or more under a low or no load condition. This will take place until the boiler's radiation losses match the heat gain. It is necessary that a dump zone be connected to dissipate this excess heat to one or more zones in the system. Setting the operating limit no higher than 180° F allows for the heat rise to occur without exceeding the recommended maximum temperatures.

The dump zone aquastat can be used to activate a zone valve or circulator as a dry contact switch. A common setting for dump zone actuation would be 210° F, with the high limit set point adjusted to 10° - 20° lower. When this high limit is exceeded, and temperature reaches the dump zone limit, one or more zones will be energized and heat distributed until temperatures fall sufficiently. See Appendix H for a variety of dump zone wiring examples.

If the dump zone is connected to provide heat to a domestic hot water tank or heat exchanger, a mixing valve must be installed on the potable system supply to prevent an unsafe condition of overheating the domestic hot water. The mixing valve outlet should be set no higher than 125° F for potable use (for this type of dump zone, see Appendix H, Example 5).

Non Powered Dump Zone

A non powered dump zone is required in some localities. It is also required for applications utilizing the UL Listed Coal Gun, and anywhere backup power is not immediately available to a powered dump zone. A non powered dump zone provides a way to dump boiler heat in the event that an over heat situation occurs, such as may occur during a power failure. This hot-water circulation loop shall be able to dissipate at least 10% of the estimated rated heat output of the solid-fuel boiler when circulation is reduced because of an electrical power

failure. The loop can only be made inoperative by a deliberate manual action. The design parameters for sizing shall be a pipe size equal to or greater than 3/4 inch (18 mm), room temperature of 65°F (18°C), and mean water temperature of 180°F (82°C).

The loop shall be positioned above the boiler, with features that promote natural thermal circulation of the water. The piping must be such that excessive pressure will not develop in any portion of the boiler or system. Larger diameters may be needed as boiler size increases. Figure 9 shows an application example of how this is accomplished.

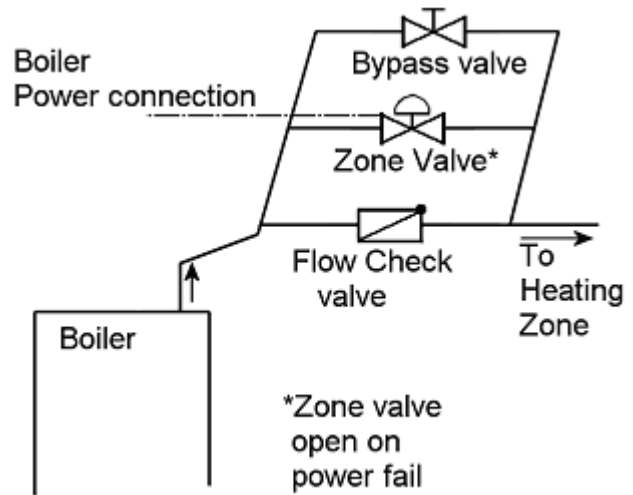


Figure 9: Non-Powered Dump Zone

This arrangement will allow a gravity flow of heat release in the event of a power failure. For other dump zone applications, see Appendix H.

Operating Information

Please read this manual before operating the boiler. Important requirements and instructions must be followed for safety and satisfactory operation of the boiler. When operating the unit you must keep the doors closed and maintain the seals in good condition. All covers or guards must be in place at all times, except for maintenance or service.

The quality and burning characteristics of coal vary widely so it is important to use the type of coal for which the Coal Gun™ was designed. Best results will be obtained using pea-size anthracite having a high ash fusion temperature. No bituminous or lignite types of coal are acceptable for use in the Coal Gun.

⚠ WARNING



PRESSURIZE AND FILL
BOILER VESSEL BEFORE
STARTING FIRE

Be sure the boiler vessel is full of water and pressurized before starting a fire. Never attempt to add water to a hot boiler if found to be only partially full. Allow the unit to cool before adding water to the boiler. Failure to do so could result in death or severe injury along with damage to boiler and surrounding property.

LIGHTING THE COAL GUN™

⚠ DANGER



NEVER USE
FLAMMABLE LIQUIDS
TO START FIRE

Never use chemicals or flammable liquids to start the fire. DO NOT burn garbage, other types of coal or any other fuel not approved for this unit.

When

and the house to be cold. This allows the Coal Gun to establish a good burn before reaching maximum temperature, after which the draft induction fan that powers combustion will slow to off-cycle speed. Before starting the fire fill the hopper full of pea coal. Turn the Main Switch to **ON** and the Grate switch to **Run**.

At this point, when you look into the coal pot through the sight hole cover, you will see coal lying close to the opening. Insert several (6-8) fire starters (such as Rutland Safe Lite, Easy Light Charcoal or Match Light Charcoal) so that they are nearly covered by the coal. The induction fan will be running at this time. Light the starters with a match, wand type lighter or propane torch. A propane torch works best for quick lighting. When the starter material is fully inflamed, let the sight tube flap drop over the tube. The sight tube flap should be pulled snugly inward against the sight tube (see Operation of Sight Hole Cover below). Allow the Coal Gun to run for one to two hours in order to allow the coal in the coal pot to burn, and for the fire to become well established. Once the ash temperature has climbed to over 155 degrees or higher, turn the grate on. The first time the grates cycle, there will be a bit of unburned coal in the ash area.

The use of emergency power from a backup generator is necessary for operating the Coal Gun™ during a power failure. Without backup power, the fire in the Coal Gun will gradually go out. The boiler will be unable to supply heat without backup power.

Warning- Risk of fire:

- Do not operate with fuel hopper lid open or ash removal doors open.
- Do not store fuel or other combustible material within marked installation clearances.
- Inspect and clean flues and chimney regular.

starting a fire, it is advantageous for both the system

Caution

- Unit is HOT while in operation.
- Do not touch during operation.
- Do not operate without the hopper lid, sight tube cover, or ash pan and ash doors in place.
- Boiler will have multiple hot surfaces.
- Keep children away.

OPERATION OF SIGHT HOLE FLAP

The proper operation of the sight tube flap is crucial both in the off cycle and during fan operation. *The flap position during the off cycle must be open allowing a gap of 3/8" or more between it and cover seat.* This allows air to bypass the fire bed, preventing over heating of unit during the off cycle.

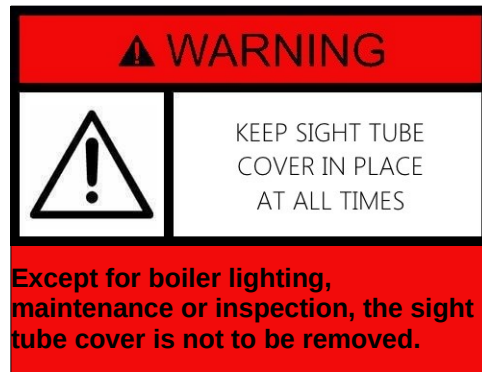
The sight tube flap is located behind the sight tube cover. To ensure safety it is imperative that the sight tube cover be in place during operation.



Sight Tube Cover in Place



Sight Tube Cover Removed



**Sight Tube Flap in Open Position
(Sight tube cover removed)**

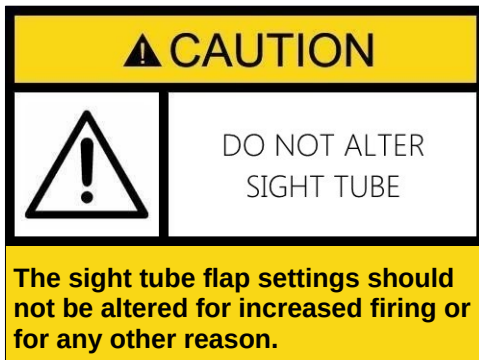


Sight Tube Flap in Closed Position

Note: In the photos above, the sight tube is displayed with the cover removed for inspection purposes.

When the fan is running and boiler is full of coal, the sight tube flap must be drawn against the cover seat automatically and held there during the time the fan runs. This is necessary to force combustion air through the fire bed rather than across the top.

NOTE: The sight tube flap must open to at least 3/8" as soon as the fan goes to Off-cycle. If it does not the boiler may over heat or burn up into the hopper!

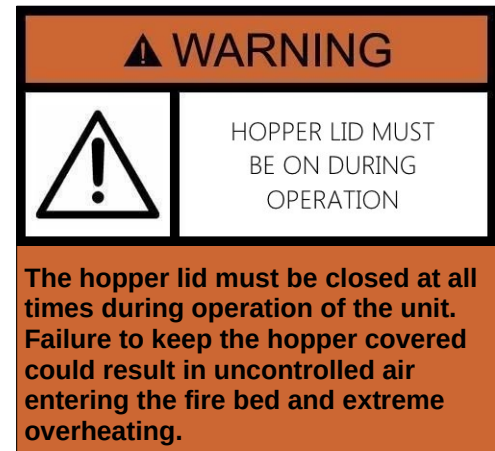


Chimney draft conditions and fuel conditions both affect the balance necessary to achieve the sight tube flap function. Adjustment of the nut and spring tension holding the sight tube flap is sometimes necessary after installation. When this adjustment has been made, be sure to reattach the cover over the sight tube.

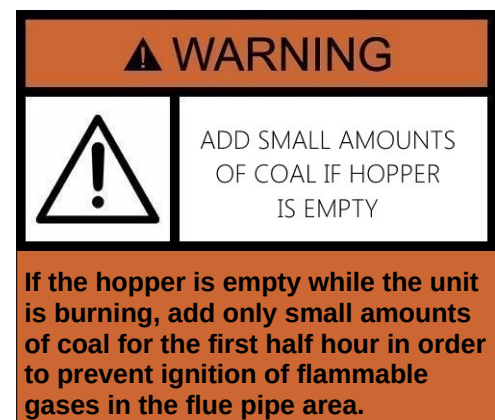
SHUTTING DOWN THE COAL GUN

When the heating season has ended, or in anticipation of a long period with no demand for heat, it will be desirable to allow the fire to go out in the Coal Gun™. Unlike non-solid fuel boilers, the fire in the Coal Gun will not go out instantly. It will necessarily have to coast to a stop.

The procedure for shutdown is to turn off the boiler "Main" switch and to simply wait until the fire goes out. It will be important during this time to maintain the sight tube cover in the open position, as pictured above. Without power to the draft-inducing fan, the boiler cannot actively fire and will over a period of days lose the fire. When the fire has gone out and the boiler has cooled sufficiently, the cleanout procedure described in Appendix D may be performed. This procedure is generally conducted at the end of each heating season.



When shutting down the boiler to clean the unit, simply stop adding coal to the hopper. Allow the remainder of the coal to burn out before turning off the main switch. Keep in mind the boiler draft motor will continue to run after the coal is used up until the main switch is turned off.



THERMO ASH-MONITORING GRATE CONTROL OPERATION

Ash that contains fuel that is not fully combusted will be a higher temperature than ash coming from thoroughly combusted fuel. The Thermo Ash-Monitoring Control automatically monitors the temperature of the ash leaving the coal pot. This provides a feedback mechanism for grate regulation that reduces the need for post install adjustments. Typically, no adjustment other than the factory adjustment is necessary to have the boiler perform at peak output throughout the burn season. Minor on-site adjustments may be necessary when the boiler is first installed to provide for a more complete burn

(less unburnt coal) or to optimize position of the fire. See the section in the Installation portion of the manual for more information. With the Thermo Ash Monitoring controlled grate, it is possible for the fire to remain lit for days during low usage periods without having to adjust the grate controls.

The ash temperature sensor is set at the factory at 130° F, for normal operation. During periods of light demand, reducing the setting to 120° or lower may aid in maintaining the proper level of coal in the coal pot. For more information see “Controls” section.

FUEL STORAGE / REMOVAL AND DISPOSAL OF ASHES

Fuel shall not be stored within the appliance installation clearances or within the space required for refueling, ash removal, and other routine maintenance operations. Store fuel in a purpose built storage unit that is adequate for the volume of fuel that you will be handling. The storage unit should keep the fuel dry and should be accessible to clean when empty.

Note: Burn Pea Or Buckwheat Size Anthracite Coal Only!

Ashes should be placed in a metal container with a tight fitting lid. The closed container of ashes should be placed on a non-combustible floor or on the ground well away from all combustible materials pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in a closed container until all cinders have thoroughly cooled to prevent inadvertently starting a fire.

TREATMENT OF BOILER WATER

Proper treatment of make-up water and boiler water are necessary to prevent scale or other deposits and corrosion within the boiler. The absence of adequate external and internal treatments can lead to operation upsets or total boiler failure. Where a choice is available, pretreatment external to the

boiler is always preferred and more reliable than treatment within the boiler.

Instructions for feed water treatment as prepared by a competent feed water chemist should be followed. Do not experiment with homemade treatment methods or compounds.

Representative samples of feed water and boiler water need to be analyzed frequently to ensure that they are in specification. The following terms and guidelines are to be used in conjunction with the advice of a water treatment specialist.

Ph

The Ph value of your boiler water is a number between zero and fourteen. Values below seven are acidic while values above seven are basic.

The Ph factor is the most important factor influencing scale forming or the corrosive tendencies of boiler water. It should be adjusted to between a minimum of 10.5 and a maximum of 11.0 to prevent acidic corrosion of boiler tubes and plates and to provide for the precipitation of scale forming salts.

Below a Ph of 5.0 the water is acidic enough to dissolve the steel boiler plates. Under these conditions the steel gradually becomes thinner and thinner until it is destroyed. At a Ph between 5 and 9.4 pitting of steel plates will occur at a rate dependent upon the amount of dissolved oxygen in the boiler.

Dissolved Oxygen

Aeration of city water supply is frequently used to remove other noxious gasses, however, efficient aeration results in saturation of the water with oxygen. The majority of corrosion problems are directly related to the quantity of dissolved oxygen in the boiler water. Elimination of the corrosive effect of dissolved oxygen can be accomplished either directly or chemically.

Direct or mechanical removal of dissolved oxygen is done through the use of a de-aerator. Chemical de-aeration is done through the introduction of specific chemicals in the boiler to

react with the oxygen. The dissolved oxygen content should not exceed 0.007 mg/l.

Sulfites

Sodium sulfite is generally used for the chemical removal of dissolved oxygen within the boiler water. To assure the rapid and complete removal of the oxygen entering the boiler feed water system the concentration of sulfite in the boiler must be maintained at a minimum of 120 ppm. (parts per million).

Solids

Solids can be broken up into two categories; suspended and dissolved. Suspended solids are those that can be removed by filtration while dissolved solids are in solution with the water.

The best test for the determination of the solids content of the boiler water is through a conductance test. The conductance value of boiler water varies by the various ionized salts present. The conductance can be used to measure the total dissolved solids in the boiler water and to serve as an accurate means for the control of solids through the use of blow down.

Another test that is sometimes used as a measure of solids is to measure the chloride present in the boiler water. The ratio of chlorides in the boiler water to that of the feed water can be used as a means to determine the amount of blow down required. The chloride test is unsuitable for feed water with low incoming concentrations, and the concentrations in the feed water must be averaged over time for accuracy.

High boiler solids will lead to foaming, priming, surging, and carry over. These conditions may only be overcome by proper daily blow down of the boiler.

Alkalinity

The alkalinity of boiler water should be sufficiently high enough to protect shell and plates against acidic corrosion, but not so high as to

produce carryover. A minimum value for alkalinity for adequate protection is 200 ppm.

High boiler alkalinity (in excess of 700 ppm) should be avoided. Values higher than this can cause the steel to become brittle.

Phosphates

Phosphates are used to react with calcium hardness in the boiler water. In order for this reaction to take place it is important to maintain a Ph at a minimum value of 9.50. It is desirable to keep the concentration of phosphates in the water to 30-50 ppm to enable the complete reaction of the phosphates with the calcium hardness entering the boiler through the feed water.

Hardness

The hardness of water is caused by calcium and magnesium ions. Water hardness will vary greatly throughout the country depending on the source of the water.

In boilers hard water can cause the formation of scale and sludge or mud. The hardness must be removed in the makeup water to the return system. Total hardness should not exceed 50 ppm.

Oils

Every effort should be made to prevent oils from getting into the boiler water. Oil causes foaming or combines with suspended solids to form a sludge, which can cause the overheating of boiler plates.

If oil does get into the boiler, the boiler should immediately be taken out of service and thoroughly cleaned.

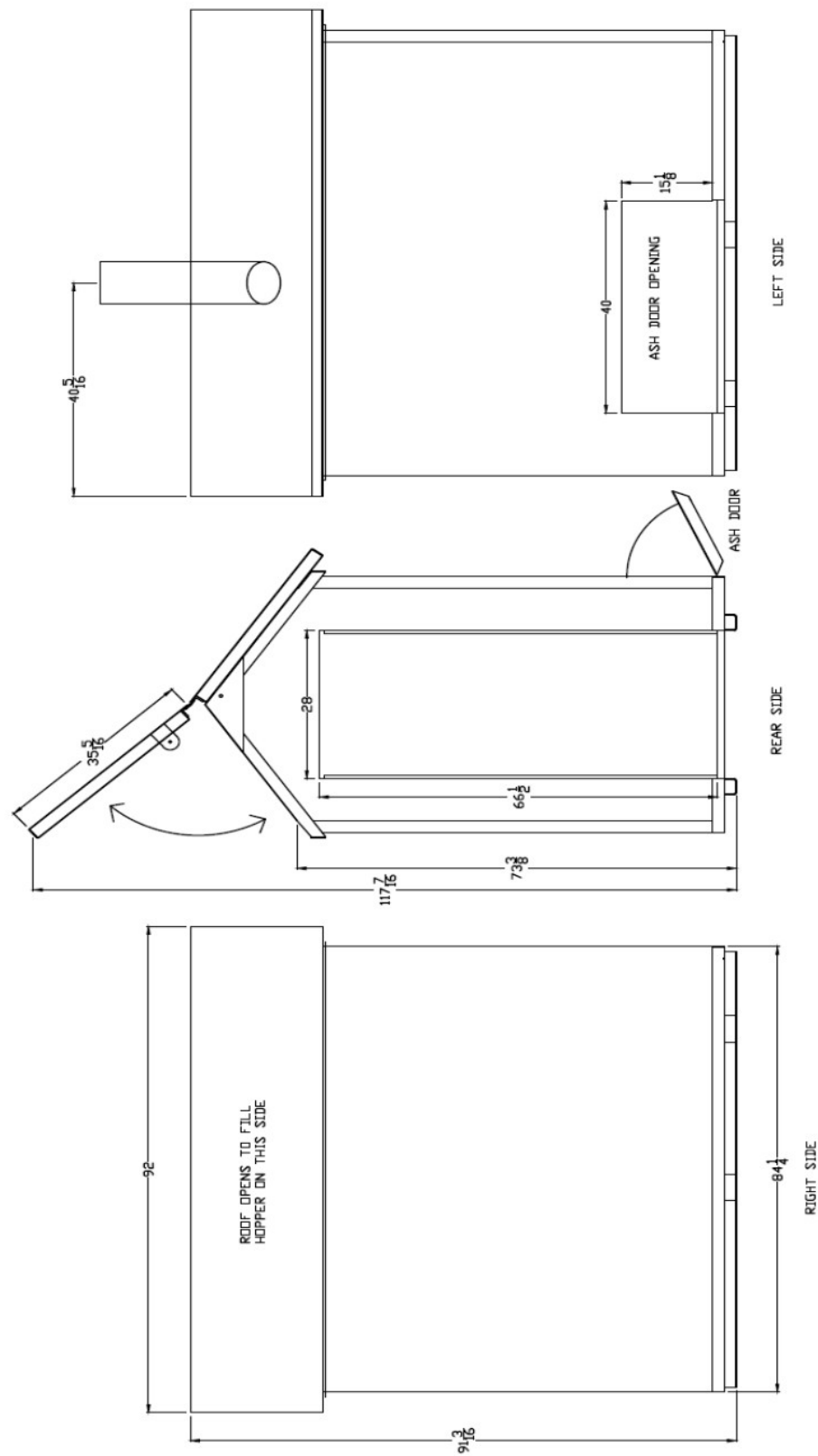
Antifreeze

Antifreeze use is recommended where there is any danger of the boiler water freezing. The Coal Gun vessel warranty does not apply to freeze damage. Use concentrations consistent with antifreeze manufacturer recommendations, but do not use pure antifreeze in your system. Glycol-water mixtures expand more than straight water, and may lead to a requirement for increased expansion tank

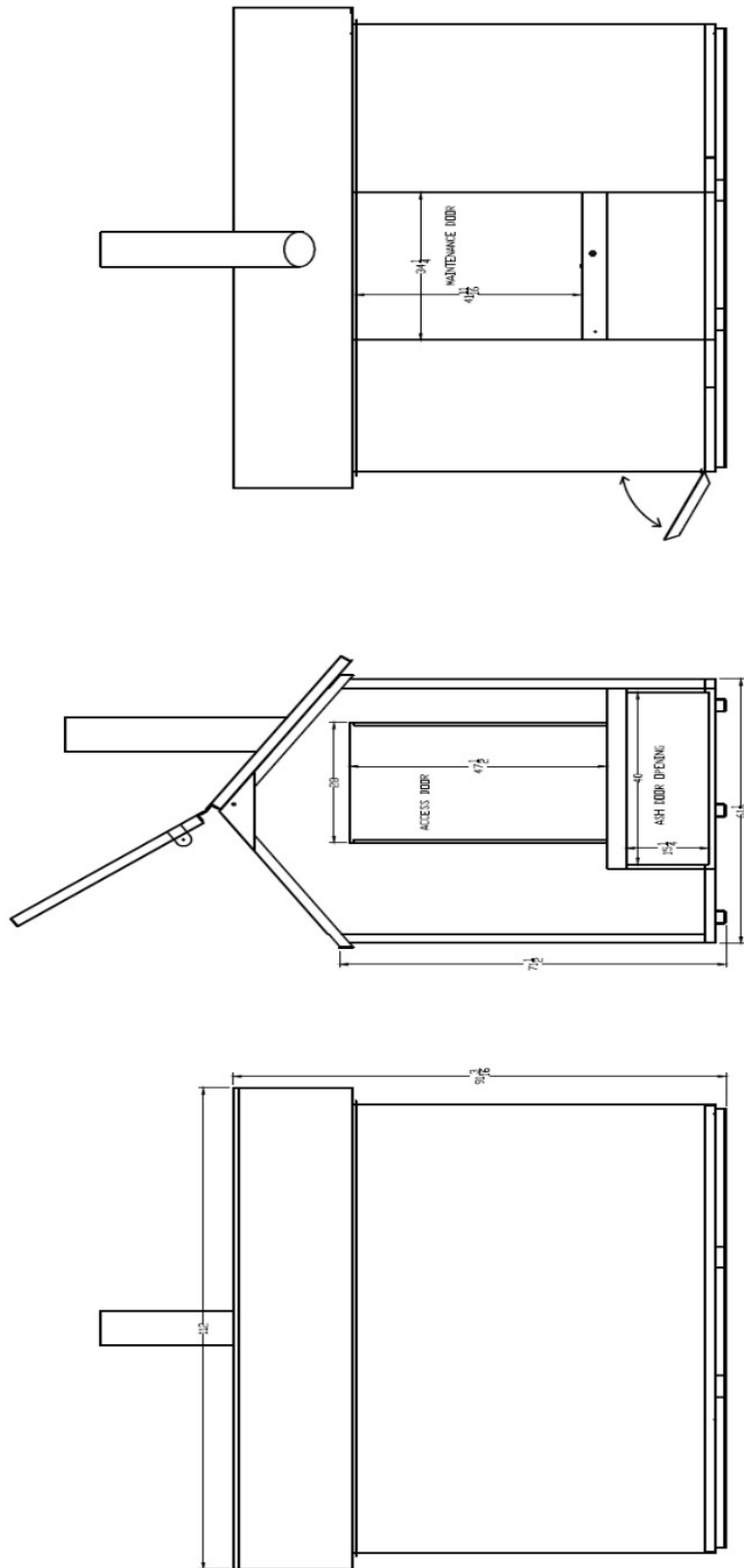
capacity over that otherwise used for straight water. Antifreeze usage, particularly containing ingredients other than propylene glycol, is often prohibited by homeowners' insurance.

Note: Low flash points for some antifreeze products create a fire hazard when pure antifreeze is used.

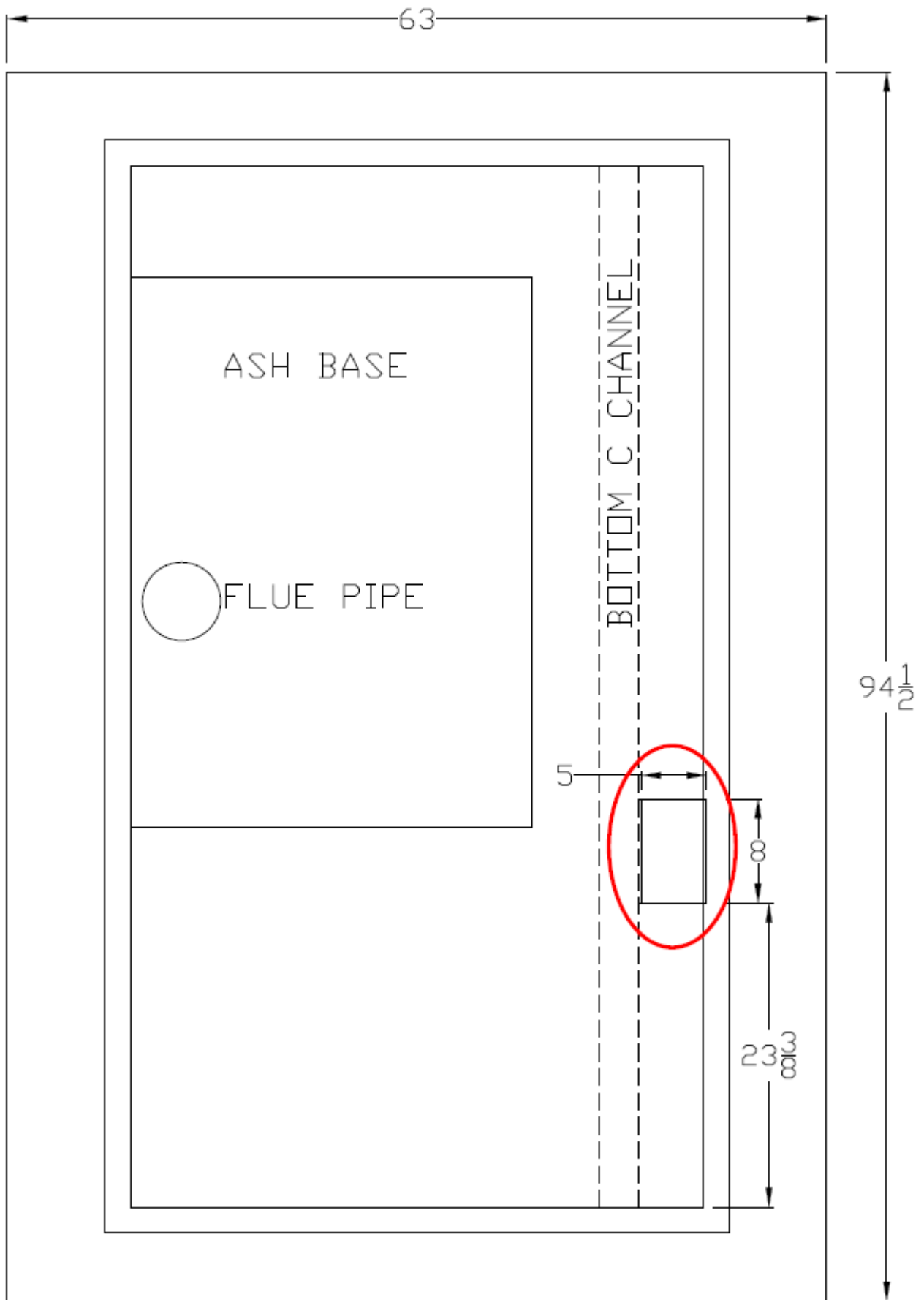
Appendix A: Boiler Specification Diagrams



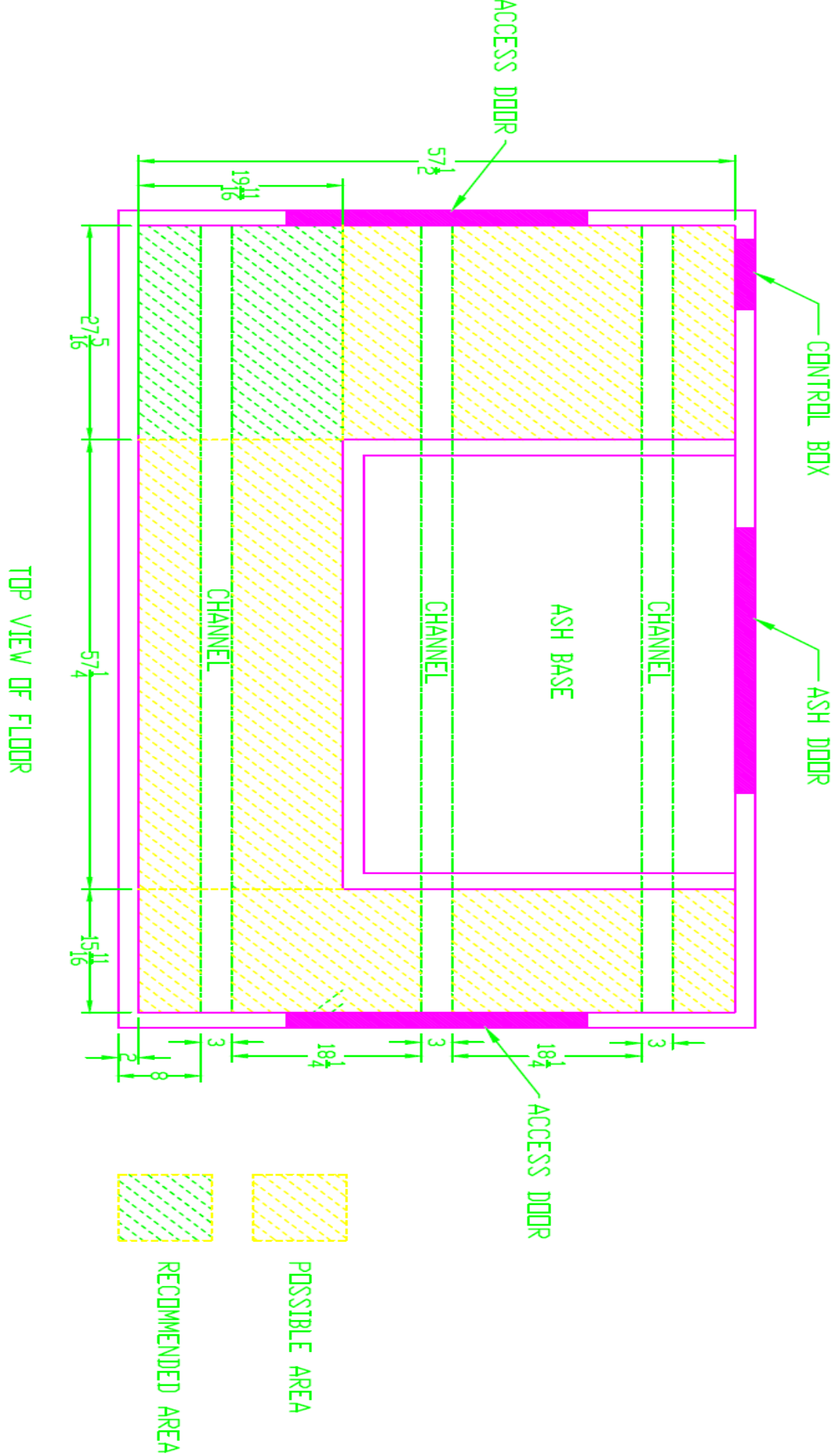
S1300BE Dimensions



S260BE Dimensions

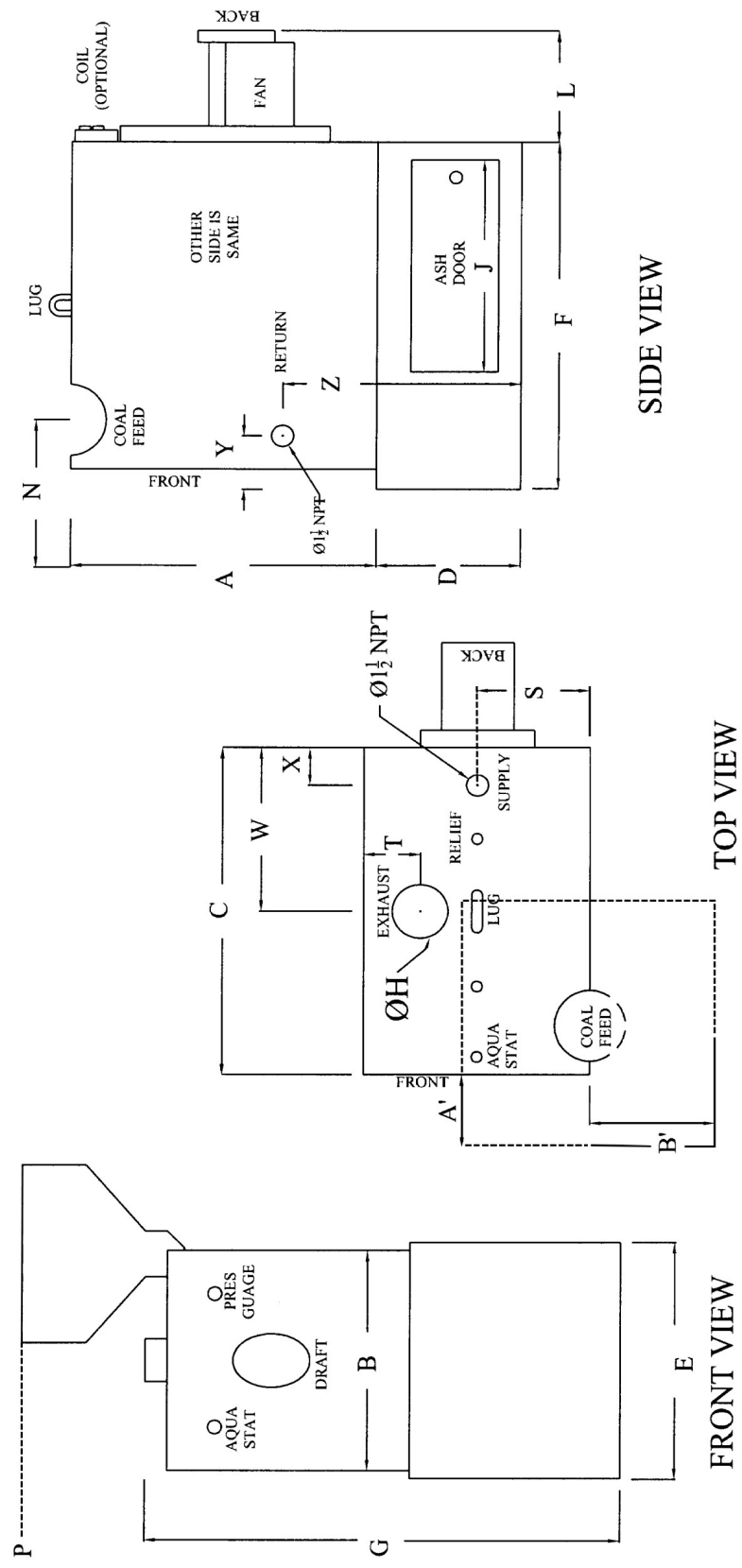


S130OBE Underground Insulated Pipe Hole Location (recommended)



S2600BE Underground Insulated Pipe Hole Location (recommended)

S130 - S260 COAL GUN SPECIFICATION DIAGRAM



	A	B	C	D	E	F	G	H	J	L	N	O	P	S	T	W	X	Y	Z	A'	B'
	BOILER HEIGHT	BOILER WIDTH	BOILER LENGTH	BASE HEIGHT	BASE WIDTH	BASE LENGTH	TOTAL HEIGHT	FLUE OPENING	ASH DOOR WIDTH	FAN MOTOR LENGTH	COAL FEED	FAN MOTOR HP	TOTAL HEIGHT SM HOPPER	CENTER LINE	EXHAUST LOC	EXHAUST LOC	SUPPLY LOC	RETURN LOC	RETURN HEIGHT	HOPPER OVERHANG	HOPPER OVERHANG
S130	22	21	31	19	24	33	45	5	23	12	10	1/3	58	10	5	15.5	3.5	5	22	4	8.5
S260	26	25	45	21	25	48	50	6	23	19	13	1/2	63	12	6	26.5	4	7	22.5	4	8.5

All dimensions in inches unless otherwise specified. Alternate Heating Systems, Inc. Copyright 2015 Specifications subject to change without notice.

ADDITIONAL SPECIFICATIONS

Pressure Drop

Pressure Drop (Line Loss) within the boiler is less than the pipe rating of the pipe within the boiler, so there is no appreciable pressure drop.

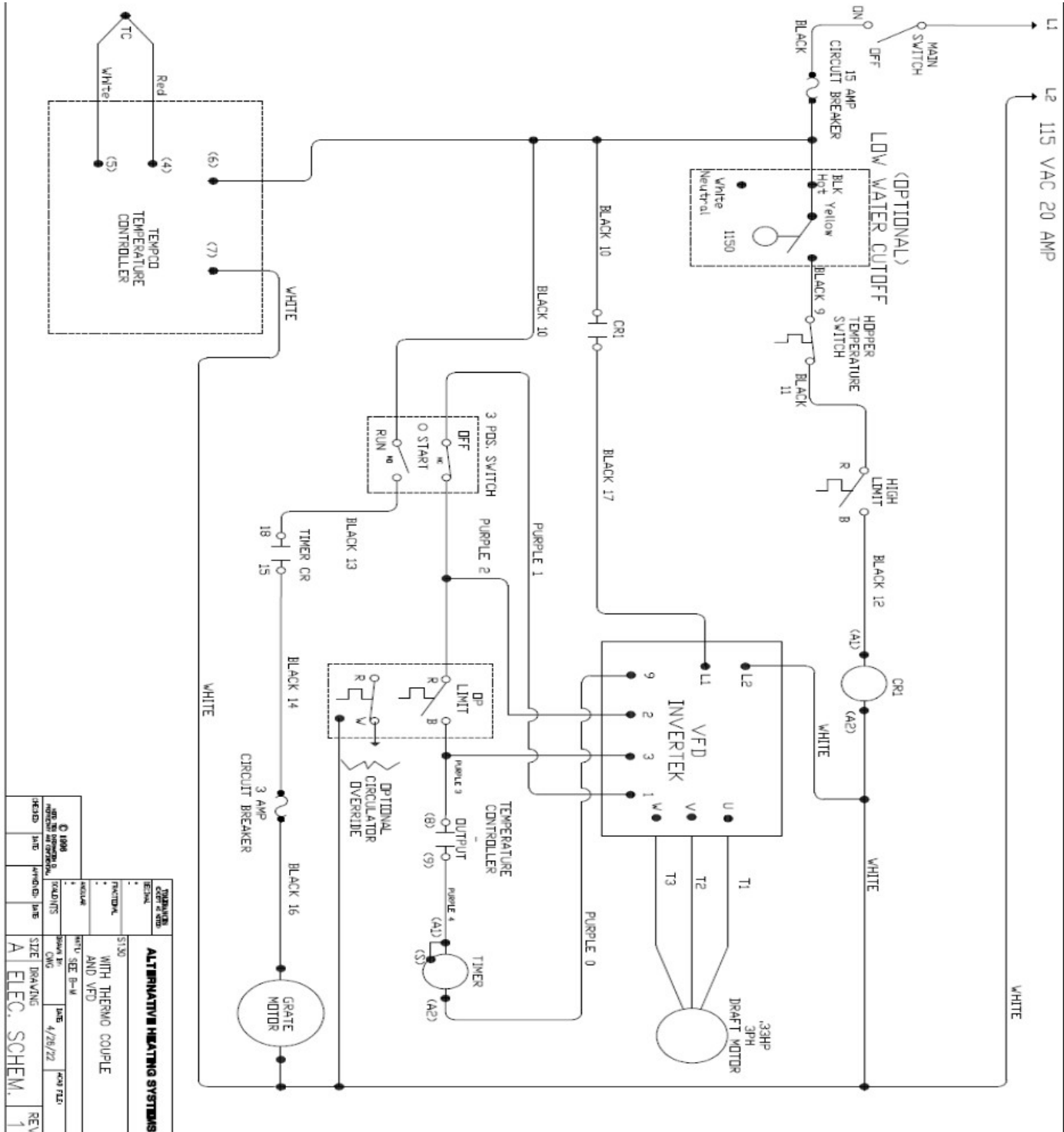
Explanation of GPM Flow

The following are given as examples of gallons per minute water flow required to deliver hot water

in order to provide heating of a given number of degrees and at a certain BTU level:

- 500K BTU's at 20 degrees temperature differential requires 50 gallons per minute.
- 250K BTU's at 20 degrees temperature differential requires 25 gallons per minute
- 1M BTU's at 20 degrees temperature differential requires 100 gallons per minute

Appendix B: Wiring Diagrams



LOW WATER CUTOFF (OPTIONAL)

HOPPER TEMPERATURE SWITCH

3 POS. SWITCH

DP LIMIT

OPTIONAL CIRCULATOR OVERIDE

TEMPERATURE GRATE TIMER

VFD INVERTEK

1 HP 3 PHASE DRAFT MOTOR

GRATE MOTOR M2

VIBRATOR 1

VIBRATOR 2 (OPTIONAL)

TEMPERATURE CONTROLLER

LEGEND

SYMBOL	DESCRIPTION
[VFD Symbol]	VFD INVERTEK
[Motor Symbol]	1 HP 3 PHASE DRAFT MOTOR
[Motor Symbol]	GRATE MOTOR M2
[Motor Symbol]	VIBRATOR 1
[Motor Symbol]	VIBRATOR 2 (OPTIONAL)
[Controller Symbol]	TEMPERATURE CONTROLLER

PROJECT INFORMATION

DATE	BY	REV.
6/25/72	SEE E-4	1

ALTERNATIVE HEATING SYSTEMS

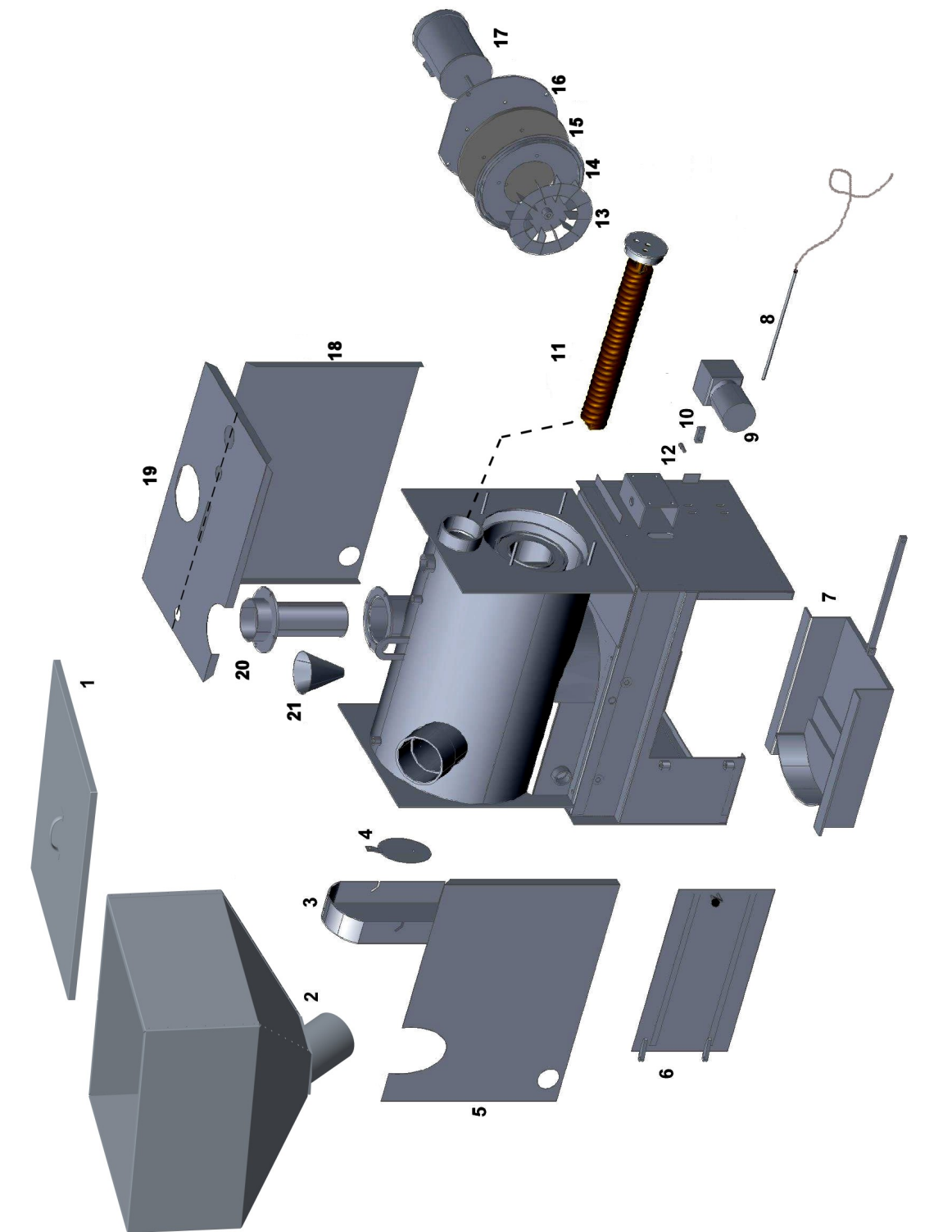
WITH THERMO COUPLE

VFD, AND VIBRATOR

SIZE DRAWING

A. ELEC. SCHEM.

Appendix C: Exploded Parts Drawing



Parts Listing

(As shown in diagram on previous page)

1. Hopper Lid
2. Coal Hopper
3. Draft Inlet Cover
4. Draft Inlet Flap
5. Right Insulation Cover
6. Grate Base Door (one on each side)+
7. Grate Assembly
8. Thermocouple for Thermo-Controlled Grates
9. Grate Motor
10. Pitman Block
11. Domestic Water Coil
12. Pitman Connecting Pin
13. Fan Disk
14. Abrasion Shield
15. Ceramic Heat Shield
16. Fan Motor Mounting Plate (Fan Cover)
17. Fan Motor
18. Left Insulation Cover
19. Top Insulation Cover (Two Pieces)
20. Flue Tube Assembly
21. Cyclone Funnel

Appendix D: Maintenance

The Alternate Heating Systems Coal Gun™ is designed to provide years of reliable service. Nevertheless, it is necessary to provide basic service in order to maintain optimum efficiency and service from your boiler. These instructions provided here are to be used as a guide. Routine maintenance should be performed every three months on units in continuous operation and at least once each heating season on residential installations.

Before the boiler is serviced, shut off power to the boiler. The coal fire must be completely out. If the boiler has been actively firing, it may take days for the fire to go out completely. Make sure the coal pot, boiler and ash grate are cool.

END OF SEASON CLEANING

Seasonal maintenance of the Coal Gun is simple but critical to maintaining top performance and longevity. To clean safely, wait until the fire has gone out and ash and water temperatures have cooled to ambient temperature. If in the process of cleaning you encounter hot ash or evidence of a still burning fire, stop and wait as long as needed to be sure the fire is extinguished and everything has cooled completely.

**AT THE END OF THE SEASON!
REMOVE ALL COAL FROM THE HOPPER.
PUSH ALL ASH AND COAL OUT OF THE COAL
POT INTO THE ASH BIN AREA. REMOVE ALL
ASH OUT OF THE ASH BIN AREA.**

Cleaning Exhaust End of Swirl Tube

The swirl tube heat exchanger vents into the ash removal cyclone just under the opening for the flue connecting pipe. To access this area, disconnect your flue pipe from the top of the boiler. With the pipe removed, loosen the nuts on the Flue Tube Assembly flange as seen in the following photo.



Flue Tube Assembly Bolted Flange

When all the nuts are removed, the flue tube assembly can be removed as shown below. In some cases, it will be necessary to pry the flanges apart using an appropriate tool.



Lifting Out the Flue Tube Assembly

Set the Flue Tube Assembly aside and look down into the cyclone ash separator. You will see a square hole located where the boiler swirl tube exits into the cyclone. You can safely insert brushes and or a vacuum hose for cleaning through this port. Fly ash built up just inside this port will restrict airflow and

result in lower performance for the Coal Gun. Annual cleaning will help maintain like new performance.



Square Swirl Tube Exit Port

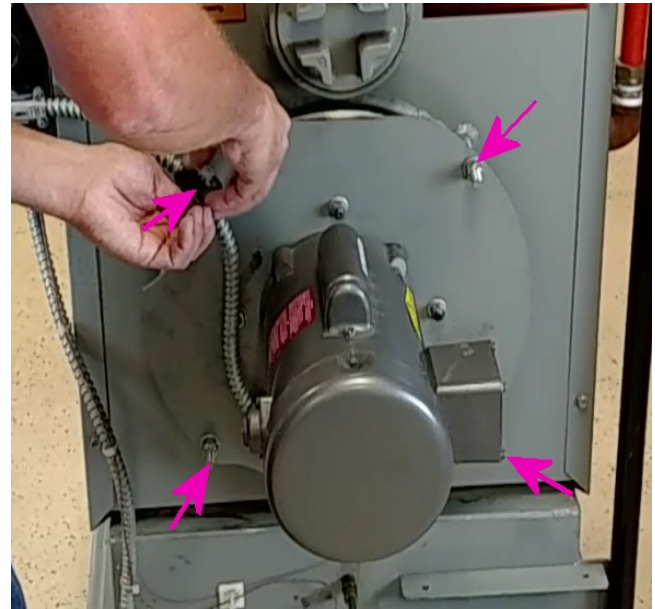
To clean through this opening with a vacuum hose, choose a hose that represents the largest diameter that will pass easily through the hole. Work the hose into the opening, then withdraw it with the vacuum running. Repeat the insertion and removal several times.



Hose Inserted into Swirl Tube Heat Exchanger

Cleaning Rear of Heat Exchanger

It is also recommended to clean the heat exchanger from the rear of the boiler annually. This is accomplished by removing the fan assembly, then vacuuming and/or scraping the exposed surfaces of the fire tubes and swirl tube. Removing the fan assembly requires removing the nuts from the mounting bolts as shown in the following photo.



Removing Fan Assembly

Once the nuts are removed, carefully pull the fan assembly back directly off the mounting bolts, and set the fan assembly off to the side. The wiring harness for the fan is too short to allow setting the fan assembly directly on the floor, so a five gallon bucket or other temporary platform will be needed. As an alternative, you may disconnect the wiring harness from the motor, giving you more freedom about where you place it. Doing so is necessary for other maintenance tasks. Be sure to note proper connections for reattaching the fan assembly. Do not drop the assembly. Handle it carefully, as the ceramic heat shield is fragile, and becomes increasingly fragile over many heating/cooling cycles. It is a good idea to keep a spare.



Set Aside Fan Assembly for Heat Exchanger Access

Once the fan assembly is out of the way, you will have access to the fire tube and rear of the swirl tube

for cleaning. Long handled brushes and the AHS Swirl Tube Scraper are good tools to have ready at hand for this. The following photo shows the Swirl Tube Scraper for the S130 Coal Gun in use. It features a curved scraper head that matches the curvature of the heat exchanger.



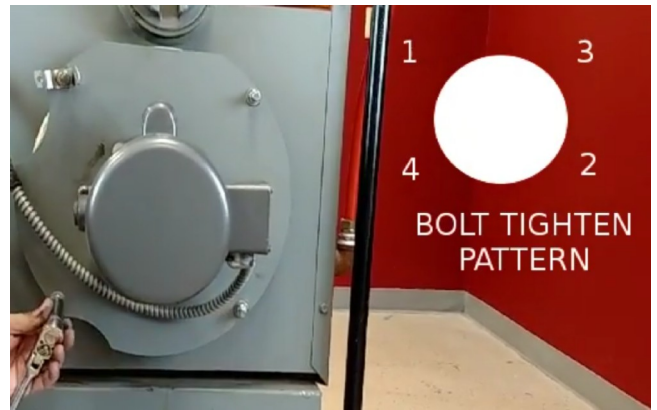
Swirl Tube Scraper

When you are finished scraping the surfaces, vacuum the loose material out of the fire tube and swirl tube. In cases of severe build-up or neglect, more than one scraping and vacuuming cycle may be needed.



Vacuuming Heat Exchanger

When you are finished cleaning the rear of the heat exchanger, reinstall the fan assembly to the boiler. Use a bolt tightening pattern as shown in the following photo and no more than 15 – 20 lb-feet of torque. Using too much torque will result in crush damage to the ceramic heat shield.



Reinstall Fan Assembly

Remember that cleaning of the heat exchanger, flue pipe and chimney is especially important at the end of the heating season to minimize corrosion during the summer months caused by accumulated ash. If your boiler is in a damp location, use any means available to reduce moisture in the area and humidity in the air. A heat source inside the fire tube of the boiler will help dry moisture inside the fire side and heat exchange surfaces. A piano heater or 40 watt incandescent rough surface light bulb are good for this task. Any free moisture will readily combine with residual fly ash and create sulfuric acid. This will cause rust and scale build-up on metal surfaces exposed to this combination.

CLEANING COAL POT, FEED TUBE AND GRATE

Remove and clean the ash pan. Remove remaining coal from the hopper, coal pot and grate. Examine all areas for damage and clean as needed. Remove grate linkage arm and manually move grate back and forth to check bearing condition. Reassemble grate arm. Lubricate grate chain (if so equipped) with chain oil and check sprockets for wear.

Other routine maintenance items include:

- Drive belts (belt drive units only) and roller chains (if so equipped) should be inspected and tightened if necessary. To adjust drive belt tension and alignment, loosen motor mount bolts (belt drive units only) and slide motor so as to affect proper tension and alignment. To adjust roller chain tension on

grate system (on commercial units), loosen grate motor mount bolts and slide grate motor so as to affect proper chain tension. This will be accomplished when there is about ¼ inch of play in the roller chain.

- The fan shaft bearings on belt drive units should be lubricated with a small amount of high temperature service grease such as Drydene Prypoplex EB 2, or the equivalent.
- Several drops of oil should be placed on the pitman shaft bearing blocks.

The chimney connector and chimney should be inspected at least monthly during the heating season to determine if ash buildup has occurred. Pay close attention especially to horizontal runs. If ash accumulates on the walls of the stovepipe and chimney, it restricts the flow of air and reduces draft.

On units that have a direct drive fan, the motor bearing may need to be replaced as often as every two years. A high pitch whine on fan startup is an early indicator for bearing failure, and replacement is a good idea when this is observed. On belt drive fans, the pillow block bearings and belt should be checked every three months. After the initial burn of two to six hours shut the boiler down and retighten the pillow block bearing set screws. To tighten the fan belt, loosen the four bolts that hold the motor to the bracket. Slide the motor down and re-tighten, being careful that the motor is properly aligned with the fan shaft. Some models have a hinged motor mount with adjusting screws. To check for proper alignment of the pulleys, use a straight edge lying across both pulleys.

After reattaching the fan motor assembly to the boiler, turn the fan over by hand to ensure that it does not bind. If a tight spot is evident, loosen the locking pillow block collars on the shaft and move the shaft in until the fan touches the boiler and mark the shaft. Then pull the shaft out until the fan touches the abrasion shield and mark the shaft. Finally, position the shaft midway between the two marks and re-tighten the collars. Be certain to

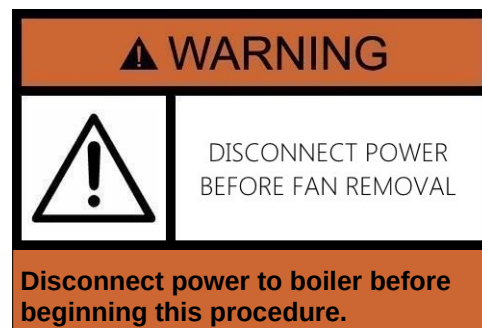
replace the belt guard if it was removed for servicing.



Belt-Driven Fan Assembly Removed from Boiler and Showing White Ceramic Heat Shield

DIRECT DRIVE FAN ASSEMBLY REMOVAL/REPAIR

This guide may be used for removal of the fan assembly and repair/removal of the fan impeller. This procedure is required when servicing the fan assembly or heat exchanger area. We recommend you contact Alternate Heating Systems for this repair procedure.



1. Remove electric wires and conduit at fan motor or junction box.

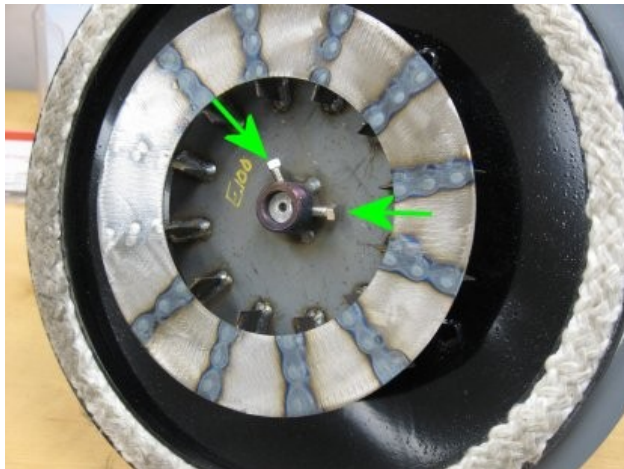
Note: Mark connections before disconnecting wires.

2. Remove the four nuts, which hold the fan assembly to the boiler. These are the outer circle of nuts on the fan plate.



3. Remove the fan assembly from the boiler and place on workbench.

4. Remove the two ¼ - 20 square head set screws in the fan hub.



5. Thread a hex nut, size 1-14 (NF), to the hub of the fan.



6. Using a manual jaw puller attached to the 1-inch nut, carefully pull the fan from the motor shaft.



6.b. Alternately, you may use part number 01-10-80 100 FAN PULLER, as shown in following images, to remove the fan.



The Fan Puller [01-10-80 100] simplifies fan removal compared to the use of jaw type pullers. Suggested procedure is to remove the fan assembly and sit on a flat surface with the fan up. Soak the end of the fan hub inside the threaded fitting and on the

exposed end of the motor shaft with a suitable penetrant. Let sit for a few hours, if possible. Loosen the setscrew on the hub (over the keyway). Attach the large nut of the fan puller to the threaded end of the hub and turn the bolt in toward the motor shaft to pull the fan off the shaft. It is likely that you will need to apply some heat to the fan hub in order to loosen it.

7. Clean shaft and apply a thin coat of anti seize lubricant to the shaft.

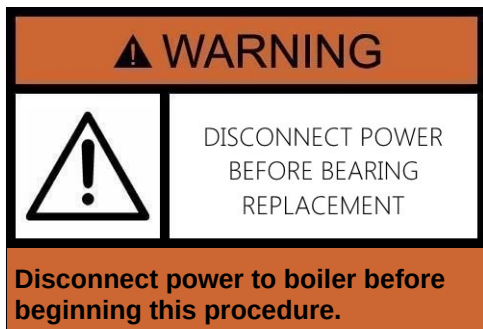
8. Place a new fan on the shaft, aligning one set screw hole with the keyed part of shaft. Notes: Fan hub should extend $\frac{1}{4}$ inch beyond the shaft.

9. Apply anti seize to the two set screws and install both securing the fan to the shaft.

10. Attach fan assembly to boiler and reconnect the wires.

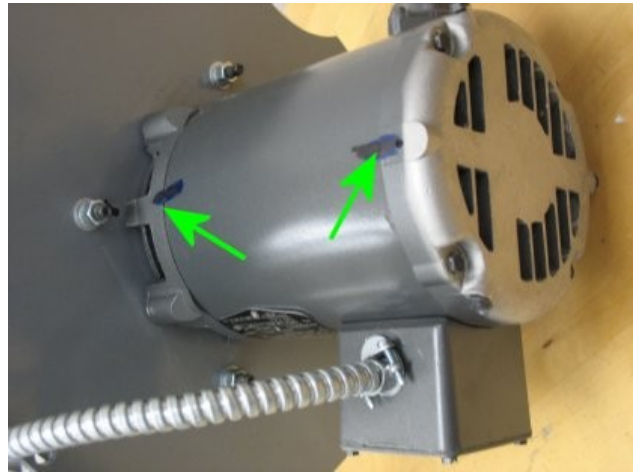
DIRECT DRIVE MOTOR BEARING REPLACEMENT

This guide may be used for replacement of direct drive induction fan motor bearings. We recommend you contact your Alternate Heating Systems for this repair procedure.



1. Follow steps 1 – 6 of Fan Assembly Removal/Repair procedure. These will guide the removal of the fan assembly.

2. On bottom of fan assembly, mark all components to assure it can be reassembled in the same orientation.



3. After fan is removed, remove abrasion shield by removing the nuts, which hold it to the fan plate. Note: these are the inner circle of nuts on the fan plate.

4. Using broad putty knife or pry bar, carefully remove the heat shield (ceramic insulation board) from the fan plate.



5. Using a hex key (allen wrench) remove the 4 countersunk screws, which hold the fan plate to the motor.



6. Remove back cover (fan cover) from motor.
The illustration in step 2 shows the motor with this cover already removed. It is secured with 3 screws on the outside of the motor.



7. From back of motor, remove the four long screws holding motor and plates together.



8. Set motor on back, shaft end up, on a workbench.

9. Using a small hammer, gently tap up on the end plate at shaft end.

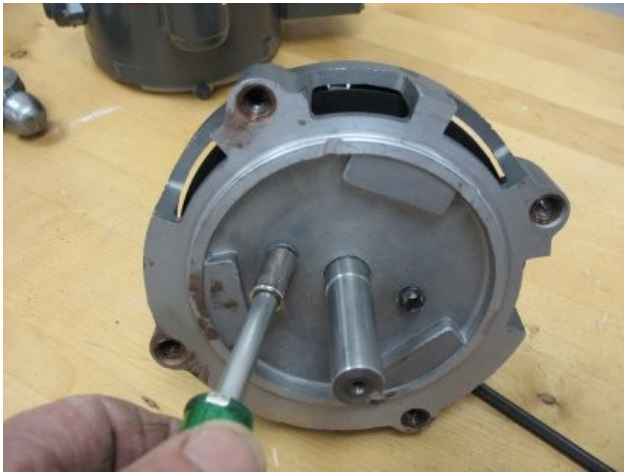


10. The plate along with the armature will come loose which should be gently lifted out.

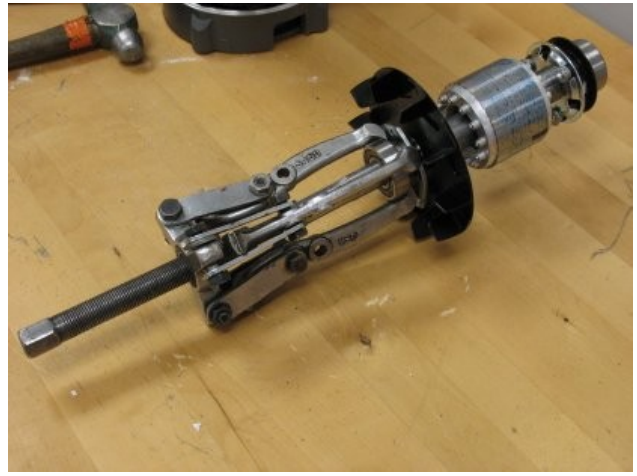


11. Check to be sure the beveled (cupped spring) washer stayed in the end cap remaining with the motor housing.

12. Remove the two screws holding the bearing to the front end cap and gently tap end cap off.



13. Using a manual jaw puller, remove bearing from shaft.



14. Install new bearing. Do not apply force on outer bearing race.

ADDITIONAL INFORMATION

For additional information on using your boiler safely, obtain a copy of the National Fire Prevention Association publication “Using Coal and Wood Stoves Safely”, NFPA No. HS-8-1974. The address of the NFPA is 470 Atlantic Avenue, Boston, Massachusetts 02210. You can also find them online at: www.nfpa.org

Operation and Maintenance Schedule for Models S130 and S260

Interval	Item	Procedure
As Needed	Ash removal	Remove ash and observe condition of ash. Adjust grate timer if necessary.
Weekly	Fire bed (when burning poor quality coal)	Check for clinkers and remove if necessary. Note: Poor quality coal produces clinkers.
Every 3 months	Drive belt	Check belt condition. Replace or adjust tension.
Every 3 months	Fan shaft bearings (belt drive models only)	Grease with high temperature grease. Check and tighten set screws on the shaft and pulleys.
Every 6 months	Abrasion shield	Check for leakage around gasket. Adjust or replace if necessary.
Every 6 months	Flue pipe	Check for leakage around seams and re-seal if necessary.
End of season	Cam bearing on grate.	Check to make sure bearings are free to rotate.
End of season	Fire box	Clean and inspect fire box.
End of season	Swirl chamber	Clean and Remove any buildup with a boiler brush. Inspect fan condition. Look for cracks and wear.
End of season	Ceramic heat shield	Check for wear around fan shaft hole-replace if gap is greater than 1/16".
End of season	Flue pipe	Remove flue tube assembly and clean. Inspect cyclone funnel.
End of Season	Empty hopper and coal pot	Remove all coal from the hopper. Push all ash and coal out of the coal pot into the ash bin area. Remove all ash out of the ash bin area.

Appendix E: Troubleshooting Guide

Problem	Possible Cause	Solution
1. Boiler overheating	a) Sight hole cover flap not releasing when fan stops b) Excessive chimney draft c) Aquastat set too high or malfunctioning	a) Check spring for proper tension b) Install barometric damper in flue c) Reduce aquastat setting or replace aquastat
2. Pressure relief valve vents	a) Expansion tank too small or "water logged" b) High limit aquastat not functioning	a) Add expansion tank capacity necessary for total volume of water in system or replace water logged tank b) Check wiring and replace aquastat if malfunctioning
3. Coal pot not full of coal	a) Hopper empty or obstruction in coal hopper b) Excessive fines, wet coal	a) Check hopper b) Use dry coal and watch fines
4. Coal burns up inlet tube	a) Grate switch turned off b) Grate not removing spent ash c) Fused coal (clinkers) in coal pot d) High demand coupled with low performance	a) Turn on Grate Switch b) Check for problem in grate motor circuit or mechanical linkage c) Remove clinkers (fused coal ash) d) Check problem item numbers 7, 9,
5. Fire goes out	a) Insufficient demand to maintain fire b) Large clinkers	a) Increase heat load b) See paragraph at end of troubleshooting guide
6. Excessive fly ash in chimney	a) Cyclone funnel plugged b) Flue pipe between boiler and chimney too long.	a) Check cyclone funnel and remove restriction. b) Reduce length of pipe run
7. Fly ash build-up on swirl tube	a) Condensation causing fly ash to stick to heat exchange surfaces.	a) Raise return water temperature, check problem item 9
8. Excessive sulfur odor in boiler room	a) Coal quality low b) Chimney draft problem: c) Down draft d) Restriction in Chimney e) Cyclone funnel on Coal Gun has deteriorated	a) Find better quality coal b) Inspect chimney c) Check chimney design & improve d) Check & clean chimney e) Replace cyclone funnel
9. Poor boiler performance	a) Inadequate air for combustion b) Obstruction to air flow inside boiler or venting system c) Excessive ash in coal pot	a) Supply adequate air supply to boiler room b) Inspect and clean swirl chamber. Remove and clean cyclone insert, check for chimney obstruction c) Adjust ash removal controls. Setting Thermal Ash Monitoring Control higher will lower position of fire and reduce amount of ash in coal pot.
10. Coal gas ignitions (evidenced by an audible bang)	a) Poor draft b) Too much raw coal on top of coal pot	a) Assure at least -.04" of WC with a manometer. Increase flue height if necessary, or use an auxiliary power vent, make sure there are no obstructions in chimney or any part of venting system b) Raise position of the fire and shrink zone occupied by raw coal – This is accomplished by setting a lower temperature on the Thermal Ash Monitoring Control. If this setting is already at 110° F or lower, consider adjusting grate timers.

CHECKING/REMOVING CLINKERS



Clinkers are clumps of ash from burned coal that have been fused together. Some coal is more prone to create clinkers due to a low ash fusion temperature. Coal that is prone to forming clinkers can often be observed to increase the amount of unburnt coal showing up in the ash pan, as pieces of coal adhere to the fused ash and are removed with the clinkers without being fully burned. Higher combustion temperatures can also increase clinker formation. These in turn are connected with higher duty cycles, high grate temperature settings,

and on belt drive systems, increasing the velocity of the induction fan with non factory pulley arrangements. Clinkers can be reduced or eliminated by changing the settings of the ash controller on the boiler. Clinkers that are approximately baseball size or smaller will be carried to the ash pan. Larger sized clinkers could cause the fire to go out if the boiler is unable to remove them.

To help remove large clinkers, remove the draft flap cover and move draft flap to the side. Be sure to wear gloves to provide protection against burns. Insert a metal rod in the sight tube and run it up and down (to the grate) through different areas of the coal pile checking for clinkers. Use the rod to break up any clinkers you find. If necessary, you can use a hammer to strike the end of the rod to break them up. You will not damage the grate if you hit it as it is made of 1/2" steel. Once the clinkers are broken up they will fall on to the grate and be carried to the ash pan.

Appendix G: Programming Controls



DIGITAL TEMPERATURE CONTROLLER PROGRAMMING

Set Grate Operation Temperature

Use ▼ and ▲ to select temperature. The grate operating temperature is set at the factory to 130° F. When the ash temperature drops to 2°F below the set value the grate system will remove ash.

ADJUSTING THE FAN SPEED

Increasing or Decreasing the Fan Speed is very simple. Open the control panel. Locate the VFD (large purple device to the right).

- Use Up and Down Buttons to navigate through parameters.
- Press the “hexagon” button for less than 1 sec. as “enter”
- Press and hold “hexagon” button for more than 2 sec. to return to operating screen.

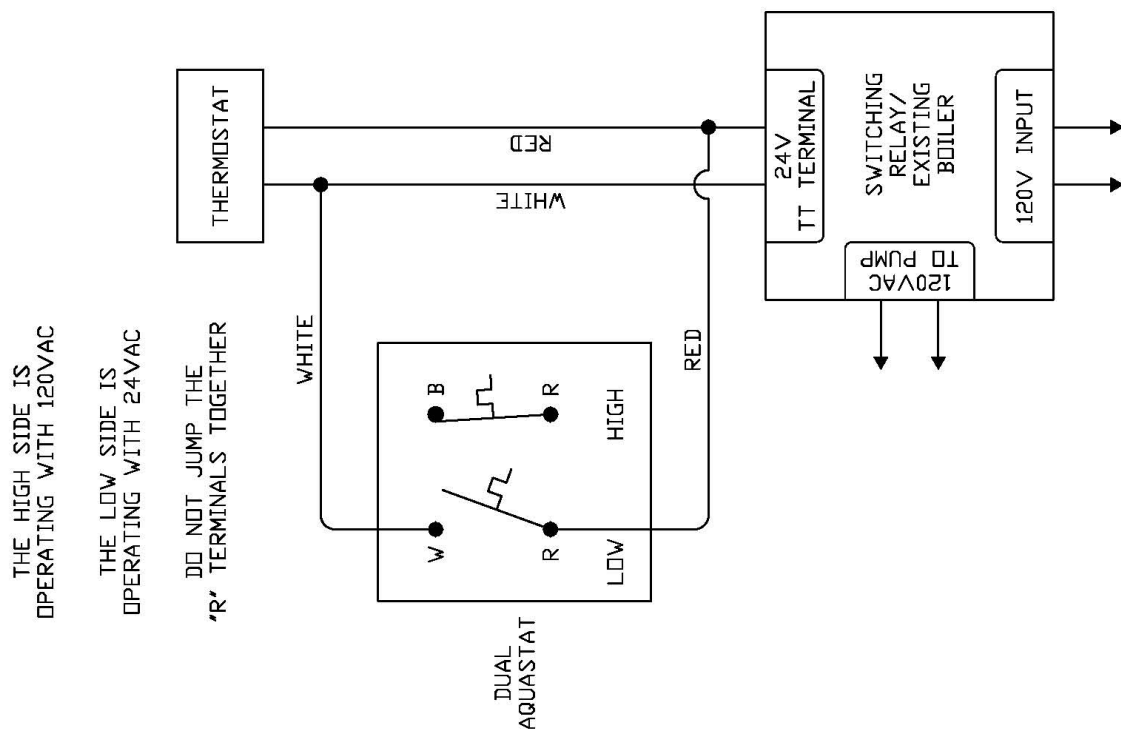
To Change the OFF-Cycle Fan Speed

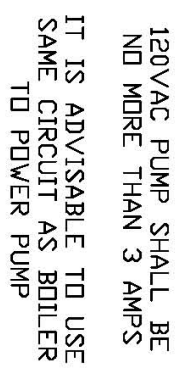
1. Press and hold “hexagon” button for more than 2 sec.
2. Use the Up or Down Buttons to find parameter P20
3. Press the “hexagon” button for less than 1 sec.
4. Use the Up or Down Buttons to change the Fan Speed.
5. After fan speed has been changed verify the draft. See the “Draft” section in this manual.

To Change the ON-Cycle Fan Speed

1. Press and hold “hexagon” button for more than 2 sec.
2. Use the Up or Down Buttons to find parameter P21
3. Press the “hexagon” button for less than 1 sec.
4. Use the Up or Down Buttons to change the Fan Speed.
5. After fan speed has been changed verify the draft. See the “Draft” section in this manual.

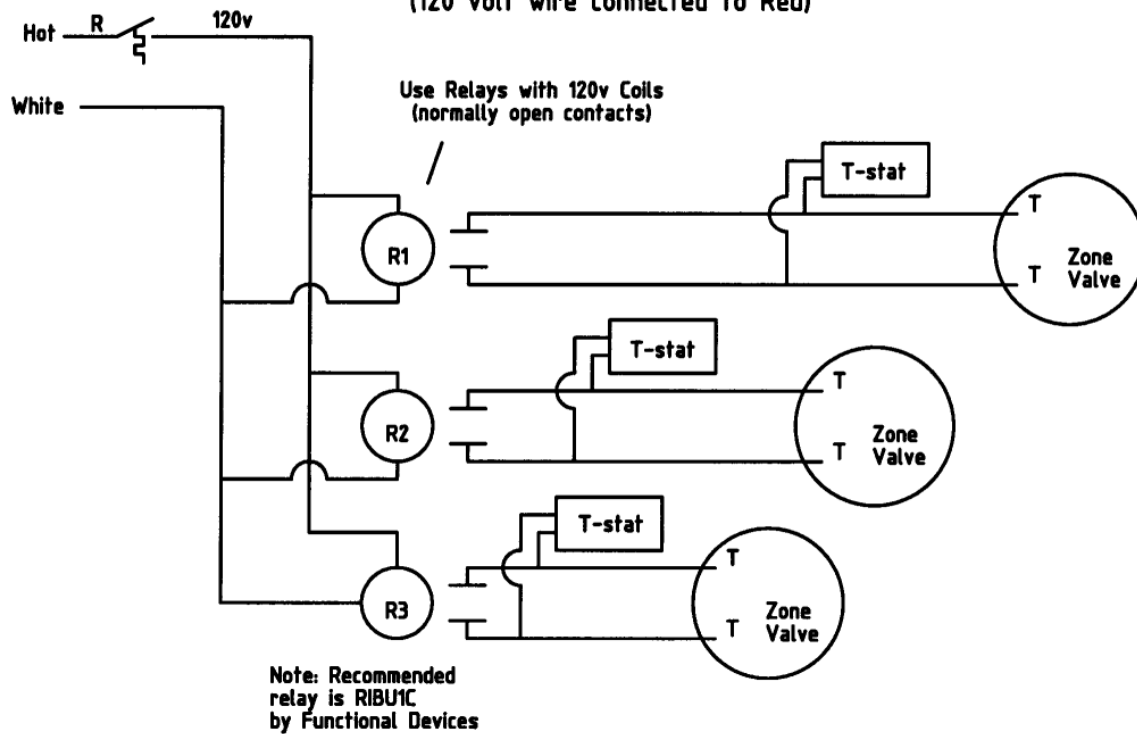
Appendix H: Dump Zone Wiring Applications

[illegible]



DESIGNATED DRAWING IN SERIES		ALTERNATE HEATING SYSTEMS	
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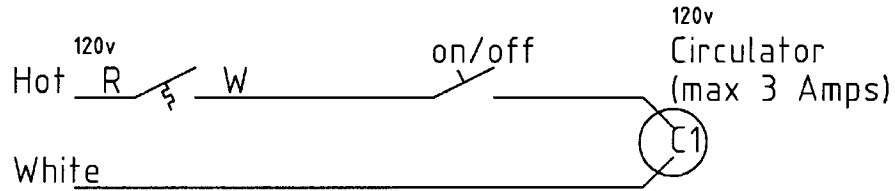
Example 2: Multiple Zone Valves
(120 volt wire connected to Red)



Example #3

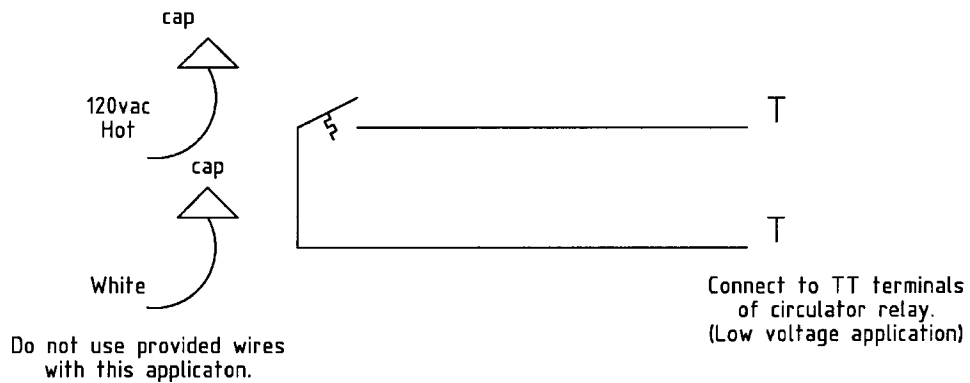
Single Zone Circulator

(120 volt wire connected to R)



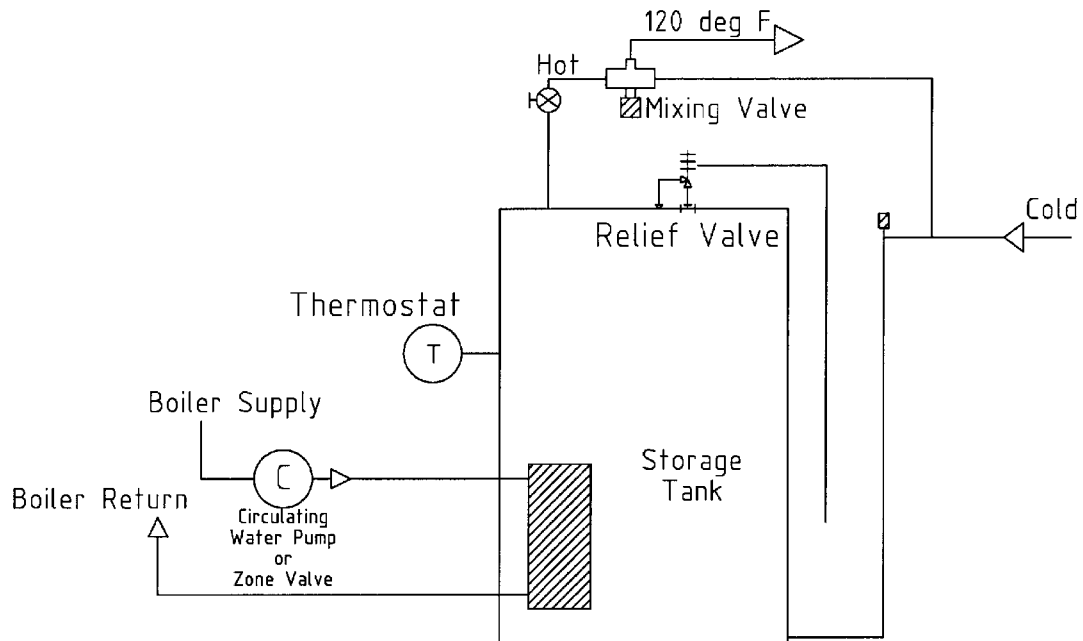
Example #4

Use of Dump Zone without use of 120v wire. The control is used as a dry contact switch (low voltage application). Use 300v or higher THHN or THWN rated wire.

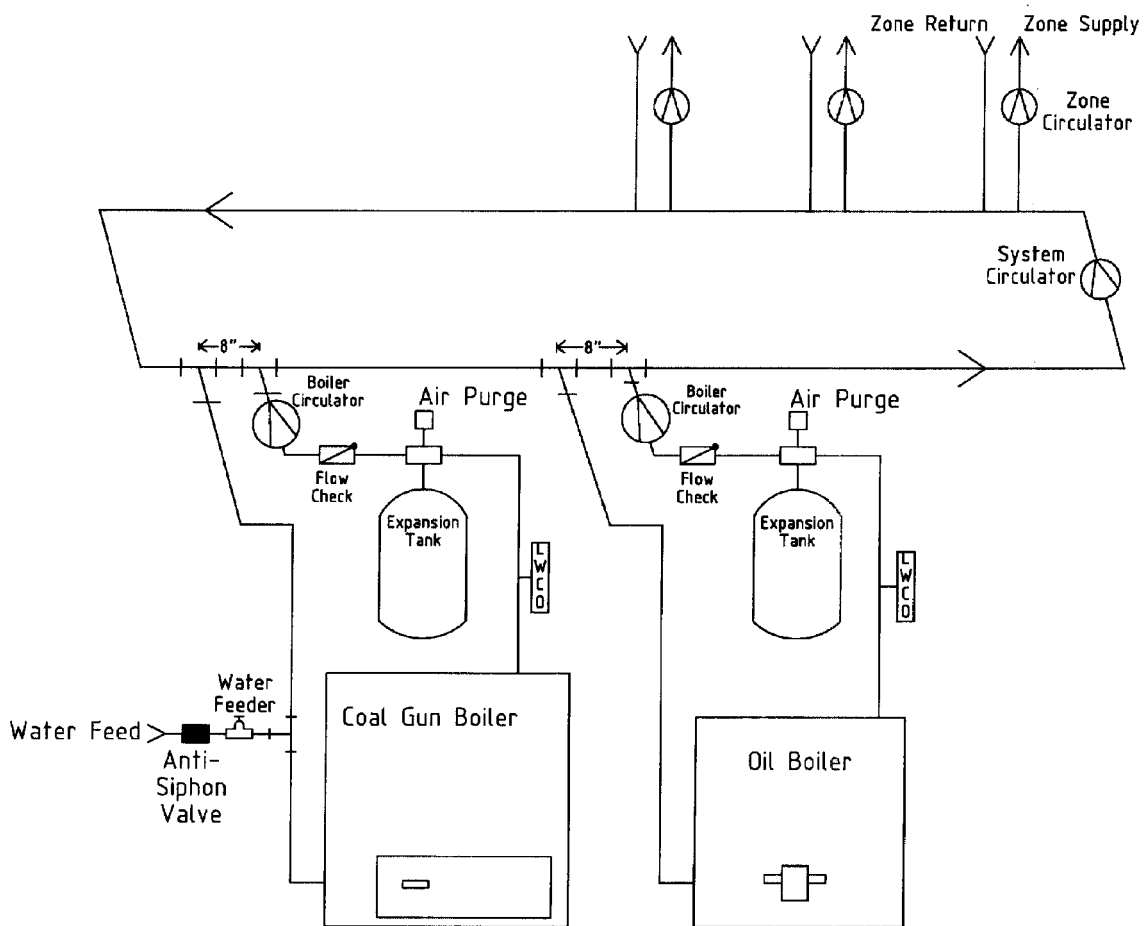


Dump Zone Example 5

(Domestic Water used as Dump Zone)



Appendix I: Boiler Piping Examples

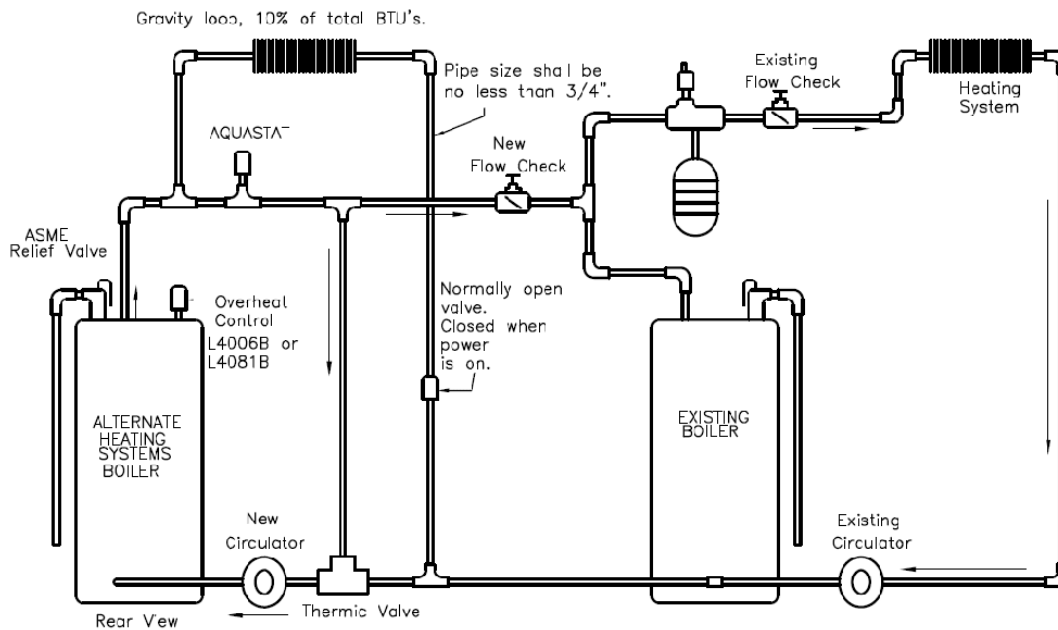


Coal Gun used in a Primary/Secondary System

Note:

1. A call for heat from any zone activates Boiler Circulators, System Circulator and Zone Circulator.
2. Each Boiler Circulator is also controlled by a low limit to prevent operation when the Boiler is cold.
3. Dump zone operation will activate one or more zones, System Circulator and Boiler Circulator.
4. Do not bypass temperature supply control system on radiant heat system. In radiant heat applications, permit activation of a call for heat but allow system controls to regulate water temperature.

Not all system components, valves and devices are shown in this drawing. Actual conditions and application requirements will vary. Please consult a heating expert or your Alternate Heating Systems dealer for additional information.



Note: The above illustrates one possible method of connecting the Coal Gun™ with an existing boiler. This connection is as follows: using a small circulator (and with the backup boiler piped into the return tapping) run another pipe from the supply tapping T, of the Coal Gun to the supply line, of the existing boiler on the lower side of the flow control valve. A minimum of 1" diameter pipe should be used for this connection on the model S130. The pipe size must be determined by taking into account the distance involved and flow required. The new circulator should be wired to the power for the Coal Gun. When power to the Coal Gun is on, the circulator should be running. An alternate option is to attach a strap on aquastat on the Coal Gun supply line that closes on temperature rise. This will automatically activate the pump at a given temperature. The add-on boiler shall be installed without interfering with the normal delivery of heated water from the original boiler. The add-on boiler shall be installed without affecting the operation of the electrical and mechanical safety controls of the original boiler.

LIMITED WARRANTY

COAL GUN™ COAL STOKER BOILERS: S130 • S260

The manufacturer, ALTERNATE HEATING SYSTEMS, warrants to the original owner, for the periods specified below, that the boiler to which this warranty applies is free from defects in materials and workmanship when installed, operated, and maintained in accordance with the printed instructions supplied with the unit.

A. WHAT IS COVERED AND FOR HOW LONG (all from date of original installation)

- 1) Boiler Vessel, twenty (20) years pro-rated (pro-rated as follows: 1st to 10th year – full: 11th year – 40%: 12th year – 30%: 13th year – 20%: 14th year – 10%: 15th – 20th year – 10%) This does not cover any corrosion or deterioration in boiler vessel due to improper PH levels in water.
- 2) All electrical and plumbing components and controls such as temperature/pressure gauge, safety relief valve, aquastat controllers, electric motor, domestic hot water coil, oil burner, fan shaft bearings, timer, draft motor, etc. purchased by Alternate Heating Systems from other manufacturers are limited to warranties offered by those manufacturers, typically One (1) year.
- 3) V-belt, pulleys, fan heat shields, fasteners, gasket and silicone rubber seals, door handle knobs, paint, wiring, and wiring devices -Thirty (30) days.
- 4) Coal Gun™ Grate – Lifetime

B. WHAT WE WILL DO AND NOT DO

- 1) Alternate Heating Systems will repair and replace, at our option, units or component parts found defective after inspection by Alternate Heating Systems or our authorized representative during the periods outlined above.
- 2) Alternate Heating Systems SHALL NOT BE LIABLE UNDER THIS WARRANTY IF:
 - a) The unit or any of its component parts have been subject to misuse, alteration, unauthorized repair, neglect, accident, or damage from handling.
 - b) The unit is not installed, operated and maintained in accordance with the printed instructions supplied with the unit and in accordance with local plumbing and/or building codes.
 - c) The unit is operated above its rated output which is shown on the nameplate attached to the unit and listed in Alternate Heating System's printed literature.
 - d) The unit is fired with fuels other than those recommended by Alternate Heating Systems. This includes fuels recommended by dealers and distributors selling Alternate Heating Systems products if these are not fuels recommended by Alternate Heating Systems.

C. WHAT THE CUSTOMER MUST DO

- 1) Contact the dealer who sold you the unit.
- 2) If said dealer cannot be located, contact any other Alternate Heating Systems dealers in your area.
- 3) If you are unable to locate a dealer, submit your warranty claim directly to Alternate Heating Systems at the address listed below.
- 4) When you make an inquiry or warranty request, be sure to include the following information:
 - a) Unit model number
 - b) Serial number
 - c) Date of installation
 - d) Dealer's name
 - e) Type of fuel burned
- 5) The OWNER and not Alternate Heating Systems or its dealers will be liable for the following costs involved in repair or replacement of the defective unit or component part
 - a) All necessary costs in returning the defective unit or component part to the factory or other location designated by Alternate Heating Systems.
 - b) All freight and delivery costs of shipping a new or required unit or replacement component part to the owner.
 - c) All labor and other costs incurred in the removal of the defective unit or part and installation of a new or required unit or part.
 - d) Any material required to complete installation of new or required unit or replacement part.

D. LIMITATIONS AND STATE LAW RIGHTS

- 1) Alternate Heating Systems neither assumes nor authorizes any representative or other person to assume for it any other obligation or liability in connection with its products other than expressly written here.
- 2) Implied warranties of merchantability and fitness for a particular purpose are limited to the duration of this LIMITED WARRANTY.
- 3) Alternate Heating Systems shall not be liable for any incidental or consequential damages such as water, smoke or heat damage to property arising directly or indirectly from any defect in its products or their use.
- 4) Some states do not allow limitation on how long an implied warranty lasts and the exclusion or limitation of incidental or consequential damages, so the above limitations and exclusions may not apply to you.
- 5) This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.
- 6) The remedies set forth herein shall be the exclusive remedies available to the owner.

ALTERNATE HEATING SYSTEMS

2393 LITTLE EGYPT RD

HARRISONVILLE, PA 17228

(717)-987-0099 ALTERNATEHEATINGSYSTEMS.COM

IMPORTANT: READ AND KEEP IN YOUR POSSESSION!