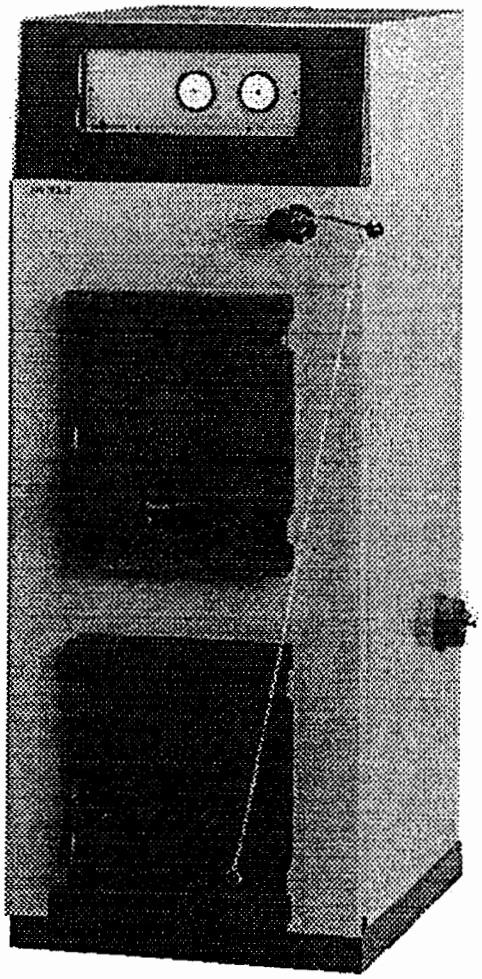
MB-SOLO MK II

INSTALLATION AND OPERATION MANUAL



HS TARM

APRIL 2003

HS TARM
TARMUSA INC

OWNER'S MANUAL

MB-SOLO MK II
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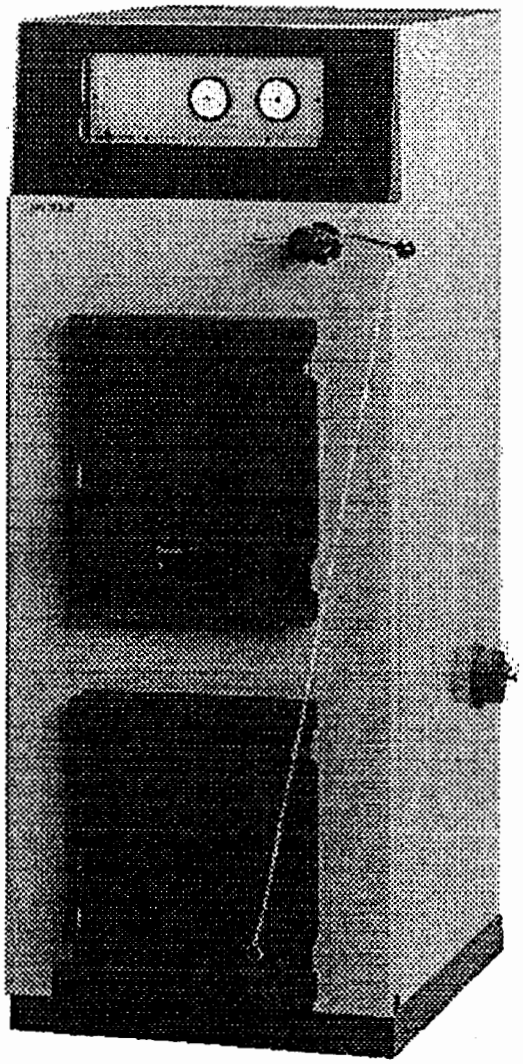

Tested & Listed By O-TL C Beaverton Oregon USA
OMNI-Test Laboratories, Inc.

DANAK Reg. nr. 5001
Kvalitetsstyringssystem certificeret i henhold til DS/EN ISO 9001 af Det Norske Veritas Danmark A/S
DNV

TABLE OF CONTENTS

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INTRODUCTION

This manual contains complete installation and operation instructions for your HS-TARM MB-Solo boiler. While both the homeowner and installer will benefit from reading the entire manual, this booklet is organized in sections for handy reference and convenience.

The **Installation** section is intended primarily for use by the heating, electrical and plumbing contractors who assemble and install your HS-TARM boiler.

The **Operation** section is designed to help you, the homeowner, understand how your boiler works and how to operate your boiler and heating system for best results.

The T**roubleshooting and Maintenance** section contains information helpful the homeowner and installer alike in identifying and correcting problems and in maintaining the heating system.

The **Warranty** is printed on page 48 herein. The homeowner should detach and fill out the separate registration card and, to validate the warranty, mail it to TARM USA, Inc., PO Box 285, Lyme, NH 03768.

HS-TARM MB-SOLO MK II
BOILER AND BASIC EQUIPMENT

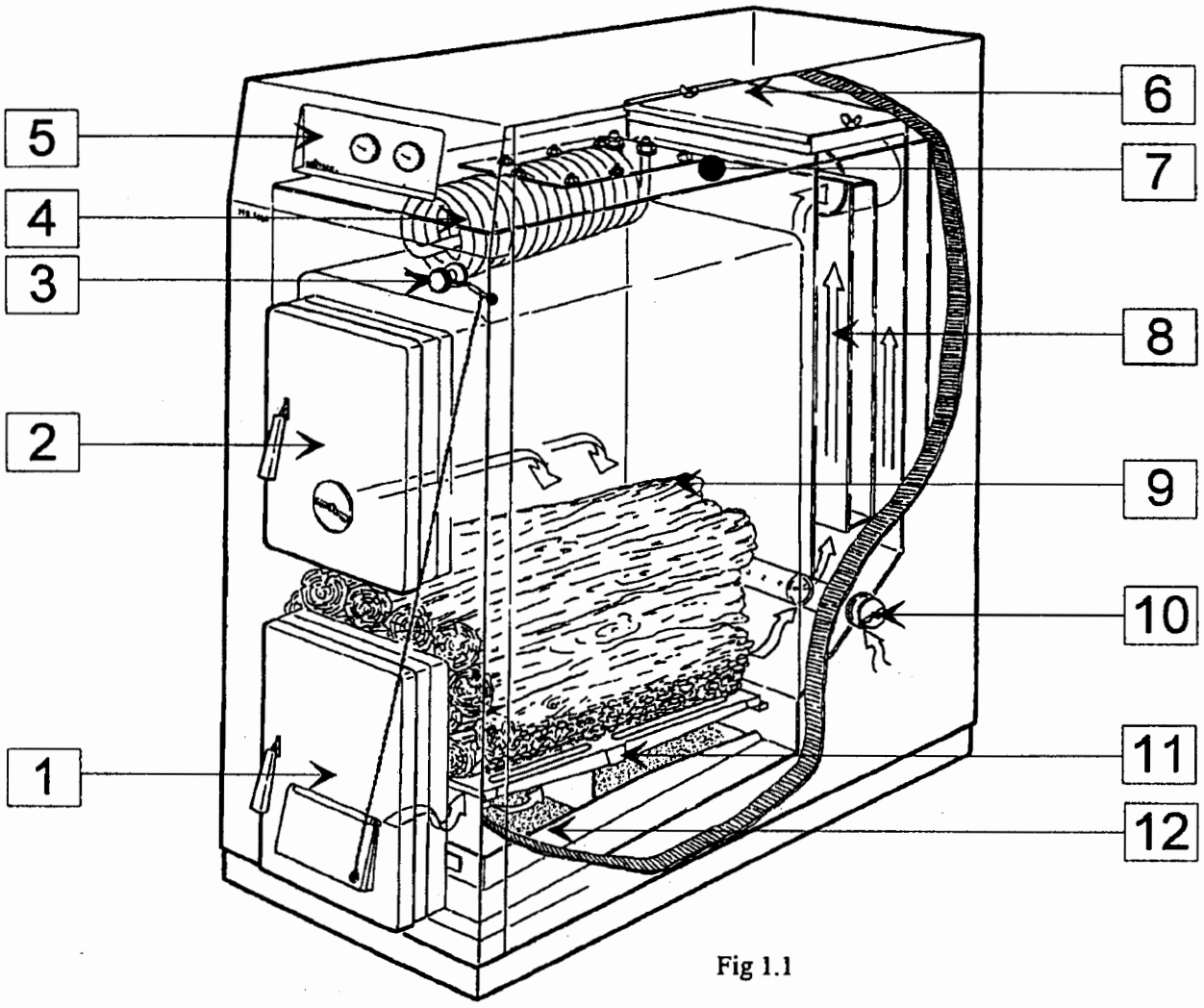

Fig 1.1

1. Ash door
2. Fuel load door
3. Draft regulator
4. Hot water coil
5. Instrument panel
6. Cleanout cover
7. Manufacturers plate
8. Heat exchange
9. Fuel storage
10. Secondary air control
11. Grates
12. Ash pan

BOILER OVERVIEW

A. OVERVIEW OF BOILER FUNCTION

The MB-SOLO MK II is designed for firing with firewood with a moisture content of 15-20% which has been cut, split and dried for 1 1/2 to 2 years.

When the boiler temperature drops and there is a glowing layer of coals about 10 inches deep at the bottom of the combustion chamber, and when the correct chimney draft is also present, the following takes place:

- The draft regulator (3) opens up the damper in the ash door (1).
- The chimney draft sucks air in through the damper in the ash door (1).
- Air is sucked through the layer of fuel which creates warm, combustible gases.
- Air is also sucked through the secondary air control (10) as well as a little air through the air control on the fuel load door (2).
- The warm, combustible gases are then mixed with the secondary air (10) and the mixture of gases ignites and burns with a bluish flame just prior to traveling up through the heat exchange area (8).
- The heat passes through the heat exchange area (8) to heat the boiler water.
- As the temperature of the boiler water rises, the draft regulator (3) gradually closes the damper in the ash door and the combustion process slows.

B. OVERVIEW OF BOILER EQUIPMENT


---Ash door...large ash door with a damper for regulation of primary air. The damper is controlled by the draft regulator (3) and opens automatically when the boiler cools down (in order to provide air for combustion).


---Fuel load door...large door facilitates loading of wood. Also has control in center of door for adjustment of overfire air.


---Draft regulator...ensures that the boiler maintains the desired temperature by opening and closing the damper flap on the ash door (1).


---Hot water coil...optional equipment for heating domestic hot water.


---Instrument panel...provides boiler temperature and pressure information.


---Cleanout cover...provides access for cleaning the heat exchange area (8).


---Manufacturers plate...gives the boiler type, serial number and basic capacities.


---Heat exchange...heat is transferred to the boiler water in this area.


---Fuel storage...chamber where fuel is loaded and stored prior to burning.


---Secondary air control...for adjustment of the secondary air for combustion of the wood gases.


---Grates...support the fuel and help for ash separation.


---Ash pan...for collection and clean-out of ashes.

PLEASE READ THIS SECTION CAREFULLY

This boiler has a limited warranty which appears in the back of this manual. To validate your warranty, detach the separate registration card, fill in the information requested, and return the card to TARM USA, Inc.

General Information:

⚠ Please read the literature enclosed by the manufacturer of the various accessory devices. These devices are warranted by the manufacturer, *not* by TARM USA, Inc. These accessory devices must be installed and used according to the recommendations of the manufacturer.

⚠ 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.

⚠ All systems should be designed by competent contractors. Only qualified installers knowledgeable in the layout and installation of heating systems shall attempt the installation of any boiler.

⚠ Small intense fires are preferable to large smoldering fires to reduce the amount of creosote formation.

⚠ When fans are used in the fuel storage area, they should be installed so as to not create negative pressures in the room where the solid fueled burning boiler is located.

⚠ It is the responsibility of the installing contractor to see that all controls are installed correctly and are operating properly when installation is completed.

⚠ Homeowners should read and familiarize themselves with boiler overheating and the procedure in event of power failures. See page 40 and 41.

⚠ Do not use gasoline, kerosene, or other flammable liquids to start or maintain solid-fuel fires in your boiler, or, serious burns may result!

Installation Information:

⚠ The boiler must be connected to a lined masonry flue or a Factory-Built Type HT approved chimney. No other appliance may be connected to the flue serving this wood boiler. Consult your local building inspector for chimney requirements and install the boiler in accordance with all applicable codes. Also, please refer to diagram and information on pages 27 and 28.

⚠ The boiler should be positioned to provide minimum side clearances of 6", top and rear clearance of 18", and front clearance of 36" between boiler surfaces and any combustible material. There must be a minimum clearance of 18" between smoke pipe and all combustible surfaces.

⚠ Use the pipe dope and wicking (supplied with boiler) or at least 5 turns of teflon tape to seal all threaded connections to the boiler. Be certain there are no leaks!

⚠ When references are made to tapping numbers, please refer to the diagrams on pages 11 and 14.

⚠ Do not use self-contained, non-electric zone valves in the zone controlled by the boiler overheat control.

⚠ **Please note: Any radiant floor tubing connected to a HS TARM boiler must have an oxygen barrier.**

Outside Combustion Air

1) 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.

2) Outside combustion air may be required if:

(a) the solid-fuel-fired appliance does not draw steadily, experiences smoke roll-out, burns poorly, or back-drafts whether or not there is combustion present;

(b) existing 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 combustion present;

(c) any of the above symptoms are alleviated by opening a window slightly on a calm (windless) day;

(d) the house is equipped with a well-sealed vapor barrier and tight fitting windows and/or has any powered devices which exhaust house air;

(e) there is excessive condensation on windows in the winter; or

(f) a ventilation system is installed in the house.

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

3) HS-Tarm boilers are not suitable for direct connection of outside air.

(a) The outside air should be ducted to no closer that 12" from the boiler. A 6" duct should be large enough for all HS-Tarm boilers unless the duct run is over 25 feet.

(b) A mechanical ventilation system: If the house has a ventilation system (air change or heat recovery),
- (I) the ventilation system may be able to provide sufficient combustion make-up air for the solid-fuel-fired appliance; and
- (II) the householder should be informed that the ventilation system may need to be re-balanced by a ventilation technician after installation of the solid-fuel-fired appliance.

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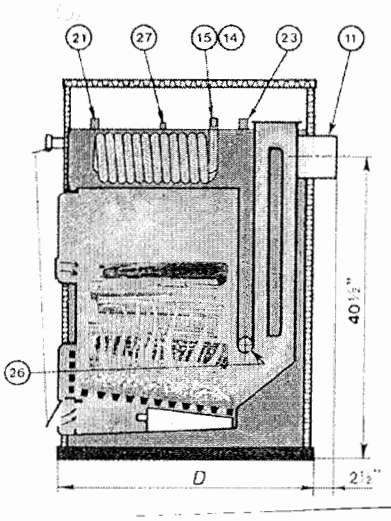
SPECIFICATIONS

Type MB-Solo MK II		40	55	75
Gross Output--Wood	Btu/hr	100,000	140,000	180,000
Gross Output--Coal	Btu/hr	105,000	160,000	200,000
Domestic Hot Water Output (Wood)	GPM	2.0	2.9	3.7
Width (B)	in	19 3/4	22 3/4	22 3/4
Length (D)	in	31 1/2	44 1/2	44 1/2
Width of Firebox	in	12 1/2	15 1/2	15 1/2
Length of Firebox	in	15 1/2	27 1/2	27 1/2
Distance (C)	in	9 7/8	12 1/4	12 1/4
1-Return Tapping	in	1 1/4	1 1/2	1 1/2
2-Supply Tapping	in	1 1/4	1 1/2	1 1/2
5-Pressure Sensor Tapping	in	1/2	1/2	1/2
10-Extra Tapping	in	1/2	1/2	1/2
11-Flue Outlet (O.D.)	in	6	8	8
14-Hot Domestic Water	in	3/4	3/4	3/4
15-Cold Domestic Water Supply	in	3/4	3/4	3/4
16-Pressure Relief Valve Tapping	in	1	1	1
18-Boiler Drain Tapping	in	1	1	1
20-Draft Regulator Tapping	in	3/4	3/4	3/4
21-Temperature Sensor Tapping	in	1/2	1/2	1/2
23-Overheat Control Tapping	in	3/4	3/4	3/4
24-Preheated Secondary Air Control		X	X	X
26-Preheated Secondary Air Manifold		X	X	X
27-Vent Tapping	in	3/8	3/8	3/8
Door Size	in	10x12	10x12	10x12
Water Capacity	Gal	36	55	55
Weight-Boiler w/jacket	lb	790	1130	1170
Pressure Test-Boiler	psi	72	72	72
Pressure Test-Coil	psi	250	250	250
Minimum Flue Size	in	8x8	8x12	8x12
Minimum Chimney Height	ft	20	20	20
Chimney Draft Required....inches of Water Column		.05-.1	.05-.1	05-.1

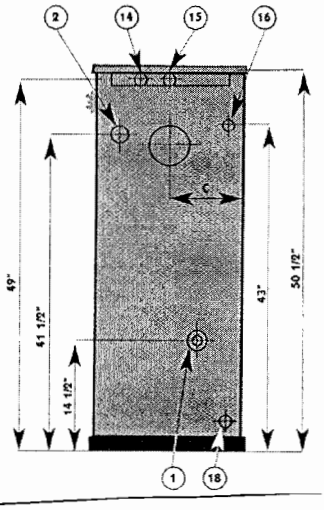
All specifications are subject to change without notice. The responsibility for determining compliance with local and state codes is the obligation of the installer.

NOTE: Adequate chimney draft is required for proper operation of all wood-fired boilers.
Please observe minimum chimney requirements in the table above.

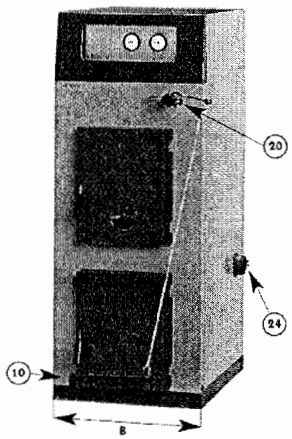
Cross Section
Solid Fuel Operation



Rear



Front



HS-TARM TYPE MB-SOLO MK II

PLEASE UNPACK THE CONTENTS OF THE BOILER BODY AND THE THREE BOXES CAREFULLY. CHECK OFF ITEMS ON THE FOLLOWING LIST:

JACKET BOX

- ☐ Jacket panels (four sides and one top)
- ☐ Preformed strips (4) for joining jacket panels

DOOR AND GRATE CRATE

- ☐ Firing door
- ☐ Ash door
- ☐ Studs for mounting doors
- ☐ Cast-iron grate sections (9)
- ☐ Grate retainer
- ☐ Bakelite door grips (2)
- ☐ Ash-scooping pan
- ☐ Secondary air control

BOILER BODY

- ☐ Long-handled flue brush
- ☐ Scraper for boiler walls
- ☐ Poker for wood fire
- ☐ Boiler instrument panel with temperature and pressure gauges.

SAFETY BOX

- ☐ SAMSON 5D Automatic Draft Regulator
- ☐ Boiler Pressure Relief Valve -- Conbraco 10-407-05 (30psi) or Equivalent.
- ☐ Boiler High Temperature Limit (overheat control) - HONEYWELL L4008-B
- ☐ Immersion Well - HONEYWELL 123870A
- ☐ Installation and Operation Manual

Please contact your dealer immediately if any of the above items are not present.

I. Boiler Setup

NOTE:
It is advisable to make all initial connections (with the exception of domestic water connections) to boiler tappings with iron fittings rather than copper. This insures that the fittings can be tightened enough to seal properly.

All threaded fittings must be wrapped with the wicking (supplied with boiler) or at least 5 turns of teflon tape to seal properly. Wicking is best for all fittings threaded into the boiler.

A. Initial Assembly

1) Unpack the items in the boiler body and the jacket carton, and check off the items enclosed against the *parts check-list,*page 12.

2) Place the boiler adjacent to the chimney and on a level concrete slab. THE BOILER SHOULD BE POSITIONED TO PROVIDE MINIMUM CLEARANCES BETWEEN BOILER SURFACES AND COMBUSTIBLE MATERIAL AS FOLLOWS:
SIDE-6"; REAR AND TOP-18"; AND FRONT-36". ANY FLAMMABLE DEBRIS, RAGS, PAPER, WOOD SCRAPS, ETC. SHOULD BE KEPT CLEAR OF BOILER, ESPECIALLY IN FRONT WHERE IGNITION OF SUCH DEBRIS IS MOST LIKELY TO OCCUR. THERE MUST BE A MINIMUM CLEARANCE OF 18" BETWEEN THE SMOKE PIPE AND ALL COMBUSTIBLE SURFACES.

3) Arrange the cast-iron grate sections on the ledges on the sides of the firebox. Insert the steel plate in the slots on the sides of the door opening. Place the ash removal pan in proper position in the boiler under the grates.

4) Remove the plug from tapping #20. Insert and tighten a plug in tapping #10. Use sufficient wicking or teflon tape to seal threads. Refer to tapping location diagram on page 11.

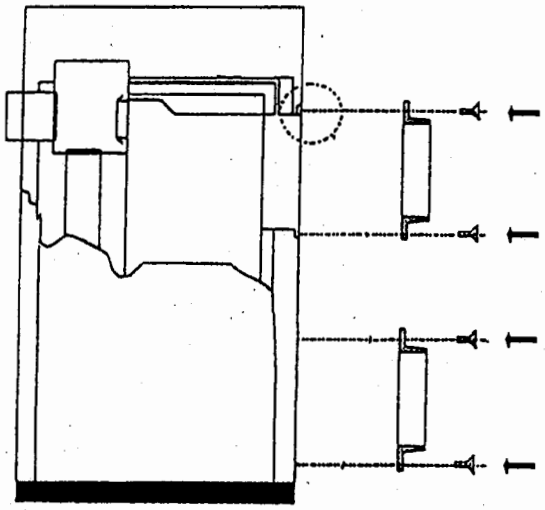
B. Jacket Assembly

The boiler comes equipped with a five-piece enameled jacket. The sections of the jacket are assembled by sliding the preformed steel strips down over the folded, vertical edges of the panel. For installations with low ceiling clearance, the jacket zip strips can be bent conveniently at the center point.

Prior to jacket installation, remove the appropriate jacket knockouts.

1) Install a 1" x 3/4" reducing bushing in tapping #16.

2) Install the front jacket panel. Place the ash door and load door over their respective openings and thread the door mounting bolts into the tapped holes in the boiler mounting flanges. Do not tighten the bolts yet! See following diagram.



3) Install the left jacket panel into place. Attach to front panel using one (1) zip strip.

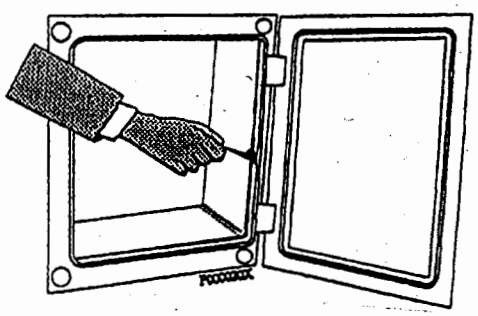
4) Install the right jacket panel into place.

5) Install rear jacket panel. Prior to placing this panel, install a 1" x 1/2" reducing bushing in tapping #18 if you are using it as your boiler drain/feed.

6) Install the boiler top panel.

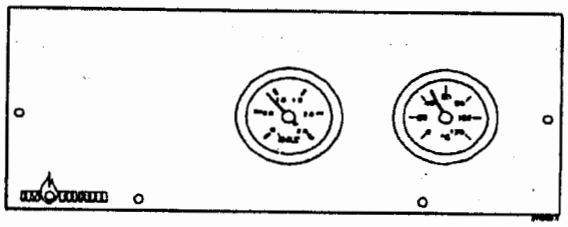
7) Check the boiler jacket for alignment.

8) Seal front door frames to face of boiler as follows:
   a) Back off door bolts until a 1/4" gap is between the door frame and the jacket sheet metal.
   b) Using the enclosed applicator tool, or a putty knife, press the Stovex sealing compound into the 1/4" space. Be sure to get some on each side of the jacket sheet metal.



   c) Check for proper jacket alignment and tighten door mounting bolts, carefully - not too hard.
   d) Remove the extra cement immediately

C. Instrument Panel



The boiler comes with an instrument panel packed in a separate box and shipped inside the boiler body. Install the instrument panel as follows:

1) Insert the boiler instrument panel into position in the top of the front jacket panel. Carefully feed the sensors and capillaries through the jacket opening in such a way that they won't be kinked or otherwise damaged. Fasten the instrument panel in place with the screws provided.
2) Install the 1/2" immersion well that was packed with the instrument panel into tapping #21.
3) Insert the temperature sensor into the immersion well in tapping #21.
4) Install the brass diaphragm well for the pressure sensor into tapping #5 and then screw the sensor on the end of the pressure capillary into this well.

D. Chimney Connection

NOTE:
THE BOILER MUST BE CONNECTED TO A LINED MASONRY OR A FACTORY BUILT TYPE HT APPROVED CHIMNEY AND 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. Please refer to pages 27 and 28. Also see page 11 for specification on the minimum flue size, chimney height and chimney draft requirements for the various MB-Solo boiler models.

E. Venting of Boiler Body

The boiler body needs to be vented during filling and operation by an automatic float air vent, in the 3/8" tapping #27 on the top of the boiler (refer to diagram above).

1) Install a 3/8" x 1/8" bushing in tapping #27.
2) Thread the vent into this bushing.
3) BE SURE TO LOOSEN THE VENT CAP 2-3 TURNS BEFORE FILLING THE BOILER WITH WATER.
4) AUTOMATIC FLOAT AIR VENTS HAVE THE POTENTIAL TO LEAK, CHECK IT MONTHLY!

F. Boiler Pressure Relief Valve

Install the Conbraco10-407-05, 30 PSI pressure relief valve supplied with the boiler in tapping #16 at the rear of the MB-Solo. Please note, as per the instructions on the relief valve, that the valve should be mounted vertically. *PIPE THE 3/4" DISCHARGE LINE FROM THIS VALVE TO WITHIN 6" OF THE FLOOR WITH NO REDUCTION! THIS VALVE MUST BE INSTALLED TO INSURE SAFE OPERATION OF THE BOILER AND FOR PROTECTION OF THE HEATING SYSTEM!* When this valve operates, hot water will be discharged. It should be piped to an open drain so that this water will not damage the room in which the boiler is located.

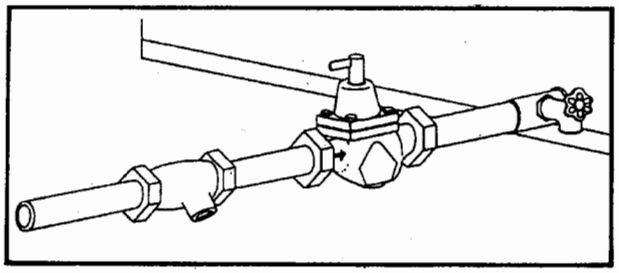
Boiler Setup (continued)

G. Fill-Valve and Drain

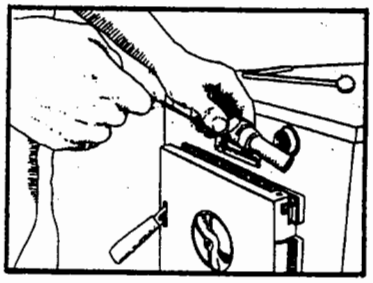
1) Install a 1/2" tee in tapping #18. Install a boiler drain on this tee, as per diagram below.

2) A WATTS S1156F Fill-Valve should be used to provide makeup water for the boiler. The makeup water should be piped in through the 1/2" tee in tapping #18. A back-flow preventer must be installed where required by code.

NOTE
Other controls may be required according to the nature of the installation. Please refer to pages 19 through 24.



Backflow preventer and fill-valve piped to tapping #18.



1.
Wrap threads on regulator with wicking or at least 5 turns of teflon tape. Install regulator in tapping #20.

H. Install Secondary Air Control

Install the secondary air control on the right side of the boiler, on fitting #24.

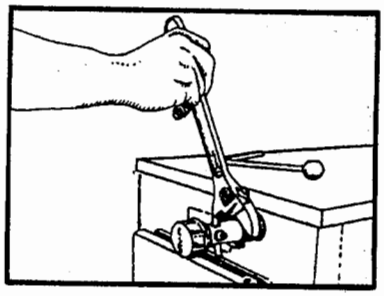
I. Samson Draft Regulator

The SAMSON Automatic Draft Regulator is installed in the boiler body tapping #20 (front view). Please refer to illustrations on the right on this page.

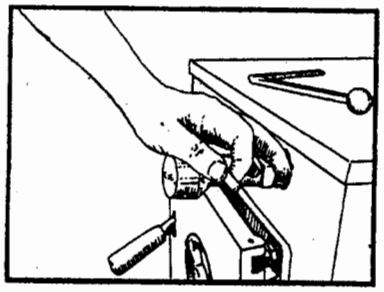
To install the regulator, apply wicking or several turns of teflon tape to the threads and screw the control into the tapping securely, but not too tightly, as the threads may be damaged if the control is turned too far. The hexagonal-head screw must be at the top so that the red figures show. The red figures will be used in making adjustments.

Carefully insert the arm into the hole from right to left, with the arm in the horizontal position, lifting and loosening the hexagonal-head screw if necessary.

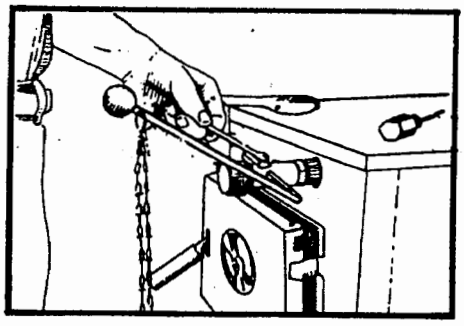
Insert the arm about three inches, so that the chain, when attached, will not interfere with the opening of the firing door. Tighten the screw onto the arm, keeping the arm in a relatively horizontal position. The screw must bear on a flat segment of the arm, not on an edge. The end of the chain with the ring and the hook should be attached to the arm of the regulator. The other end of the chain attaches to the hole in the lower door air flap. After the ring is attached to the arm of the regulator, all adjustments of the regulator (see page 26) should be made with the hook in this ring; in this way, the chai can be unhooked (thereby closing the draft flap) when fueling the boiler. It is undesirable to close the flap by turning the knob when fueling the boiler, as it causes unnecessary wear on the regulator.



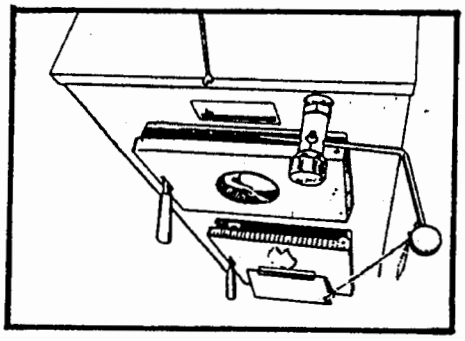
2.
Tighten regulator with adjustable wrench-hex bolt should be vertical when complete. Do not over-tighten regulator!



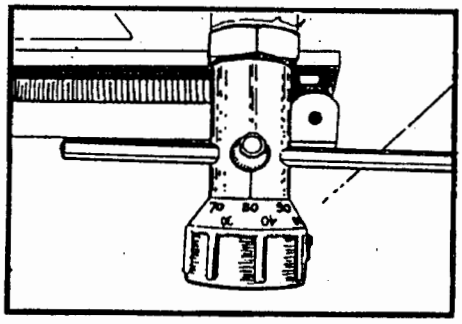
3.
Loosen hexagonal bolt and remove wooden dowel from pivot joint. Note correct position of pivot joint when installed



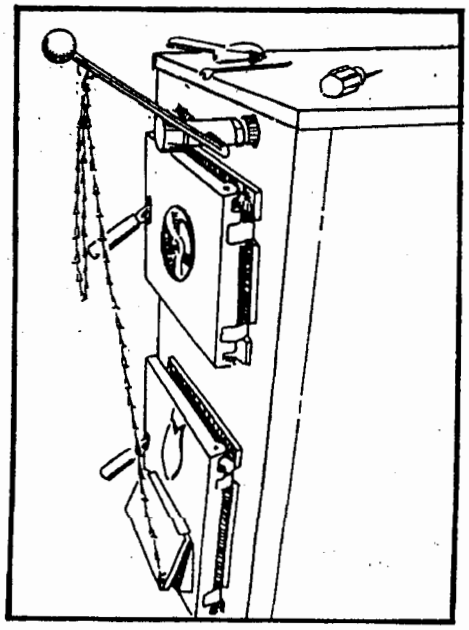
4.
Install control arm and tighten hexagonal bolt, making sure it bears on a flat on the arm.



5.
Top view of completed installation. Install chain as shown.



6.
Regulator adjusted to 80 on dial.



7.
Side view showing door position when boiler has reached set temperature.

II. Domestic Hot Water System

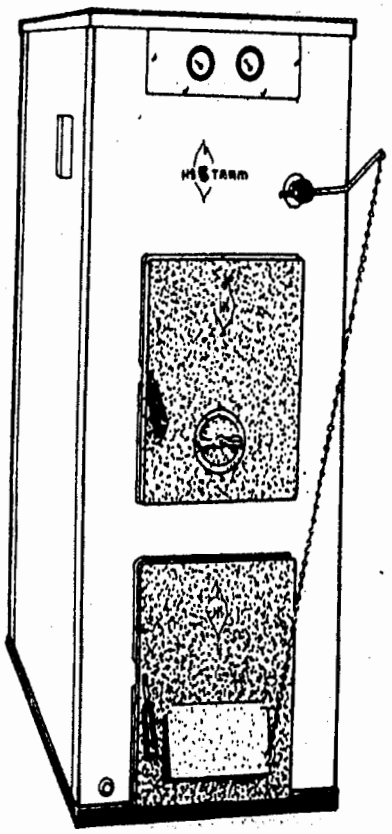
A tank-less coil for heating domestic hot water is available as an option on the MB-Solo boiler.

Domestic hot water piping is led into the boiler through the holes in the top rear of the boiler jacket. Bring the pipes in so they will not interfere with removal of the heat exchanger cleaning cover. Pipe the cold water to tapping #15, and hot water from tapping #14. It is desirable to install unions external to the boiler in both the cold and hot water lines.

Install the Pressure Relief Valve (Conbraco 17-402-01, 100 psi) in a tee on the cold water supply to the tankless coil. There must be no shut-off valve or check valve between the relief valve and the tankless coil. THE RELIEF VALVE DISCHARGE LINE MUST BE PIPED TO WITHIN 6" OF THE FLOOR NEAR A DRAIN, AND MUST BE 3/4" PIPE WITH NO REDUCTION. IF THIS VALVE OPERATES, HOT WATER WILL BE DISCHARGED, IT SHOULD BE PIPED TO AN OPEN DRAIN, SO THAT THIS WATER WILL NOT DAMAGE THE ROOM IN WHICH THE BOILER IS LOCATED.

NOTE:
In certain areas, existing water supplies may have a high mineral content. This will lead to liming of the coil over time, depending on the mineral content of the water and the amount of water passing through the coil. In situations such as this, the coil must be cleaned. Cleaning should always be done as soon as there is any indication that the hot water supply is being restricted. *Cleaning out a lime buildup is a dangerous procedure that should only be attempted by a qualified and experienced person.*

Typical Front View of MB-Solo Boiler



III. Connection to Heating Radiation and/or Another Boiler

***When planning your boiler installation a first consideration is to make provisions to handle the excess heat from an overheated boiler both with and without electricity.**

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 loop must be large enough to dissipate atleast 10% of the boiler's maximum rated output on solid fuel, assuming an ambient temperature of 65° F in the area heated by the loop, and a mean water temperature of 180° F.

The minimum pipe size for this loop is 3/4", and, if possible, the loop should be located and pitched to maximize natural thermal convection of the water. The design of the loop must be such that it can be made in- operative only by deliberate manual action. If large enough, an existing heating radiation zone may be used for the overheat loop, if it is equipped with zone valves which will open automatically during a power failure. (We recommend the use of AUTOMAG automatic zone valves for this application. TARM USA, INC. can supply these valves.)

OVERHEAT LOOP: WITH ELECTRICITY: To handle an overheated boiler the L4008B aquastat set at 200 degrees F should be wired in parallel with the thermostat for the zone with the most heat loss in the main living area. If the boiler temperature reaches 200 degrees F the dump zone pump will be activated to take heat away from the boiler as it overrides the zone thermostat. The homeowner should be alerted by the extra heat caused by the overheat and can investigate the cause.

With experience and time most owners can learn to operate their boilers so that overheating problems are greatly reduced.

- **Choosing the right system:**

The MB-Solo may be used either as the only boiler or in conjunction with an existing oil-, gas- or electrically-fired boiler by a parallel, Auto-Mix, or primary-secondary plumbing hook up. In the latter combinations, the MB-Solo serves as the primary boiler and the existing unit as the backup boiler.

The type of installation chosen will depend upon the requirements of a given heating system. Please refer to the piping schematics on page 21 when reading the description of each system:

- **Only Boiler:** The MB-Solo boiler can be used as the sole heating source for a hot water system. This installation is relatively simple and inexpensive; however, there is no backup system for times when the wood fire will be untended or when it is undesirable to be heating centrally with wood. To install the MB-Solo as the only boiler, see page 19.

- **Parallel:** When the MB-Solo is connected in parallel with an existing oil-, gas- or electrically-fired boiler, domestic hot water can always be heated by a wood fire. The parallel connection also minimizes standby loss from the MB-Solo when not in use. To install the MB-Solo in parallel with another boiler, see page 20.

- **HS Auto-Mix:** The HS Auto-Mix, when piped as shown in the diagram, provides for the most convenient and economical heating system possible with the MB-Solo boiler.

The HS Auto-Mix system is a method of controlling house temperature that is different from and more sophisticated than conventional systems. In the average hydronic system, the temperature in the house or zone is controlled by circulating or not circulating water of a fairly high and relatively constant temperature to the radiation. The thermostat used in such a system is a simple temperature- actuated switch that turns a circulator on and off. In the Auto-Mix system, the circulator runs continuously, and the temperature of the water flowing to the house is controlled by the mixing valve, which adds more or less heated supply water to the water being pumped to radiation. The valve is controlled automatically by a thermostat.

Connection to Heating Radiation and/or Another Boiler(continued)

A system controlled by the HS Auto-Mix has several advantages over conventional systems: These are:

- a more comfortable house because the heat is more even. Rather than have the heat turn completely on and completely off in response to heating demands, thus causing fluctuation in house temperature, this heat is always "on" with the temperature of the radiation adjusting gradually to respond to the house's heating needs.

- longer boiler life due to the elimination of thermal shock to the boiler caused by surges of cold return water at circulator start-up.

- longer circulator life, as most wear in circulators occurs during motor start-up.

- quieter house during the heating season, as the noises caused by sudden changes in water temperature in the radiation are eliminated.

- increased fuel efficiency and savings, up to 15% on oil or gas alone, according to reports from testing laboratories.

The Auto-Mix has important advantages when used with wood-or coal –burning systems. Unlike oil-or gas-fired systems, wood or coal fires always produce a minimum amount of heat. In a solid-fuel heating system without a mixing valve, the circulator runs intermittently. When the circulator does not run, heat is not drawn from the boiler and the boiler is therefore prone to overheating. In addition, when heat is not drawn from the boiler, controls will greatly reduce the flow of air to the fire. A slow-burning fire causes incomplete combustion and produces creosote.

The Auto-Mix is especially important in installations with cast-iron radiation. The large volume of returning cold water from cast-iron radiation causes boiler temperature to drop suddenly and results in poor boiler performance on solid fuel, unless a mixing valve is used to keep the radiation warm at all times in proportion to heating demand.

In an Auto-Mix system the circulator runs constantly. Heat is always being drawn from the boiler, thus minimizing the likelihood of boiler overheating and creosote formation. The HS Auto-Mix promotes safer, cleaner and more efficient burning of any solid fuel.

See page 24 for installation instructions for the HS Auto-Mix.

- **Primary-Secondary:**

Installations using a primary -secondary piping configuration are becoming more popular with installers. Refer to the diagram on page 21 for a conceptual illustration of this type of hook-up.

A. Only Boiler (Plumbing)

Refer to diagram on page 21.

1) Thread a 1-1/4" (MB40) or 1-1/2" (MB55 /75) x 4" nipple into supply tapping #2 on rear of boiler. Thread a tee (T-1) of the same size onto this nipple with the run horizontal. From the side outlet of T-1, pipe to a normally open Automag zone valve and then to the supply of the overheat zone downstream of any flow check valve.

2) Using a 4" nipple threaded into the run of T-1 connect to an air purger and expansion tank. An Amtrol 60 or equivalent is suitable for most MB installations as it can handle systems of up to 86 gallons. For systems of greater capacity, consult your installer.

3) Pipe from the air purger to a tee (T-2). From the side outlet branch of T-2, pipe down through a balancing valve and then into port #1 of the Termovar 3-way thermostatic tempering valve.

4) Pipe from the run outlet of T-2 to the supply manifold of the heating zones of the home.

5) Pipe from the boiler return, tapping #1, to a circulator C-3 (consider isolation valves).

6) Pipe from the C-3 circulator to a tee (T-3). From the T-3 side outlet, pipe to the return of the overheat zone. From the run or through outlet of T-3, pipe to port #3 of the Termovar 3-way thermostatic valve.

Connection to Heating Radiation and/or Another Boiler(continued)

7) Pipe from port #2 of the Termovar to the return from the heating zones of the home.

8) The C-3 circulator must be controlled by a circulator relay, Honeywell RA89A or equivalent. This relay is powered when any heating zone calls, or when the boiler temperature trips the L4008B overheat control. The C-3 circulator must run on any call for heat.

9) Install the ¾" immersion well in tapping #23 on top of the boiler.

10) The Boiler Overheat Control, HONEYWELL L4008-B, should be positioned on the upper front corner of either side panel. Use the control as a template to make two small holes for sheet metal screws. Be sure to mount it so that it will not interfere with the installation of the top jacket panel. Drill two holes and mount the control. Drill or cut a small hole at least 5/8" in diameter in the jacket adjacent to the location of the L4008-B aquastat . Being careful not to kink the capillary tube of the L4008-B feed it through the hole in the jacket and insert the sensing element in the immersion well previously installed in boiler tapping #23.

NOTE:
The excess length of capillary tube on top of the boiler can be tidied up by forming it into a spiral coil, using a short length of large-diameter pipe as a mandrel.

All interconnecting wiring must be completed as per the wiring diagrams, page 22.

NOTE:
When the MB-Solo boiler is being fired, the possibility of boiler overheating does exist, especially during relatively mild weather. Should this happen, the Boiler Overheat Control, set at 200° F must turn on the overheat zone and the C-3 circulator pump to dissipate heat through the heating radiation system. IF MORE THAN ONE ZONE EXISTS, THE OVERHEAT CONTROL MUST BE CONNECTED TO THE RELAY OR ZONE VALVE THAT CONTROLS THE CIRCULATOR FOR THE ZONE WITH THE LARGEST AMOUNT OF HEATING RADIATION AND C-3 CIRCULATOR.

THE CONTROL SHOULD BE WIRED TO TURN ON THE CIRCULATORS WHEN THE BOILER WATER REACHES THE TEMPERATURE SET ON THE CONTROL DIAL. DO NOT USE SELF CONTAINED, NON-ELECTRIC VALVES IN THE ZONE CONTROLLED BY THE OVERHEAT CONTROL! SUCH VALVES WOULD PREVENT THE OVERHEAT CONTROL SYSTEM FROM COOLING THE BOILER WHEN NECESSARY.

B. Parallel Hookup (Plumbing)

Refer to diagram on page 21.

1) Install an additional tee in the supply and return manifolds of the oil or gas boiler.

2) Using a 3" nipple, pipe out from tapping #2 of MB-Solo boiler to a 1 ¼" X 1 ¼" X ¾" tee (MB 40) or 1 ½" X 1 ½" X ¾" (MB55/75) tee (T-1) with the tee horizontal. From the side outlet of T-1 install a ¾" by 2" nipple and a ¾" coupling. Install a Honeywell L4006-B or equivalent into the ¾" coupling, using a ¾" immersion well.

3) From the run of T-1 install a nipple and another tee (T-2).

4) From the side outlet of T-2 pipe to a normally open Automag zone valve and then to the supply pipe of the overheat zone downstream of any flow check valve.

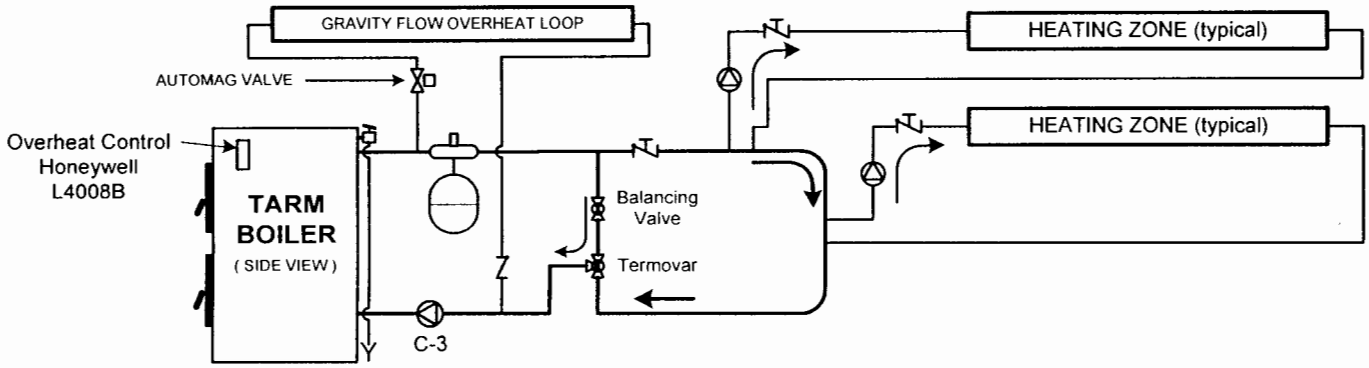
5) Using a nipple threaded into the run of T-2 connect to an air purger and expansion tank. An Amtrol 60 is suitable for most MB Solo installations as it can handle systems of up to 86 gallons. For systems of greater capacity, consult your installer.

6) Pipe from the air purger to tee T-3. From the side outlet branch of T-3 pipe down through a balancing valve to port #1 of the Thermovar 3-way thermostatic tempering valve.

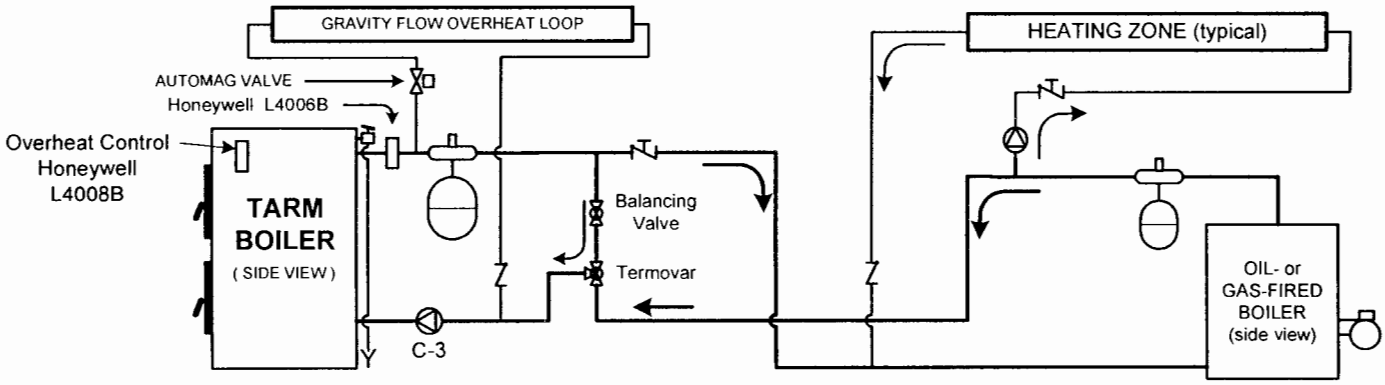
7) Pipe from the run outlet of T-3 to a flow check and then to the tee previously installed on the return manifold of the oil or gas boiler.

PIPING LAYOUT CONCEPTS DIAGRAMS

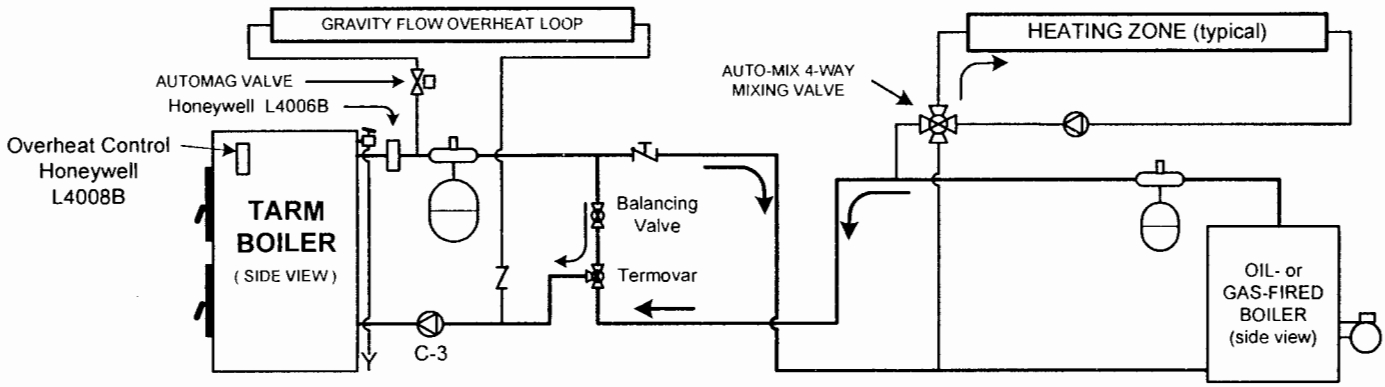
ONLY BOILER



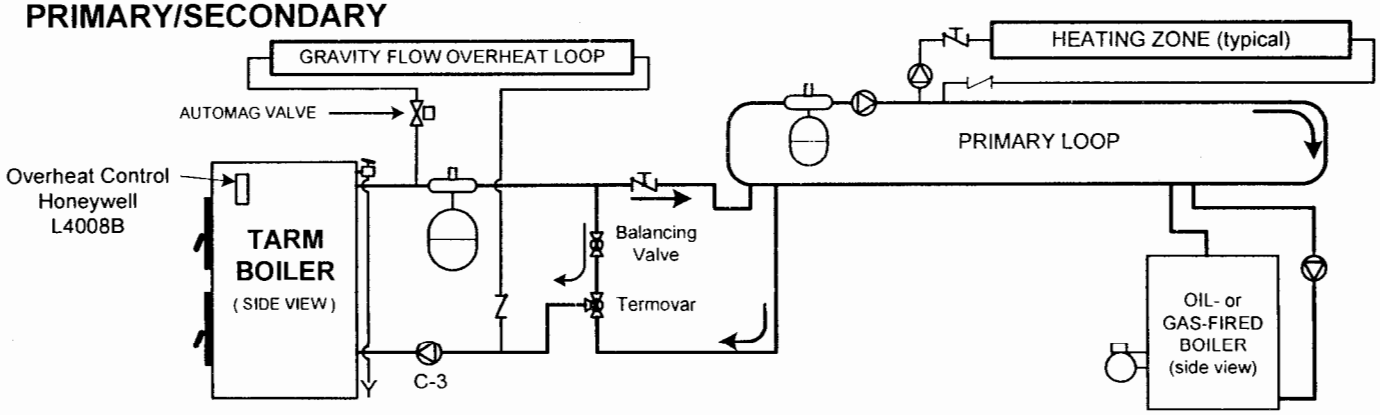
PARALLEL



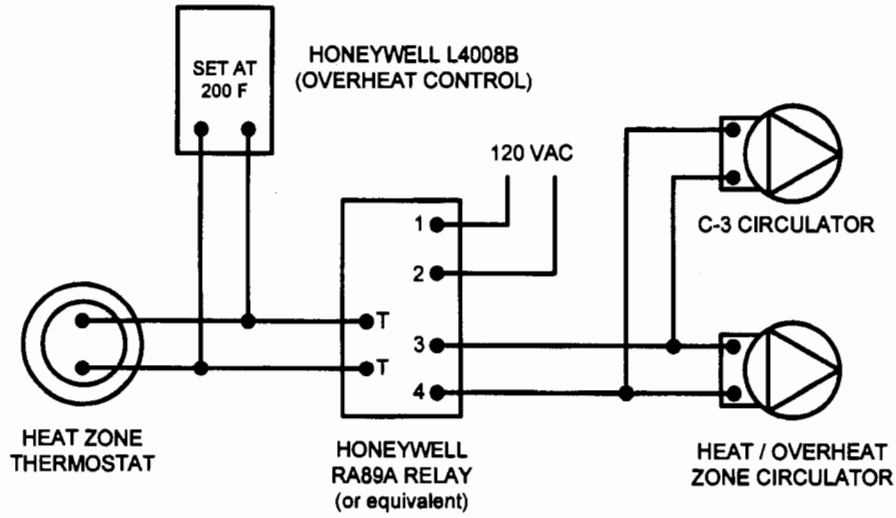
AUTO-MIX



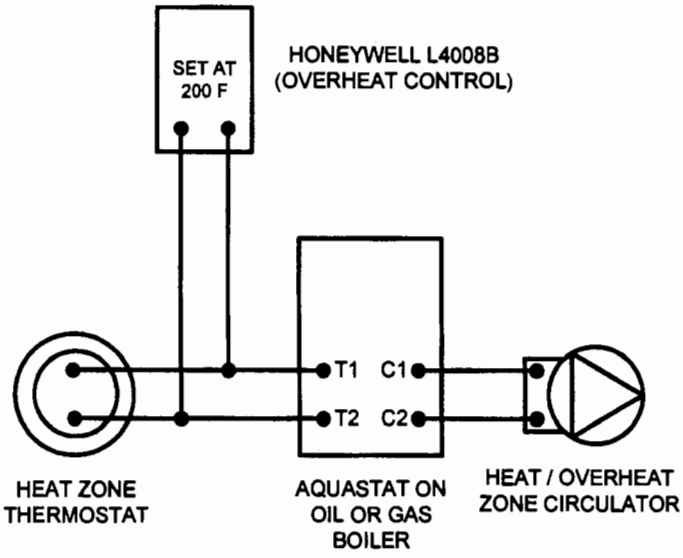
PRIMARY/SECONDARY

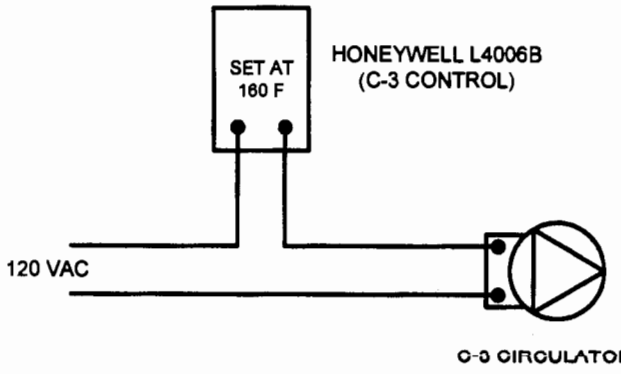


TARM AS ONLY BOILER

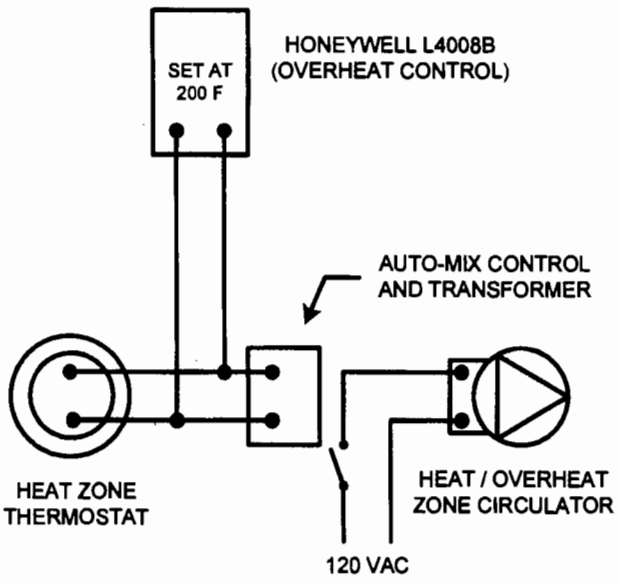


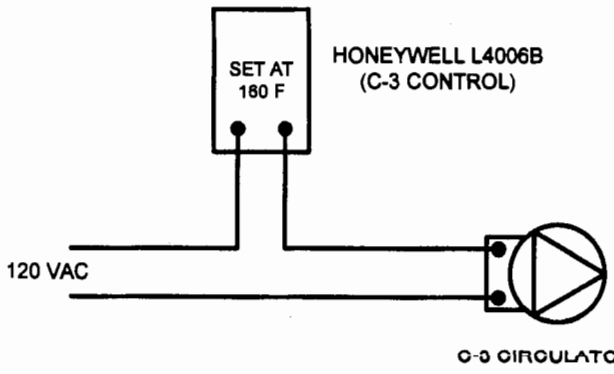
PARALLEL SYSTEM





AUTO-MIX SYSTEM





Connection to Heating Radiation and/or Another Boiler(continued)

8) Install piping between the MB-Solo return tapping #1 and the tee previously installed on the existing boiler's supply manifold as follows: Working from the MB –Solo, first pipe to the C-3 circulator (consider isolation valves) and then to a 1 ¼" or 1 ½" tee(T-4) and then to port #3 of the Termovar. Now pipe from port #2 of the Termovar to the tee previously installed on the existing boiler's supply manifold. Refer to the piping schematics (page 21) for the correct direction of flow.

9) Pipe from the side outlet of T-4 to the return of the overheat zone. Make sure there are no valves that can restrict gravity circulation in this loop.

10) All wiring for C-3 and the overheat zone control should be as shown in the diagram on page 22.

11) The Boiler Overheat Control, a HONEYWELL L4008-B (supplied with the MB-Solo), should be positioned on the upper front corner of either side panel. Use the control as a template to make two small holes for metal screws. Be sure to mount it so that it will not interfere with the installation of the top jacket panel. Drill two holes and mount the control. Drill or cut a small hole at least 5/8" in diameter in the jacket adjacent to the location of the L4008-B aquastat. Being careful not to kink the capillary tube of the L4008-B feed it through the hole in the jacket and insert the sensing element into an immersion well (3/4") installed in boiler tapping #23.

12) Operation: Both HONEYWELL controls installed above are "close-on-rise" type in operation .

The L4006B control installed in T-1 is set at 160°F and is connected to the C-3 circulator. When the MB-Solo boiler is being fired and it is above 160°F operating temperature, the C-3 circulator will start and circulate water through both boilers. This allows the MB-Solo to handle the domestic hot water and heating load on the other boiler. When the circulators in the piping to the heating zone(s) are inactive, their resistance, plus that of the flow-check valve, will prevent circulation through the heating zones by the C-3 circulator.

The Boiler Overheat Control, HONEYWELL L4008-B, is set at 200°F, and should be wired to the T-1 and T-2 terminals of the relay for the circulator supplying water to the zone with the mos radiation. This "overheat" control acts as a safety device in case the MB-Solo boiler should overheat

The excess heat from the MB-Solo is dumped in the overheat zone when the circulator is powered.

DO NOT USE SELF-CONTAINED, NON ELECTRIC VALVES IN THE ZONE CONTROLLED BY THE OVERHEAT CONTROL! SUCH VALVES WOULD PREVENT THE OVERHEAT CONTROL SYSTEM FROM COOLING THE BOILER WHEN NECESSARY.

When the MB-Solo boiler is inactive, the termovar valve installed between the two boilers prevents thermal siphoning and consequent standby loss from the MB-Solo boiler. The aquastat on the existing boiler should be set as follows:

High Limit	160° F
Low Limit	150° F

The "High Limit" setting of 160° prevents the oil- or gas-fired burner from starting on a call for heat, unless the MB-Solo is unable to maintain the boiler above this temperature. The "Low Limit" setting is the temperature at which the burner turns off when there is no call for heat.

These settings can be raised if the MB-Solo is not to be fired for an extended period of time.

For more information about parallel systems, consult your dealer.

Connection to Heating Radiation and/or Another Boiler(continued)

C. Auto- Mix Hook up

NOTE: REFER TO THE SEPARATE AUTO-MIX II INSTRUCTION MANUAL.

With an auto-mix hookup, the plumbing between the two boilers is the same as with a parallel hookup. The difference is the addition of the 4-way mixing valve on one or more zones from the oil or gas boiler. The mixing valve is added by installing an additional tee on the supply and return manifold of the oil, gas or electric boiler and as follows:

1) Pipe from the tee installed on the supply manifold of the oil, gas, or electrically fired boiler to tapping #1 (supply) on the 4-way mixing valve.

2) Connect the supply side of the heating zone controlled by the mixing valve to the "UP" tapping on the mixing valve.

3) Pipe from the return side of the heating zone through a circulator to tapping #2 on the mixing valve.

4) Pipe from tapping #3 (opposite the "UP" tapping on the mixing valve) to the tee installed on the return manifold of the oil, gas or electric boiler.

5) If the addition of the MB-Solo has increased the capacity of the heating system beyond the rating of the existing expansion tank, an additional tank should be added to the system. Consult your installer if in doubt about the requirements of your heating system.

6) Install the HONEYWELL L4008-B Boiler Overheat Control as described in item 10 above on previous page.

NOTE:
When the MB-Solo boiler is being fired, the possibility of boiler overheating does exist, especially during relatively mild weather. Should this happen, the Overheat Control will open the mixing valve and dissipate heat through the heating zone that was connected to be used as the "overheat" dump zone when the boiler temp reaches 200°F.

DO NOT USE SELF-CONTAINED, NON-ELECTRIC VALVES IN THE ZONE CONTROLLED BY THE OVERHEAT CONTROL! SUCH VALVES WOULD PREVENT THE OVERHEAT CONTROL SYSTEM FROM COOLING THE BOILER WHEN NECESSARY

D. Primary-Secondary Hook-up

Installations utilizing a primary-secondary plumbing configuration are becoming more popular with installers. Refer to the diagram on page 21 for a conceptual illustration example of this type of hook-up.

E. HEAT STORAGE

TARM USA recommends that the best installation of all HS TARM boilers is one that includes a heat storage tank. Until you burn wood in a TARM boiler that is installed with a properly sized heat storage system, you won't know how easy it can be to heat with wood. By storing boiler heat in an insulated water storage tank you gain increased operating flexibility and you can easily heat at full output with the cleanest and most efficient operation. However, the output is usually greater than the heating requirements of the house. This "extra" heat is then transferred to the storage tank for use later. Because of the buffer the heat storage system provides, you are free to fire the boiler when it is convenient for you. On most days in the winter, you will be able to load the boiler once in 24 hours. In summer you will be able to go 4-10 days between firings to heat all your domestic hot water. You don't need to rush home or get up early to load more wood. There are no problems with creosote or overheating if the boiler is oversized. The insulated storage tank absorbs the heat produced at maximum boiler output until the wood is consumed and the boiler shuts off. Heat is recaptured from the storage tank as heat and domestic hot water is needed in the house.

How do you add heat storage to your system? The first requirement is to get a tank. We recommend a 600-gallon tank with the Solo Plus 30, MB 40 and EXCEL 2000. Tanks of 800 gallons or more are recommended for the Solo Plus 40, Solo Plus 60, MB55, and MB 75 and the EXCEL 2200. Any suitable insulated water tank may be utilized However, the system design will determine whether a particular tank is suitable. Three types of systems you may consider are atmospheric, pressurized, or unpressurized.

The tank in an atmospheric system will need to be able to withstand the pressure of the water column above the tank. (For information, the pressure on a tank installed in a two-story house with an open expansion tank above will run 10 to 12 pounds.) A large capacity tank that can withstand this pressure will be expensive and in most cases difficult to get into a basement.

A pressurized system running at up to 30-lbs. pressure will require a much heavier tank. Tanks of 600-800 gallons designed to take this system pressure and with the ability to accept a domestic hot water heater exchanger wil be expensive, hard to handle, and hard to find. In addition, an expansion tank big enough to handle the expansion of this much water will cost as much as the storage tank.

Using an unpressurized tank with heat exchangers offers many advantages. Stainless steel or plastic bulk storage tanks can often be found. These tanks will not corrode, and can be insulated once in place. Openings in the tops of these tanks are usually large enough to allow the installation of heat exchange coils. External heat exchangers could also be considered. The size of these tanks also may make it difficult to get them into an existing basement.

TARM USA Inc. has available a collapsible urethane foam tank with an EPDM rubber liner and embossed aluminum outer skin. These tanks range in size from 415 to 1205 gallons, and are shipped in a 19" wide crate and ca easily be moved through narrow doors or down stairs. The 48" tank height allows the use of fully immersed vertical heat exchangers, which take full advantage of heat stratification in the tanks. It is unique and has the capability to be used for space heating, heating domestic hot water, solar heat storage or electric heat storage.

There are many way to incorporate heat storage into your system. If correctly installed, you will never regret it. You will get highest efficiency, burn less wood, and have cleaner combustion, longer boiler life and freedom to fire you boiler when it is convenient for you. It doesn't get any better than this!

Please contact us at TARM USA, INC. We will be glad to recommend a heat storage system for your HS-TARM boiler utilizing an STSS system.

The heat storage systems have separate plumbing and wiring diagrams not covered in this manual.

HOW TO BURN WOOD IN YOUR HS-TARM BOILER

The following information is intended to help both the beginning and advanced woodburner learn how to fire the HS-TARM type MB-Solo boiler. Boiler operation is different from woodstove operation, and only experience will produce the best results.

Much of the information in this section is applicable to coal-firing. In order to start a coal fire, for example, you must first build a wood fire. Therefore, you are urged to read not only the section on coal burning but also this section on wood burning before attempting to burn coal in your boiler.

IV. Wood-Firing Instructions

PLEASE READ THIS SECTION BEFORE BUILDING YOUR FIRST WOOD FIRE!

A. Chimneys

The chimney is one of the most critical factors in the successful operation of any heating system. A good chimney should provide a continuous and dependable draft (See specification sheet, page 11, for draft requirements of each MB-Solo model.)

The top of the chimney should be at least three feet above the point it passes through the roof and two feet above any point on the roof that is within 10 ft., measured horizontally. If an adjoining roof section is higher than the section where the chimney is located, the chimney should be at least as high or higher than that tallest section. If these two conditions are not satisfied, a down draft may result. Down drafts may also be caused by other nearby buildings or trees that are taller than the chimney.

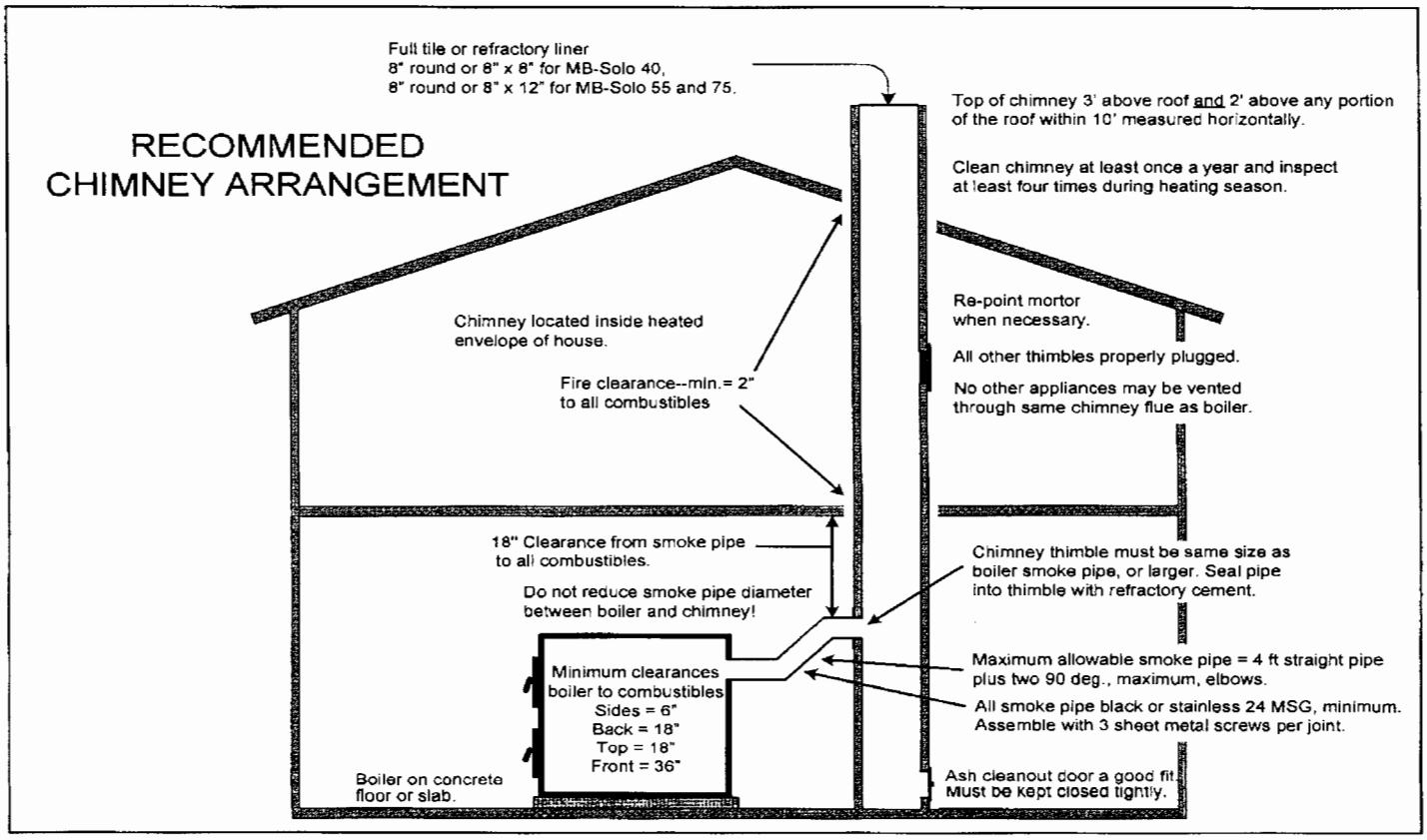
The boiler must be connected to a lined masonry or a Factory Built Type HT approved chimney and the chimney must be in good condition. If the boiler is connected to a dirty or inadequate chimney, it can present a serious fire hazard. No other appliance may be connected to the flue serving this wood boiler.

Natural draft in a chimney depends on two variables. First, draft is created by the aspirating effect of air currents blowing across the top of the chimney. When the temperature of the flue gas is higher than the temperature of the atmosphere around the chimney, natural draft also will result. Because of this, insulating the chimney flue liner will increase the draft as well as make it more consistent. Insulation also will reduce creosote deposits by reducing the amount of condensation from the flue gases.The chimney also should be within the heated envelope of the house.

The following notes and the diagram below briefly summarize some of the most important points about chimney construction:

1) Proper height is required for adequate draft to occur. The minimum height generally required is 20 feet.

2) The interior surface of the flue should be as smooth as possible to avoid friction and to help decrease the possibility of creosote buildup.



3) The connecting smoke pipe should be the same diameter or larger where it enters the chimney as where it leaves the heating unit. In other words, it should never get smaller in diameter going from the heating unit to the chimney. Connecting pipe should be black or stainless and 24 gauge or heavier.

4) Chimney cleanout doors must be airtight or they will admit cold air, both lowering stack temperatures and spoiling the draft. Such doors should be located at least one block section from the base of the chimney, so that any creosote that may drip down inside the chimney does not run out the door if it accumulates.

5) Air leakage in cracks where mortar has fallen out will mean a cold chimney.

6) A chimney must be kept warm (above 250°F) for proper draft to occur.

7) The smallest cross-sectional area should be considered the effective area of the chimney. For example, an 8" x 8" chimney that is restricted to 8" x 6" at some point should be considered only as effective as an 8" x 6 " chimney.

8) Connecting smoke pipe must be kept a safe distance from combustible materials. This distance is specified in local codes, and should be referred to by the installer. In no case should non-insulated smoke pipe be closer than 18" to a combustible surface. Insulated pipe should be installed according to manufacturer's instructions.

9) The area where the connecting pipe enters the chimney should be sealed with refractory cement so that the connection is airtight.

B. Chimney Cleaning

Check your chimney and smoke pipe at least twice a year to see if they require cleaning. Check more frequently if you are new to woodburning, or have reasons to believe that soot or creosote is building up.

It is not unusual to have a little smoke come into the room as you open the door to add more wood. You can generally avoid this by opening the upper door slightly for five to ten seconds before you open it completely. But if your boiler begins to smoke increasingly as you open the door to add wood, you may have a chimney blockage.

To find out what is wrong, look into the chimney from above or below. If either is inconvenient, use a mirror and a flashlight. The cleanout door is a handy place to use a mirror to look up the flue.

There are a large number of wire "flue brushes" on the market that are manufactured in sizes to match most smoke pipes and chimneys in common use. When equipped with handles and enough extensions, these brushes are the fastest and most effective method of cleaning chimneys and smoke pipes.

Chemical chimney cleaners such as "Chimney Sweep" and "ACS" are on the market. These cause creosote to crumble and disintegrate. We cannot testify to what the long-range effect on the chimney or boiler may be, but we have been advised that any chemical salt added to the fire may cause serious corrosion in insulated metal chimneys or plain smoke pipe or boilers.

C. Starting a Fire

Read and understand this entire manual, and be certain the heating system is fully installed and all electrical and auxiliary systems have been checked out *before starting a fire.* The system must be filled with water and vented to remove air.

There are two controls important to starting a proper fire in your MB-Solo boiler. These are the upper door air inlet and the secondary air inlet on the right side of the boiler.

The primary air inlet is controlled during normal operation by the SAMSON Automatic Draft Regulator.

The regulation of the upper door air inlet and the secondary air inlet is extremely important for the efficiency of boiler operation. As wood is heated in any fire it emits gases which, when burned, yield heat. When they are not burned completely, they can represent a significant loss of efficiency and in some cases form a tar-like flammable deposit called creosote. Creosote is formed when flue gases condense in the boiler or chimney. The MB-Solo's base-burning principle encourages burning of these gases. The smoke leaves the firebox at its base where flammable gases are drawn over the fire's hot coals. The admission of additional air through the secondary air inlet or the upper door air inlet allows these gases to be burned as they go over the coals, rather than having them proceed wastefully and dangerously up the chimney.

Wood-Firing Instructions (continued)

To start your first fire, turn the SAMSON Automatic Draft Regulator control so that the flap on the lower door is wide open. Open the air inlet in the upper door far enough to admit two fingers. The secondary air inlet should remain closed at this time, and should always be closed when starting a new fire or adding a great deal of wood to a fire that is nearly out.

Start the fire in the conventional manner, using paper, kindling and two or three small logs. Pile all these on the grates. Once the logs are burning well, add more, larger logs. The largest wood may be added when the fire is burning well with some coals forming. Logs should be 1 or 2 inches shorter than your firebox and be of such diameter as not to "bridge" or jam in the firebox. The burning wood should be able to settle easily as it is consumed. For this reason, it is important that the logs be stacked horizontally.

D. Adjusting the SAMSON Draft Regulator

The SAMSON Draft Regulator should be adjusted as follows: Turn the black knob to set the red number 80 at the red line. Allow the wood fire to slowly bring the boiler temperature up to about 200°F. When this temperature is reached, adjust the chain and then the knob so that the small air inlet flap is barely closed but is still maintaining tension in the chain. The control will open and close the air inlet flap automatically to allow the proper combustion air to enter the firebox to maintain the selected boiler temperature.

It may take several trials working with the control setting and chain positioning to maintain a proper boiler temperature, during wood-firing, of approximately 170 - 180°F. The final control setting may be more or less than 80 on the dial.

Many boiler owners find that their boilers run better and make less creosote when operated at 200°F. In addition, the radiation in many houses is designed to provide adequate heat at a boiler water temperature of 200°F. If your boiler can maintain a temperature of 180°F, but your house is not getting enough heat when the outside temperature is low, it may help to operate your boiler at 200°F. All that need be done to raise your boiler temperature is to set the SAMSON Draft Regulator to a higher number.

The setting of the secondary air inlet and the upper door air inlet will vary according to chimney draft, type of wood, dryness of wood and other factors. If shut too tightly, insufficient air will be admitted to burn all the flammable gases, and creosote and soot will form more readily. If opened too far, too much air will be admitted and the primary draft control will have little effect on slowing the rate of combustion. The primary air inlet must be able to shut the fire down or open it up, according to the heating demands of the house. Accurate setting of these inlets will develop quickly with practice, if the above instructions are kept in mind.

If you are pushing your boiler in colder weather, take note of the flue pipe temperature. If you experience temperatures over 800-900°F, it is recommended that you install a flue pipe damper to keep the flue temperatures at 900°F or less. Temperatures higher than 900°F°F°F are indication of an overheated boiler.

E. Long-Term Firing

In long-term maintenance of the boiler fire, frequent stoking with small amounts of wood is more desirable than infrequent stoking with large amounts. When the firebox is full, you are using heat energy to drive ordinarily burnable gases in the unburned wood up the chimney, wasting energy and increasing creosote formation. When you are going to bed, or plan to be away for more than a few hours, it will be necessary, however, to load up. Normal use, and especially large loads of wood, will often leave you with quite a few coals when you next stoke the fire. Such accumulations of coals should be pulled forward in the firebox (your boiler cleaning tool is handy for this) where they can get sufficient air to burn and set fire to the next load of wood.

When adding fuel to the boiler, the lower air flap should be closed by removing the hook from the ring at the top of the chain. Without delay the upper door should be opened gradually, so as to build up the draft while preventing a build up of hot gases. These procedures will minimize smoke escaping from the upper door when it is open and will minimize the potential of a flashback.

Ashes should be emptied before they build up to a level where they are touching the grates. Grates are normally kept somewhat cooler than the fire by air flowing under them. Ash buildup can prevent this cooling, causing grates to wear out prematurely.

F. Creosote and Soot

One of the most critical aspects of operating a wood-burning central heating system is the control of creosote and soot. This is especially important when there is a low demand for heat, such as in the fall or spring. A good understanding of the causes and cures for excess creosote or soot formation is essential to the operation of the MB-Solo boiler.

Your boiler and, for that matter, all types and makes of wood-burning equipment can make excessive creosote under certain conditions. You should be aware of these conditions and avoid them.

When wood burns slowly, it produces acetic and other pyroligneous acids which combine with expelled moisture to form creosote. Highly combustible in its solid and semi- liquid states, creosote is present in the gases given off by burning wood. A SERIOUS FIRE MAY BE IGNITED IF A SUFFICIENT CREOSOTE BUILDUP IS PERMITTED. Creosote may build to a considerable thickness on the interior surface of the chimney, thus, substantially reducing the chimney opening, which is not good.

Creosote condenses from the flue gases more quickly when the temperature in the chimney is low. The actual amount of creosote deposited is dependent on: (1) the amount of moisture in the flue gases, (2) the temperature of the stack, (3) the rate at which the wood is burned, (4) the amount of draft in the stack, and (5) how completely the combustible elements in the flue gases have been burned in the combustion chamber. Most problems with creosote are due to insufficiently dry wood, poor chimneys with low draft and cold walls, and/or to a low rate of burning when little heat is required during the spring and fall months.

Moisture in the flue gases may be controlled by:
- using properly seasoned firewood
- mixing small pieces (preferably slab wood) with every full load
- never using only large wood (usually less dry) during mild weather when combustion is relatively slow.

The temperature in the stack may be controlled by:
- using as short a length of smoke pipe as possible between the boiler and the chimney
- using an insulated smoke pipe to connect the boiler to the chimney.

The amount of draft in the stack may be controlled by:
- having as few bends as possible
- insuring adequate chimney height and preventing
- air leaks
- eliminating external obstructions in the chimney
- having only one appliance per flue.

NOTE:
Accumulations of creosote on the boiler jacket can be removed with a mixture of electric dishwasher soap and water, using a scrub brush or sponge. This mixture should not be used to clean the inside of the boiler, smoke pipe and chimney.

G. Chimney Fires

Chimney fires are caused when an excessive buildup of creosote in the smoke pipe or 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 your 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 creosote formation, by maintaining your chimney in good condition, and by cleaning your chimney regularly.

H. Firewood

Burn dry and well-seasoned hardwood, with a moisture content of 20% or less. Season wood an absolute minimum of a year, preferably eighteen months. Woodburners who ignore this advice are almost certain to have dirty chimneys and inadequate performance from their boilers.

Wood-Firing Instructions (continued)

Theoretically, there are about 8600 BTU available as heat from each pound of wood. It takes about 1000 BTU to evaporate each pound of moisture from a log. The wetter the wood, the more energy it takes to get the moisture out of your firewood and the less energy is available to heat your home.

Seasoned wood will produce less creosote. Seasoned wood also produces more usable heat, 20-25% more in the case of some hardwoods.

A cord of wood measures four by four by eight feet. A cord of four-foot logs thus stacked occupies 128 cubic feet and contains about eighty cubic feet of solid wood, the rest being air space between logs.

If you buy a cord of wood, cut it to length, then split it, you will find it does not occupy 128 cubic feet when stacked. You have not necessarily been cheated. A cord cut to length and split packs more tightly and occupies less space.

If you want your wood to dry as quickly as possible, cut it to length and split it. Stack it where the air can move through the pile and shelter it from the weather. A woodshed with air vents in the side walls is effective.

If you cut your trees in the spring or summer, let them lie a while. Until the leaves wither, they will draw moisture from the wood, drying it more quickly than if you limbed the tree immediately.

A good time to cut your own wood is in the late winter or early spring. Then hold the wood for use in eighteen months. This is often the best time to buy wood, too. Green wood can sometimes be had at rock bottom prices in spring or early summer.

The moral is: Don't burn green wood. If you buy green wood, season it before using. With some experience you can spot green wood easily. It is heavier; it looks different. Seasoned wood will often show cracks radiating outward like wheel spokes from the heartwood toward the bark. Green wood will not show this pattern of cracks.

Use the longest piece that will conveniently fit the firebox. The wood will tend to burn (especially with the draft turned low) from front to back in the firebox. The longer the stick, the longer the fire will hold.

You get roughly the same amount of heat from a pound of wood no matter what the species of tree it comes from. But wood is not sold by the pound; it is sold by volume--by the cord. Therefore, the dense heavy woods are the ones to buy, because they will give you more pounds per cord.

The following figures compiled by the United States Forest Products Laboratory indicate the amount of heat available per cord of wood from a few representative tree species:

AVAILABLE HEAT PER CORD, MILLIONS OF BTU

Species	Green Wood	Air Dry	Percent More Heat for Air-Dry Wood
Ash	16.5	20.0	21
Aspen (popple poplar)	10.3	12.5	25
Beech, American	17.3	21.8	26
Birch, yellow	17.3	21.3	23
Douglas Fir, heartwood	13.0	18.0	38
Elm, American	14.3	17.2	20
Hickory, shagbark	20.7	24.8	19
Maple, red	15.0	18.8	24
Maple, sugar	18.4	21.3	16
Oak, red	17.9	21.3	19
Oak, white	19.2	22.7	18
Pine, eastern white	13.1	13.3	10
Pine, southern yellow	14.2	20.5	44

Wood-Firing Instructions (continued)

I. Seasonal Adjustments

1) Winter

Information for winter firing will be found on pages 28 and 29. Control settings for the aquastat of an existing oil- or gas-fired boiler will be found on page 23.

2) Fall and Spring

One of the more critical aspects of operating the MB-Solo boiler is regulation during the period when the heating season is starting or tapering off. For example, if you build a wood fire on a day when the outside temperature rises to 60°F, you will be faced with a lot of heat being generated and nothing very useful to do with it. (In a case such as this, the overheat control would come on and circulate heated water through your house, no matter what the inside temperature was.)

Low heat demand will mean unusually slow burning, creosote-producing fires.

If you are committed to using wood during such times, the best thing you can do is monitor the quantity or quality of the wood you burn. By intermittently building small fires utilizing shorter bigger diameter wood or by using wood with a low caloric value (poplar, for example), you may be able to avoid overheating and creosote buildup.

However, the most efficient and easiest way to burn wood in milder weather is to use a storage tank or tanks. This allows the boiler to be burned at full output until the load of wood is consumed. If the house doesn't need all of the heat produced during this full hot burn, the heat produced can be stored in the tank(s) for use at a later time. With this method of firing, the boiler is not sitting idle with wood smoldering causing creosote formation and probably overheating. Contact TARM USA for more information on the STSS storage tank systems.

Another solution exists if your MB-Solo is hooked up in combination with another oil- or gas-fired boiler. By not building fires in the MB-Solo and by unhooking the chain on the SAMSON Draft Regulator (thereby closing the draft flap and minimizing the standby loss), this other boiler will heat your house as if the MB-Solo were not in the system.

Another solution exists if your MB-Solo is hooked up in combination with another oil- or gas-fired boiler. By not building fires in the MB-Solo and by unhooking the chain on the SAMSON Draft Regulator (thereby closing the draft flap and minimizing the standby loss), this other boiler will heat your house as if the MB-Solo were not in the system.

3) Summer

Wood and coal burning invariably produce ash and sulphur deposits in the smoke pipe and boiler firebox. When combined with moisture, these deposits produce sulphuric acid and other corrosive substances, which will corrode and drastically shorten the life of the boiler and stack. Since summertime humidity will promote condensation, the following steps must be taken to minimize the formation of these corrosive acids.

At the end of the heating season, remove any soot and ash by thoroughly cleaning the boiler firebox and smoke pipe. During the summer, the MB-Solo must be maintained at a temperature of 140°F to prevent condensation in the firebox and the smoke pipe.

If it is not possible or practical to maintain this temperature, first remove the smoke pipe. Clean the pipe thoroughly and block it with newspaper; do not reconnect the smoke pipe to the MB-Solo until the heating season begins in the fall. Then, to keep condensation from forming in the firebox, suspend a 40W bulb inside the firebox.

FAILURE TO FOLLOW THESE RECOMMENDATIONS MAY VOID YOUR WARRANTY!

HOW TO BURN COAL IN YOUR HS-TARM BOILER

Coal is a popular home heating fuel in many areas of this country. Formerly the most widely used home heating fuel, coal declined markedly in use with the introduction of oil-burning equipment in the 1940's. But with abundant domestic supplies still available, the price of coal has remained stable for many years. Today, coal is cheaper than fuel oil in many areas.

When equipped with the optional coal shaker grates and baffles your HS-TARM *boiler is designed to burn coal efficiently and reliably. But as with firewood, specific knowledge and experience are essential if coal is to be burned safely and effectively. Coal shaker grates and baffles are available from your dealer.*

So that you are better able to decide whether or not to burn coal, please consider carefully the advantages and disadvantages of using this fuel. Following you will find a chart that compares coal with wood burning and a formula for calculating the cost of coal relative to other fuels.

COAL VS. WOOD BURNING

Advantages

Coal burns for a longer time than wood; burn times of 14 hours or more are common.

Anthracite coal produces no creosote and very little soot; even well-seasoned wood contains moisture and will produce creosote.

Coal produces very even heat, whereas wood produces a varying heat output. Once established, a coal fire, if properly regulated, burns more smoothly than a wood fire.

Coal may be loaded easily by shovel. There are no problems with logs being an inch too long or with packing irregularly-shaped logs into the firebox!

Coal is uniformly cheaper than fuel oil in most places and, in some places, good firewood.

In a given boiler, coal produces up to 20% higher maximum heat output than wood, which means that the boiler will heat a larger space when burning coal than when burning wood. Coal also contains more heat per volume than wood; thus, a single firebox load of coal will burn longer than one of wood.

Disadvantages

Coal can cause a boiler to overheat more severely than wood if the air flow to the firebox is not regulated properly (e.g., the ash door is left ajar by mistake), due to the fact that a firebox full of coal contains more heat than an equivalent amount of wood.

Coal has a high ash content, and ashes must be emptied once a day. (The best coal will produce 250 lbs. of ash per ton, whereas an equivalent amount of hardwood will produce only 40 lbs). Coal ashes, unlike wood ashes, are **not** suitable for use on gardens.

Coal is a non-renewable resource; firewood is essentially "stored solar energy" and therefore a renewable resource. The mining of coal contributes to erosion and scarring of land and carries occupational health and safety hazards as well.

Coal produces more carbon monoxide gas than wood (see page 36). Also, a coal fire produces sulfur oxides, which cause the "acid rains" that now threaten plant and animal life in many parts of the world.

Coal must be lit by first building a wood fire; wood fires are easier to start and they get the boiler to temperature more quickly.

RELATIVE FUEL COSTS

To compare the price of coal in your area with the price of other fuels, first determine the unit price of the fuels.

Fuel	Unit Price (in dollars)
Coal	price per ton (delivered)
Cord wood (dry hardwood)	price per cord (cut, split, delivered)
Fuel oil	price per gallon
Natural gas	price per 100 cubic ft. (1 therm)
LP gas	price per gallon
Electricity	price per kilowatt

Then, to determine the unit price of each fuel for an equivalent amount of Btu's, multiply each price by the factor listed

Unit Price	x	Factor=	Cost/million Btu
Coal		0 .069	
Cord Wood		0 .088	
Fuel oil		11.11	(Example: Coal at $105/ton
Natural gas		15.4	X 0 .069 = $7.24/million Btu)
LP gas		15.4	
Electricity		294.0	

The costs you have calculated take into account the actual burning efficiency of each fuel. For example, it would be inaccurate to compare the total available heat contained in $10 worth of firewood with that in $10 worth of fuel oil since oil burns more efficiently than wood. Burning efficiencies must be taken into account for a realistic comparison.

Once you know the cost of one million Btu's of any fuel, it is easy to compare costs. For example, let's say you want t know how much you could save by burning coal instead of fuel oil. Your coal would cost $7.24 per million Btu's, and your oil would cost $11.11 per million Btu's. Divide the price of coal by the price of oil:

$$\frac{\$7.24}{\$11.11} = .65$$

The cost of burning coal would be 65% of the cost of burning oil -- or 35% cheaper.

V. Coal-Firing Instructions

A. Warning About Carbon Monoxide Poisoning from Burning Coal

All coal fires produce large quantities of carbon monoxide (CO), a highly poisonous gas. Exposure to this gas produces drowsiness, sleep and, in some cases, brain damage or death. Since carbon monoxide is odorless and colorless, the victim is rarely aware that he or she is being overcome until it is too late.

Your HS-TARM boiler is designed to burn coal safely. **BUT IF THE OPERATOR FAILS TO MAINTAIN THE COMBUSTION SYSTEM PROPERLY, UNBURNT CARBON MONOXIDE COULD ESCAPE FROM THE COMBUSTION CHAMBER, SMOKE PIPE, FLUE OR CHIMNEY, AND ENTER THE HOUSE.** This could occur if any of the following conditions exist:

- A blocked chimney;
- A closed smoke pipe damper;
- A poor chimney draft;
- An internal blockage in the heating appliance that can be caused by a buildup of ashes or creosote, poor position of the fuel, or the use of too much fuel.

WARNING:
The flue outlet in the bottom rear of the firebox must be kept clear. As this opening is directly above the grates (which slope towards the back), **do not allow fuel, ash or hot coals to build up in the back of the firebox and restrict the flue opening!** Keep the coal bed towards the front of the firebox and clean out ashes at least once a day.

HS-TARM now offers an optional cast-iron baffle that prevents buildup of fuel and ash in the rear of the firebox. Consult your dealer for more information.

Your HS-TARM boiler is designed to provide years of safe, efficient operation. HOWEVER, THE DANGERS OF COAL BURNING ARE REAL. Make certain that your boiler, accessories and related equipment are maintained properly to avoid these dangers.

If you have any questions about coal burning, please consult your dealer.

B. Choosing the Right Coal

Coal varies in type, size and grade. Just as there is good and bad firewood, there is good and low quality coal.

We generally recommend anthracite (hard) coal of the "nut" size; you may find, however, that different sizes (such as pea or stove coal) or layers of two or more sizes may produce the best results in your particular boiler/heating system/chimney combination. For example, stove coal produces more heat output but a shorter burn time than nut coal, while pea coal may produce less output and a longer burn.

There are many grades of anthracite coal; we recommend one with a low ash and low sulphur content. (Less ash means less cleaning, and less sulphur means less pollution.) Coal is rated also for its slate content. The more slate, the more solid the residue -- and the harder it will be to shake ashes through the grates.

We do not recommend bituminous (soft) coal. Bituminous coal is messy to handle and produces large amounts of pollution when burned.

Before ordering any type of coal in large quantities, buy a bag or two of the coal you intend to use and try it first in your boiler. As you experiment, bear in mind the following points:

- The larger the size of coal used, the deeper the coal bed must be to maintain a good fire.
- Coal sizes should not be mixed but applied in separate layers for best results.
- Smaller sizes of coal can be used to "bank" a fire on top of the bed for longer burns.
- If your boiler has too great a draft, causing the fire to burn to quickly or too hot, use a smaller size of coal.
- If the draft is sluggish, use a larger size of coal.
- If the coal doesn't burn completely, leaving a "heart" of unburned coal surrounded by residue, use a smaller size of coal.

Coal-Firing Instructions (continued)

C. Grates

Because all coal fires produce large quantities of ash and solid residue, most coal-burning appliances are equipped with special, moveable grates. These grates stir, shake, grind or otherwise get ash, slate and clinkers (residue fused together by high temperatures) through the grates and into the ash pan below.

HS-TARM shaker grates are designed specifically for coal burning and are essential for best results. Coal may be burned on the standard wood grates, but reloading the firebox and cleaning the grates and ash pan are more time-consuming and difficult tasks.

D. Starting the Fire

First check to see that the boiler controls are set in proper position:

- secondary air dial on door open halfway
- secondary air control on right side of boiler open 1/3

The settings are intended as a starting point for your initial fire. You may find that variations from these settings are appropriate for your particular installation. For example, the greater the draft, the lower the secondary air setting(s) may be. Whatever the installation, however, the primary air inlet flap should be kept wide open until the coal fire is burning well; coal fires need a lot of air to get started.

NEVER USE GASOLINE, KEROSENE, LIGHTER FLUID OR ANY OTHER CHEMICAL TO START YOUR FIRE NOR USE THESE CHEMICALS ONCE YOUR FIRE IS ESTABLISHED.

To start a coal fire, first build a small wood fire, using lots of dry, softwood kindling and small pieces of dry hardwood. Concentrate the greatest amount of wood in the front of the firebox. Be sure that the bed of wood is burning well before you add any coal.

Add coal in a thin layer, leaving a small region in the front of the firebox uncovered. After about ten minutes, add another layer, making sure that the wood in the front of the firebox is still burning well. When adding coal in layers, wait until last layer of coal produces blue flames before adding the next layer.

Add thicker layers of coal over shorter intervals until the firebox is filled to within two to three inches of the bottom of the firing door. If you cannot avoid overheating when maintaining this large a fire, you can assume that it is too warm outside to be burning solid fuel.

The SAMSON Draft Regulator should now be adjusted. The procedure for adjusting this regulator is the same for burning coal as for burning wood (see page 29).

If the fire starts to die down as layers of coal are added, use a poker, rake or shovel to dig a channel through the coal to the glowing embers. Stir the embers or, if necessary, move them into areas that are not burning.

Whenever adding a thick layer of coal, be sure to make a hole in the new layer so that glowing coals in the bed below are visible; this opening will ensure that gases produced by the burning coal can surface and then be burned or vented up the chimney.

E. Maintaining the Fire

Once the coal is burning well, a very constant heat output can be maintained. The SAMSON Draft Regulator will control the boiler water temperature as precisely as it does when wood is used.

Cold spots in the coal bed may develop in areas with insufficient air for combustion. Should this occur, use a poker, rake or shovel to dig into the bed (to the level of the grates) and stir or agitate the embers to increase air flow to the spot. If the cold spot gets larger or if the fire goes out, first shake the grates (see next section). Then clear a small area at the front of the firebox and start a small wood fire with kindling. When the wood fire is burning well, rake coals up over the burning wood.

F. Reloading the Firebox

Normally, reloading is necessary only at eight-hour intervals. To reload the firebox, add several layers of coal on top of the bed. Then shake the grates until the ash pit is glowing uniformly.

<u>Shaking the grates:</u>
It is important to avoid jamming the shaker grates with pieces of unburned coal. Jamming will make shaking difficult, and, in the worst cases, the firebox will have to be emptied completely before the grates can be un-jammed.

Coal-Firing Instructions (continued)

To clear small amounts of ash, it is necessary only to "vibrate" the grates rather than swing them as far as they can move in either direction.

When clearing larger accumulations of ash (which must be done at least once a day), shake the grates more vigorously, using short, choppy motions, to grind up the residue on the grates. Shake or rock the grates only until the ash falling through the grates turns red; if you shake the grates too long and whole pieces of coal become pinched between the grate sections, the grates may jam.

When clearing unusually large amounts of ash and residue, it may be necessary to break up the residue first with a straight poker, so that it may be shaken more easily through the grates. To break up the residue, open the ash door and slide the poker through the small vertical swinging grate and over the top of the grates, plunging the poker repeatedly back and forth. Cover as much area as possible by plunging the poker in different directions. Then shake down the ash as described above.

After shaking the grates, be sure that a small amount of ash is left on the grates to protect them from the direct heat of the burning coal. Also make sure the ashes in the ash pan do not build up so they touch the grates. Always have air space between the bottom of the grates and the ash.

As fires normally burn front to back, it is important to have good hot coals in the front of the firebox. Let the coal fire heat up for about 15 minutes before completely filling the firebox with new coal. Watch for any cold spots that may develop.

When reloading the firebox with pea or other small-sized coal, it is advisable to leave a glowing "crater" of already burning coal exposed at the center or sides of the firebox.

Coal burns best at a uniform rate. Hard firing followed by slow firing often produces clinkers and may cause premature failure of the grates.

G. Overnight Firing

First bring the boiler to operating temperature with the coal fire. When the fire is burning well, poke the bed with a poker and shake the grates. Then load the firebo with new coal. Spread a layer of ash or a layer of small-sized coal over the top of the bed to insulate the coal for a long burn. If the boiler has a flue damper, be sure to close it.

H. Reviving a Nearly Dead Fire

Do not poke the fire or shake the grates. Spread a thin layer of good, dry coal on the fire and open the draft. When this new coal has ignited and is burning well, shake the grates and reload the firebox as usual (see page 37).

I. Special Coal-Burning Problems

The two most common difficulties encountered by coal burners are inadequate output and having the fire go ou Both problems are caused by trying to maintain too sma a fire.

Many people avoid building a large coal fire because they believe that a large bed of glowing coal will overheat the boiler. The truth, however, is that despite coal's high energy density, a large bed of burning coal is **easier** to control than a large wood fire. A coal bed has more resistance to air movement and it burns more uniformly than firewood; hence, it can be regulated well over a wide range of heat outputs by the SAMSON Draft Regulator.

If you leave the ash door open by mistake, however, a coal fire will overheat the boiler more severely than will a wood fire of the same size!

A small coal fire can die out easily and can be put out easily by additions of even modest amounts of coal. Remember, a coal fire requires a minimum "critical mass" of burning coal to maintain itself.

You can add new coal to a large, established fire withou danger of putting out the fire. This feature is particularly advantageous at night, when you must provide enough fuel for a long burn and also insulate the burning mass below the new fuel so that the fire will burn evenly when the demand for heat is low.

TROUBLESHOOTING AND MAINTENANCE

This section is designed to assist the homeowner and the installing contractor in the care of the heating system as well as in the correction of some of the more common problems encountered in the operation of the MB-Solo boiler.

It is not possible within the scope of this manual to cover all possible service aspects of hydronic heating systems. Your HS-TARM *dealer is your best source of information on all aspects of your heating system.*

VI. Troubleshooting

A. Boiler Overheating

NOTE:
The wood fire in the MB-Solo boiler will always produce a certain amount of heat, even when there is no heating demand on the system. This fact makes the behavior of such a system quite different from an oil- or gas-fired boiler, where heat is produced "on demand". The "baseline" heat output that is continuously generated by a wood fire must be absorbed by the boiler itself. If there is no heat being called for, the boiler temperature will rise causing the overheat control to circulate heated water to the house even when the thermostat is satisfied. Such potentially wasteful overheating is most likely to occur during spring and fall (see page 32) and is more likely to occur in certain systems than in others. Before choosing a particular system for your installation, the possibility of using a mixing valve arrangement to avoid such problems should be considered. HS-TARM makes a 4-way mixing valve system designed especially for use with your MB-Solo boiler. The system is available in both automatic and manual versions. Such an arrangement can be added to any heating system. Please see page 18 for more information. Your dealer can help you decide whether such a system is desirable for your installation.

*We recommend the use of a termovar mixing valve and a heat storage system with all MB-Solo boilers. Please see page 19 for mixing valve information or ask TARM USA for heat storage information. Also see page 25.

Overheating in the MB-Solo boiler is an occurrence that all homeowners must be familiar with, so that it can be corrected when it should occur.

When the boiler temperature rises above a preset limit (usually 200°F), causing the overheat control and perhaps eventually the pressure relief valve to open, the boiler is overheated.

The most common causes of this overheating are:

- Overfiring the boiler (i.e., putting in too much wood for heating needs of the house at a given time.) For proper firing, see page 27-32.
- Improper adjustment of the SAMSON Draft Regulator (see page 29).

Following the recommendations in the manual will minimize overheating. Even the most experienced person will occasionally overheat his boiler. To cope with this problem, the boiler is equipped with two safety devices - the Overheat Control and the Pressure Relief Valve.

The Overheat Control is wired to circulate excess boiler heat to the house when the boiler reaches a preset temperature (200°F). It does this by turning on a circulator and opening any zone valves in the largest heating zone, even if there is no call for heat from the thermostat. This will generally cool an overheated boiler within 15 minutes.

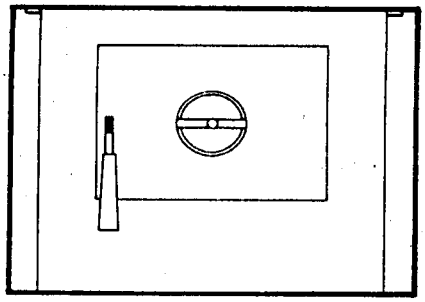
If the overheating condition is more severe, the temperature will continue to rise. At about 250°F, the pressure in the boiler will have reached 30 psi, and the pressure relief valve will open, discharging steam. The valve prevents the boiler from reaching a dangerous pressure. For your information, all MB-Solo boilers are pressure tested to 72 psi at the factory.

To prevent the possibility of serious burns or property damage from the steam, the discharge tube must be piped to a point 6" from the floor or to a drain. The reason steam rather than water is discharged is due to the fact that water under pressure can reach temperatures above 212°F without boiling (as in a boiler), but, when released to the atmosphere by the relief valve, it turns immediately to steam if it is over 212°F.

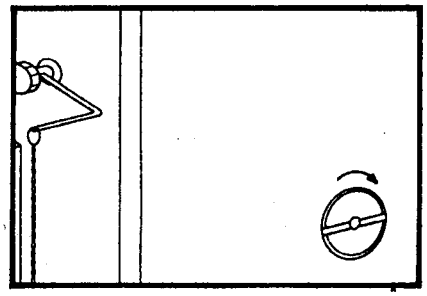
TO COOL A SEVERELY OVERHEATED BOILER, (relief valve discharging, or temperature rising over 230°F), follow these steps:

1.
Make sure the lower door air flap and all secondary air inlets are closed.

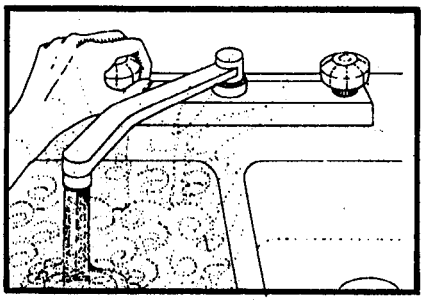
a.
(view of flap on door)



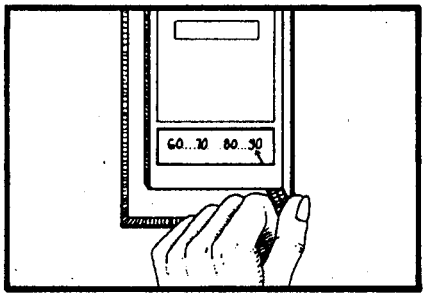
b.
(closed secondary air inlet on load door



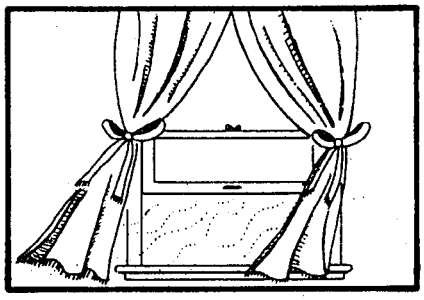
c.
(closed secondary air inlet on side of boiler



2.
Open all hot water Faucets in the house if the boiler has a domestic hot water coil.



3.
Turn all thermostats up to their highest setting.



4.
Open windows as Necessary to keep the house cool.

When the boiler has cooled to normal operating temperature, resume normal operation.

B. Procedure in Event of Power Failure

Should your electricity go off during the heating season, there are several procedures that should be followed in order that you may continue to safely operate your heating system. These procedures apply to the wood-fired boiler, as the gas- or oil-fired boiler, if any, will be completely inoperative.

1) Locate any "flow-check" and zone valves in the system, and manually open them. (This will allow a certain amount of heated water to circulate by convection throughout the house, preventing the pipes from freezing and keeping the house partially heated.)

2) The SAMSON Automatic Draft Regulator will continue to control the wood fire in the absence of electric power. It is important to remember that the heating system cannot safely use the heat from a great deal o firewood without the circulators running. Under such conditions, extreme caution must be used to avoid overfiring. DO NOT LOAD LARGE AMOUNTS OF WOOD INTO THE BOILER! Fire the boiler cautiously until you are able to determine how quickly the boiler i consuming wood without overheating.

3) When the power has returned, reset all flow-check an zone valves and resume normal operation of the system.

NOTE:
This does not apply to gravity systems, as they have no flow-check valves and will continue to operate normally without electricity.

Troubleshooting (continued)

C. Low Heat Output

The following table is intended to help you and your heating contractor diagnose and correct heat output problems.

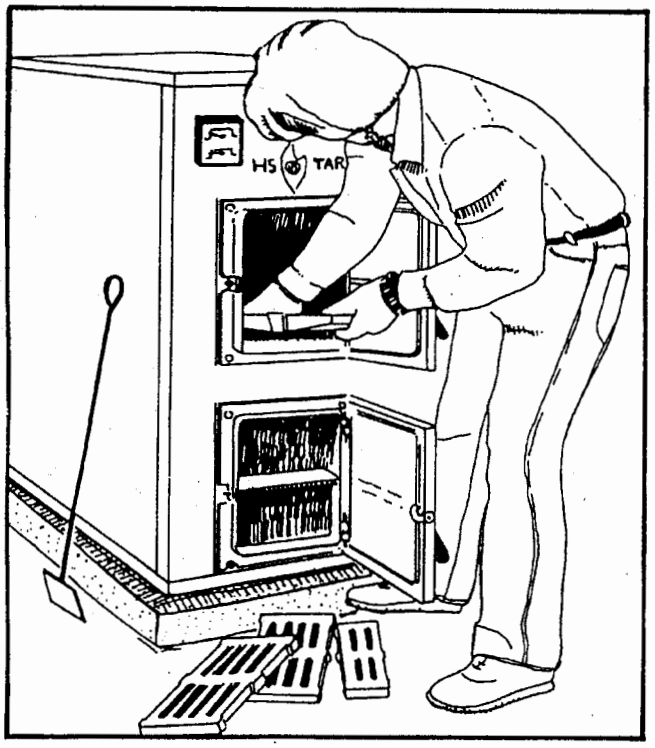
Symptom	Cause	Solution
Fire will not burn fast: creosote forms in chimney or boiler at high rate: lots of smoking from door when loading boiler.	1)Poor chimney draft (under .05in/wg during moderate boiler output).	Seal all leaks in chimney. Clean chimney. Insulate chimney, if possible. Shorten smoke pipe to boiler: Eliminate elbows in pipe, if possible. Remove other appliances from chimney and plug these openings. Build new inside chimney.
	2) Improperly seasoned wood (moisture content greater than 20%)	Use well-seasoned wood – wood should be cut at least 18 months ahead then split and stored under cover in dry place with good air circulation as soon as possible after cutting.
Fire will burn fast: wood consumed quickly but still inadequate heating.	1) Improperly seasoned wood.	See above solution.
	2) Excess draft (over 1.06 in/WG.)	Install barometric damper or smoke pip damper.
Boiler functions well with good burn times but inadequate heat on coldest days.	1) Boiler temperature to low.	Increase temperature b adjusting Samson Draft Regulator for 200 F boile temperature.
	2) Inadequate radiation in house.	Add radiation where appropriate, if possible.
	3) Excessive creosote inside boiler has reduced heat transfer.	Clean boiler (burning a load of anthraci coal often will make tar-like creosote flakey and thus easier to scrape off).
Inadequate output, even after all other possible causes have been eliminated.	Boiler to small for home.	Add insulation to house and weatherstripping to doors and windows Insulate all boiler piping located in Unheated spaces. Use your oil burner to supplement wood heat output. Burn coal, which can increase output by up to 25%

VII. Periodic Maintenance

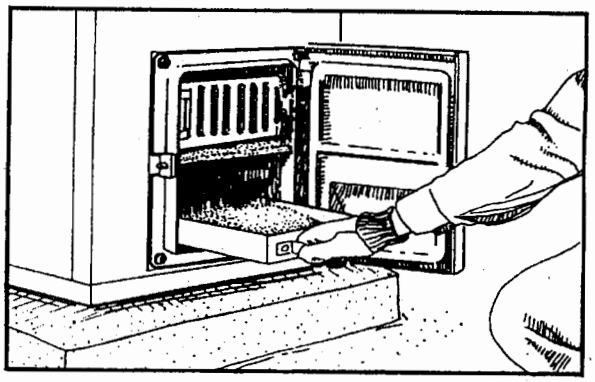
The efficiency of the MB-Solo boiler is affected greatly by the amount of creosote and soot coating the inside of the boiler. A layer such as this acts as an insulator, preventing the wood fire from heating the water, and results in valuable heat escaping up the flue.

The inside of the boiler should be cleaned periodically during the heating season. If you are new to burning wood in your MB-Solo, it is recommended that you check the heat exchange area of you your boiler every week or two at first. After removing the cleanout cover, if you find creosote build up scrape and brush the heat exchanger area as needed. At least once every two months (more often if burning partially green wood or when firing during periods of low heating demand), allow the fire to die out, then remove the grates, the ash pan, and all ash or unburned wood. Turn off your oil burner.

Using a long- handled steel bristle brush or a wire wheel on a flexible shaft connected to an electric drill, and your boiler scraping tool, clean all accumulated creosote and soot from the inside of the boiler. This is also a good time to disassemble the smoke pipe leading to the chimney, and to clean and inspect it for corrosion. At this time, the top jacket panel should be removed and the cleanout cover over the heat exchanger at the rear removed. This allows cleaning of the heat exchanger area with scraper and brush. Any wood ashes removed from the boiler should be placed in a steel container with a tightly fitting lid and moved outdoors. Other waste shall not be placed in this container. Be sure to turn on your oil burner again when cleaning is complete.

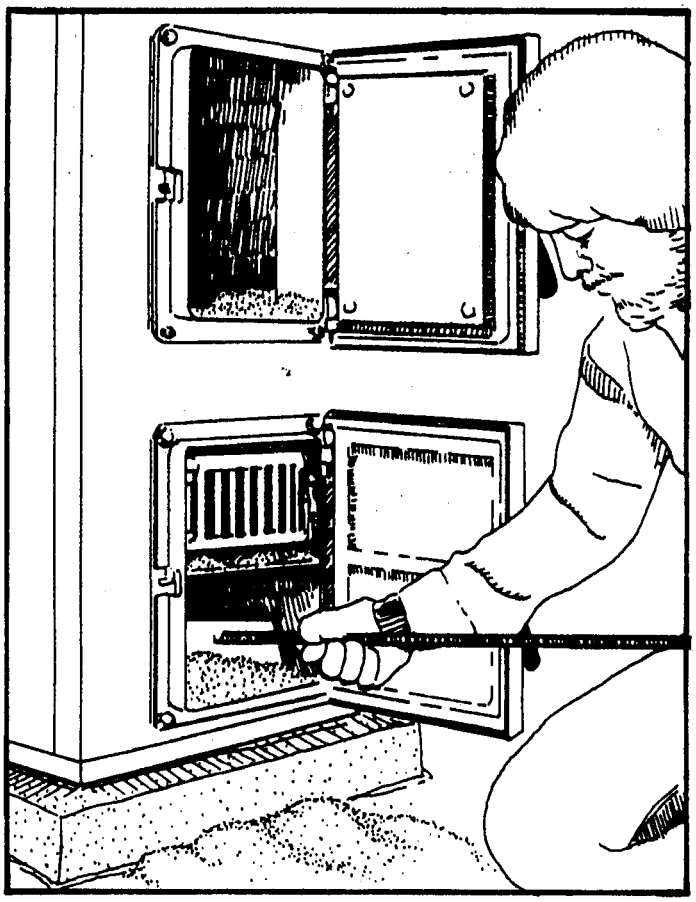


Remove grates from boiler.

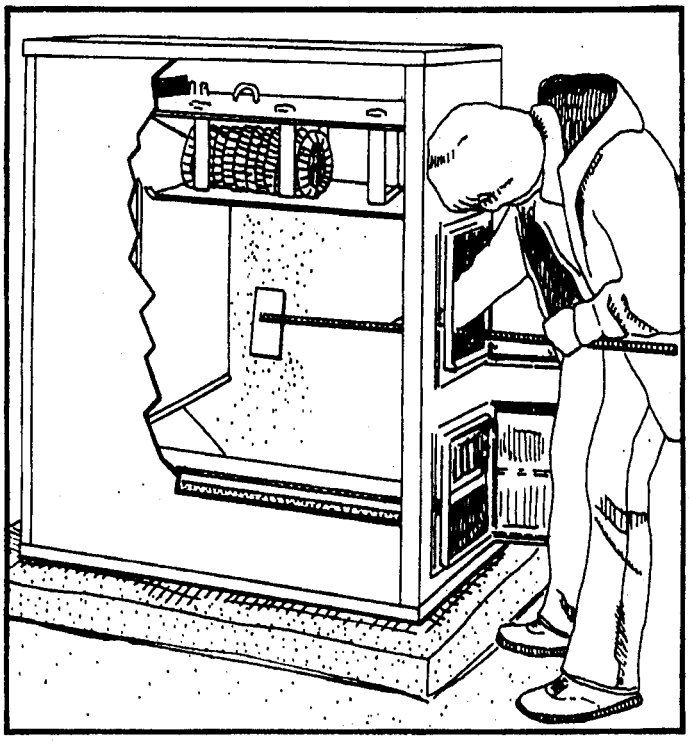


Remove ash pan.

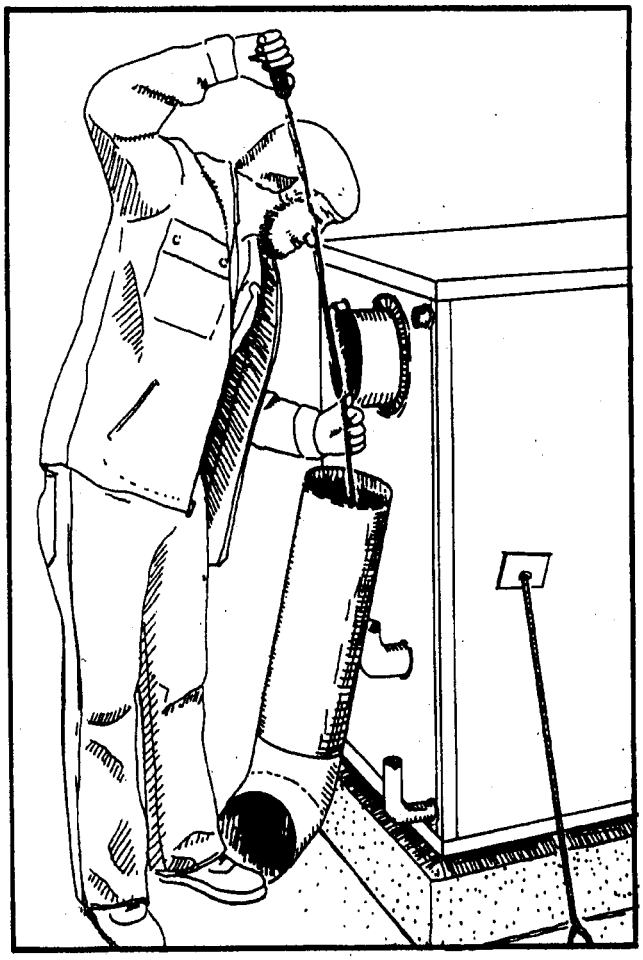
VII. Periodic Maintenance (continued)



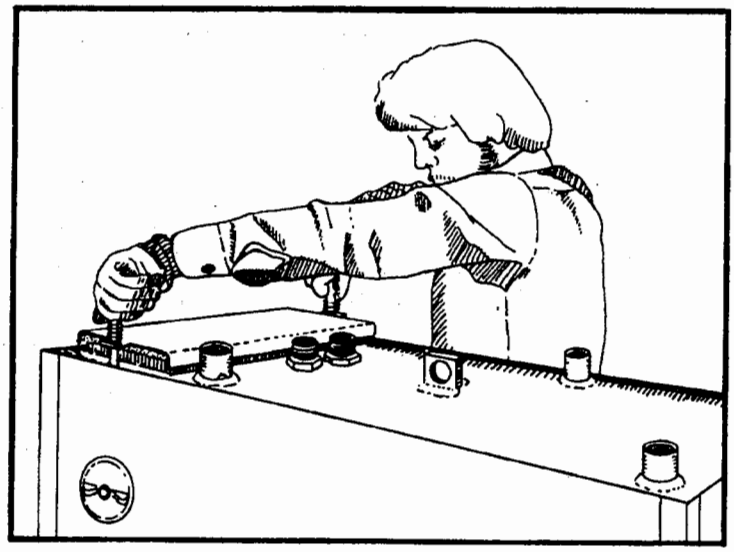
Scrape all ashes from firebox



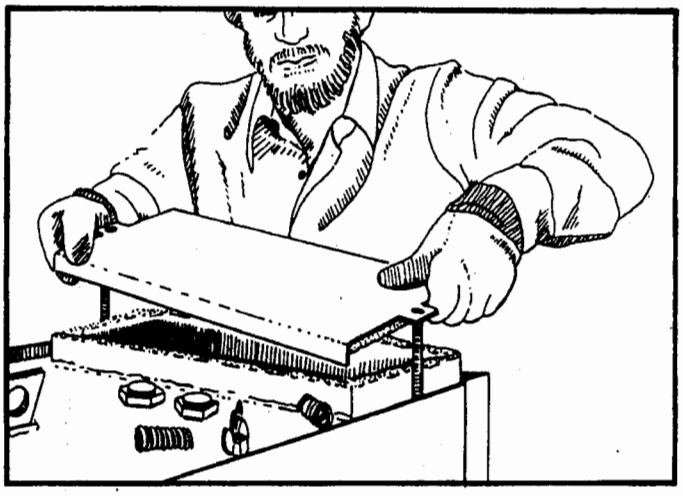
Scrape creosote from sides and top of firebox.



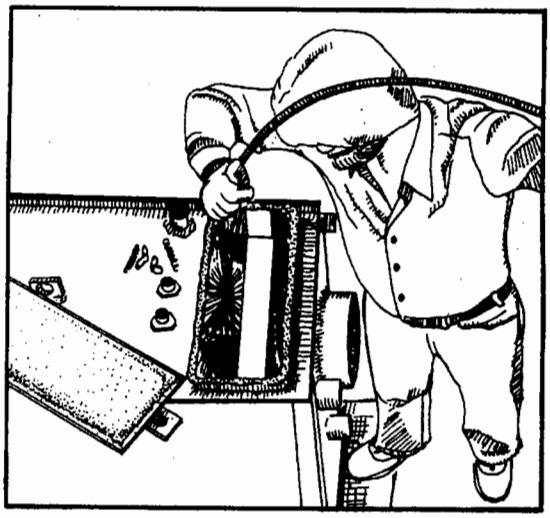
Clean smoke pipe with flue brush.



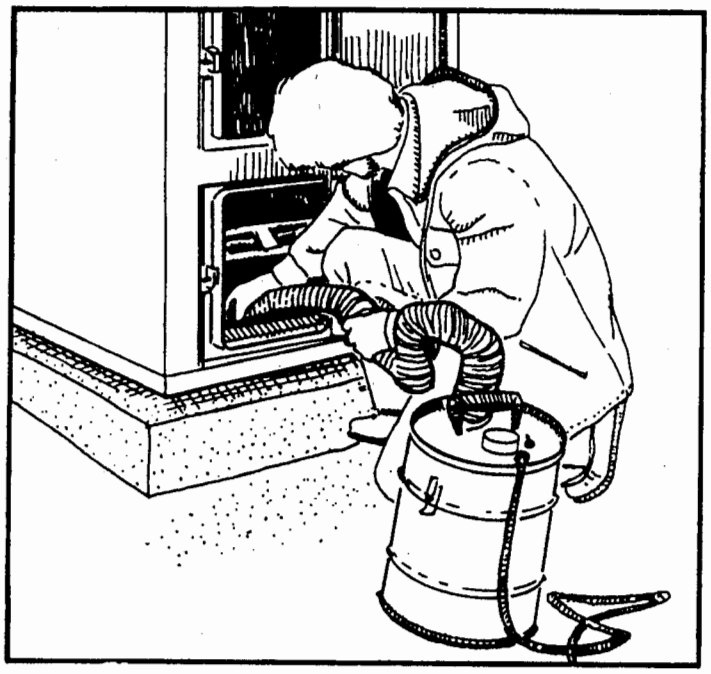
Unscrew wing nuts on cleanout cover.



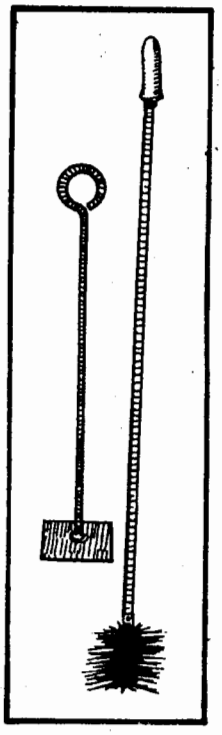
Remove cover, taking care not to damage gasket.



Finish cleaning heat exchanger with flue brush.



Vacuum firebox.



Scraper and flue brush

MB-SOLO LISTING LABEL

A copy of the ETLM listing label for the HS-Tarm MB-Solo MK II series boilers is shown below:

Tested & Listed By Beaverton Oregon USA

OMNI-Test Laboratories, Inc.
Report #236-S-02-2

Manufactured By: BAXI A/S; Tarm, Denmark
Imported By: Tarm USA, Inc.; Lyme, New Hampshire
Test Standards: UL 391-1995, CAN/CSA B366.1-M91
Test Dates: 04/03/2001 – 04/13/2001
Serial #:_____

MB Solo MKII

SOLID FUEL-FIRED BOILER

FOR USE WITH SOLID WOOD FUEL OR COAL ONLY.

✔	Model	Fuel	BTUH Output
	MB Solo 40, MKII	Wood or Coal	100,000 (30.0 Kw)
	MB Solo 55, MKII	Wood or Coal	140,000 (41.0 Kw)
	MB Solo 75, MK II	Wood or Coal	180,000 (53.0 Kw)

Clearances to Combustibles			
Side Wall to Appliance	6"(152mm)	Combustibles to Flue Pipe	18"(457mm)
Back Wall to Appliance	18"(457mm)	Ceiling to Appliance	18"(457mm)
Front of Appliance to Combustibles	36"(914mm)		

Insert Month Bar
Insert Year Bar

BOILER WARRANTY

WARRANTY - FOR USE IN THE USA and CANADA

Tarm USA, INC (Importer) warrants the residential steel boiler identified below and the hot water tank or coil, and the cast iron doors and grates, against defects in material and workmanship under normal home use and service, TO THE ORIGINAL PURCHASER AT THE ORIGINAL INSTALLATION SITE in the United States and Canada, under the following terms.

BOILER BODY
LIMITED 10 YEAR WARRANTY

Subject to all the limitations stated below, Importer warrants the steel boiler body (but not including cast-iron doors, coil or other components) against defects in materials and workmanship resulting in breaks or leaks causing significant impairment of performance.

IMPORTERS OBLIGATION: The Importer's sole obligation under this limited warranty is to provide payment of the below listed percentage of the cost of the repair of the warranted item. The Importer may at its option decide to use this sum as a partial allowance to replace the warranted items. Importer will pay all required labor and the cost of all materials for the repair of the boiler defects arising during the first five years of the warranty period. In years six through ten, Importer will pay for a percentage of labor and materials for the repair of the boiler body up to a maximum of the same percentage of the Manufacturer's retail price for the HS Tarm model during the year in which the boiler was originally purchased. Shipping charges in connection with replacement or repair shall be paid by the owner.

Warranty Year	
1-5	100%
6	50%
7	40%
8	30%
9	20%
10	20%

Example #1: Repair costing $250 in year 7. Importer will pay $100.00 (40%) of this repair.

Example #2: Boiler (original cost $4000) needs major repairs in year 9. Importer will pay $800.00 (20% of $4000) toward replacement with similar HS TARM boiler or up to 20% of the repair cost ($1200 maximum)

OTHER COMPONENTS
LIMITED THREE YEAR WARRANTY

YEARS ONE THROUGH THREE: Subject to all the limitations stated in the following table, Importer warrants the cast iron doors, hot water tank or coil, refractory and combustion chambers, cast-iron separation baffles and plates against defects in materials and workmanship resulting in breaks or leaks causing significant impairment of performance.

Warranty Year	
1	100% of parts & labor
2	100% parts only
3	50% of parts only

CONDITIONS OF WARRANTY

- This limited warranty covers only repairs or replacements resulting from defects in materials and workmanship.
- This warranty shall be void if the boiler is installed by someone other than a qualified contractor whose principal occupation is the sale or installation of plumbing and heating equipment.
- This warranty shall be void if the owner fails to have the boiler serviced or inspected at least once every two years by an experienced and qualified service person.

EXCLUSIONS: Expressly excluded from coverage by this limited warranty are the following:

- Ordinary wear and tear, repairs or replacements necessitated by normal home use as described in the Installation and Operation Manual.
- Repairs or replacements arising from the effects of corrosive water supply or corrosive products of combustion.
- Repairs or replacements arising from the use of the boiler in a "cold start" system.
- Repairs or replacements of fittings, motors, fuel units, oil and gas burners, any and all other controls, relief or regulating valves. transformers, and accessories.
- Repairs or replacements to repair damage caused by operation with inadequate draft, or too hot operation from a cold start or any other use in violation of the instructions or cautions set forth in the Installation and Operation Instruction Manual.
- The repair or replacement of any component furnished by any other manufacturer, or damage caused by the functioning or malfunctioning of any such component.

PURCHASER'S LEGAL RIGHTS: This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state. This warranty shall not be construed as inconsistent with any federal, state or municipal law or any regulations promulgated in connection herewith.

Questions regarding this warranty may be referred to TARM USA INC., 5 Main St., Lyme, NH 03768 Phone: 1-800-STAY-WARM

HOW AND WHERE TO GET SERVICE 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 which is not covered by this limited warranty or which is not authorized by the dealer.