

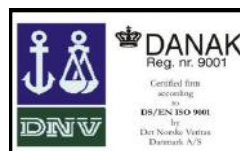


Bonus Plus

Model 30

Wood-fired central heating boiler

Installation and Operations Manual



UL 2523-2009 (R2013) "Solid Fuel-Fired Hydronic Heating Appliances, Water Heaters, and Boilers."

Bonus Plus Instructions

Tarm Biomass

1-800-782-9927

Version 11/14

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1.0 Introduction

1.1 Foreword

SAVE THIS INSTRUCTION MANUAL FOR FUTURE REFERENCE

**Congratulations on your purchase of the HS Tarm Bonus Plus log wood boiler from
Tarm Biomass!**

The Bonus Plus boiler is produced using the highest quality materials and a modern production system. The use of high technology laser cutting and robotic welding system, accompanied by time honored European design, craftsmanship and attention to detail, results in a long lasting boiler with unmatched fit and finish.

With proper installation, operation and maintenance your Tarm Biomass Bonus Plus log wood boiler will provide years of safe, dependable, economic and earth friendly heating.

This manual contains paragraphs that require your special attention. These paragraphs are marked with the symbols described below:



Warning: there is a risk of an accident of personal injury or serious damage to the property.



Caution: there is a risk of damaging the boiler or its individual components.

1.2 Units of Measurement

Most hardware and fittings on the boiler are metric (all plumbing fittings are British Straight Thread). In this manual the convention used for dimensions is that values are presented in English units, followed by metric units in parenthesis, for example: 6" (152 mm).

Note: A conversion table between Centigrade and Fahrenheit is provided in Appendix A. In this manual temperatures are presented first as degrees Centigrade then as degrees Fahrenheit in parenthesis, for example: 80 °C (176 °F).

1.3 Installation and Warranty Requirements

It is strongly recommended that the installer resist the temptation to simply get started without reading this manual. Hours of time and frustration can be prevented by a simple understanding of this product. This manual has been written with much care and thought. We want the first time installer to find installation as simple as for the experienced installer. Time spent reading now will save more time in the long run.

The Bonus Plus boiler must be installed with a thermal storage system capable of absorbing the complete output of the boiler during periods when the building is not calling for heat. A means for protecting the boiler against cold return temperatures must also be provided. Further information on acceptable ways of meeting these warranty requirements is provided in Section 3.0, Installation.

This product is provided with a limited warranty which is described in Section 7.0 of this manual. The warranty is contingent upon the successful and legal installation of the boiler. At a minimum, the installation, adjustment, start up, service, and maintenance of this product must be performed by a licensed professional heating system installer. Where applicable, the installation must be inspected and accepted by the legally responsible entity. Conditions described in the text of the warranty for keeping it in force must be followed by the owner/ system operator.

If the boiler has been purchased through a dealer, the warranty claim must be made to the dealer. Otherwise, claims may be made directly to Tarm Biomass.

Please read the literature enclosed by the manufacturer regarding the various accessory devices. These devices are warranted by the manufacturer, NOT BY Tarm Biomass. These accessory devices must be installed and used according to the recommendations of the manufacturer.

Failure to follow these instructions could result in property damage, bodily injury, or death. All boilers must be installed in accordance with national, state, and local plumbing, heating, and electrical codes and the regulations of the serving electric, water, and gas utilities. Contact local building or fire officials before installation about restrictions and installation inspection requirements in your area. This boiler is safety tested and listed. The Bonus Plus boiler does not carry an ASME stamp.

The instructions in this manual and in supporting documentation (additional instructions, diagrams, and component information provided by Tarm Biomass) must be followed. If the instructions are in conflict with local code requirements, the local code requirements will prevail. When in doubt, contact Tarm Biomass.

The manual and supporting documentation must be retained by the owner/ system operator for reference and future use.

The installer is responsible for familiarizing the owner/ system operator with all aspects of boiler operations, safety procedures, monitoring and cleaning requirements, shut down procedures, and annual maintenance requirements.

2.0 Product Description and Requirements for Safe Operation

2.1 Boiler Overview

2.1.1 Boiler Cut-away

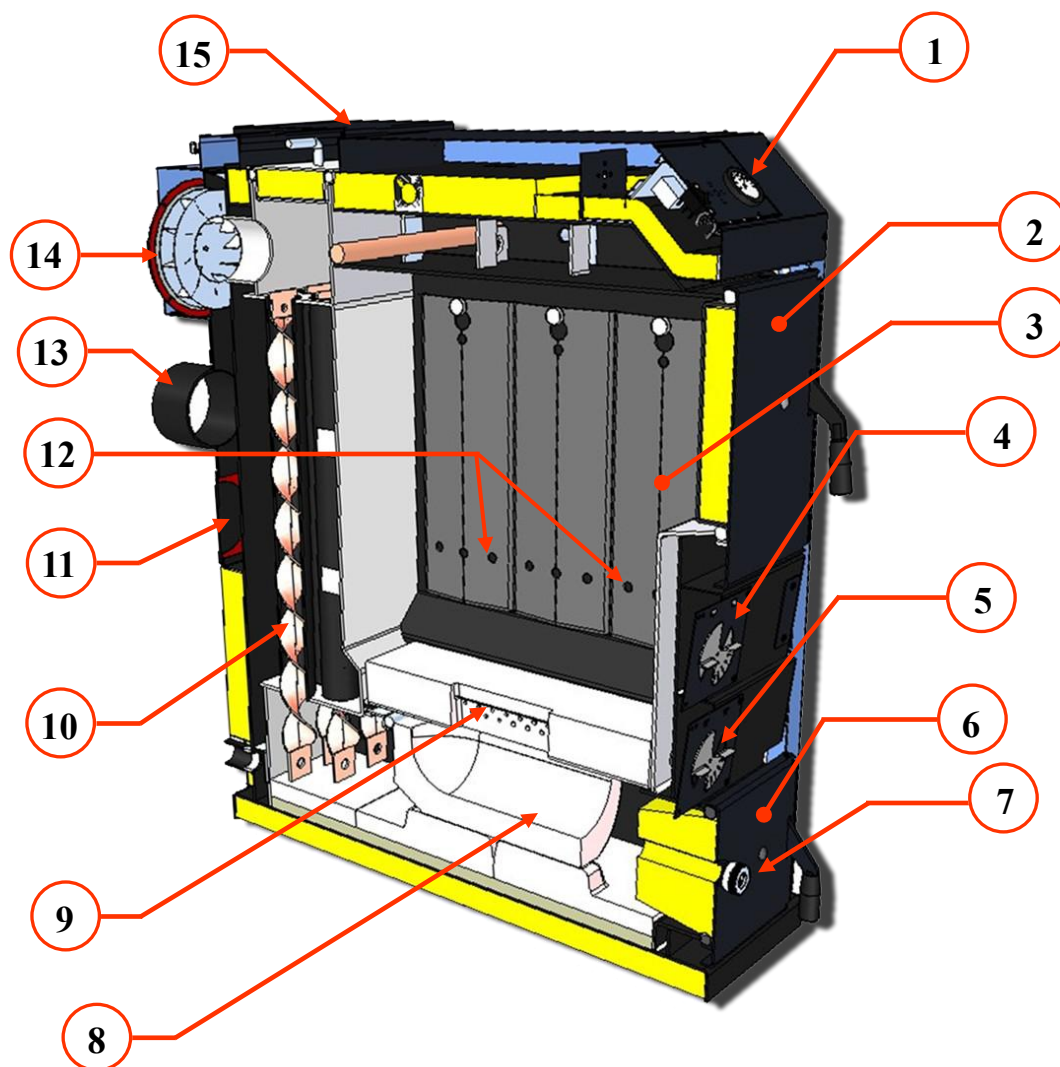


Fig 2.0

- | | |
|-----------------------------|---|
| 1. Control Panel | 9. Secondary Air Injection |
| 2. Loading Door | 10. Heat Exchanger Tubes and Flue Gas Turbulators |
| 3. Fire Chamber | 11. Cleanout |
| 4. Primary Air Adjustment | 12. Primary Air Injection |
| 5. Secondary Air Adjustment | 13. Flue Collar |
| 6. Ash Door | 14. Induced Draft Fan |
| 7. Sight Glass | 15. Cleanout Cover |
| 8. Gasification Tunnel | |

2.1.2 Boiler Control Panel

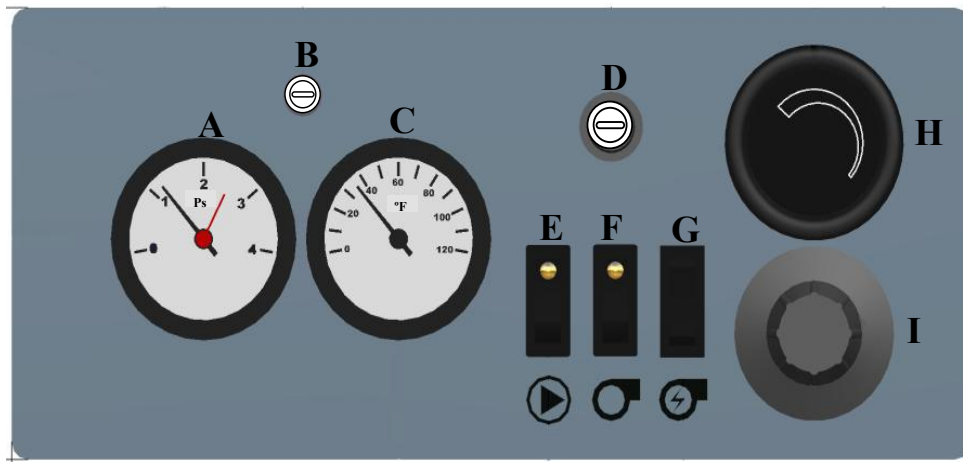


Fig 2.1

- (A) Boiler pressure gauge
- (B) Fuse, 6.3 Amp (behind the panel) Blows if overloaded. Contact an electrician if the fuse blows frequently.
- (C) Boiler temperature gauge.
- (D) Overheat Thermostat 100 °C (212 °F)) manual reset after boiler drops below 75 °C (165 °F).
- (E) Boiler circulator pump switch (not used in North America).
- (F) Fan switch

2.2 Boiler Function

2.2.1 General Operation

A generalized discussion of the operation of the Bonus Plus follows. Please refer to the cut-away views of the boiler in **Fig 2.0 and 2.1**.

The Bonus Plus boiler is an induced draft wood gasification boiler designed to efficiently burn wood as a component of a hydronic heating system.

The **control panel** (1) has the switch's, gauge, and controls for the boiler's operation.

Fuel is loaded through the **load door** (2) into the **loading chamber** (3) and the fire is kindled.

Air is controlled by the **primary air control** (4) and the **secondary air control** (5).

Secondary combustion takes place behind the **ash door** (6) and ashes are also removed through this door.

Combustion can be monitored through the **sight glass** (7).

Chimney connector is attached to the **flue collar** (13).

The **clean-out cover** (15) is detachable and allows access for cleaning the heat exchanger pipes.

The induced **draft fan** (16) pulls combustion air into the boiler via the primary and secondary air controls and pulls gases from combustion through the heat exchanger and exhausts them out of the boiler.

The **flue gas turbulators** (10) provide for turbulent flow of the flue gas in the heat exchanger, increasing heat transfer.

The heat **exchanger tubes** (10) transfers the heat from the combustion gasses to the boiler water.

The **firebox** (3) is the primary combustion chamber where the wood is loaded and the fire is started.

Secondary combustion air is injected in the nozzle just above the **gasification tunnel** (8) that serves to hold combustion gasses in a high temperature, turbulent environment to achieve high efficiency combustion.

The highly efficient wood combustion in the Bonus Plus boiler is achieved by the draft fan continuously operating once wood in the boiler is ignited to achieve an efficient and clean burn of all the wood loaded in the firebox. Due to the continuous heat output once the Bonus Plus is ignited the boiler must be connected to a thermal storage system.

2.2.2 Description of Burn Process

A key component of the Bonus Plus boiler operation is the induced **draft combustion fan**. Both primary and secondary combustion air are both drawn into the boiler by the induction blower mounted on the breach of the boiler. Primary and secondary combustion air are metered through air ducts into the boiler with the precise volume necessary for proper combustion. The combustion air is drawn through individually adjustable **primary and secondary air valves**. Primary air then is drawn into the firebox where it is dispersed behind the **firebox aprons** into the **primary combustion chamber** just above the top of the **ceramic refractory combustion stones**. Secondary air is drawn downward and then back into the center combustion stone where it enters the **combustion throat**. Here secondary air is turbulently mixed at high velocity with hot combustion gasses, which ignite and are burned very completely before being exposed to the heat exchange surfaces between the combustion chamber and the breach. The correct proportions of air for combustion from the fan and gases from the wood are a prerequisite for optimal and environmentally friendly burning of the wood with the highest possible efficiency.

A noteworthy construction feature is the special **ceramic fuel tunnel** (8) in the heart of the boiler which ensures that the combustion temperature reaches more than 1800 °F (1000 °C). Combustion is efficient, soot-free, and ensures optimal fuel use. The secondary combustion stones are essential to achieving complete combustion with log wood. The stones allow the combination of exhaust gasses and secondary air to reach very high temperatures while isolated from the quenching affect of the water jacket.

Carefully engineered **heat exchange tubes** downstream from the combustion process are fitted with removable **turbulators** to help ensure that a maximum amount of energy is transferred from the fuel to the hot water jacket. The heat exchange tubes can be accessed for cleaning through the **access panel and door** located at the top rear of the boiler **Operation of the fan assumes that the boiler can discharge its heat continually. The Bonus Plus must always be connected to a buffer tank of adequate size (see page 53).**

2.2.3 Safety Systems

The Bonus Plus comes with safety systems to prevent the following:

- Pressure in the boiler exceeding 30 psi (2 bars) (over pressure)
- Boiler water temperature exceeding 212 °F (100 °C)

To prevent an **over-pressure** condition, an ASME stamped pressure relief valve (provided) must be installed on the boiler which opens at 30 psi to relieve the boiler pressure (**See Section 3.5.1**). **Normal pressure in the boiler should be 12-15 psi.**

On the control panel there is an overheat thermostat. If the boiler exceeds (212 °F) 100 °C it will shut off the fan to the boiler.

A gravity over-heat dump loop is also required. In the event of a power failure this loop should provide dissipation for at least 10% of the boiler's maximum rated output, assuming an ambient temperature of 65 °F. in the area heated by the loop, and a mean water temperature of 180 °F (82 °C) (**See Section 3.4.2**).

2.2.4 Accessories

The boiler is shipped with loose and installing parts. See **Section 3.3.2** for a complete listing of these parts. Cleaning tools are provided with the boiler.

A **barometric damper** (draft stabilizer) is available for regulating chimney draft.

Plumbing around the boiler must include a three-port mixing valve in the orientation shown on installation drawing. The valve must be a **Termovar Model 4440A-3, Lk810** or equivalent with a 72 °C element. Tarm Biomass provides this valve at an extra cost.

A **flue thermometer** (Part #339N) is highly recommended to help monitor the performance of the Bonus Plus. This part is available from Tarm Biomass .

A **Thermal Storage System** is available from Tarm Biomass.

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2.1.5 Boiler Fabrication and Testing

Your boiler was manufactured by HS Tarm, a world leader in hot water (hydronic) heating for over 80 years. The HS Tarm Bonus Plus Series boiler conforms to traditional high standards for quality and reliability. It offers modern wood gasification technology with operating efficiencies at over 80% when run properly. If treated properly and operated according to the guidelines in this manual it will provide years of safe, dependable, and economical heating.

Bonus Plus boilers are designed and built in accordance with European Standard CEN 303-5. Safety and performance testing and listing for U S markets have been performed by OMNI Test Laboratories, Inc., Portland, Oregon. The boiler is tested and listed to applicable UL standards. The boiler is not ASME stamped. The installer should follow local or state installation requirements.

The Bonus Plus wood gasification boiler is a log wood fired boiler designed and constructed for highly efficient combustion of log wood. Do not burn other fuels in the Bonus Plus boiler. The Bonus Plus **is not** a self contained weather-tight boiler. It should be installed within the heated building. **Bonus Plus log wood boilers must be installed with a thermal storage system capable of absorbing the complete output of the boiler during periods when the building is not calling for heat.**

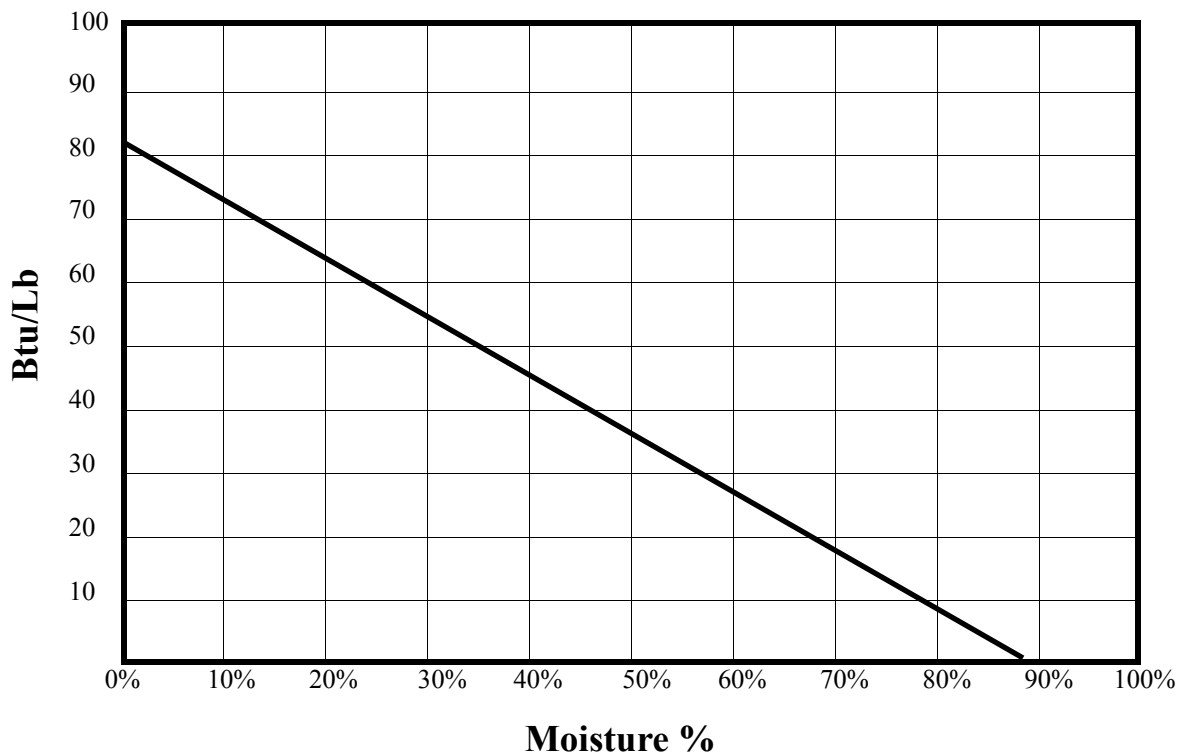
2.1.6 Models and Applications

The Bonus Plus model 30 is available with an output of 102,000Btu/hr (30 kW). Specification data for the Bonus Plus is provided in Section 6.3.

The boiler can be utilized as a single heat source, or in parallel with another boiler. Residential and non-residential applications are appropriate.

2.3 Fuels

Chemically treated or painted wood is unsuitable as fuel. The Bonus Plus boiler is designed for burning of cord wood only. Any species may be used, however, the wood must be properly seasoned and with a moisture content below 25%. Wood should be split into pieces with a diameter of four to six inches and stacked in a well ventilated, covered, indoor or outdoor space for at least one full year. A traditional, covered, outdoor wood stack can work well, but may require more drying time. A woodshed is ideal. We recommend the use of a wood moisture meter to test the core moisture content of your wood. Wood briquettes or manufactured pure wood logs can also be used as fuel provided they have a minimum cross section of 2.5 sq in. Manufactured logs should be at least 12" (0.25m) in length. Excessively small and compact pieces of wood or wood pellets are not suitable. Coal cannot be used as it becomes too compact and closes the combustion slot. The firebox can be filled to the top.

**Fig 2.2**

This chart shows how many Btu's are lost by burning fuel with higher moisture content. We recommend fuel with a moisture content of 20% or less.

The Bonus Plus is made to burn natural **firewood**. Both hardwood and softwood are suitable, but oak should not be burned as the only source of wood for long periods because of its high acid content. For effective gasification, the wood must be dry, i.e. moisture content **15-25%**. In addition to increasing the likelihood of generating creosote in the boiler, burning wet wood uses a substantial amount of the wood energy to evaporate the water present in the wood, reducing the available energy for heat (**Fig 2.2**).

The wood will dry out most quickly if it is cut into the appropriate length and split into pieces 4"-6" (100-120mm) thick. The best length is 20" (0.5 m) for the Bonus Plus 30. The wood is best stored in the open air under cover. Ideally the wood should be stored for at least one and a half years (two summer seasons). Do not burn small pieces of wood or wood chips in the boiler as they can block the combustion slot. Also, it can be difficult to control the combustion process effectively with small wood pieces and chips.

WARNING

If a fan is used in the fuel storage area, it should be installed so as not to create negative pressures in the room where the solid-fuel burning appliance is located.

2.4 Building Requirements

- The boiler must be connected to a tile-lined masonry **chimney** or to a factory-built Type UL 103 HT approved chimney in good condition. See the details in **Section 3.2**
- A dedicated supply of **fresh combustion** air provided near the boiler is recommended for efficient, safe operation. This supply must not be directly connected to the boiler.
- Installation on a non-combustible floor only.
- A dedicated 120 VAC **power supply is required (See Section 3.4.9).**
- Revision of **existing heating system** piping may be appropriate to properly utilize the equipment. Although Tarm Biomass can provide advice and design detail on the integration of this boiler with the heating system of the building, the ultimate responsibility for the performance of the system rests with the installer.
- Please observe the guidelines and the various **national and local regulations.**
- **Bonus Plus** boilers are designed and approved as heaters for hot water systems with permissible outflow temperatures of up to 203 °F (95 °C).

2.5 Owner Responsibilities

Successful operation of this boiler will require daily involvement by the owner/system operator. Biomass boilers operate differently from fossil fuel boilers, requiring more oversight and a diligent cleaning regimen.

- The owner/system operator is responsible for correct operation of the boiler per guidelines in Sections 4.0 and 5.0 of this manual.
- Incorrect operation can reduce the boiler life.

DANGER



Risk of Fire or Explosion!

Do not burn garbage, gasoline, gasoline type lantern fuel, kerosene, charcoal lighter fluid, drain oil, or other flammable liquids to start or “freshen up” a fire in the boiler.

WARNING



Risk of Fire!

- **Do not operate with flue draft exceeding –.10 (-2.54mm) water column.**
- **Do not operate with fuel loading or ash removal doors open.**
- **Do not store fuel or other combustible material within marked installation clearances.**
- **Inspect and clean flues and chimney regularly.**
- **Do not use chemicals to start unit firing.**

CAUTION



Hot Surfaces!

- **Keep children away.**
- **Do not touch during operation.**
- **Maximum draft marked on nameplate.**

CAUTION

Safety faults or deficiencies with the boiler or installation must be rectified as quickly as possible. Either by the owner/system operator or the installer.

CAUTION

All cover plates, enclosure, and guards must be maintained in place at all times, except during maintenance and servicing.

3.0 Boiler Installation & Start-up

This section is directed at the installer.

3.1 Planning

3.1.1 Sizing the Boiler

It is critical to size the boiler properly. A proper, up to date heat load calculation is advised. An accurate history of building fuel usage over several years can help to calculate the proper size boiler.

Boiler sizing is the responsibility of the installer. Tarm Biomass bears no responsibility for boiler sizing, but can provide sizing input.

3.1.2 Choosing an Installer

Choosing a competent, licensed installer is critical to the successful installation of the boiler. The installer is responsible for all planning, installation, start-up, troubleshooting, owner training, and annual maintenance for the boiler. Some aspects of the system piping, start-up, and operation may differ from normal practice in fossil fuel boiler installation. To be successful, the installer must study this manual, understand the installation tasks, and contact Tarm Biomass for help when necessary.

3.1.3 Locating the Boiler and Boiler Clearances

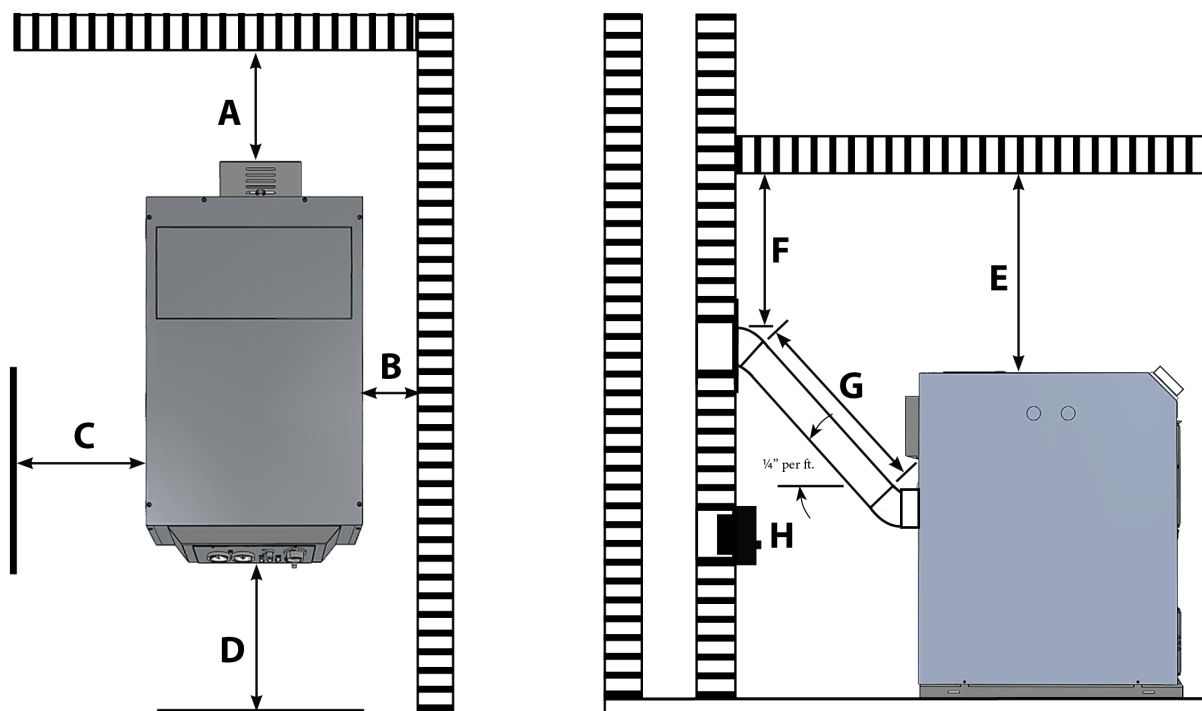
The boiler must be installed with the **minimum installation clearances** to combustible materials outlined on the next page. Clearances may only be reduced by means approved by the regulatory authorities.

- The boiler is not suitable for outdoor installation. It must be located in a conditioned space.
- The boiler must be placed on a level, non-combustible floor, such as a concrete slab on earth. If you have the boiler 8" above the floor it makes it easier to load and clean the boiler.
- If the boiler is placed near inhabited rooms, so that flue gas can easily penetrate into these rooms, a carbon monoxide alarm must be installed that can give a warning regarding possible escapes of carbon monoxide into the inhabited rooms.

CAUTION

 **DO NOT INSTALL THIS BOILER IN A MOBILE HOME.** There is no safe way this boiler can be installed inside a mobile home.

The boiler must be installed with the **minimum installation clearances** to combustible materials outlined below. Clearances may only be reduced by means approved by the regulatory authorities.



Recommended Distances in the Boiler Room	Units	Bonus Plus 30
A-Minimum Clearance for Blower Maintenance	Inches	21
B-Minimum Clearance to Combustibles	Inches	12
C-Minimum Distance for Cleaning and Maintenance Tasks	Inches	21
D-Minimum Clearance to Combustibles	Inches	36
E-Minimum Clearance to Combustibles	Inches	24
F-Minimum Distance for Combustibles to Pipe	Inches	18
G-Maximum Distance for Flue Pipe	Feet	0-4
H-Ideal Location for Draft Regulator (Barometric Damper)	-	-

3.1.4 Plumbing and Mechanical

The boiler must be connected to a suitable **chimney**. Chimney requirements are discussed in **Section 3.2**.

A dedicated supply of fresh **combustion air** should be provided near the boiler for efficient and safe operation, but must not be directly connected to the boiler. Outside combustion air is especially important for the Bonus Plus due to its powerful induction blower (**See Section 3.2.1**).

For the heating system piping, it is possible to use either copper or iron piping materials. The supply and return pipe should be insulated to avoid heat loss. Included in **Section 6.5** are conceptual piping diagrams showing the correct layout for a variety of situations. Tarm Biomass can provide additional conceptual plumbing diagrams

A permanent pressurized domestic **water supply** must be provided with proper automatic filling and pressure reduction valves.

Use of a suitable **antifreeze mix** is allowed, but will cause a loss in heat transfer efficiency.

CAUTION

☀ Any plastic or rubber tubing used with a Tarm Biomass boiler must have an **oxygen barrier**, or boiler corrosion will occur. If radiant tubing without an oxygen barrier is installed, water in the tubing part of the heating system must be separated from the boiler. Separation of system components is typically done by using a heat exchanger. Use of radiant tubing without an oxygen barrier will void the boiler warranty.

If **water quality** is poor, water treatment additives should be considered. Boiler system water pH should be 8.0-8.6.

A **thermostatic mixing valve or loading unit** (not provided), set to open at 140-160 °F (60-72 °C), is required to temper return water to prevent cold return water from reaching the boiler. This helps prevent boiler corrosion. Tarm Biomass can provide this valve or loading unit for an additional cost.

A **circulator** (Size and brand to be determined by the installer (not provided)) should be installed as C3 per drawings suggested by Tarm Biomass.

An **aquastat** (Honeywell **L4008B** (provided)) must be installed to protect the boiler from over-temperature conditions by energizing a chosen heating zone.

An **aquastat** (Honeywell **L6006A** (provided)) must be installed to protect the boiler from over-temperature conditions by energizing the C3 boiler circulator.

A **tankless hot water coil** is not available for the Bonus Plus.

Tarm Biomass recommends the use of the **BLTCONTROL** (available through Tarm Biomass) when burning the Bonus Plus in conjunction with a back up boiler. The **BLTCONTROL** is a three position control that allows switching between wood only, wood with automatic back up, or back up only, by controlling the operation of the back up auxiliary boiler. **BLTCONTROL** takes input from a zone relay control and determines, based on the thermal storage system temperature, whether to pull heat from the thermal storage system or the back up auxiliary boiler. The **BLTCONTROL** easily integrates the Bonus Plus boiler and thermal storage system with an existing fossil fuel heating system.

3.1.5 Electrical

For the Bonus Plus boiler a **120 VAC, 60 hertz, 3-wire power supply is required**. This electrical connection should be from a dedicated 15 amp circuit breaker. A master service switch for the boiler, mounted on the boiler or on the wall in the proximity of the boiler, is recommended (see Section 6.4.2). Locally enforced electrical codes must be followed.

3.2 Preparing the Chimney

The chimney is one of the most critical factors in the successful operation of any solid fuel heater, including the Bonus Plus boiler. A good chimney will provide a continuous and dependable draft to pull the exhaust gasses out of the building.

Follow manufacturer's installation instructions for installing and supporting any specific chimney product.

NOTE

The boiler must be connected to a tile-lined masonry chimney or to a Factory-Built Type UL 103 HT approved chimney. The chimney must be in good condition. If the boiler is connected to a dirty or inadequate chimney, it can present a serious fire hazard. All chimneys and connections must conform to NFPA standard #211. No other appliance should be connected to this flue unless allowed by the local code authority. Consult your local inspector for chimney requirements and install the boiler in accordance with all applicable codes. Please review the following diagram before connecting the boiler to the chimney.

Flue gas exhaust temperatures can be low enough to cause condensation in chimneys. Condensation will, over time, damage a masonry chimney. Accordingly, installation of a stainless steel chimney liner (made with 304, 316, or 321 alloys) inside the chimney flue is strongly recommended.

At the connection to a factory-built chimney, a dripless adaptor must be used.

The chimney draft must be stable and between -0.025" (-0.6 mm) and -0.05" (-1.25 mm) water column.

WARNING



If the draft exceeds the recommended maximum, it could cause a solid fuel fire to burn out of control.

The top of chimney must be 3 feet (0.9 m) above the roof and 2 feet (0.6 m) above any structure within 10 feet (3.0 m) measured horizontally.

For the Bonus Plus 30 best draft will be provided by a chimney which has an 6" (152mm) ID round flue, is 20-30 feet (6.0-9.0m) in height and which is located inside the heated structure. The chimney must be capable of maintaining a breech draft of -0.05" (-1.25mm) WC during normal boiler operation.

Your Bonus Plus gasification boiler is designed to burn efficiently and with virtually clear emissions, but under certain conditions creosote deposits can form in your chimney. Chimneys that are too large, are poorly insulated, or have bends in the flue passages are especially prone to problems with draft and/or creosote.

The smoke pipe connecting the boiler to the chimney flue must be black or stainless, have a minimum thickness of 24 gauge, and rise a minimum of ¼" per foot of run toward the chimney (**Fig3.1**). Smoke pipe sections must be attached to one another with a minimum of three sheet metal screws and sealed with high-temp silicone. The smoke pipe should not contain more than two 90° elbows (45° elbows are preferred over 90° elbows).

MASONRY CHIMNEYS: Masonry chimneys must be lined, either with code-approved masonry or pre-cast refractory tiles, stainless steel pipe, or poured in place liner. Do not use an unlined chimney

FACTORY BUILT CHIMNEYS: Factory built chimneys must be tested and listed for use with solid-fuel burning appliances to the High Temperature (HT) Standard (2100 °F(1148 °C)), UL 103, for the United States. Factory-Built chimneys must be installed as per the manufacturers instructions.

Strong winds blowing across the top of a chimney or a chimney which has a particularly strong natural draft can cause the Bonus Plus boiler to continue burning (heating) when the draft fan is off. This is an unlikely scenario, as the blower on a Bonus Plus, used with a thermal storage system, should rarely be off while a fire is present. If however, an irregular or excessively high draft presents problems, the solution is the use of a barometric draft regulator or the use of a proper chimney cap that helps in the prevention of down drafts.

Installation requirements for a barometric damper (draft regulator).

- The diameter of the draft regulator must be equal or greater than that of the chimney connector.
- The draft regulator should be installed as close as possible to the boiler, on the chimney connection or on chimney itself.
- The draft regulator adjustment should be made with a vacuum gauge, if possible, with the boiler operating at full output. If the start-up is made in warm weather, a readjustment may be necessary in cold weather.
- If, at the maximum adjustment (maximum opening of the shutter of the draft stabilizer), the draft is always higher than -0.05" (1.25 mm) of water column, a second draft regulator may be required.
- Recommended draft regulator location (1) is shown in **Fig 3.1**.

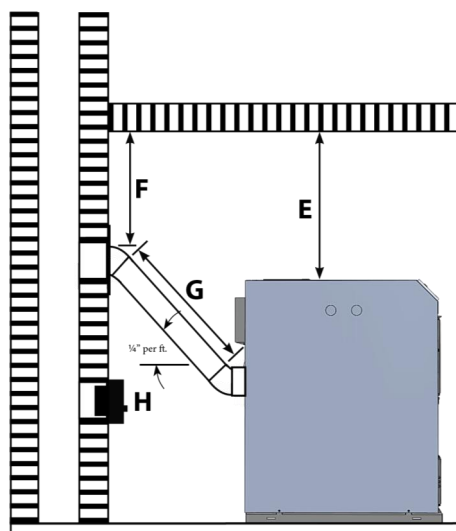


Fig 3.1

3.2.1 Outside Combustion Air

Provision for outside combustion air may be necessary to ensure that fuel-burning appliances do not discharge products of combustion into the house. Guidelines to determine the need for additional combustion air may not be adequate for every situation. If in doubt, it is advisable to provide additional air. The Bonus Plus, due to its powerful induction fan, needs adequate air to make up for the air being pushed up the chimney especially during start up before the chimney is warm.

Outside air may be required if:

1. The solid fuel fired appliance does not draw steadily; experiences smoke roll out from the loading door, burns poorly, or back-drafts whether or not there is combustion present.
2. Existing solid fuel fired equipment in the house, such as fireplaces or other heating appliances smell, do not operate properly, suffer smoke roll out when opened, or back-draft whether or not there is any combustion present.
3. Any of the above symptoms are alleviated by opening a window slightly on a calm (windless day).
4. The house is built very tightly with a well sealed vapor barrier or foam type insulation and tight fitting windows and/or has any powered devices which exhaust in the house.
5. There is excessive condensation on windows in the winter.
6. A non-balancing ventilation system is installed in the house.
7. Where fans are used in the fuel storage area, they should be installed so as not to create negative pressures in the room where the boiler is located.

If these, or other indications, suggest that infiltration air is inadequate, additional combustion air should be provided from the outdoors.

Bonus Plus boilers are not suitable for direct connection to outside air. Outside air should be ducted to no closer than 12" (305mm) from the boiler. A 6" (152mm) duct should be large enough for all sizes unless the duct run is over 25 feet (7.6m).

If a mechanical ventilation system (air exchange or heat recovery) is already present in the home it may be able to provide sufficient combustion make-up air for the solid fuel fired appliance. The ventilation system may need to be re-balanced after installation of the Bonus Plus.

3.3 Setting the Boiler

3.3.1 Receiving the Boiler

Boilers are shipped on a single skid. Loose materials are consolidated into boxes strapped to the skid or placed inside the combustion area of the boiler. Please unpack the boxes and verify that all items have been received. Make certain that any damage or shortage is noted to the shipping receiver.

To move the unit into the boiler room the lift ring on the top of the boiler can be used.

To move the boiler around the inside of the boiler room rollers can be used under the boiler.

3.3.2 Temporary Storage

If the boiler installation is going to take place at a later date the boiler and components need to be stored in a safe, dust-free, dry location. Moisture can damage the insulation, electrical components, and ceramics. If boiler is subjected to this kind of environment, it could void the warranty.

3.3.3 Moving the Boiler

See **Section 6.3** Specification Data for weights and measurements of the Bonus Plus boiler. **The boiler is heavy and large!** Moving the boiler into place requires planning and resources. The boiler may be unloaded using a pallet jack or forklift. Alternately, it can be lifted from above by utilizing the lifting rings welded to the top of the boiler.

3.3.4 Boiler Set-up

After the packaging is removed and the boiler is set into place, it should be checked to assure that it is level and securely placed. Loose parts and accessories shipped with the boiler should be removed and stored in a safe place. A copy of this manual is shipped with the boiler for reference during installation. The boiler can be set using leveling bolts located on each corner.





It is not necessary to remove the wooden shipping braces and wedges located within the boiler. They will burn away within a few hours of initial firing.

3.4 Connections to the Boiler

The following connections must be made to the boiler, in order for it to function:

- The boiler flue gas exhaust collar must be connected to the chimney system.
- The heating system piping must be connected to the boiler supply and return connections.
- Electrical power must be provided at the boiler electrical terminal box.

3.4.1 Chimney Connection

CAUTION	
	Do not install a flue damper in the exhaust venting system of this unit.
	Do not connect this unit to a chimney flue serving another heating appliance, unless approved by the local code authority.
	Do not connect the boiler to any air distribution duct or system.
	Install vent at clearances specified by the vent manufacturer.

The connection between the boiler and the chimney system should be single wall 24 gauge (minimum) stainless or black pipe, unless prohibited by the local code authority.

- The single wall chimney connector must not pass through an attic, roof space, closet or similar concealed space, or a floor, or ceiling.
- Where passage through a wall or partition of combustible construction is desired, the installation must conform to NFPA 211.
- The chimney connection pipe must be placed over the outside of the boiler's flue gas exhaust pipe. A flue collar adaptor is available from Tarm Biomass.

- The chimney connector sections must be attached to the boiler and to each other with the crimped (male) end pointing away from the boiler. All joints, including the connection at the boiler collar, must be secured with at least three sheet metal screws. All joints need to be sealed with a hi-temperature (>500° F) silicone.

3.4.2 Safety Plumbing

NOTE

SYSTEM DESIGN: Consider provisions for handling excess heat produced by an overheating boiler both with electricity and during a power failure.

OVERHEAT LOOP: NO ELECTRICITY: The piping and controls must be connected to the boiler in such a way that in the event of a power failure there is one loop of radiation available for gravity circulation. This loop must not be obstructed by any valves or other accessories which would prevent gravity circulation during a power failure. The piping is plumbed in such a way that excessive pressure will not be developed in any portion of the boiler or system. The loop must be large enough to dissipate at least 10% of the boiler's maximum rated heat output, assuming an ambient temperature of 65 °F (18 °C) and a mean water temperature of 180 °F (82 °C).

The minimum pipe size for this loop is ¾" (1" is recommended) and if possible, the loop should be located and pitched to maximize natural thermal convection of the water. The loop must be positioned above the boiler. The design of the loop must be such that it can be made inoperative only in a deliberate manual action. If large enough, an existing heating radiation zone may be used for the over-heat loop. The loop must be equipped with zone valves which will open automatically during a power failure. We recommend AUTOMAG zone valves for this application (offered as an accessory).

OVERHEAT LOOP: WITH ELECTRICITY: The HONEYWELL L4008B aquastat provided with this boiler must be wired in parallel with the thermostat on the zone with the most heating capacity in the main living area (dump zone). Upon reaching the aquastat set point, the dump zone will be activated, pulling heat away from the boiler. The home owner is alerted to a potential problem with the boiler by an overly warm living space.

Do not use self contained, non electric zone valves in the zone controlled by the overheat control! Such valves would prevent the overheat control system from cooling the boiler when necessary.

NOTE

THE THERMAL STORAGE SYSTEM MAY NOT BE USED AS A DUMP ZONE!

3.4.3 System Plumbing

There are numerous possibilities for connecting your Bonus Plus and thermal storage system to your home heating system. Tarm Biomass provides diagrams as concept diagrams only. Final design, installation, and code compliance details are the responsibility of the designer/installer of the system.

NOTE

Any radiant tubing used with the Solo Plus boiler must have an oxygen barrier! Non oxygen barrier tubing must be separated from the boiler using a heat exchanger.

NOTE

The Normal Operating pressure is between 12-15psi.

3.4.4 Pipe Connections – Choice of Material

Copper or black iron pipe may be used. Do not use galvanized iron pipe. The supply and return flows must be carefully insulated to avoid heat loss.

3.4.5 Immersion Tubes and Wells

Remember to install the immersion tubes provided in the corresponding well. **Remember to plug wells which are not used in the chosen form of installation.**

3.4.6 Expansion Tank

The size of the expansion tank is determined by the total water content of the heating system.

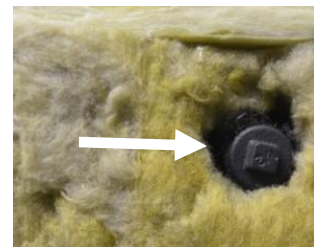
3.4.7 Pump Size

The size of the circulation pump is determined by the size of the system and the pipe dimensions.

3.4.8 Installing the Circulator Aquastat

The Honeywell L6006A aquastat provided is installed to activate the boiler's circulator in case there is a temperature rise after the boiler has shutdown.

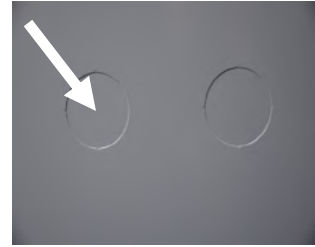
First, remove the boiler's top panel.
Next, remove the side panel (can be left or right) Remove the ½" fitting (Shown in image).



Install the new ½" sensor well.



Remove left knock-out on side panel.
The side panel can now be re-installed.



The Honeywell L6006A aquastat can now be attached to sensor well. (Note: Image does not show side panel installed.)



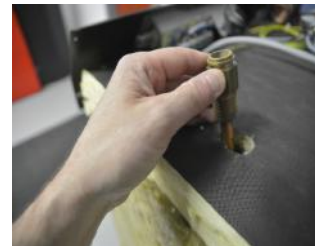
3.4.9 Installing the Overheat Aquastat

The Honeywell L4008B aquastat provided with this boiler must be installed and wired in parallel with the thermostat on the zone with the most heating capacity in the main living area (dump zone). Upon reaching the aquastat set point, the dump zone will be activated, pulling heat away from the boiler.

Find the spare sensor well #8 located on the top of the boiler (located on the right side of boiler). Remove the existing sensor well.



Replace with new 1/2" sensor well.



The bulb for the Honeywell L4008B overheat aquastat can now be installed. Top panel can also be re-installed.



3.4.10 Installing the 339N Probe Thermometer

The 339N Probe Thermometer (Part # 339N) is to be installed just downstream of the boiler's flue collar. Drill a 1/4" hole in the side of the pipe and insert the probe all the way in (see **Fig. 3.5**). This thermometer indicates of how well the wood is burning and when to clean the heat exchange tubes. If burning dry wood that is split, it should achieve temperatures of 350-450 °F (176-232 °C) or more on the probe thermometer.

If operation of the boiler is not achieving temperatures this high, check the following things:

1. Does the chimney have proper draft (see **Section 3.2**)?
2. Is there proper make-up air into the room (see **Section 3.2.1**)?
3. Are the vanes on the draft fan clean (see **Section 4.11.4**)?
4. Are the primary air channels open (see **Section 4.11.6**)?
5. Is the wood dry (<20%) and split to the proper size?
6. What is the condition of the firebox ceramics?



Fig. 3.5

In most instances, low stack temperatures are an indication that the wood is not dry.

If boiler operations have been producing consistent temperatures and the flue temperature has been creeping upward, this is an indication that it is time to clean the heat exchange tubes by brushing.

3.4.11 Electrical Connections

The control panel on the Bonus Plus is supplied as a pre-wired assembly. All that is required on-site is to connect to 120 Volt service at the junction box that was installed on the back panel of the boiler. Please refer to electrical drawings in section 6.

3.5 Commissioning the Boiler

3.5.1 Safety Plumbing

The temperature /pressure indicator (provided, Part # **PT1088**), boiler pressure relief valve (provided, part # **1040705**), must be installed as shown in **Fig. 3.10**. A 1" nipple, 1"X 3/4"X 1" tee and 1"X 1/4" reducer is provided to ease operation. Follow applicable codes.

Installed relief valve and temperature/pressure indicator.



Fig. 3.10

A thermostatic **mixing valve** or **loading unit**, and boiler circulator (included with the loading unit) should be incorporated into the heating system piping as shown in **Fig. 3.11**. When the **K4440A3** is used, a ball valve (not provided) must be installed upstream of Port 1 of valve **TV-1**. The valve should be set at half open (and the handle removed), in order for the tempering loop to function correctly. If accessory **K4440A3** Termovar mixing valve is provided for use as **TV-1**, the unions supplied with the valve have internal valves which must be fully open.

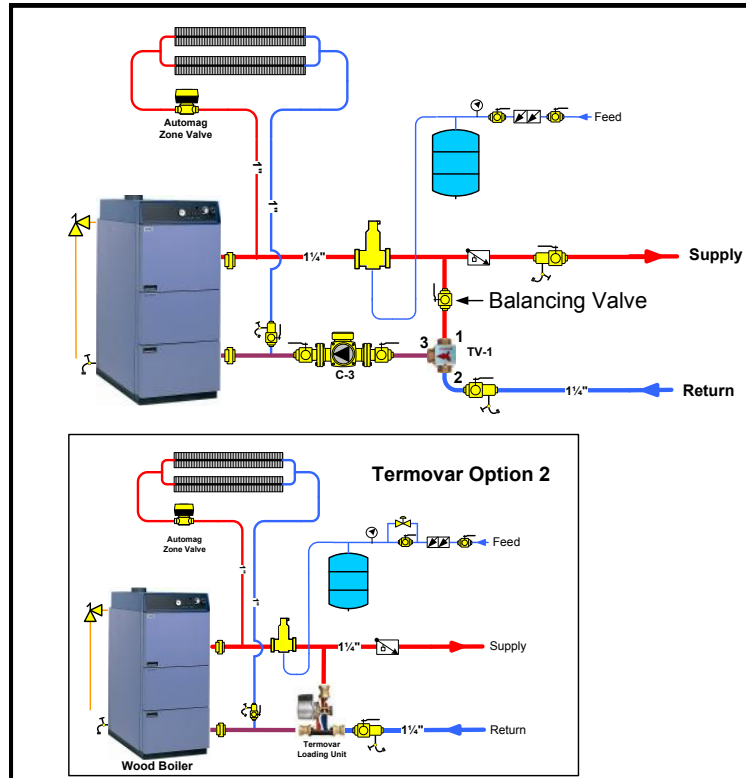


Fig. 3.11 Typical Plumbing Schematic

3.5.2 Filling and Venting

The best connection for filling the boiler with water is at the boiler drain. During filling the circulation pump is switched off. Filling takes place through a hose which is screwed onto the boiler drain and connected to a water supply faucet. Fill the hose prior to filling the boiler, otherwise air in the hose will be pushed into the boiler system. Remove the hose after filling up. High quality air elimination equipment is recommended in the heating system installation.

NOTE

The heating system main supply and return piping will need to be at least 1.25" (32 mm) for correct boiler heat output distribution. All field-run piping should be back-flushed to clean and remove debris. Adequate filling and venting ports should be added so that air can be removed from the system. The system should be pressure tested before being placed into service.

NOTE

If water quality is poor or PH unsatisfactory, the installer should consider water treatment additives during filling and water testing as part of annual maintenance.

4.0 Boiler Operation, Maintenance, and Service

4.1 Control Panel Orientation

Letters in brackets () in this section refer to the button with the corresponding letter on the control panel. All temperature values are in degrees Centigrade.

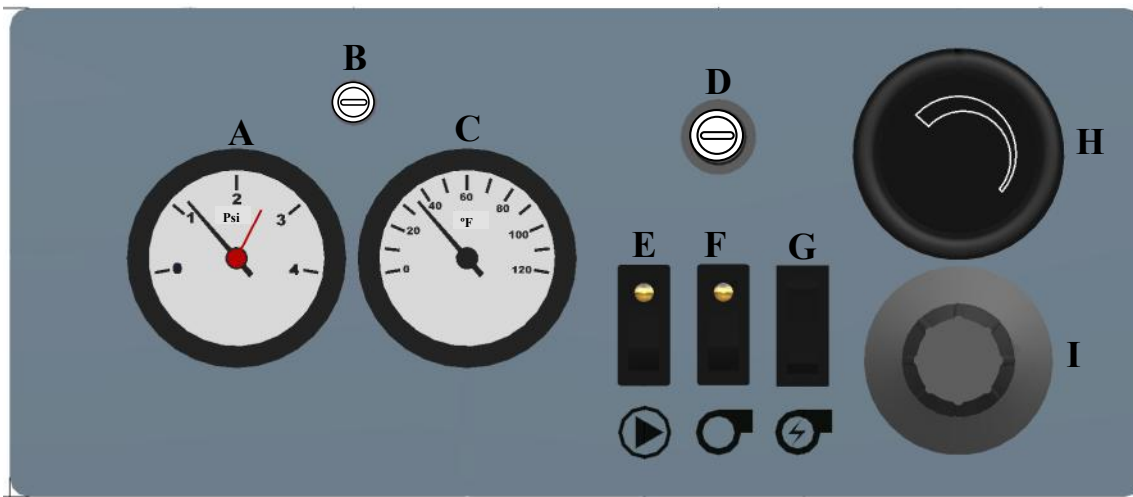


Fig. 4.1

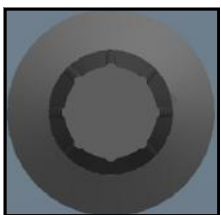
- (A) Boiler pressure gauge
- (B) Fuse, 6.3 Amp (behind the panel) blows if overloaded. Contact an electrician if the fuse blows frequently.
- (C) Boiler temperature gauge.
- (D) Overheat Thermostat 100 °C (212 °F)) manual reset after boiler drops below 75 °C (165 °F).
- (E) Boiler circulator pump switch (not used in North America).
- (F) Fan switch



(G) Reset Switch. The fan switches off automatically if the boiler has burned out and the boiler/flue gas temperature falls. If the temperature at the Lo-Limit Thermostat falls below 90 °C the reset switch **(G)** must be pressed to restart combustion in the boiler.



(H) Operating Thermostat 0-90 °C (0-195 °F) The recommended set-point temperature is 82-85 °C (180-185 °F)



(I) Lo-Limit Thermostat. The Lo-Limit Thermostat switches off the fan when the wood has burned out. It is set to 90 °C. Minor adjustments can be made to adjust how many coals are left after the burn cycle.

The Lo-Limit Thermostat Sensor location.



Fig. 4.3

The sensor should be inserted into the sensor well at a depth equal to the width of the cleanout opening.

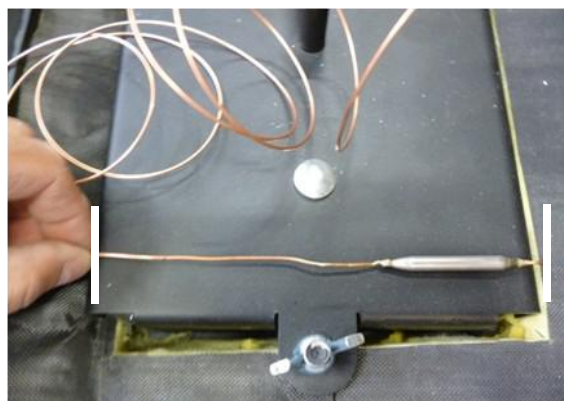


Fig. 4.4

The Lo-Limit thermostat (I) should only be adjusted by a qualified user only.

- The sensor is placed in the sensor well above the fan housing, inboard from the fan, located on the top of the boiler at the back left. The sensor measures flue gas temperature and should be set to the factory setting of 90 °C.
- When the flue gas temperature drops below this set-point at the end of a burn cycle, the combustion fan shuts off. This prevents the fan from continuing to run after the fire has burned out which would cool off the boiler and send heat up the chimney.

The Operating Temperature setting (H) should only be adjusted by a qualified user only.

- The standard operating temperature of the boiler should be at least 80 °C. The recommended default setting is 85 °C and can be monitored by the boiler thermometer (C). The boiler must be used with a thermostatic boiler protection device such as the Lk Armatur LK810 Loading Unit with the ability to supply a minimum return water temperature of at least 60 °C.
- The ideal scenario is when the boiler burns up the last of the fuel load and the fan shuts off just before the boiler and thermal storage tank(s) reach the boiler set-point temperature. If the boiler and thermal storage reach set-point temperature before the fuel load is completely consumed, the combustion fan will shut off and the boiler will go into a standby idle mode. This will cause unnecessary, and potentially damaging, creosote build-up in the boiler and is to be avoided.

When might an adjustment of these aquastats become necessary?

It may be desirable to lower the boiler aquastat setting to 80 °C (176 °F) if you experience tripping of the thermal fuse or if the pressure relief valve has let go.

It may be desirable to adjust the setting of the flue gas thermostat if the amount of embers left at the end of a burn cycle (after the induction fan has shut off) is not enough to easily ignite the next fire. Poor fuel quality and excessive chimney draft can also contribute to this problem. Some suggestions for changes you may want to make:

If, after the induction fan stops, there are no embers remaining in the firebox, set the flue gas thermostat to 110 °C (230 °F) – 120 °C. (248 °F).

If there are too many embers left in the firebox, covering the entire bottom of the firebox, try setting the flue gas thermostat to 85 °C (182 °F) or 80 °C (176 °F).

Safety thermostat (D)

This thermostat cuts the electricity supply to the combustion fan if the boiler temperature exceeds 100 °C (212 °F). If this happens, it is advised that you:

- 1) Wait for the boiler to cool down to 75 °C (167 °F) or lower.
- 2) Unscrew the cap (D), push the little button under the cap which resets the safety thermostat, screw the cap back on
- 3) Restart the boiler and use normally.

If this happens again, please have a service technician check the following:

- Check that the boiler has been used correctly
- Check that the boiler supply and distribution system are installed and operating correctly
- Check the function of the boiler temperature thermostat.
- Check the function of the safety thermostat.
- Check that the chimney draught is not too strong.

Closing the ash door

The ash door latch must be firmly secured against the screw, highlighted in orange below, when the boiler is in use to avoid the door opening inadvertently while the boiler is running.

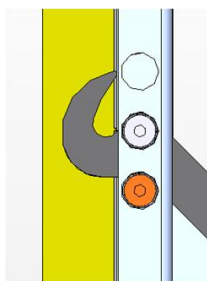


Fig. 4.5

Door Locked

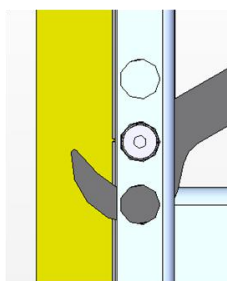


Fig. 4.6

Door Unlocked

A 4 MM Hex wrench is necessary to fit/unfit the screw (screw highlighted in orange at left)

4.2 Items to Check Before Using

NOTE

THE BOILER MUST BE FILLED WITH WATER. WATER MAY NOT BE ADDED TO THE BOILER WHILE IT IS RUNNING.

1. Check the heating system water pressure before using the system.
2. Ensure that the chimney connector pipe is connected to the chimney, properly sealed and screwed together, and that the chimney is free of obstructions.
3. Ensure that all circulators are connected and operational.
4. Turn on the main electrical service switch.
5. Open any valves that may have been closed temporarily during set-up.
6. The transport protectors for the ceramic bricks are made of wood and will quickly burn. Do not try to remove them. Assure that the tunnel stone is in the proper position.
7. Check the Operating Thermostat for proper setting. The stop on the underside of the knob should be on the left hand side of the stop screw. The knob should be resting against stop screw.
8. Confirm that the setting on the Honeywell **L4008B** (overheat aquastat) and L6006A Circulator aquastat) are set to 200 °F (94 °C).
9. Confirm correct settings for the primary and secondary air shutters. See instructions in Section 4.9.

4.3 Boiler Lighting/Starting Process

1. Switch on the power to the boiler and turn on the Fan Switch (**F**). The pump switch (**E**) is not used in North American and should be left in the off position. Make sure that the lower door is securely closed. Lay about 10 pieces of kindling (approx. 1" cross section and 18" long) in a random pattern on floor of the firebox. Crumple several sheets of newspaper and lay it on top of the kindling. Light the newspaper.
2. Immediately turn on the fan by pressing the reset switch (**G**). Leave the loading door open slightly. Air will be pulled through the boiler and the wood will ignite quickly. Remain at the boiler during this lighting stage.
3. The fire is well established once a small bed of embers has formed. With the fan on, slowly open the upper door with care: only an inch or two for the first couple of seconds. Then load 3 to 4 small splits, followed by the amount of wood required to recharge your thermal storage. Close the loading door.
4. During the initial firing of the boiler, or if fuel (wood) type is changed, both the primary and secondary air shutters must be adjusted. Once the boiler has reached a water temperature of at least 65°C, adjust the primary and secondary air shutters according to Section 4.9. Then, using the three figures shown on table, fine tune the secondary air setting while looking through the site glass in the lower (ash) door.

NOTE

THE FAN SHOULD ONLY SWITCH OFF FOR SHORT PERIODS OF TIME DURING A BURN-CYCLE. MAKE THE BEST POSSIBLE USE OF THE THERMAL STORAGE SYSTEM AND DO NOT ADD TOO MUCH WOOD.*

***Standby time and starting/stopping of the fan do not give clean combustion. Furthermore, condensation will occur in the filling chamber, causing corrosion in the steel walls. Excessive standby operation can also damage combustion aprons.**

4.4 Adding Wood to an Already Established Fire

It is very important not to add more wood than is needed to raise the thermal storage system to its temperature limit. The maximum heat storage vessel temperature should only be reached when all the wood in the firebox has burned.

1. If the fan is on go to step 3.
2. Press the start switch **(G)**. The fan should start.
3. Open the filling door slowly 1 inch (2 cm).
4. If thick smoke is seen, wait until it is purged by the fan (about 30 seconds).
5. Slowly open the door.
6. Add wood. Try to stack the wood as evenly as possible.
7. Close the door.

NOTE

If wood is stored in the boiler room, ensure that it is not stored within the clearances to combustibles or in a way that will impede daily firing or maintenance.

4.5 Daily Firing

The boiler should not be started nor should more wood be added until the thermal storage system is cool enough to absorb the heat produced by an additional firing. For most applications the tank should be able to rise 40 °F (20 °C) per load of wood. Depending on the load placed on the heating system, a single firing of wood during the non-heating season may produce enough energy to last from 3 to 6 days. During the heating months, most owners will find that loading each 12 or 24 hours with a fresh load of wood is adequate. **If loading within a 12 hour interval, it may be possible to re-kindle the fire by placing fresh wood in on top of red coals.** Kindling may not be necessary. It is good practice to clean out the “U” shaped tunnel stone, accessed through the ash door, before each firing. If black cinders are present, leave them between the U stone and door, they will be burned.

WARNING



It is important to keep the load and ash doors closed during operation. Maintain the door seals in good condition. Door gaskets will compress after a few weeks of use. It may be necessary to adjust the loading door and ash door via the adjustment screws found on the hinges. During the first year, this adjustment may have to be made several times. Thereafter, the adjustment should be checked once or twice per year. The silicone coated rope gaskets used assure a good seal. A non-coated gasket will harden and will need to be replaced more often.

4.6 Shutting Down the Boiler

Switch off the boiler by turning off the fan switch on the control panel. The circulating pump will shut off when the boiler is cool. Take care not to shut off power to the boiler circulator if there is any chance that the boiler may heat up again.

4.7 Operation with Thermal Storage System

Tarm Biomass requires that the Bonus Plus be permanently connected to a Thermal Storage System. The boiler will always be able to discharge its heat resulting in better combustion, less depositing of soot and tar, and longer boiler life. Operation is simplified as the filling chamber can be completely filled. The boiler can be fired when you have time and the house can be supplied with heat as required

from the thermal storage system. An added benefit is that domestic hot water can also be created in the reservoir. Keep in mind that the amount of wood placed in the boiler's filling chamber depends on the size and the temperature of the heat storage reservoir. The boiler should not be fired beyond the reservoir's heat storage capacity. Do not add wood until the temperature in the thermal storage system has fallen to 140-160 °F (60-72 °C), so that the reservoir will again be able to absorb heat.

4.8 Creosote

Tar deposits are not normally a problem in a Bonus Plus which is fired as directed. If soft or tar like creosote is found in the firebox it can be a symptom that the boiler is being filled with more wood than is necessary. Glazed, crunchy and scaly creosote in the main firebox is common and expected. Glazed, crunchy, or scaly creosote should never be found in the lower combustion chamber, heat exchange tubes, or in the chimney. When wood is burned slowly, it produces tar and organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire. The chimney and chimney connector should be inspected at least twice monthly during the heating season to determine if a creosote build-up has occurred. If creosote has accumulated it should be removed to reduce the risk of a chimney fire.

4.9 Adjusting Combustion

The Bonus Plus features adjustable and secondary air controls for optimal burning. The controls are located on the front of the boiler between the loading and ash doors. The primary control is the upper control **(A)** and the secondary air control is the lower control **(B)**. An observation glass is located in the center of the ash door. The flame should be yellow and pale bluish, and the flame length should be as pictured below with flame just starting to pour out the front of the "U" or tunnel stone. **Do not open the lower door while actively burning!** It is normally only necessary to adjust the settings if the fuel is changed (for instance if moisture content or wood species vary dramatically). If full output is required, both air controls can be opened 100%.

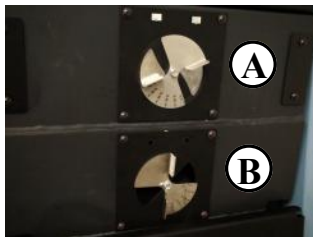
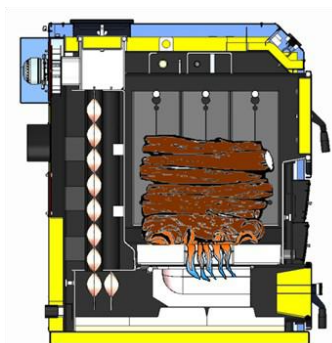
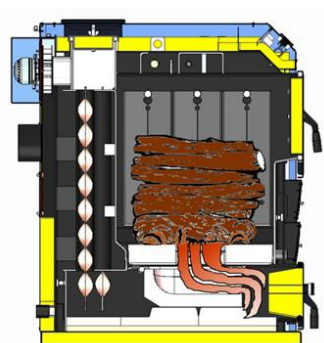


Fig. 4.7

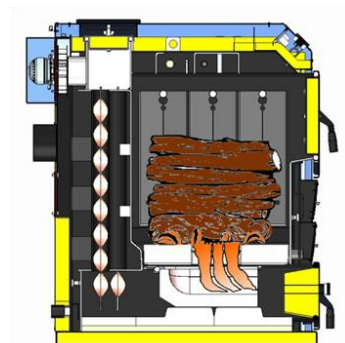
Manual Air setting-Standard Values		
Tree Type	Primary Air	Secondary Air
Hardwood	50%	50%
Softwood	75%	25%



Too much secondary air. The flame is too short and blue-tinged: reduce the secondary air.



Not enough secondary air. The flame is too long and orange / reddish: increase the secondary air.



Good setting. The flame reaches the edge of the tunnel stone and is yellow and light blue-tinged.

4.10 Cleaning and Maintenance

4.10.1 Removing Ash

WARNING



Before performing any cleaning or maintenance on the boiler, allow boiler to completely burn through all fuel and to normally cool down and shut off. Turn off power to the boiler before performing any cleaning or maintenance.

Regular maintenance (cleaning) of the boiler is the responsibility of the owner. An annual inspection by a heating professional is required.

A metal brush with a bent handle and an ash pan are supplied with the boiler. **The ash pan is to be placed on the floor in front of the ash door. The edge of the ash pan fits just under the lower lip of the ash door opening as shown in photo.**

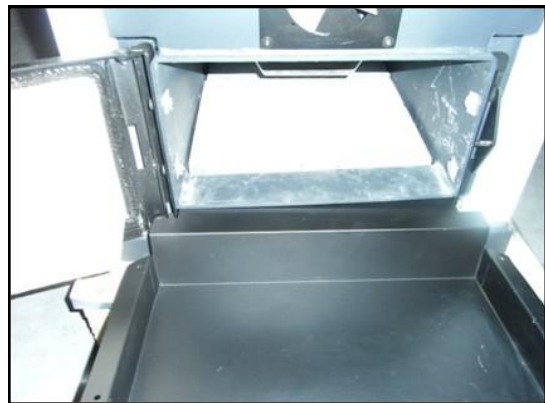


Fig. 4.8

WARNING



Ashes removed from the boiler should be placed in a metal container with a tightly 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 the closed container until all cinders have thoroughly cooled. Other waste should not be placed in this container.

Ash Removal from the Tunnel Stone

Ash removal from the secondary combustion tunnel must be done regularly (daily in winter). The tunnel must not be obstructed by ash so that the secondary combustion can take place normally and the tunnel stone does not over heat. Neglected maintenance can result in irreparable damage and a premature wear of the tunnel.

It is not necessary to remove the tunnel stone for cleaning .



Fig. 4.9

Ash removal from behind the tunnel stone

Removing ash from behind the tunnel must be done regularly. Ash depth should not be allowed to exceed 2".



Fig. 4.10

Ash removal from the upper firebox and checking of the primary air outlets

Ash removal from the upper firebox should be done when the ash bed reaches 2". Ashes may also be removed sooner. Be sure not to let ashes accumulate in the corners of the firebox. The quantity of ash produced depends on the type of wood used, its age and its general quality. It is necessary 2 – 3 times per year to remove the firebox aprons and clean behind them. This involves removing any accumulated creosote and ash from the firebox walls and primary air outlets. Neglected maintenance will result in premature wear of the ceramic pieces, irreparable deformation of the firebox aprons and excessive clogging of air passages.

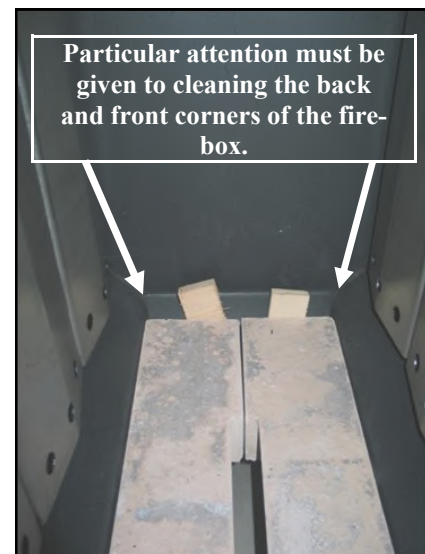


Fig. 4.11

Cleaning the heat exchange tubes

The vertical tubes at the back of the boiler are the primary means of capturing heat from the burning process. Being the last passage in the boiler that the hot exhaust gasses pass through, they will accumulate some ash and soot over time and must be brushed regularly. While the frequency of cleaning may be more often, the tubes should be brushed at least monthly. Remove the access cover on top of the boiler. Pull out and brush the turbulators. Run the round wire brush up and down the tubes repeatedly. Replace the turbulators and access cover taking care that it is properly seated and centered.



Fig. 4.12

NOTE

Poor quality fuel may cause tar deposits on the heat exchange tubes. This may make removing the turbulators difficult and may require more frequent heat exchanger cleaning.

NOTE

Clean heat exchanger tubes and smoke box mean better heat transfer from the flue gas to the water and thus better operating economy.

NOTE

Elevated flue gas temperatures above 500 °F (260 °C) may indicate the need to brush the heat exchange tubes.

WARNING

Solid-fuel burning appliances need to be cleaned frequently because soot, creosote and ash may accumulate. If there is a soot or creosote fire, please do the following:

- Establish a routine for the storage of fuel, care of the appliance, and firing techniques.
- Check daily for creosote buildup until experience shows how often cleaning is necessary.
- Be aware that the hotter the fire, the less creosote is deposited, and that weekly cleanings may be necessary in mild weather, even though monthly cleanings may be enough in the coldest months.

4.10.2 Cleaning the Induction Fan

WARNING



Before accessing the fan shut off the power supply to the boiler.

For inspection and cleaning, remove the induced draft fan on the back of the boiler. Check for build-up and damage 2-3 times per year. Clean the draft fan wheel inside and out using a stiff brush. Remove ash deposits from the induced draft fan housing using a putty knife, and vacuum loosened material from the housing and draft fan. Check the silicone gasket for condition and replace if necessary.

When the chimney connector is connected vertically directly under the chimney, the fan must always be removed and cleaned after each cleaning of the chimney.

1. Shut off the power supply to the boiler.
2. Remove the fan housing.
3. Remove the wing-nuts holding the fan in place and remove the fan.
4. Clean the fan blades, fan housing, and the flue gas sensor well (pipe). See pictures on following page.

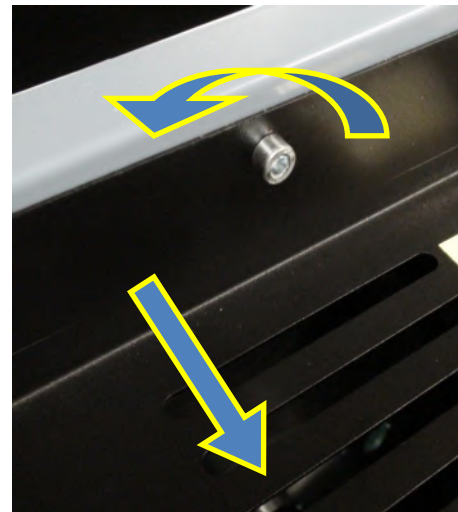


Fig. 4.13

NOTE

Please inspect the draft fan carefully – even a thin coating of ash significantly reduces the air flow and must be removed.

NOTE

If the fan motor is blocked because of lack of cleaning, the motor can be damaged.

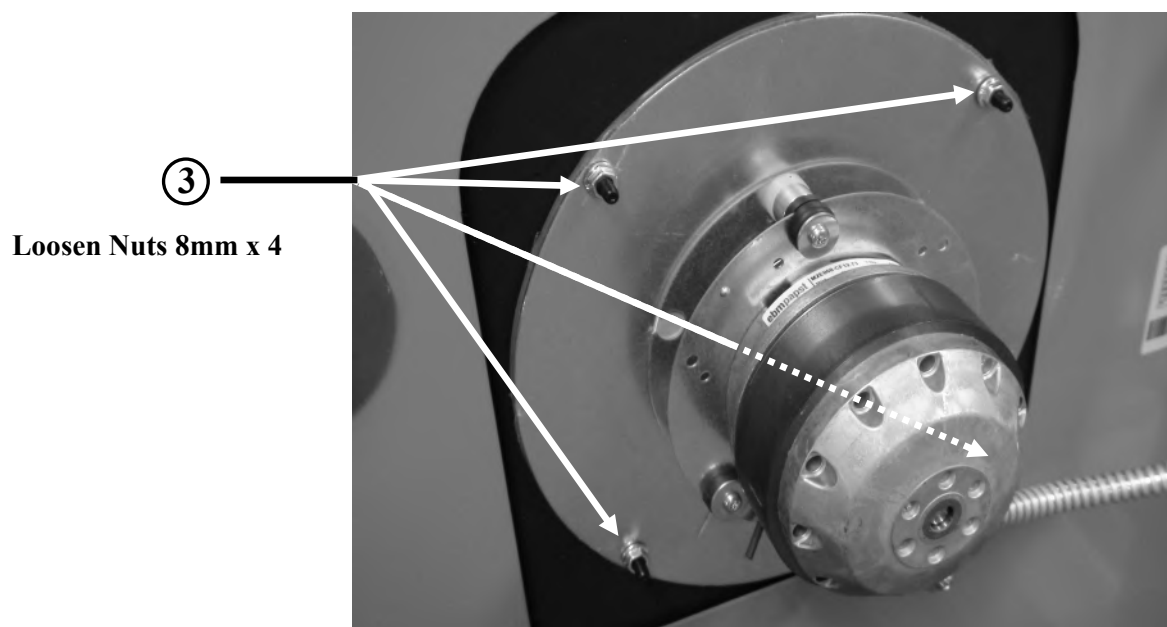


Fig. 4.14

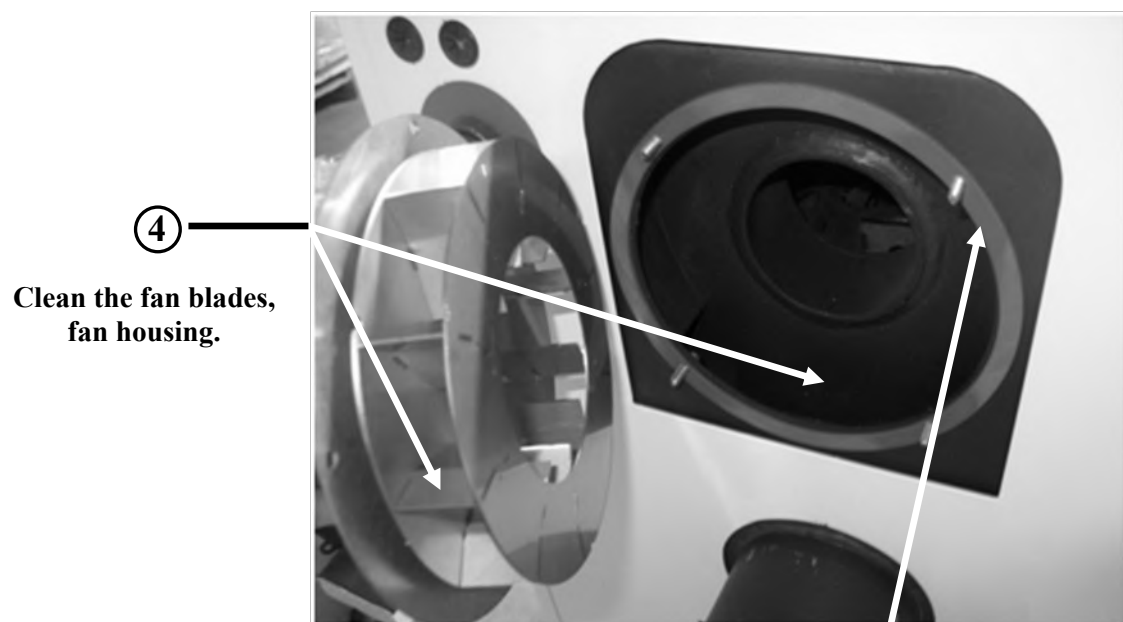


Fig. 4.15

Clean the flue gas sensor well (pipe)
located in the fan housing.

4.10.3 Maintaining Door Seals

Check the loading door and ash door gaskets regularly to insure that they are sealing well and that there is no unwanted air leakage into the boiler. Poor seals can result in air leakage into the boiler and lead to inefficient burning of the boiler or the escape of smoke and gasses from the boiler.

Check the seal for alignment on the door frame by examining the imprint made by the frame on the seal.

Steps to Replace the Door Seals:

1. Remove the two door hinge bolts that and take off the door.
2. Remove the old sealing with a screwdriver or a chisel.
3. Clean the sealing groove.
4. Press new sealing into the groove. When half the sealing has been inserted, adjust the end and press in the rest.
5. Secure the sealing by gently tapping with a hammer.
6. Replace the door.
7. Close the door and check its seal.

4.10.4 Cleaning the Primary and Secondary Air Channels

The primary air channels (on both sides of the boiler) can occasionally become blocked reducing the primary air flow to the firebox.

Checking the Primary Air Openings:

1. Open the firebox door.
2. Lift and remove the firebox aprons (**Fig.4.10**).
3. Check the primary air ventilation holes (**Fig.4.11**) for unobstructed airflow.
4. If necessary, clean the openings and air channels.

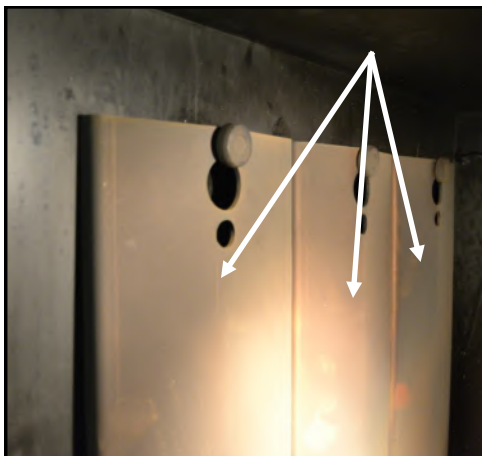


Fig. 4.10 Firebox Aprons

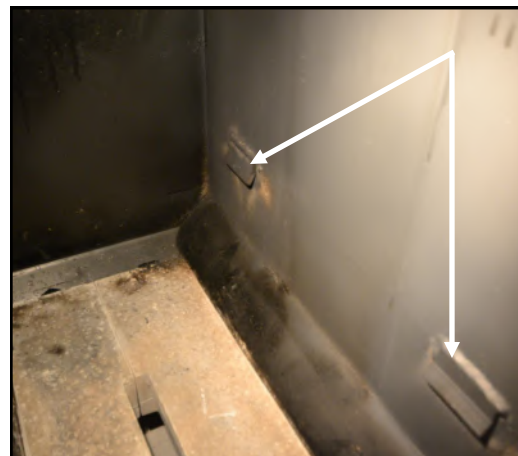


Fig. 4.11 Primary Air Ventilation Holes

How to Clean the Primary Air Channels :

1. Remove Primary Air cover plates (A) (Fig. 4.12). (The right plate has already been removed).
2. Brush and vacuum channel if needed.

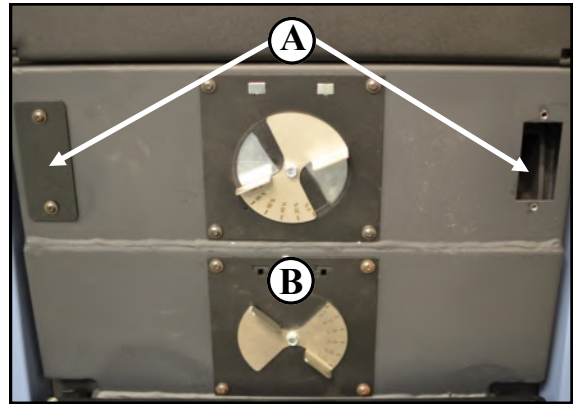


Fig. 4.12

How to Clean the Secondary Air Channels:

1. Remove bottom square plate (B) (Fig. 4.12).
2. Inspect and clean air holes (C) (Fig. 4.13).

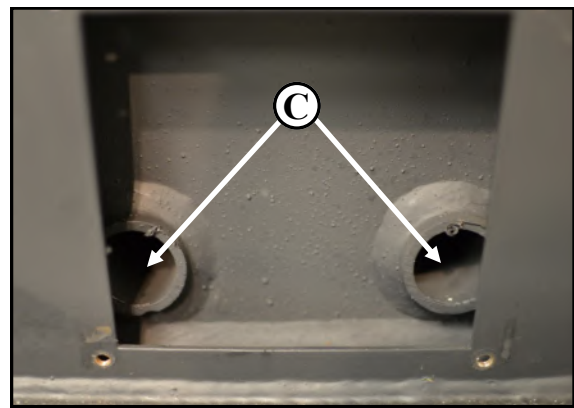


Fig. 4.13

Wear and tear of the refractory, firebox aprons and related gaskets

The refractory material (insert stone and tunnel stone), the firebox aprons and the associated gaskets are wear items and should be expected to be replaced periodically. How long these parts will last depends on how much the boiler is used, how much wood is burned, the type and quality of the wood burned, and how well the boiler is maintained. **Wear is perfectly normal and these pieces/items must be replaced only when they are not fulfilling their functions.**

Minor cracks and crumbling will not normally require replacing the refractory insert or tunnel stone as long as they are still functioning properly. This kind of wear is perfectly normal, is to be expected and is no reason for concern.

The removable firebox aprons are also subject to high temperatures and can become damaged or deformed over time. To minimize this damage and extend the life of the aprons, avoid long exposure to deep ember beds. Ideally the boiler should not be re-fuelled until only a small ember bed remains in the boiler or the fire has burned out.

NOTE

It is imperative that the user regularly check the boiler, boiler gauges and heating system for correct function. It is also essential to ensure that there are no leaks from the boiler, the supply and return lines, the pressure relief valve, the boiler drain, etc. All leaks must be addressed immediately. An damage caused by external leaks is not covered by the factory warranty.

NOTE

When loading the boiler with wood never “throw” the logs into the firebox. Place them gently into the boiler to avoid damaging the refractory.

NOTE

Extended operation of the boiler in idle mode will cause premature wear of the firebox aprons and refractory components. See instructions for correct boiler operation.

NOTE

The boiler must not be installed in a damp or humid environment.

4.10.5 Smoke Pipe Inspection and Cleaning

The chimney and the chimney connector must be inspected and cleaned annually. Annually disassemble the stove pipe and clean ash accumulation and inspect for corrosion. If any pipe is substantially corroded, this section must be replaced. Cleaning the connecting pipe between the boiler and the chimney is very important for horizontal smoke pipes!

NOTE

Chimney inspection and maintenance is a critical part of any wood-burning maintenance schedule. Make sure that the chimney connection is secure and airtight. The chimney connector and chimney should be inspected at least twice monthly during the heating season to determine if creosote buildup has occurred.

If creosote has accumulated it should be removed to reduce the risk of chimney fire.

4.10.6 Chimney Fires

Chimney fires are caused when excessive buildup of creosote in the chimney connector pipe or the chimney is ignited by a racing fire, or when a burning piece of material is swept out of the firebox into the chimney. If you have a chimney fire, you will hear a roaring sound in your chimney, almost like a jet airplane. In addition, sparks may be seen flying from the chimney outside the house. Chimney fires can set fire to the interior of your house or roof. They are potentially very dangerous, and the following procedure should be followed if you think you have a chimney fire:

1. Call the fire department.
2. Shut all doors and close all air inlets on your boiler.
3. Evacuate your house.
4. If possible, wet your entire roof with a garden hose.

Chimney fires can be avoided by following the recommendations in this manual for minimizing ash formation, by maintaining your chimney in good condition, and by cleaning your chimney regularly.

A chimney fire should never happen with a Bonus Plus boiler.

4.10.7 Checking the Barometric Damper

Annually check the barometric damper flap for ease of operation. The barometric damper flap should operate freely and maintain a chimney draft between -0.04 to -0.06 inches water column.

4.10.8 Cleaning the Jacket

Soot on the jacket and the doors can be removed with a cleaner containing ammonium chloride and acetic acid. Clean the jacket regularly as required to preserve the boiler's appearance.

4.10.9 Check for Creosote Build-up

Check for creosote buildup in the heat exchange tubes, the smoke pipe and the chimney twice a month. If during cleaning and maintenance a buildup of creosote is noted anywhere besides the fire-box, something is wrong with the boiler operation. Check the seal of the door gaskets, the load door to the smoke duct and the smoke box cover.

WARNING



Creosote-Formation and Need for Removal-When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow burning fire. As a result, creosote residue accumulates on the flue lining. When ignited this creosote makes an extremely hot fire.

4.10.10 Seasonal Shutdown Procedure

If the boiler is not being used during the summer season, it is important that the boiler be properly cleaned. The upper and lower combustion chambers, heat exchanger tubes and upper smoke baffle should all be cleaned. After the boiler is cleaned, keep all doors and air dampers closed. Remove the flue pipe and stuff insulation into the flue collar. If you notice condensation forming on the inside of boiler, hang a 15-25 watt light bulb inside boiler.

4.10.11 Checking the Pressure Relief Valve

The pressure relief valve protects the system from dangerously high pressure by opening at a preset pressure rating to allow fluid to be safely released. The pressure relief valve should be seated properly and not drip system water. The pressure relief valve should be inspected and maintained according to the manufactures recommendations.

4.10.12 Checking System Pressure

The system expansion tank in a closed system allows for the thermal expansion of the fluid in the heating system. See the expansion tank's operating instructions for maintenance requirements.

4.10.13 Heat Storage System Maintenance

As described above, the Bonus Plus boiler needs to be installed with a thermal storage system or other heat storage system. Please follow the recommended maintenance schedule for these parts of the heating system. Specific maintenance items for the heat buffer will be specified by the system manufacturer, but items may include checking any safety valves, anode in any connected hot water reservoir, or system water level and system PH in static water storage systems.

4.11 Power Outages

The boiler will not operate in the event of a power failure. Do not open the loading or ash doors until power is reestablished. The fan needs to be able to operate to remove combustible gasses. It is good practice to close the primary and secondary air dampers (move the dials counter-clockwise to first position). Remember to open the dampers before the next firing.

5.0 Troubleshooting

5.1 Troubleshooting Guide

Bonus Plus Troubleshooting Guide		
PROBLEM	ROOT CAUSE	Solution
No Heat in the System	Thermostat (H) set too low	Set Thermostat higher
	Fan cut out because the min. thermostat temperature has fallen below 90 °C (194 °F).	Press Reset Switch (G)
	Overheat thermostat triggered	Reset thermostat
	Termovar (Mixing Valve) is closed or defective	Check valve for proper operation Check balancing valve for proper position which is half open
	Circulator pump is not running	Switch on or replace pump
	Insufficient water in the system	Add water to the system Note: Never add water to an overheated boiler. Wait until the boiler has cooled down
	Air in the system	Bleed air from system
	Fuse (D) is blown	Replace fuse in boiler control
Combustion will not stop	Excessive chimney draft	Have a serviceman install a draft regulator
Loss of pressure in the system		Bleed the system and add water
The fan does not switch off when the fire burns out	If the boiler is operated from cold, the flue gas temperature must reach normal operating temperature (above 90 °C (194 °F)) to switch over the min. thermostat. If normal operating temperature is not reached, the fan will not switch off but continue to run, even though the wood has burned out and the min. thermostat temperature has fallen below 90 °C (194 °F).	Ensure that the boiler is brought to normal operating temperature (about 85-90 °C (185-194 °F)) each time it is used.
Boiler temperature doesn't increase or increases slowly	Incorrect air settings	Check the air settings (adjust the primary air shutter as necessary).
	Dirty heat exchange tubes	Confirm that the heat exchanger tubes, the upper firebox and the combustion tunnel are clean (see Section 4.10 Cleaning and Maintenance).
	Blocked primary air	Confirm that the primary air injection ports are clear and flowing freely.
	Leaking door gaskets	Confirm that the ash door gaskets are in good condition and the door is sealing properly. A leaking ash door seal will reduce primary and secondary air flow and result in poor performance and reduced output.
	Draft fan	Check the condition of the draft induction fan blades (see Section 4.10.2 Cleaning the Induction Fan).
	Improper flue gas temperature	Check the temperature of the flue gas; it must be in the range of 150° C to 200° C. If it is too low, the wood is probably not suitable. Try with a different type of wood or different lot.
	The fuel	Test the moisture content of the wood with a moisture meter.

PROBLEM	ROOT CAUSE	Solution
Boiler stops before the fuel load is consumed and the storage tank is not yet fully charged.	Flue gas thermostat	The flue gas thermostat is not in place, incorrect temperature (default 90° C) or it is defective.
	The fuel	The wood may be too long, too wet, or poorly positioned in the upper firebox. If the wood hangs up and does not settle, the bottom of the fuel load burns out and the fire goes out or is greatly reduced to the point where the flue gas temperature drops below the cut-off setting (I) and the boiler shuts down. If the fuel is too wet, combustion temperatures will be very low and boiler output reduced.
	Too much ash in upper firebox	Combustion can be stifled by an accumulation of too much ash in the upper firebox. Too much ash can restrict combustion air flow which will result in reduced heat output to the point where stack temperature drops too low and the boiler shuts down.
Nothing happens when you push the switches	No power	Check the power supply to the boiler. Make sure the boiler is not too hot. If the boiler exceeds 100° C, the safety thermal fuse will trip and the boiler will not operate until the boiler temperature has dropped well below boiler set-point temperature and the thermal fuse has been reset. Check the electrical fuse panel.

6.0 Data and Drawings

6.1 Measurement Data

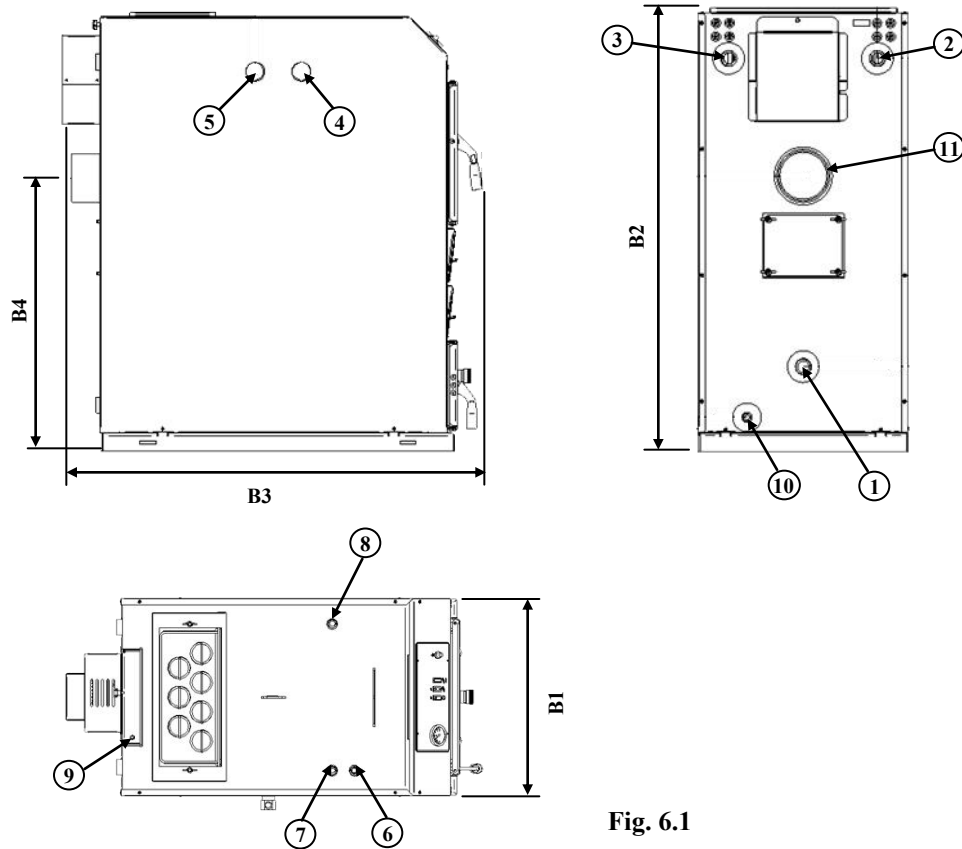


Fig. 6.1

Description	Units	30
1. Return Connection	inches	1
2. Supply Connection	inches	1
3. Overheat/Pressure Relief Connection	inches	1
4. Side Connection (Both Sides)	inches	½
5. Side Connection (Both Sides)	inches	1
6. Pressure Gauge Sensor Well	inches	½
7. Boiler Temperature Sensor Well	inches	½
8. Overheat Aquastat Sensor Well	inches	½
9. Flue Gas Temperature Sensor Well	inches	¼
10 Drain/Fill Connection	inches	½
11 Flue Pipe, External Diameter	inches	5
B1 Measurement	inches	21¼
B2 Measurement	inches	45
B3 Measurement	inches	43
B4 Measurement	inches	28

6.2 Positioning Data

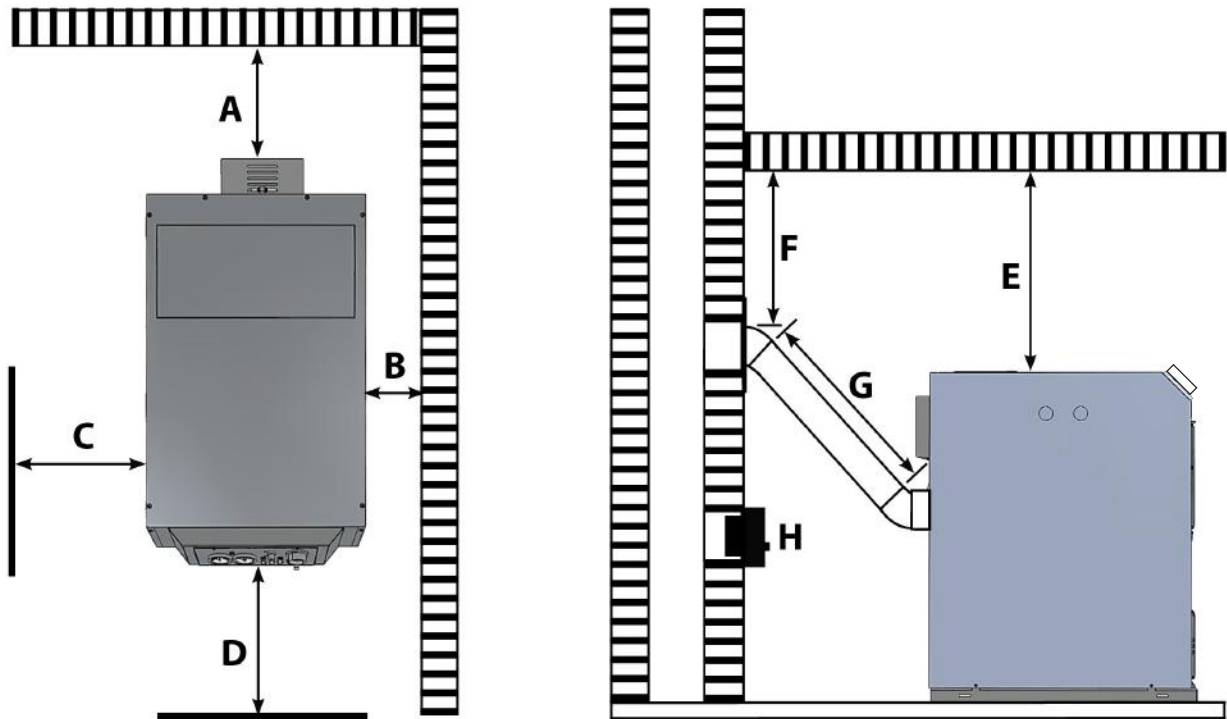


Fig. 6.2

Clearances to Combustibles		
Measurement	Units	Bonus Plus 30
A-Minimum Clearance for Blower Maintenance	inches	21
B-Minimum Clearance to Combustibles	inches	12
C-Minimum Distance for Cleaning and Maintenance Tasks	inches	21
D-Minimum Clearance to Combustibles	inches	36
E-Minimum Clearance to Combustibles	inches	24
F-Minimum Distance for Combustibles to Pipe	inches	18
G-Maximum Distance for Flue Pipe	feet	0-4
H-Ideal Location for Draft Regulator (Barometric Damper)	-	-

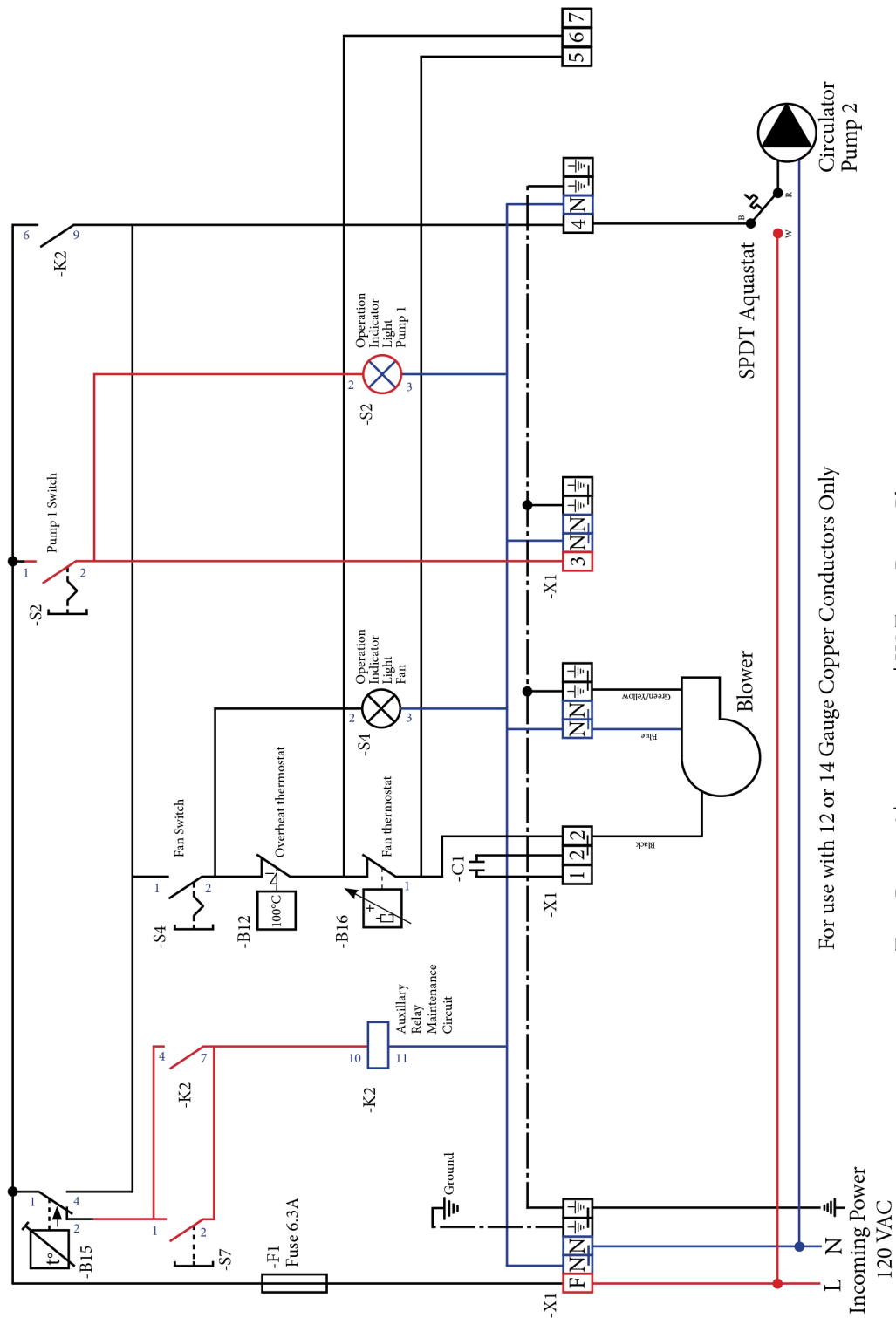
6.3 Specification Data

Technical Data	Units	30
MEASUREMENTS		
Depth- Boiler -Total	inches	43
Width- Boiler -Total	inches	23
Height to Chimney Connection	inches	28
Flue Collar Outside Diameter	inches	5*
Weight- Empty	lbs	825
Water Contents	gals	31.7
Loading Door	inches	13¾ X 12
Combustion Chamber Depth	inches	21¼"
Combustion Chamber Volume	gals	23.7
	cubic ft.	3.2
Recommended Wood Length	inches	18-20
Wood Diameter (Max)-Softwood	inches	4
Wood Diameter (Max)-Hardwood	inches	6
OPERATING DATA		
Operating Temperature-Water	F°	180-190
Nominal Output	Btu/Hr	102,000
Flue Gas Temperature at Nominal Output	F°	363
Required Draft	inch WC	-.025" to -.05"
Safety Listings	-	UL 2523-2009
ELECTRICAL DATA		
Boiler Power Requirement	-	120V-60Hz/15A
Electrical Consumption	W	70
PIPING DATA		
Boiler Test Pressure	psi	65
Boiler Relief Valve Setting	psi	30
Supply & Return Pipe Stub Size (male NPT)	inches	1
Minimum Boiler Loop size	inches	1¼
Fill/Drain Valve Size	inches	½"
Mixing Valve Opening Setting	F°	140
Internal Overheat Aquastat Setting	F°	212

Fig. 6.2 *6" with flue collar adaptor. Specifications subject to change.

6.4 Electrical Diagrams

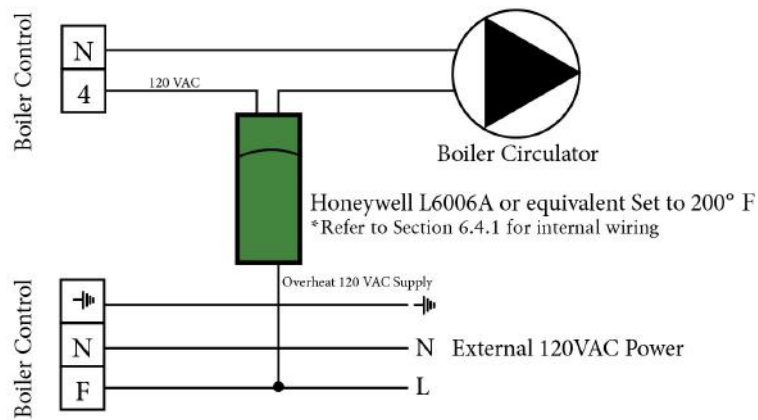
6.4.1 Wiring Diagram A (Boiler Circuit Ladder Diagram)



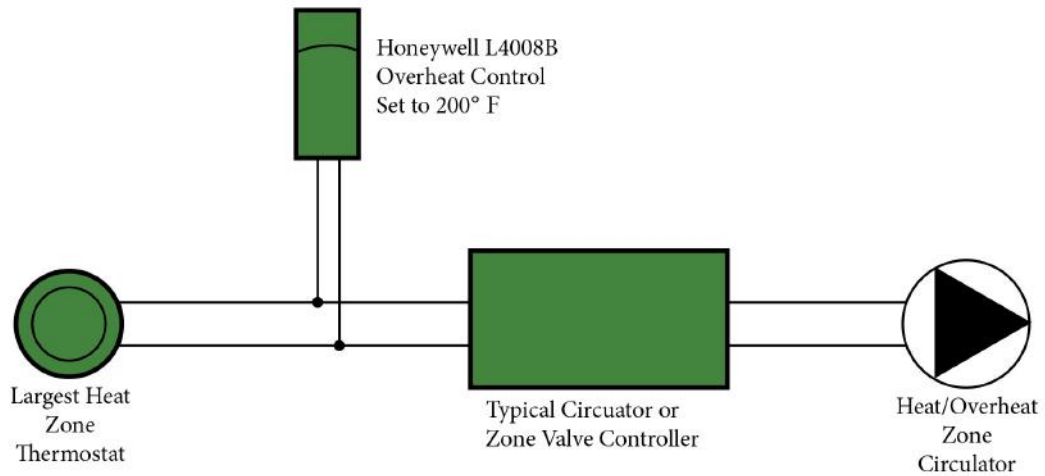
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6.4.2 Circulator and Overheat Aquastat Wiring Connections

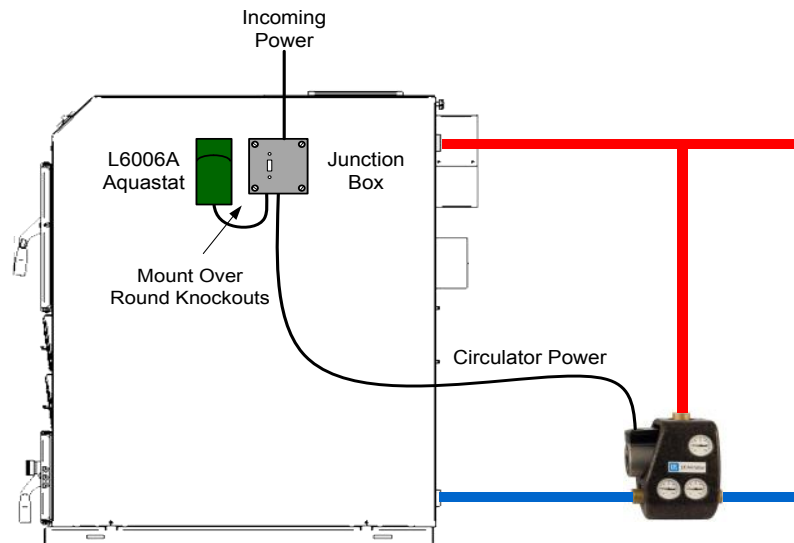
C-3 Circulator Connections



Overheat Aquastat Connections



Suggested Wiring Layout



7.0 Warranty Information

7.1 HS-Tarm Bonus Plus Wood Boiler Warranty

LIMITED WARRANTY - FOR USE ONLY IN UNITED STATES

Tarm Biomass warrants the steel boiler identified below and its component hot water tank or coil and cast iron doors and ceramic refractory against defects in material and workmanship under normal use and service ***TO THE ORIGINAL PURCHASER AT THE ORIGINAL INSTALLATION SITE*** in the United States under the following terms.

WARRANTY IS VOID if the boiler is installed without adequate thermal storage.

BOILER BODY -- LIMITED 20 YEAR WARRANTY: Subject to the below limitations, Tarm Biomass warrants the steel boiler body (not including cast iron doors, coil, or other components) against defects in materials or workmanship causing breaks or leaks that significantly impair the boiler's performance. During the first five years of the warranty period Tarm Biomass will pay for all required labor at the usual and customary rate paid by Tarm Biomass for similar labor performed in Lyme, NH, and provide or pay the cost of all materials for the repair of the warranted unit. In years six through twenty Tarm Biomass will pay the below stated percentage multiplied times the retail price of the warranted unit on the date of purchase to the original purchaser toward of the cost of repair of the warranted item or, if Tarm Biomass and the original purchaser agree, use the resultant sum as a partial allowance toward Tarm Biomass's replacement of the warranted item. The original purchaser shall be responsible for all shipping and installation charges in connection with any replacement or repair.

<u>Warranty Year (beginning from date of purchase)</u>	<u>Percentage Tarm Biomass will pay</u>
1-5	100%
6	60%
7	50%
8	40%
9	30%
10-20	20%

Example 1: Repair costing \$250.00 in year 7, Tarm Biomass will pay \$125.00 (50% of this repair).

Example 2: Boiler (original retail \$4,000.00) needs major repair in year 9. Tarm Biomass will pay \$1,200 (30% of \$4,000) toward replacement with similar warranted unit or up to 30% of the repair cost (\$1,200 maximum).

OTHER COMPONENTS -- LIMITED THREE YEAR WARRANTY

Subject to the application of the following percentages to parts and/or labor, Tarm Biomass provides the following limited warranty on its firebox cladding plates, doors, ceramic refractory and turbulators against defects in material and workmanship causing breaks or leaks that significantly impair the boiler's performance.

<u>Warranty Year (beginning from date of purchase)</u>	<u>Percentage Tarm Biomass will pay</u>
1	100% of parts and labor
2	100% of parts ONLY
3	50% of parts ONLY

OTHER COMPONENTS -- ONE YEAR WARRANTY

Motors, electronic controls and other electrical components have a one year warranty.

Rev. October 2014

TARM BIOMASS' LIMITED EXPRESS WARRANTY IS ONLY EXTENDED TO AND COVERS THE TARM USA PRODUCT'S END USER WHO OWNS THE BUILDING IN WHICH THE TARM USA PRODUCT IS INSTALLED, AND COVERS ONLY REPAIRS OR REPLACEMENTS RESULTING FROM DEFECTS IN MATERIALS AND WORKMANSHIP. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION IN THIS LIMITED WARRANTY, AND Tarm Biomass' LIMITED WARRANTY IS IN LIEU OF AND TO THE EXCEPTION OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, WARRANTIES OF MERCHANTABILITY OR WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. EXCEPT AS OTHERWISE PROVIDED BY THIS LIMITED WARRANTY, TARM BIOMASS TAKES NO RESPONSIBILITY FOR THE QUALITY OF Tarm Biomass PRODUCTS OR THAT THE GOODS WILL BE FIT FOR ANY PARTICULAR PURPOSE FOR WHICH YOU MAY BE BUYING THESE GOODS. UNDER NO CIRCUMSTANCES SHALL TARM USA BE SUBJECT TO INCIDENTAL, CONSEQUENTIAL, INDIRECT, SPECIAL, PUNITIVE, ENHANCED COMPENSATORY, OR CONTINGENT DAMAGES, WHETHER A CLAIM IS BASED ON CONTRACT, TORT, STRICT LIABILITY, OR ANY OTHER THEORY OF LAW, ALL SUCH DAMAGES AND CLAIMS BEING SPECIFICALLY DISCLAIMED.

Tarm Biomass' limited warranty is void if a Tarm Biomass product is installed by someone other than a qualified contractor whose principal occupation is the sale or installation of plumbing and heating equipment, or if the original purchaser fails to have the boiler serviced or inspected at least once every two years by an experienced and qualified service person. Repairs or replacements under this limited warranty must be performed by your dealer or someone authorized by him. You may be required to present this limited warranty to the dealer before any work is performed. You must pay for any work performed that is not covered by this limited warranty or that is not authorized by the dealer. Tarm Biomass' limited warranty shall be construed under the laws of New Hampshire. Any dispute arising out of this warranty shall be tried only in a court in the State of New Hampshire, including the United States District Court for the State of New Hampshire. If any legal action is brought in connection with this limited warranty, the prevailing party shall be entitled to recover all reasonable expenses it incurs in the action, including its reasonable attorneys' fees, from the nonprevailing party.

TARM USA'S LIMITED WARRANTY EXPRESSLY EXCLUDES COVERAGE FOR THE FOLLOWING:

1. Ordinary wear and tear and repairs or replacements necessitated by normal use.
2. Repairs or replacements arising from corrosion including, but not limited to, the effects of a corrosive water supply or corrosive by-products of combustion formed when a boiler is run during warm weather temperatures or under other conditions that do not permit the boiler to reach necessary operating temperatures on a frequent basis as described in the Owner's Manual provided by Tarm Biomass.
3. Repairs or replacements of fittings, motors, fuel units, oil and gas burners, any and all controls, relief or regulating valves, transformers, and accessories.
4. Repairs or replacements to repair damage caused by (i) operation with inadequate draft, (ii) having installed a boiler model that is incorrectly sized for the application (too few or too many BTU's under normal operating conditions) or that is otherwise inappropriate for the application, (iii) excessive boiler internal temperature from burning improper materials as fuel or operating the boiler without appropriate draft control (for example, burning the boiler too hot when the boiler is coming up to temperature from a cold start), or (iv) any similar use that violates or is not recommended in the Owner's Manual provided by Tarm Biomass.
5. The repair or replacement of any component furnished by any other manufacturer or damage caused by the functioning or malfunctioning of any such component.

This warranty gives you specific legal rights. You may also have other rights that vary from state to state. This warranty shall not be construed as inconsistent with any federal, state, or municipal law, regulation, or code that was applicable to the original installation site on the date the Tarm Biomass product was installed.

Questions regarding this warranty may be referred to:

Tarm Biomass, 19 Archertown Rd, Box 322, Orford, NH 03777 U.S.A. (603) 795-9100

KEEP THIS INFORMATION FOR YOUR RECORDS:

Model: _____ **Place of Purchase:** _____

Serial No.: _____ **Installation Date:** _____ **Installer** _____

8.0 Installation Report for Boiler System

Installation Performed by: _____

Bonus Plus Model / Serial No. _____ / _____

Boiler System Installed and Adjusted: _____
Date

Warranty Certificate Filled and Sent: _____
Date

Measured and Adjusted Values

	Date	Date	Date	Date
Fuel Type				
Fuel Moisture Content				
Secondary Air Setting				
Primary Air Setting				
Pump Speed (C-3)				
Other Data/Adjustments				
Setting Done By: Signature				

Appendix A-Temperature Conversion

Temperature Conversion Table

°C	°F		°C	°F		°C	°F		°C	°F
40	104		80	176		135	275		220	428
45	113		82	179.6		140	284		225	437
50	122		84	183.2		145	293		230	446
52	125.6		86	186.8		150	302		235	455
54	129.2		88	190.4		155	311		240	464
56	132.8		90	194		160	320		245	473
58	136.4		92	197.6		165	329		250	482
60	140		94	201.2		170	338		255	491
62	143.6		96	204.8		175	347		260	500
64	147.2		98	208.4		180	356		265	509
66	150.8		100	212		185	365		270	518
68	154.4		105	221		190	274		275	527
70	158		110	230		195	383		280	537
72	161.6		115	239		200	392		285	545
74	165.2		120	248		205	401		290	554
76	168.8		125	257		210	410		295	563
78	172.4		130	266		215	419		300	572

Appendix B - Contact Information

Manufacturer

HS Tarm A/S
Smedevej 2
Tarm
Denmark
PHONE +45 9737 1511
E-MAIL info@hstarm.dk

www.hstarm.dk

Importer



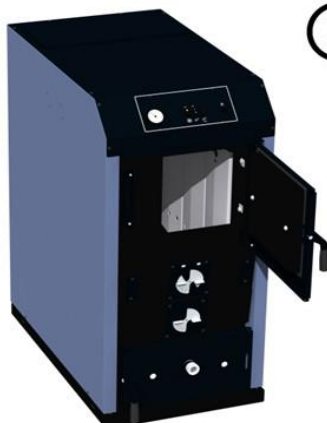



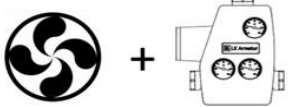



Tarm Biomass
19 Archertown Rd
Orford, NH 03777

PHONE 800 782 9927
E-MAIL info@woodboilers.com

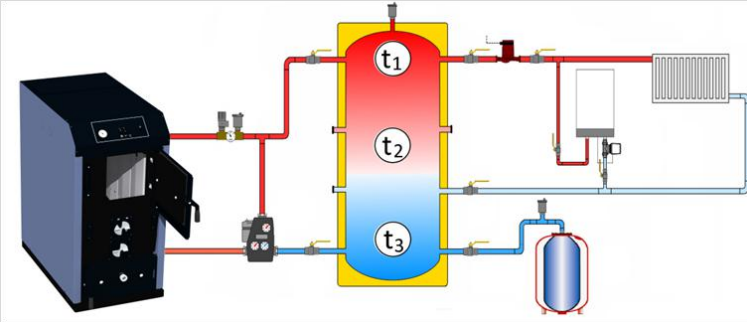
www.woodboilers.com

Local Dealer

Appendix C - Quick Start Guide

<p>①</p>  <p>Cover the bottom with kindling. < 10 % moisture</p>	<p>②</p>  <p>Add crumpled newspaper.</p>	<p>③</p>  <p>Add some more kindling.</p>
<p>④</p>  <p>Ignite the paper...</p>	<p>⑤</p>  <p>Upper door partly open...</p>	<p>⑥</p>  <p>Middle button II Press START</p>  <p>running</p>
<p>⑦</p>  <p>Leave upper door cracked. Wait for kindling to catch fire completely.</p>	<p>⑧</p>  <p>How much fuel? See next page.</p>	<p>⑨</p>  <p>Adjust air supply. See next page.</p>

Correct amount of wood logs



The wood log:

18" long logs, which are 4"-6" in diameter.

The logs shall have a moisture content < 20 %

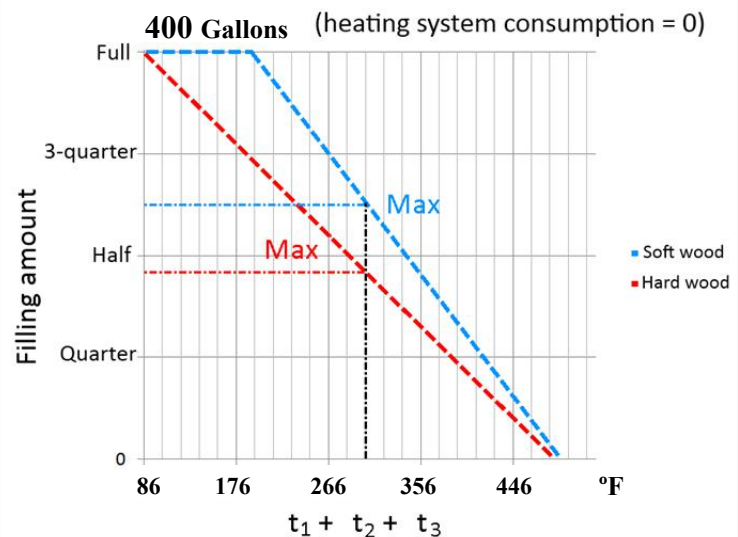
Keep always the next load in the boiler room – this will help dry the fuel for the next firing.

Do not over fill the boiler with logs. The fan should stop after all of the logs have been burned.

Otherwise the boiler will get full of soot.

All of the energy created by the boiler should be able to go to the storage tank and/or heating system..

Use the curves to the right as a guide for the correct amount of logs. Read the three temperatures on the tank, add them together and find the recommended amount of fuel to fill the boiler. The heating system is not included in these equations.



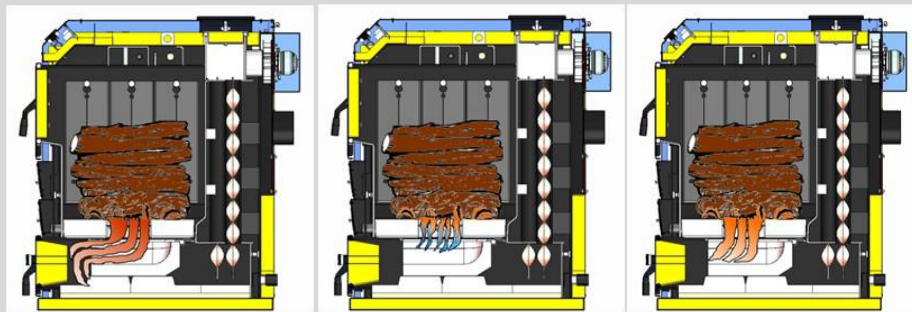
Guidance - the amount of logs is very much dependent on the quality of the wood and the actual energy consumption of the heating system

Adjustment of combustion air

Primary air (top damper):

Hard wood (e.g. Oak) < 20 % moisture	Soft wood (e.g. spruce) < 20 % moisture
25 – 50 %	50 – 100 %

Secondary air (lower damper):



Too little

Too much

Correct
