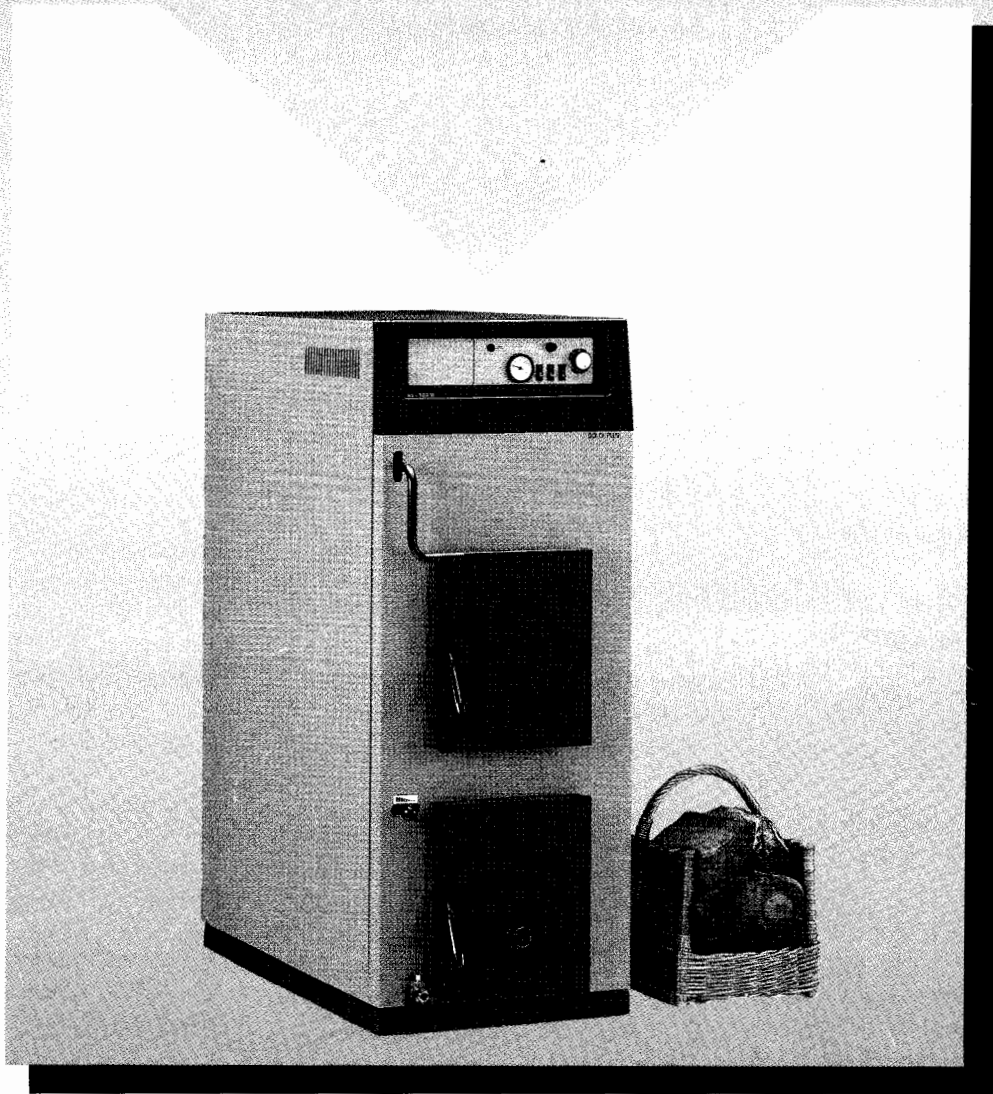


SOLO PLUS-MKII

INSTALLATION AND OPERATION MANUAL



SETTING THE STANDARD FOR EXCELLENCE IN WOOD-BURNING BOILERS

HS  **TARM**

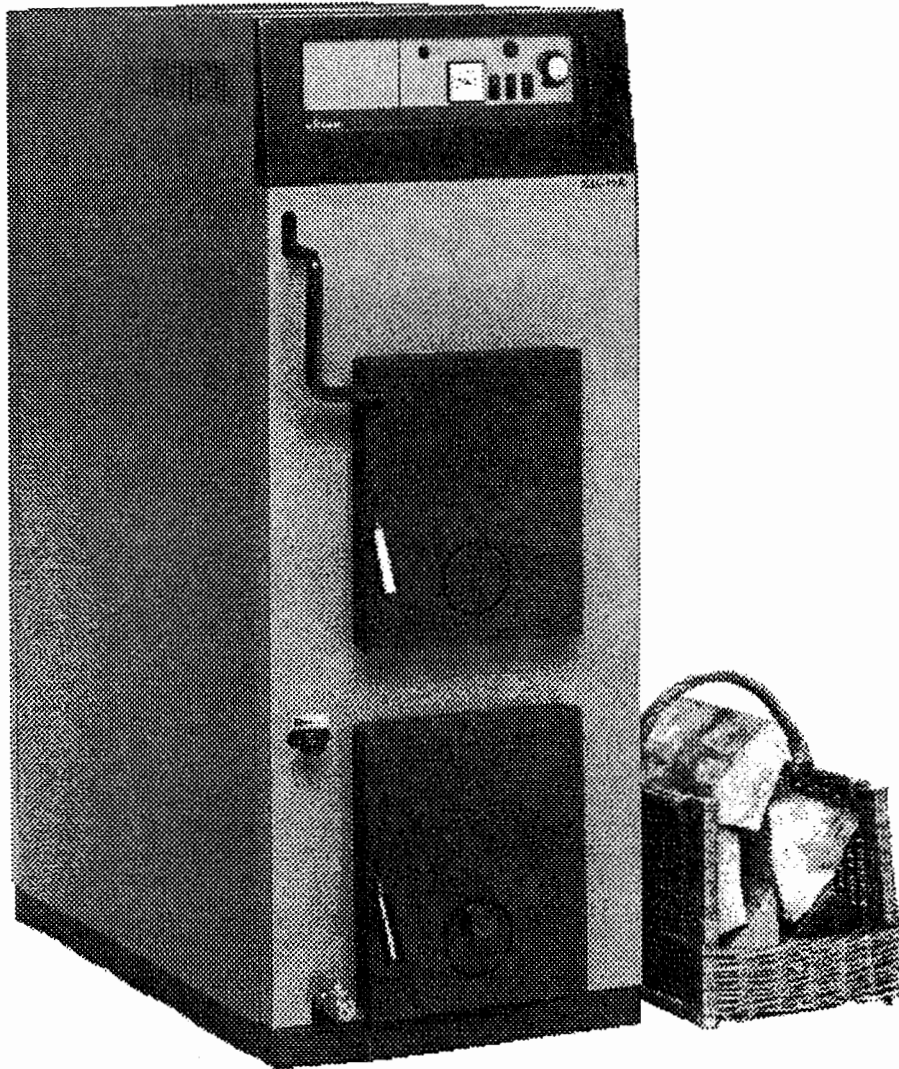
April 2003



OWNER'S MANUAL

Solo Plus MK II
Revision 03

SOLO PLUS – MK II



INTRODUCTION

Thank you for purchasing an HS-Tarm Gasification boiler.

Your boiler was manufactured by HS-Tarm, a world leader in hot water (hydronic) heating for over 70 years. The HS-Tarm Solo Plus Series boiler conforms to traditional high standards for quality and reliability. It is truly state-of-the-art in high efficiency, clean-burning wood heat. When installed and operated properly, your boiler will operate at over 80% heating efficiency on wood fuel. If treated properly and operated according to the guidelines in this manual it will provide years of safe, dependable and economical heating.

HS-Tarm Solo Plus boilers have been tested and listed by Omni-Test Laboratories, Inc. The test standards used are UL 391 and CAN/CSA B366,1-M91 for the United States and Canada. The Solo Plus boilers also meet stringent European test codes and standards for safety and quality assurance.

This manual contains installation, operation and maintenance guidelines for HS-Tarm Solo Plus Wood Gasification boilers. Your heating system design and installation should be done by a competent professional contractor.

NOTE: Installation must be done in accordance with local ordinances, which may differ in some ways from this owners manual.

Please note that the installation instructions refer to specific makes of controls and accessories. Equivalent makes and models of these devices may be used successfully. The installing contractor is the best judge of a system's specific requirements, as well as of local availability of different devices. However, be certain that no substitutions are made for the standard safety equipment, control panel and relief valves that we have supplied with the boiler. The installation of these devices is absolutely necessary for safe operation of the boiler and for protection of the heating system.

Every effort was made during the writing of this manual to produce a guide which would be easy to understand and contain all pertinent information.

NOTE: 1. We urge you to thoroughly familiarize yourself with this manual before installing and operating the boiler.

2. Please keep this manual handy for future reference.

Included is information which will make operation of your new boiler an easier and more enjoyable experience. If questions arise during the installation, operation or maintenance, or if you are in doubt about any aspect of your boiler, please contact your installer, your dealer or TARM USA, Inc.

What is an HS-Tarm Wood Gasification boiler? It is a wood-fired boiler designed and constructed for the highly efficient combustion of firewood. Do not burn other fuels in the Tarm Solo Plus boiler.

WOOD COMBUSTION

Very important to the function and design detail is the wood fire combustion draft fan. The primary and secondary air are both fed through air ducts into the firebox with the precise volume necessary for proper combustion.

The primary air is introduced into the top of the firebox through an opening at each top corner of the boiler load door opening. The secondary air is forced through the refractory, where it is heated and distributed through two channels and the many air nozzles on each side of the center slot in the refractory. The secondary air is injected with high velocity directly into the hot gases and flame to complete the wood combustion.

A very important design detail of Tarm Gasifiers is the refractory combustion tunnel in the heart of the boiler. These refractory blocks ensure that the wood combustion temperatures exceed 1800° F, several hundred degrees more than is needed to burn wood smoke and gas. This combustion is extremely efficient and virtually smoke and creosote free.

The optimal and environmentally desirable combustion of wood with the highest efficiency demands the correct proportional mixture of gas from the wood and combustion air from the fan.

The heat is transferred to the boiler water by means of heat exchange tubes located behind the firebox and refractory combustion tunnel.

RESPONSIBILITY

The user is responsible for the operation of the boiler and that the guidelines in this manual for firing are observed and followed. Not following the instructions can result in lower efficiency and environmental pollution because the desired clean flue gas is not obtained. Furthermore, misapplication will reduce the boiler's life. The correct operation and installation is the best guarantee of a properly operating boiler with a long lifetime and less pollution. It is a prerequisite that the user has the will and the right attitude towards firing with wood. In spite of everything, some work must be done to benefit from this environmentally desirable and most economical method of heating your home.

MAINTENANCE

It is also the responsibility of the user that the boiler be cleaned and maintained according to:

- normal practice,
- the instructions of this manual,
- instructions for the controls or equipment, and
- other circumstances described in the written warranty.

SAFETY

If an unsafe condition occurs it is to be repaired as soon as possible by a qualified serviceperson. Outlets, ventilating ducts, fresh air conduits and others must not be closed or clogged up.

PLEASE READ THIS PAGE CAREFULLY!

This boiler has a limited warranty which is included with your boiler as a separate enclosure. To validate your warranty, detach the postcard, fill in all information requested and return the card to TARM USA, INC. Please always raise questions or warranty claims with your installer/dealer who delivered the boiler to you. The installer/dealer then passes the claim on to TARM USA, INC., IF NEED BE. However, claims may also be raised directly with TARM USA, INC.

General Information

Please read the literature enclosed by the manufacturer regarding 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.

NOTE: 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.

Plumbing diagrams in this manual are for basic information only and do not show all valves, vents, fittings, etc that are normally included in finished boiler installations.

All systems should be designed by competent contractors, and only persons qualified in the layout and installation of heating systems should attempt the installation of any boiler.

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

If any fans are used in the fuel storage area, they should be installed so as not to create negative pressure in the room where the solid-fueled burning appliance is located.

Please read carefully the section "OPERATION DURING SUMMER". Failure to protect your boiler from condensation during the warmer months MAY VOID YOUR WARRANTY! SEE PAGE 46.

Homeowners should read and familiarize themselves with "BOILER OVERHEATING" and "OPERATING IN THE EVENT OF POWER FAILURE". SEE PAGES 49, 50 AND 51.

WARNING: Do not use gasoline, kerosene or other flammable liquids to start or maintain solid-fuel fires in your boiler. Serious burns and property damage may result.

WARNING: Do not store any combustibles, including fuel for the boiler, within the fire clearances specified below in "Installation Information". Keep fuel clear of the fuel-loading and ash-removal access areas.

WARNING: This boiler is designed to burn wood. Both hard and soft woods may be used, but under no circumstances should you burn coal or small pieces of wood or wood waste that can fall through the center slot in the refractory.

Installation Information

The boiler must be connected to a tile-lined masonry flue or to a Type HT approved chimney. No other appliance should be connected to this flue. Consult your local building inspector for the chimney requirements, and install the boiler in accordance with all applicable codes.

The boiler requires adequate fresh air supply for efficient and safe operation. For more information refer to NFPA Standard #31 and page 10.1.

The boiler must be positioned to provide minimum clearances from combustibles or combustible surfaces as follows: LEFT SIDE=6"; RIGHT SIDE=6"; TOP AND REAR=18"; FRONT=36".

There must be a minimum clearance of 18" between smoke pipe and all combustible surfaces. Clearance to hot water pipes is 1 inch.

Use the wicking and pipe dope supplied with the boiler to seal all the threaded connections to the boiler and Termovar.

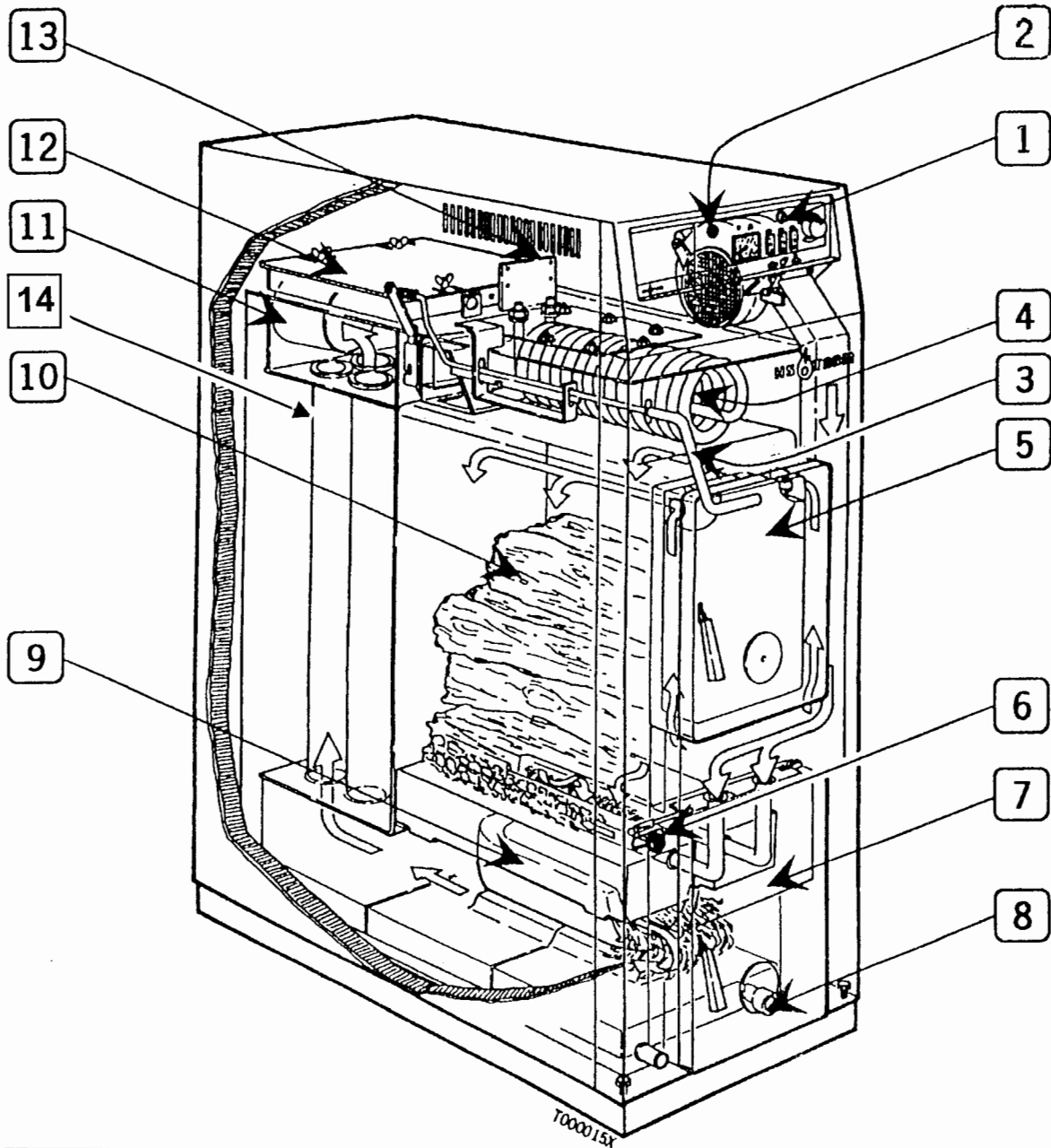
When references are made to tapping numbers, please refer to Page 58.

Do not use self-contained, non-electric zone valves on the main heating zone as it is to be used as the overheat/dump zone.

Do not use any radiant floor heat tubing that does not have an oxygen barrier with any Solo Plus Boiler.

**Installation must conform to ANSI/NRPA standard #211
MINIMUM REQUIRED FLUE SIZE – 8" X 8: TILE OR 8" ROUND
MINIMUM DRAFT -- .05 IN/WG DURING NORMAL OPERATION**

HS-TARM SOLO PLUS MK II BOILER AND BASIC EQUIPMENT



- | | |
|-------------------------|--------------------------|
| 1. Control panel | 8. Viewing window |
| 2. Draft fan | 9. Ceramic refractory |
| 3. By-pass damper lever | 10. Wood magazine |
| 4. Hot water coil | 11. Flue outlet |
| 5. Loading door | 12. Cleanout cover |
| 6. Secondary air preset | 13. Name plate |
| 7. Ash door | 14. Heat Exchanger Tubes |

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BEFORE YOU BEGIN

SAFETY NOTICE: READ THIS ENTIRE MANUAL BEFORE YOU INSTALL AND OPERATE YOUR NEW BOILER. FAILURE TO FOLLOW THE INSTRUCTIONS MAY RESULT IN PROPERTY DAMAGE OR BODILY INJURY.

Contact local building or fire officials as the installation must be done in accordance with local ordinances, which may differ in some ways from this manual. Your local building official is the final authority for approving your installation as safe and determining that it meets local and state codes.

The metal testing and listing label, permanently attached to the top of your Tarm boiler (also shown on page 53 of this manual), indicates that the boiler has been tested to current UL and CSA standards and gives the name of the testing laboratory. Clearance information also is printed on this label. When the boiler is installed according to the information both on the label and in this manual, local authorities in most cases will accept the label as evidence that the installation meets codes and can be approved.

IMPORTANT: Failure to follow these installation instructions and guidelines may result in a dangerous situation. Follow the instructions and do not allow makeshift compromises to endanger property or personal safety.

PLANNING THE INSTALLATION

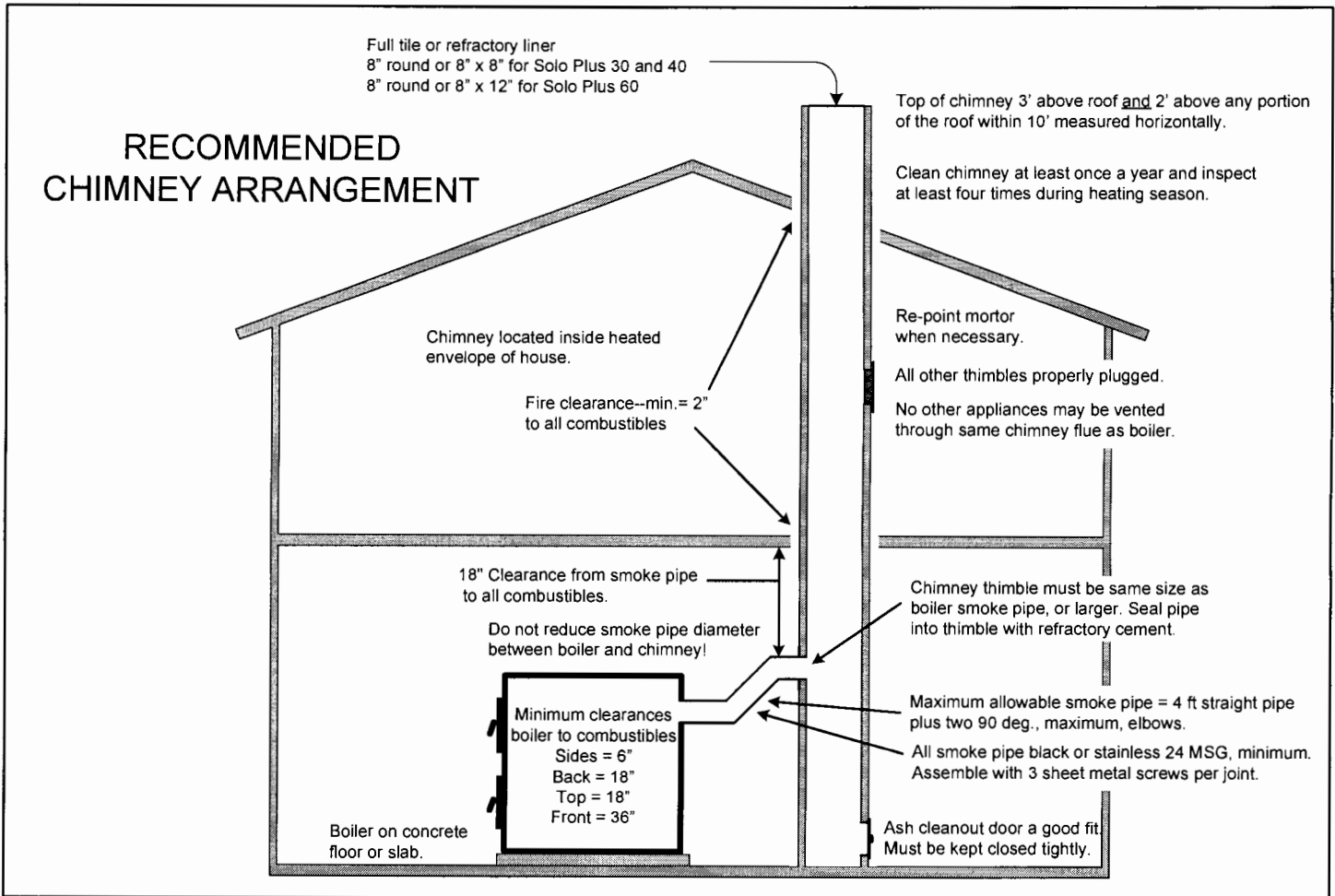
NOTE: Heating system design and installation should be done by a qualified local professional contractor.

Only persons knowledgeable in the layout and installation of heating systems should attempt the installation of any boiler. Proper planning and installation of your heating system and boiler will help to assure many years of safe, dependable, comfortable and economical heating.

CHIMNEY REQUIREMENTS

The chimney is one of the most critical factors in the successful operation of any solid fuel heater, including your HS-Tarm boiler. A good chimney will provide a continuous and dependable draft to pull the exhaust gases out of your house.

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. All chimneys and connections must conform to *NFPA* standard #211. Please read the following before connecting the boiler to the chimney.



- No other appliance may be connected to the flue serving this wood-burning boiler. Consult your local building inspector for chimney requirements and install the boiler in accordance with all applicable codes.
- For the Solo Plus 30, 40 & 60 boiler best draft will be provided by a chimney which has an 8" ID round flue or an 8" x 12" flue, is 20 ft. to 30 ft. in height and which is located inside the heated structure. The Solo Plus 30 or 40 may operate satisfactorily on a minimum flue size of 6" ID round or an 8" x 8" flue 20' in height. The chimney must be capable of maintaining a breech draft of 0.05" WC during normal boiler operation.

CHIMNEY REQUIREMENTS (continued)

- Your Tarm Gasification boiler is designed to burn efficiently and nearly smoke-free, but under certain conditions creosote deposits can form in your chimney. Chimneys that are too large, are poorly insulated, or have bends in the flue passages are especially prone to problems with draft and/or creosote.
- If the chimney is too short and/or there is not enough draft, it may be necessary to add a draft inducing fan. However, we suggest that you determine first whether there are any problems before you invest in a draft inducer.
- **DRAFT REGULATORS**: Strong wind blowing across the top of a chimney or a chimney which has a particularly strong natural draft can cause the Tarm boiler to continue burning (heating) when the draft fan is off. This should not be allowed to happen because it can cause creosote formation and/or overheating of the boiler. The solution to this problem of excessively high or irregular draft is to use a barometric draft regulator in the smoke pipe.
- Turbulators may be added to the heat exchange tubes increasing heat exchange efficiency and restricting draft. However, there is some risk that turbulators will cause the exhaust gases to cool too much which will lead to undesirable condensation in the chimney connector and/or flue. It is best to use turbulators only with a heat storage system.
- The smoke pipe connecting the Tarm boiler to the chimney flue must be black or stainless, have a minimum thickness of 24 gauge and must rise a minimum of 1/4" per foot run toward the chimney. Smoke pipe sections must be attached to one another with a minimum of three sheet metal screws.
- **MASONRY CHIMNEYS**: Masonry chimneys must be lined, either with code-approved masonry or pre-cast refractory tiles, stainless steel pipe, or "poured-in-place" liner. **Do not** use an unlined chimney.
 - An existing chimney should be examined for cracks, loose mortar, other signs of deterioration, and blockage. Repair any defects or reline the chimney before use.
 - The chimney's clean-out door must seal tightly.
 - A newly-built masonry chimney must conform to local or national code.
- **FACTORY-BUILT CHIMNEYS**: Factory-Built chimneys must be tested and listed for use with solid-fuel burning appliances to the High-Temperature (H.T.) Standard (2100°F), UL 103, for the United States and High Temperature (650°C) Standard ULCS-629 for Canada. Factory-Built chimneys must be installed as per the manufacturers instructions.

OUTSIDE COMBUSTION AIR

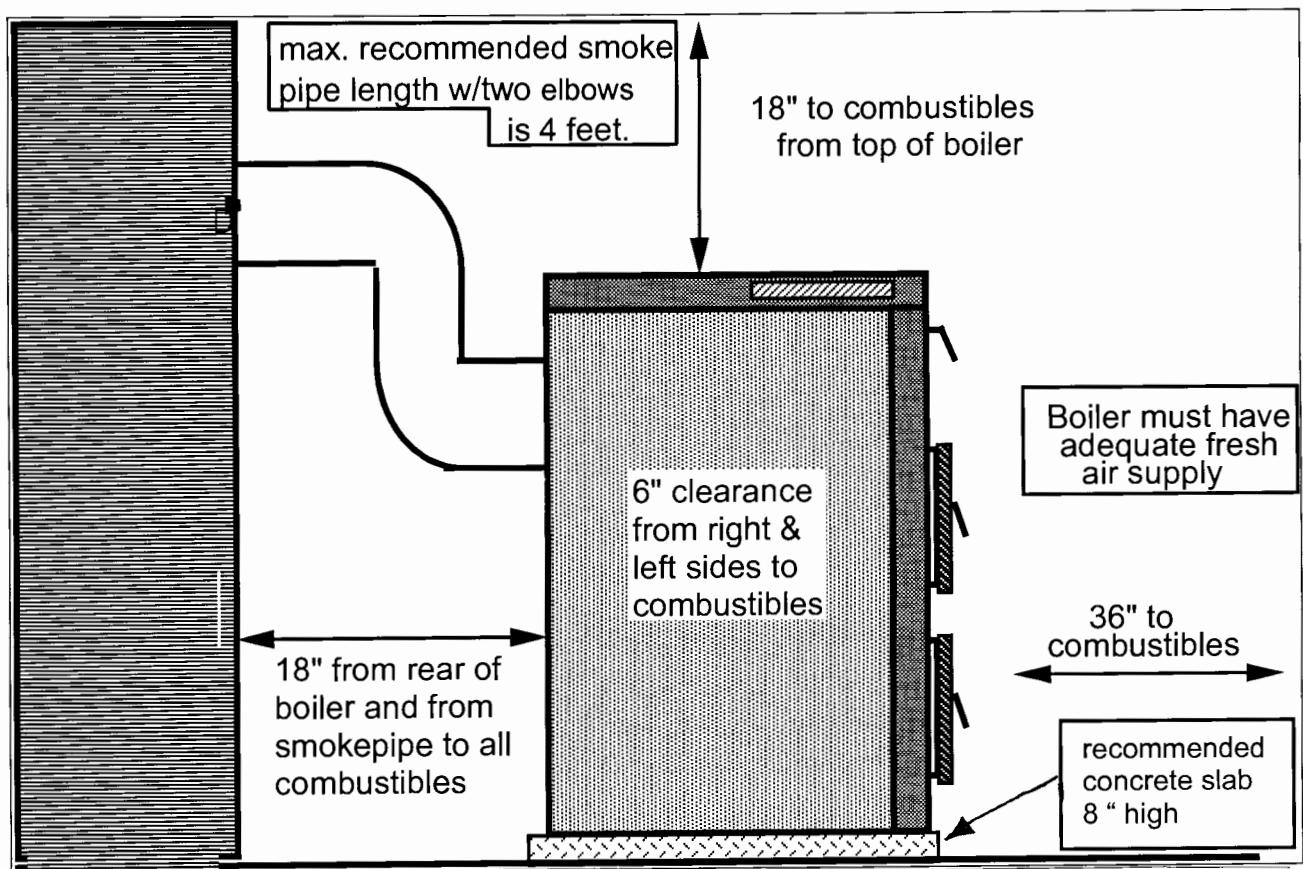
1. Provision for outside combustion air may be necessary to ensure that fuel-burning appliances do not discharge products of combustion into the house. Guidelines to determine the need for additional combustion air may not be adequate for every situation. If in doubt, it is advisable to provide additional 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 in the house;
 - (e) there is excessive condensation on windows in the winter; or
 - (f) a ventilation system is installed in the house.

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

3. The HS-TARM boilers are not suitable for direct connection of outside air. The outside air should be ducted to no closer than 12" from the boiler. A 6" duct should be large enough for all HS-TARM boilers unless the duct run is over 25 feet.
4. A mechanical ventilation system: If the house has a ventilation system (air change or heat recovery),
 - (a) the ventilation system may be able to provide sufficient combustion make-up air for the solid-fuel-fired appliance; and
 - (b) 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.

BOILER PLACEMENT REQUIREMENTS

- The boiler must be placed on a level, non-combustible floor, such as, a concrete slab. Many owners choose to raise the boiler 8" above the floor to make loading and cleaning more convenient. Four inch solid concrete blocks are often used for this purpose.
- Refer to the diagram below for the required minimum clearances between the boiler and combustibles or combustible surfaces. Smoke pipe clearances also are shown. Please keep in mind that these are minimum clearances for safety. For easy cleaning and maintenance of your boiler we recommend 24" of clearance each side of the boiler and 48" in front.



PACKING LIST--- HS TARM SOLO PLUS MK II BOILERS

PLEASE UNPACK THE CONTENTS OF THE BOILER BODY AND THE THREE (3) BOXES CAREFULLY, AND CHECK OFF THE FOLLOWING ITEMS ON THE LISTS BELOW:

The complete Solo Plus boiler, as shipped from our warehouse, consists of four (4) pieces, as follows;

1. Boiler body

- - - In or on the boiler body you should find;
- Refractory combustion chamber (installed)
- Ash removal pan
- Ash removal/scrapper tool
- Cleaning Brush
- By-pass damper lever (installed)
- Installation manual
- Flue collar adapter
- Draft Fan

2. Jacket box

- One front panel
- Two side panels
- One rear panel
- Two top panels (front and rear)

3. Door box

- Loading door
- Ash door
- Secondary air bakelite knob
- Stovex sealing compound
- Package of door bolts (8)

4. Safety control package

- Boiler control panel with immersion well
- Boiler pressure relief valve (Conbraco 10-407-05, 30 psi or Equiv.)
- Aquastat control (Honeywell L4008B) with 3/4 immersion well
- 3/4" x 1/2" bushing
- NOTE: boilers equipped with tankless coil come with a 100psi coil relief valve

Please contact your dealer immediately if any of the above items are missing! TARM USA Inc. reserves the right to substitute equivalent equipment for any of the controls and accessories specified above.

BOILER SET-UP

Initial Assembly

1. Unpack the items in the boiler body, door box and jacket box and check off the items enclosed against the packing list on page 12. Be sure to inspect all packages for damage from shipping. All shipping damage claims must be made with the carrier at the time of delivery.
2. Place the boiler in its planned location on a non-combustible floor and positioned for the proper chimney connection. The guidelines on pages 9, 10, and 11 of this manual should be observed!
3. Using the leveling bolts located on each corner of the boiler's base, level the boiler both front to rear and side to side.
4. Remove the sheet metal retainer plate from the lower door opening. Inspect the refractory chamber bricks for damage or cracks. There is no need to remove the large rectangular brick in the lower door, unless you believe there is damage to the refractory. If you remove the rectangular brick, be careful not to damage the donut gaskets on top. Check to make sure the combustion tunnel brick is slid fully to the rear as it may have shifted out of place during shipping.
5. Locate the secondary air adjustment lever at top left corner of lower door frame and turn it out so it will protrude through the jacket opening when the jacket is assembled.
6. It is not necessary to remove the wooden shipping braces on the boiler floor. They will burn up within a few hours of initial firing.
7. Install the Domestic Hot Water Coil, if used. (optional equipment)

Jacket and Door Assembly

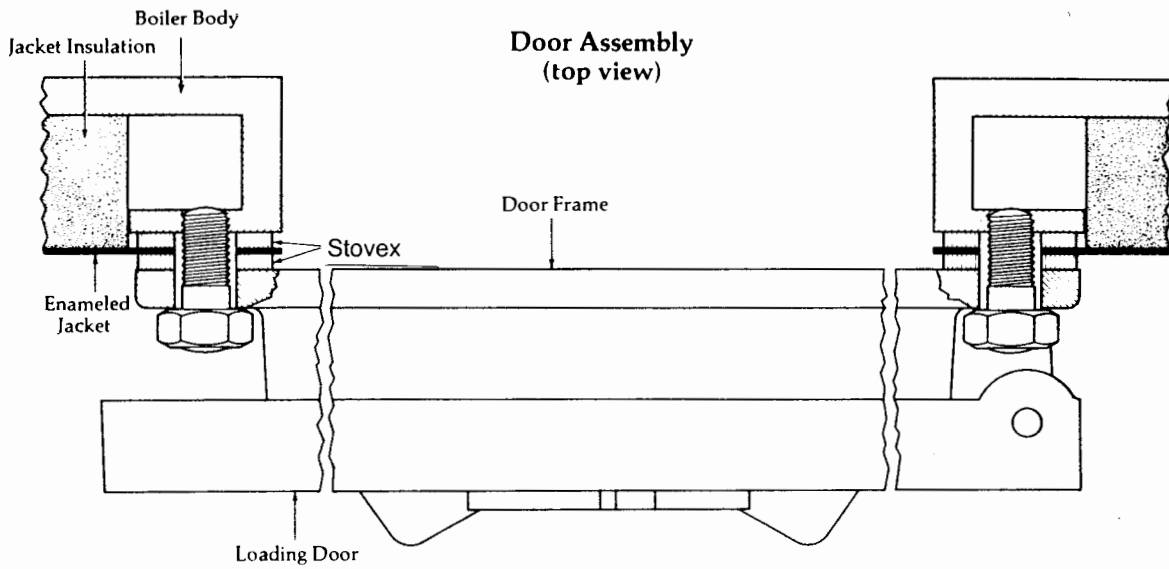
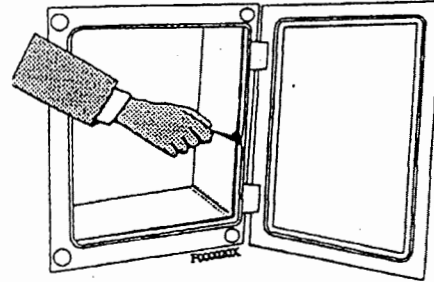
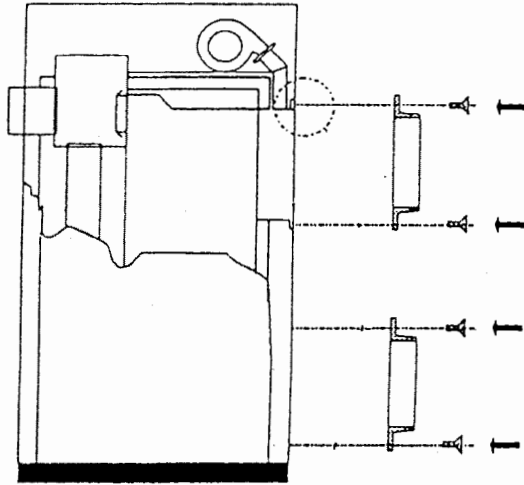
- NOTE:** Prior to jacket installation, remove the appropriate jacket knockouts and plug any extra tappings (see tappings diagram on page 58).
- NOTE:** The boiler comes with a six-piece enameled jacket. The sides of the jacket are assembled by sliding the pre-formed steel strips down over the folded, vertical edges of the panels. For installations with low ceiling clearance, the jacket zip strips can be conveniently bent at the center point.
- NOTE:** The boiler body, front jacket panel and the door frames form a three (3) layer sandwich in final assembly.
- NOTE:** Before mounting the doors, for ease of handling, separate the doors from the door frames by pulling the hinge pins. Make sure to keep the doors and frames matched. The doors hinge to the right, and the bottom door has the observation port.
1. Remember, locate and position the secondary air control lever so that it will protrude through the cut-out in the front jacket panel.

Jacket and Door Assembly (continued)

2. Install the left jacket panel into place. Attach to front panel using one (1) zip strip.
3. Install right jacket panel into place.
4. Install rear jacket panel. Prior to placing this panel, install a 1 1/4" x 1/2" reducing bushing in tapping #18 if you are using it as your drain/feed (refer to step 1 on page 16).
5. Install top front and rear panels by putting into place and pressing downward.
6. Check jacket for alignment.
7. Seal front door frames to face of boiler with Stovex or furnace cement using the following procedure:
 - a. After thoroughly mixing the Stovex compound, place a bead of Stovex on the boiler flanges and the doorframes. Install the front jacket panel. Mount the doorframes in place by just catching the threads, leaving the door loose.
 - b. From inside the door opening force additional Stovex into the space between the doorframes and the boiler.
 - c. Check for proper jacket alignment as you tighten the studs evenly. Excess Stovex will be squeezed out leaving a perfect seal at the doors. Immediately wipe excess cement from the jacket with a damp rag.
8. Attach the doors to the door frames by inserting the pins.
9. Install the round bakelite knob on the secondary air control lever.

NOTE: LOADING DOOR SMOKE FLAP. Tarm Usa, Inc. recommends that the heavy "C" shaped smoke flap not be permanently installed in the door opening: Doing so may damage the door over time. If you have smoke spillage when loading wood, place the smoke flap in the door opening and remove it before closing the door. If your boiler is installed with a Heat Storage System, you may be able to mount the smoke flap permanently without problems. However, do not allow creosote build-up to occur on the load door behind the smoke flap.

Jacket and Door Assembly (continued)



Your jacket and doors are now fully assembled!

Installation of Fill-Valve, Drain, Pressure Gauges and Pressure Relief Valve

NOTE: All piping connections to the boiler must be sealed with the wicking and pipe dope supplied with the boiler or with at least 5 turns of teflon tape.

1. Install a 1/2" iron tee in tapping #18 (at the rear of the boiler). Install a boiler drain on this tee.
2. Pipe feed water to the boiler through a WATTS S1156F Fill-Valve (not supplied) into the other end of the tee. Where required by law, a backflow preventer must be installed in the line to the fill-valve.

CAUTION : Use of any antifreeze with ethylene glycol or toxic heat transfer fluid instead of water is not recommended. Consult your code officials and heating expert for more information on this subject.

3. Install the Conbraco 10-407-05 30 psi Pressure Relief Valve (supplied in safety package) in tapping #2 using the appropriate bushing. **THIS VALVE MUST BE INSTALLED TO INSURE SAFE OPERATION OF THE BOILER AND FOR PROTECTION OF THE HEATING SYSTEM.** Pipe the 3/4" discharge line from this valve to within 6" of the floor with no reduction in pipe size.

NOTE: Please mount the relief valve vertically as per the instructions on the relief valve.

Installation of Domestic Hot Water System

A tankless coil for heating domestic hot water is available as an option on the TARM Solo Plus boiler. For ready access to the coil, remove the top front jacket panel of the boiler.

Pipe the cold water to tapping #15, and hot water from tapping #14 (or vice versa). It is desirable to install unions external to the boiler in both the cold and hot water lines.

NOTE: If a separate hot water heater will be used to heat domestic water during the warmer months, please follow precautions for preventing corrosion described on page 46 of this manual.

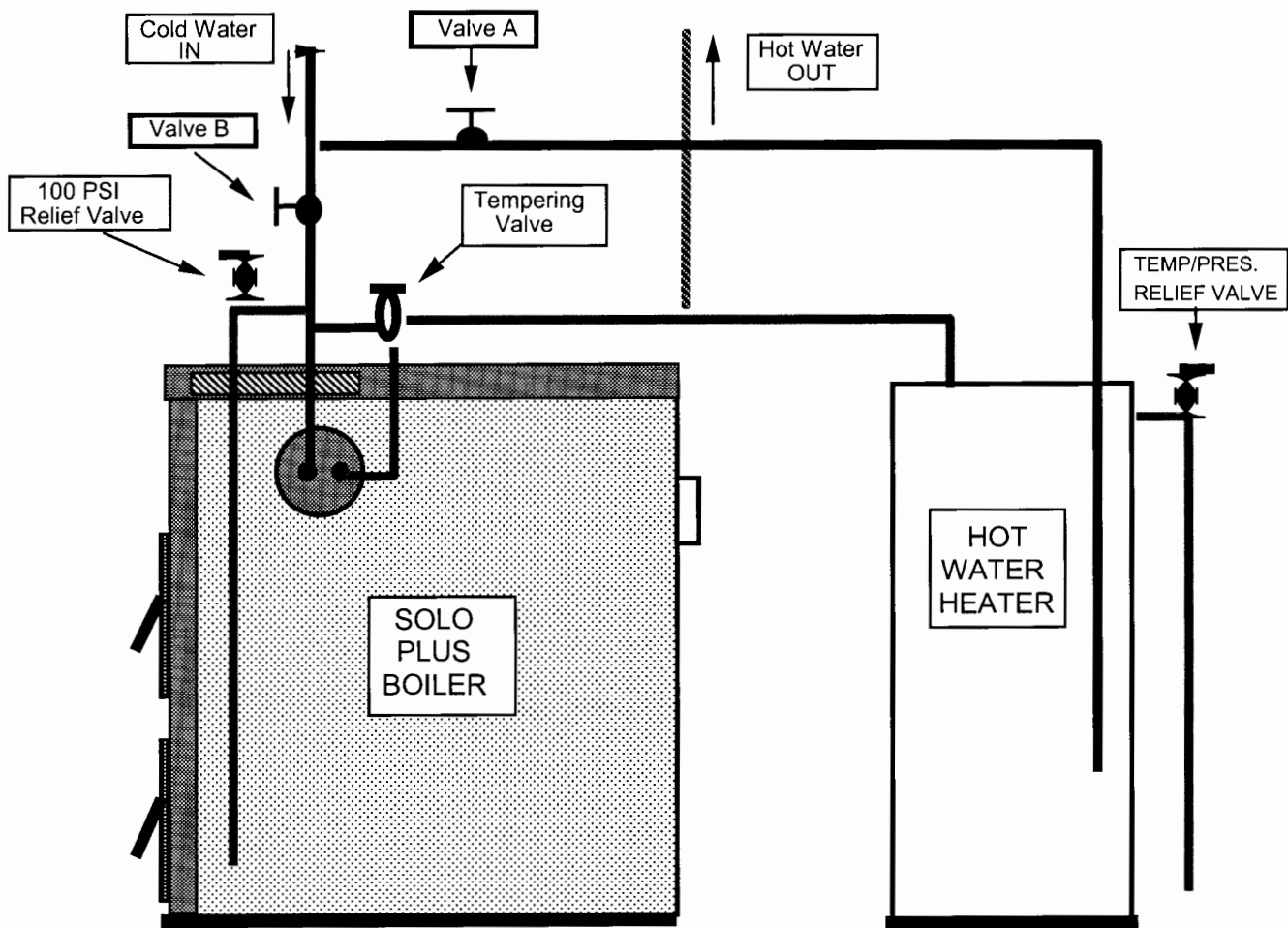
Cold water must be piped separately to the separate water heater, not through the coil in the TARM boiler. **Cold water must not flow through the TARM domestic coil if the TARM boiler is unheated! Condensation and corrosion of the boiler body can result if water flows through the unheated boiler.** Install the Pressure Relief Valve (Conbraco 17-402-01 100psi) 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: To prevent the possibility of a person sustaining serious burns from domestic hot water, a tempering valve (Watts 70A or equiv.), and or an appropriate anti-scald device must be installed to protect against dangerously high domestic water temperatures.

NOTE: In certain areas, water supplies may have a high mineral content. This will lead to lime build up in the coil and blockage depending on the mineral content, boiler temperature, and the amount of water passing through the coil. Keeping your boiler temperature under 160 degrees F will greatly reduce mineral build up. Coils should be cleaned as soon as there is any indication that the hot water supply is being restricted. Coils can be cleaned with hydrochloric acid -- **CLEANING THE COIL IS A DANGEROUS PROCEDURE THAT SHOULD BE ATTEMPTED ONLY BY A QUALIFIED AND EXPERIENCED PERSON.**

DOMESTIC HOT WATER PIPING WHEN A SEPARATE DHW HEATER IS USED IN THE SUMMER MONTHS

IN SUMMER: (or when TARM boiler is shut down) CLOSE Valve B and OPEN Valve A.
 IN WINTER: (when TARM boiler is in operation) OPEN Valve B and CLOSE Valve A.



SYSTEM DESIGN: When planning your boiler installation, a first consideration is to make provisions to handle the excess heat from an overheated boiler both with electricity and during a power failure.

- **OVERHEAT LOOP: NO ELECTRICITY:** The piping and controls must be connected to the boiler in such a way that in the event of a power failure there is one loop of radiation available for gravity circulation. This loop must not be obstructed by any valves or other accessories which would prevent gravity circulation during a power failure. The loop must be large enough to dissipate at least 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 inoperative 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° F should be wired in parallel with thermostat for the zone with the most heat loss in the main living area. If the boiler temperature reaches 200°F the overheat dump zone pump will be activated to take heat away from the boiler as it overrides the zone thermostat. The homeowner is alerted by the extra heat caused by the overheat and can investigate the cause.

With experience, most Solo Plus boiler owners will learn to operate and maintain their boilers so that overheating problems are practically non-existent.

CONNECTION TO HEATING RADIATION AND/OR ANOTHER BOILER

Choosing the Right System

The HS-Tarm Solo Plus may be used either as a stand-alone boiler or in conjunction with an existing oil, gas- or electrically-fired boiler with a parallel, auto-mix, or primary-secondary piping configuration, configured with or without a heat storage system. The TARM serves as the primary boiler and the existing unit as the backup system. The type of installation chosen will depend upon the requirements of a given heating system. Please refer to the piping schematics on page 20 when reading the description of each system.

NOTE: All boilers should be installed with a Termovar automatic thermostatic 3-way mixing valve. This valve helps prevent condensation, increases efficiency and extends the life of the boiler.

NOTE: All piping connections to the boiler and the Termovar must be sealed with the wicking and pipe dope supplied with the boiler or with at least 5 turns of teflon tape.

Only Boiler

The HS-Tarm Solo Plus boiler can be used as the sole heating source for a hot water system. This installation is relatively simple and inexpensive; however, back-up heat, if required, would have to be provided. To install the HS-Tarm Solo Plus as the only boiler refer to instructions on page 21.

Parallel Note: This is the preferred method when using the TARM as an add-on boiler.

When the TARM Solo Plus boiler is connected in parallel with an existing oil-, gas-, or electrically-fired boiler, domestic water can always be heated by a wood fire regardless of whether the coil is located in the TARM or in the other boiler. For instructions on the parallel hookup refer to page 22.

HS Auto-Mix

In an auto-mix system the circulator runs constantly.

The thermostat controls the mixing valve so that the temperature of the water circulating is only as hot as is needed to heat the house at any given time. The amount of hot boiler water mixed with the circulating water varies with the heating demand. This evens out the combustion load on the boiler promoting a better and a quieter system. The HS Auto-Mix is especially beneficial in a system with large water volume such as one with cast iron radiators. For instructions on an Auto-Mix installation refer to page 23.

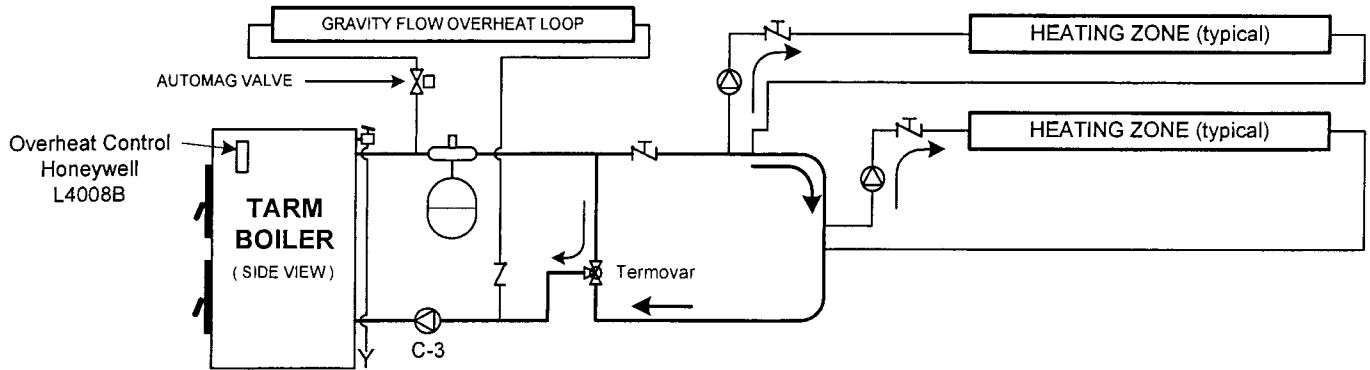
Primary/Secondary

Primary/Secondary piping configurations are often used when connecting to another boiler and to multiple high and low temperature heating loads. The one disadvantage of this system is the need for an extra circulator.

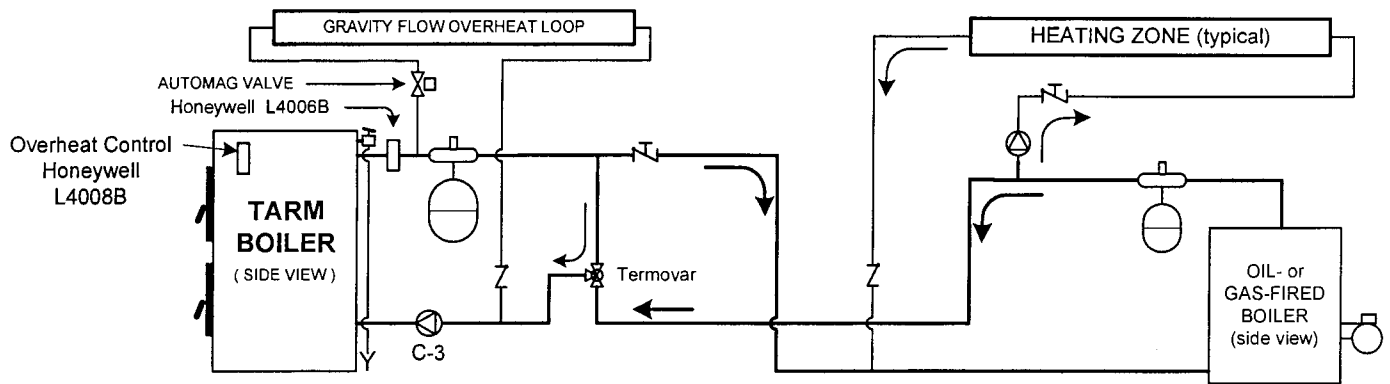
For Conceptual drawing of a Primary/Secondary hookup refer to page 20.

PIPING LAYOUT CONCEPTS DIAGRAMS

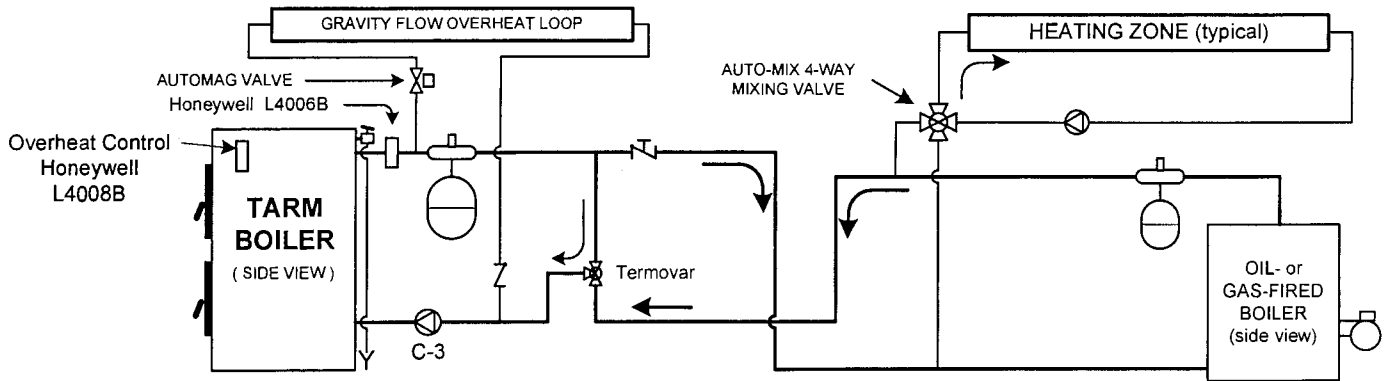
ONLY BOILER



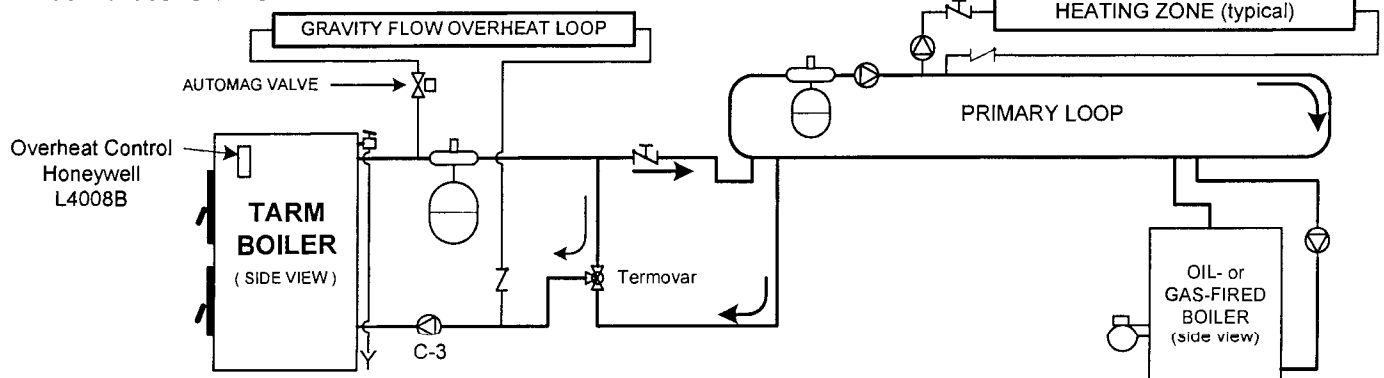
PARALLEL



AUTO-MIX



PRIMARY/SECONDARY



TARM SOLO PLUS AS ONLY BOILER

Refer to concept piping diagram on page 20.

1. Thread a 1 1/4"X 4" nipple into the supply tapping #16 on the rear of the 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 expansion tank is suitable for most Solo Plus Systems as it can handle water volumes up to 86 gallons. gal. capacity. For systems of greater capacity, consult your installer.
3. Pipe from the air purger to a tee (T-2). From the side outlet 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.
7. Pipe from port #2 of the Termovar to the return from the home heating zones.
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. All interconnecting wiring should be connected as per the wiring diagram on page 25.

NOTE: When the Solo Plus boiler is being fired, the possibility of boiler overheating does exist. 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 to cool the boiler. 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 MOST RADIATION AND THE C-3 CIRCULATOR.

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

TARM SOLO PLUS USED IN PARALLEL HOOKUP

Refer to concept piping diagram on page 20.

NOTE: All pipe connecting the two boilers must be 1 1/4".

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 supply tapping #16 of Solo Plus boiler to a 1-1/4"x1-1/4x 3/4" tee (T-1) with the run horizontal. From the 3/4" side outlet of T-1 install a 3/4" by 2" nipple and a 3/4" coupling. Install a Honeywell L4006-B or equivalent into the 3/4" coupling using a 3/4" immersion well.
3. From the run of T-1, install a 2" 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 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 Solo Plus 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 another tee (T-3). From the side outlet branch of T-3, pipe down through a balancing valve to port #1 of the Termovar 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.
8. Install piping between the Solo Plus return tapping #1 and the tee previously installed on the existing boiler's supply manifold as follows: Working from the Solo Plus, first pipe to the C-3 circulator (consider isolation valves) and then to an 1 1/4" 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 piping schematics (page 20) 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 25.

NOTE: The Honeywell L4006B aquastat mentioned above is a "close-on-rise" control. It is set at 160°F, and is connected to the C-3 circulator installed between the TARM boiler and the existing boiler. When the TARM is being fired, and reaches operating temperature, this circulator will start and circulate water through the boilers. This allows the TARM to handle the domestic hot water and heating load on the other boiler. When the circulator in the piping to the radiation is inactive, its resistance, plus that of the flow-check valve, will prevent circulation through the radiation by the circulator between the two boilers.

TARM SOLO PLUS USED IN PARALLEL HOOKUP (continued)

When the Tarm is inactive, the Termovar and flow check valves prevent thermal siphoning and consequent standby heat loss from the TARM. The aquastat on the existing boiler should be set as follows:

High- Limit 150° F
Low- Limit 145° F

The “High-Limit” setting of 150° F prevents the oil or gas burner from starting on a call for heat unless the TARM is unable to maintain a higher temperature than this. 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 TARM is not to be fired for an extended period of time. For further information on adjusting the aquastat of your oil- or gas-fired boiler, consult your installer.

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

With an Auto-Mix hook-up, the plumbing between the two boilers is the same as with a parallel hook up. The difference is the addition of the 4-way mixing valve on 1 or more zones. The mixing valve is added by installing an additional tee on the supply and return manifold of the oil, gas or electric boiler as follows:

Refer to concept piping diagram on page 20.

1. Pipe from the tee installed on the supply manifold of the oil, gas or electrically-fired boiler to tapping #1 (supply) of the four-way mixing valve.
2. Connect the supply side of the heating radiation of the zone controlled by the mixing valve to the “UP” tapping of the mixing valve.
3. Pipe from the return side of heating radiation through circulator “A” to tapping #2 of the mixing valve.
4. Pipe from the unmarked tapping (it may be labeled #3) (opposite the “UP” tapping of the mixing valve) to the tee installed on the return manifold of the oil, gas or electric boiler.
5. If the addition of the TARM Solo Plus boiler 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 TARM installer if in doubt about the requirements of your heating system.
6. Install the HONEYWELL L4008B Boiler Overheat Control as described in (10), page 28.
7. All wiring for C-3 and the overheat zone control should be as shown in the diagram on page 25.

NOTE: When the Solo Plus boiler is being fired, the possibility of boiler overheating does exist. Should this happen, the Hot Water Overheat Control will open the mixing valve and dissipate heat through the heating radiation system.

THE L4008B CONTROL SHOULD BE WIRED TO OPEN THE MIXING VALVE 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.

PRIMARY/SECONDARY HOOKUP

Installations utilizing primary/secondary plumbing configurations are becoming more popular with installers. Refer to diagram on page 20 for a conceptual illustration of this type of hook up.

RADIANT FLOOR HEATING

An increasing number of HS Tarm boilers are being installed with radiant floor heating systems. Your heating system installer and/or your radiant floor equipment supplier will supply needed design and installation details.

NOTE: Any radiant tubing used with an HS Tarm boiler must have an oxygen barrier! If not, water in the tubing must be separated from the boiler by using a heat exchanger.

HOT AIR HEATING

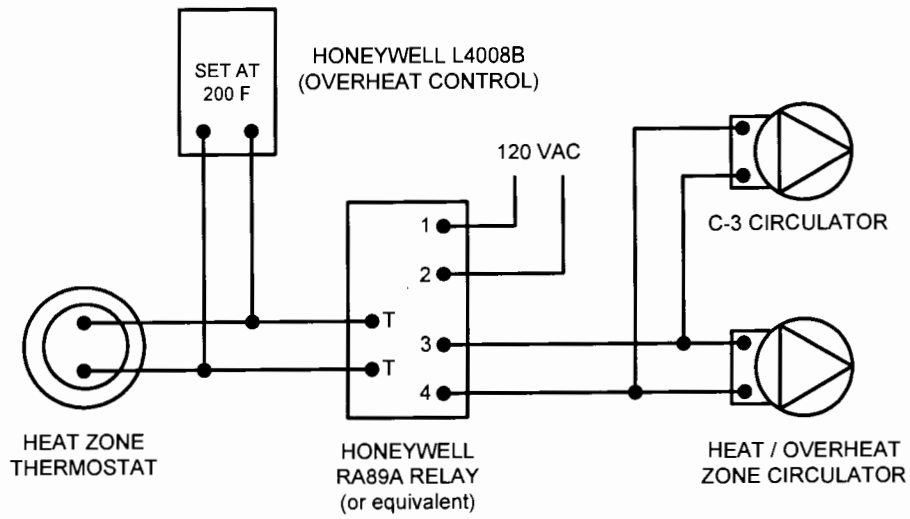
Boilers can be used in a number of ways to provide hot air heating. This can be done with existing forced hot air heating systems and in new construction. Again, your system installer and/or your equipment supplier should supply the needed design and installation details.

FILLING YOUR BOILER

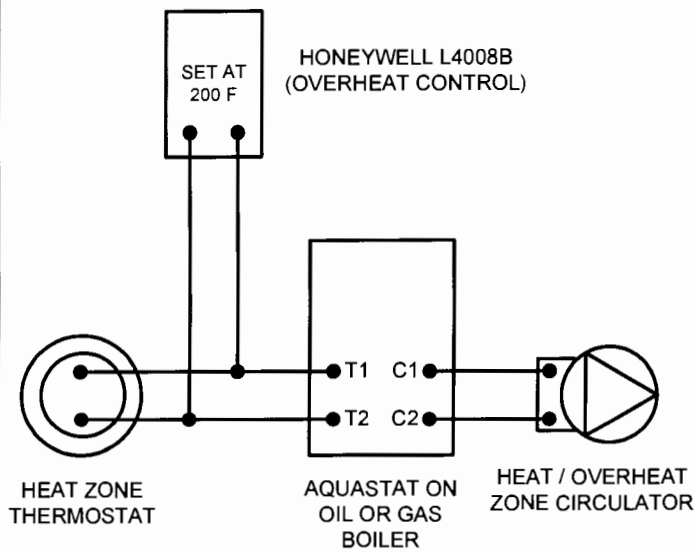
Fill your Tarm boiler and heating system in the conventional manner.

NOTE: The boiler may be protected with antifreeze. It should be propylene glycol and should be checked annually for proper freeze protection and P.H. level. HOWEVER, please remember that the domestic hot water coil, if you have one, is not protected by the antifreeze.

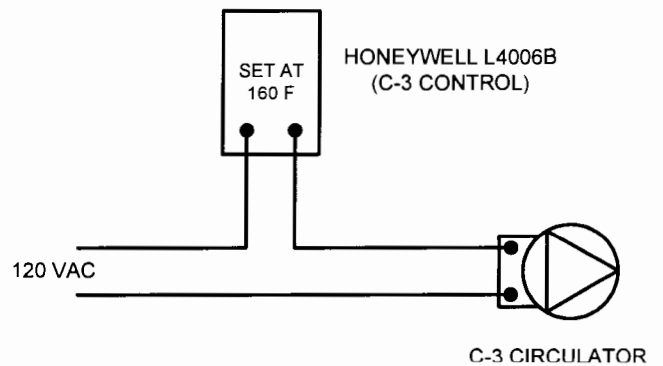
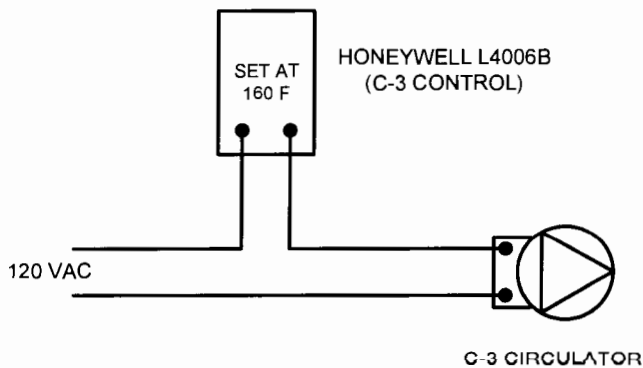
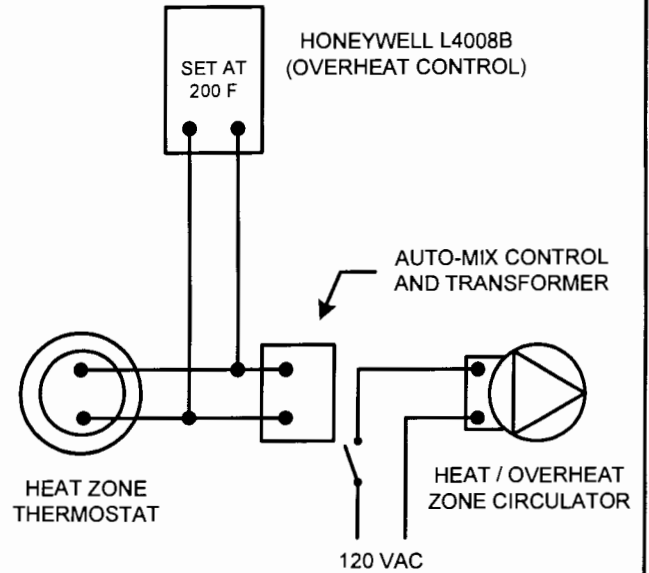
TARM AS ONLY BOILER



PARALLEL SYSTEM



AUTO-MIX SYSTEM



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. The Tarm boiler's heat output is usually greater than the heating requirements of the house. The "extra" heat is 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 only need 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 will 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 a vented, 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 can 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. Sven Tjernagel of STSS CO. INC designed this tank and heat exchange system. 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 your boiler when it is convenient for you.

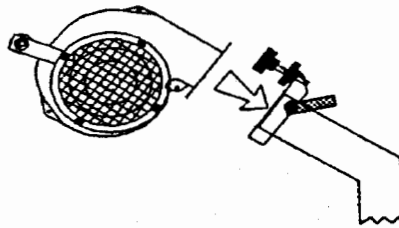
It doesn't get any better than this!

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. We provide installation and operational support for the STSS Storage system sold by TARM USA INC. The heat storage systems have separate plumbing and wiring diagrams not covered in this manual.

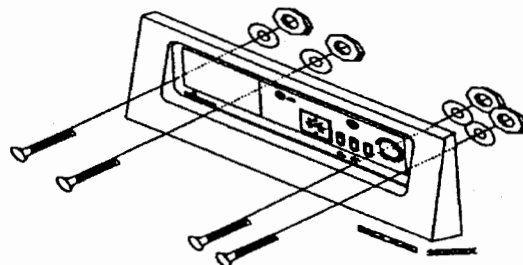
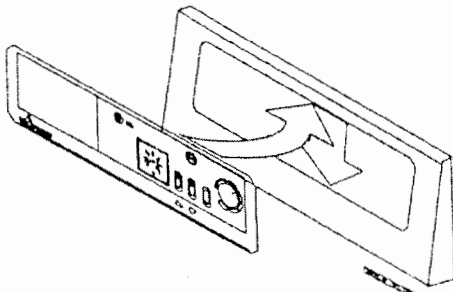
CONTROLS AND DRAFT FAN ASSEMBLY

NOTE: All piping connections to the boiler and the Termovar must be sealed with the wicking and pipe dope supplied with the boiler or with at least 5 turns of teflon tape.

1. Install the silver colored 1/2 inch immersion well, packaged with the control panel, into tapping #21 on top of boiler (refer to tappings diagram on page 58).
2. Install the 3/4 inch immersion well into tapping #4 on top of boiler.
3. Install a coin air vent in tapping #27.
4. The by-pass damper lever is adjusted at the factory but should be checked on the job, as correct adjustment is essential for proper combustion. To check adjustment, push the by-pass lever in and down. It should lock into place on the front bracket with a firm push. If the stop on the rod is engaged on the front bracket, but the handle still has front to back play; or if the handle will not push in far enough to engage the stop, the by-pass must be adjusted.
5. Place the 2" thick insulation material (found in the jacket box) on top of the boiler, matching cutouts with the tappings. Do not leave insulation in the top jacket cover panel.
6. Remove the metal bracket protecting the adjusting screw and draft fan flange. Using the same screws attach the draft fan to the flange.



7. Insert the boiler control panel into position in the top of the front jacket panel. Be very careful to feed the various control sensors and capillaries through the jacket opening in such a way that they won't be kinked or otherwise damaged. Fasten the control panel in place with the screws provided.



CONTROLS AND DRAFT FAN ASSEMBLY (continued)

8. Insert the three smaller sensing bulbs attached to the control panel into the immersion well previously installed in tapping #21 on top of the boiler. One of these sensors is for the temperature gauge, one is for the operating control, and one is for the high limit control. Secure the sensors in the well with the spring clip provided. Place the longest probe under the insulation on top of the boiler. This long probe controls the fan low limit which should be set at 60 degrees C. The placement and setting of this probe will be different if you have a heat storage system.
9. Install the brass diaphragm well for the pressure gauge capillary tube into tapping #23 and then screw the capillary sensor into this well.
10. Mount the L4008B overheat aquastat (provided with your Tarm boiler) just below the air intake grill on the right side of the boiler and approximately 12" back from the front of the boiler. Noting the top of the insulation on top of the boiler, cut or drill a 5/8" diameter hole in the boiler jacket approximately 16" back from the front of the boiler and above the level of the insulation. Being careful not to kink the capillary tube of the L4008B aquastat, feed it through the 5/8" hole and insert it into the 3/4" immersion well previously installed in tapping #4.
11. Wire from the L4008B aquastat, using thermostat wire, to the T.T. terminals of the relay controlling the largest heating zone circulator. Set the L4008B aquastat at 200°F. If the boiler reaches this overheat temperature, the aquastat will cause the circulator to run to help cool the overheated boiler.

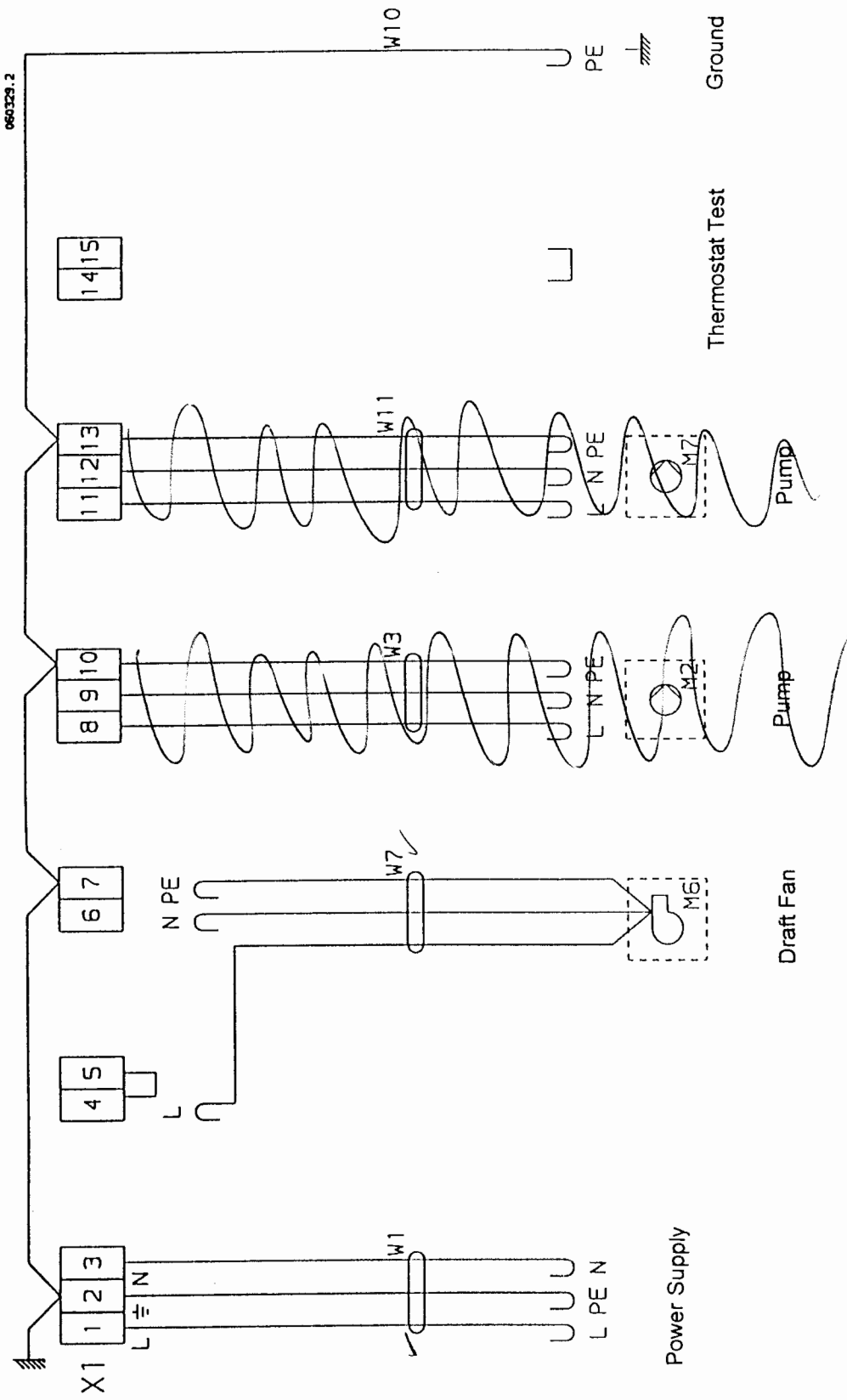
NOTE: Do not use self-contained, non electric zone valves in the zone controlled by the overheat control! Such valves could prevent the overheat control from cooling the boiler when necessary.

12. Step 13, which follows, describes how to supply electric power to the Tarm Solo Plus boiler. Because the control panel is supplied as a pre-wired assembly, all that is required on-site is to connect to a 120 volt service and to connect the draft fan wiring to the control panel. Refer to the electrical drawings on pages 29 and 30.

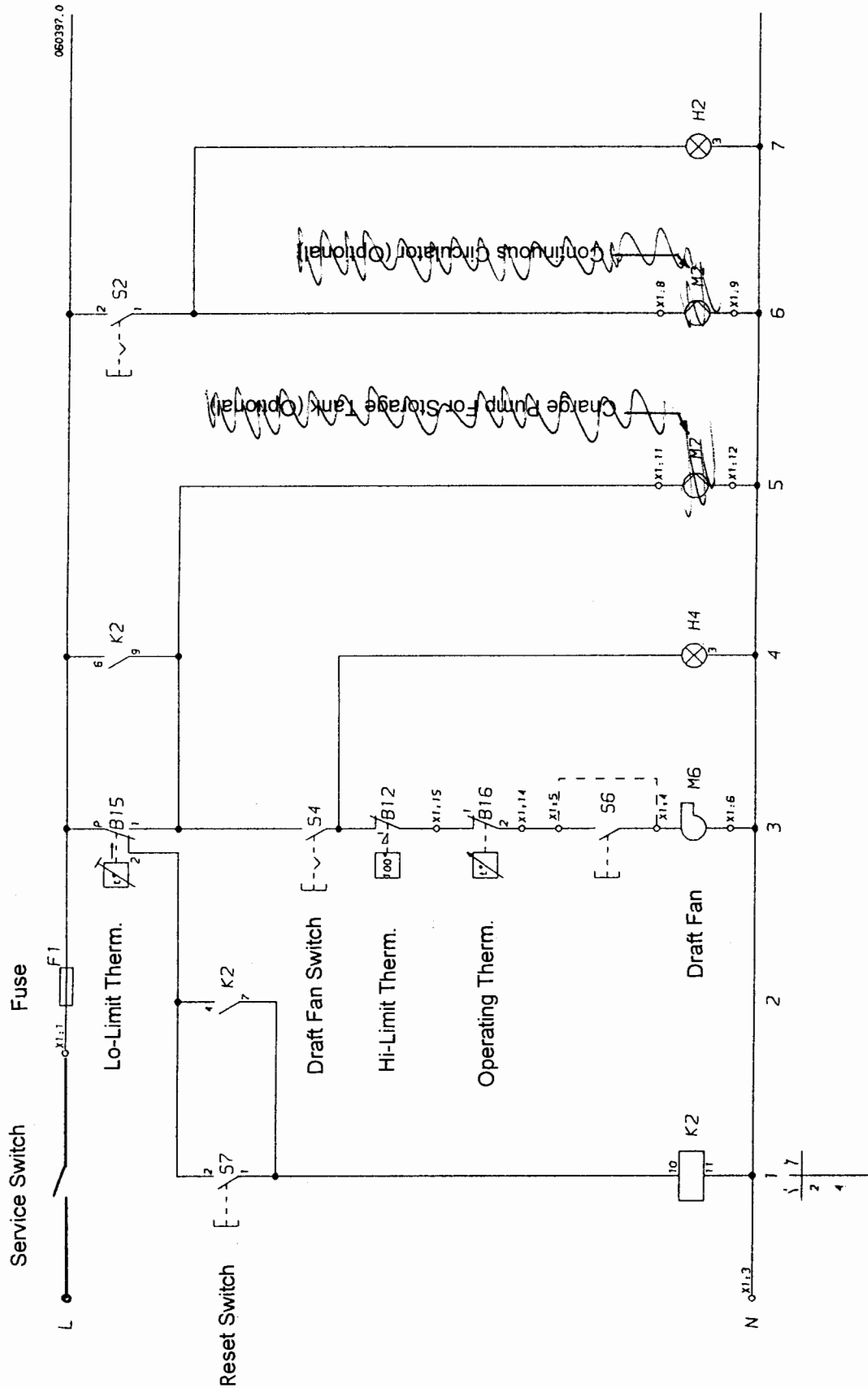
NOTE: The electrical system of the boiler shall be supplied from a single branch circuit. The boiler itself must be grounded in accordance with the requirements of Local, State, and National Electric Codes.

13. Remove a knockout in the rear of a 4" square electrical junction box and mount this box with the removed knockout over the plastic grommet located at the top left corner of the right jacket panel. Feed the power supply cord from the boiler's control panel through the grommet into the 4" square junction box and connect to the 120 volt power supply. Provide a service switch mounted in the cover of the 4" square electrical junction box.
14. The draft fan is powered from the boiler control panel. Connect the draft fan electric cord to the control panel terminal strip as follows:

Connect the green striped yellow (ground) wire to terminal #7,
Connect the blue (neutral) wire to terminal #6, and
Connect the brown (hot) wire to terminal #4.

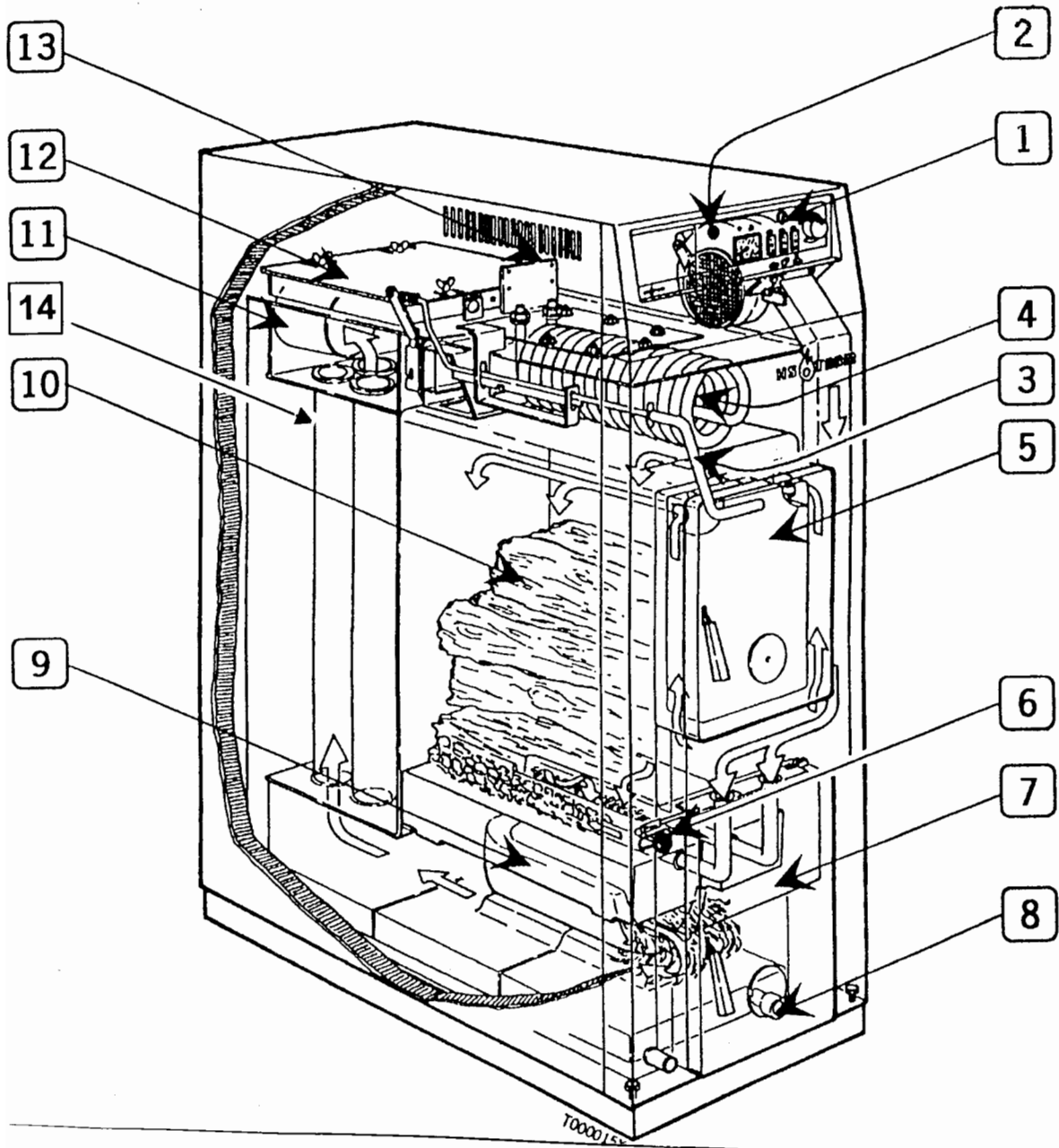


WIRING DIAGRAM
HS TARM SOLO PLUS MKII



WIRING DIAGRAM
HS TARM SOLO PLUS MKII

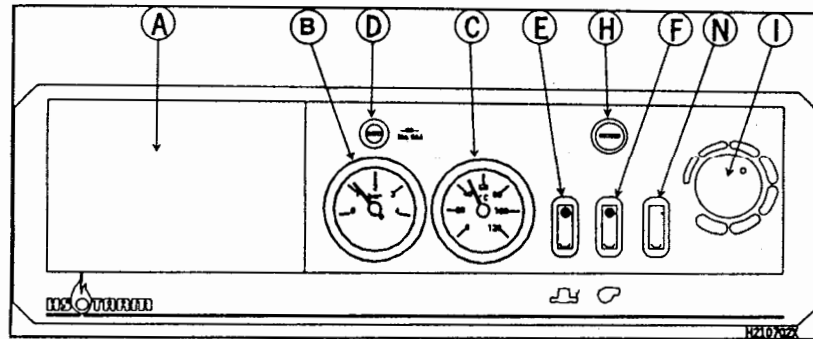
HS-TARM SOLO PLUS MK II BOILER AND BASIC EQUIPMENT



- | | |
|-------------------------|--------------------------|
| 1. Control panel | 8. Viewing window |
| 2. Draft fan | 9. Ceramic refractory |
| 3. By-pass damper lever | 10. Wood magazine |
| 4. Hot water coil | 11. Flue outlet |
| 5. Loading door | 12. Cleanout cover |
| 6. Secondary air preset | 13. Name plate |
| 7. Ash door | 14. Heat Exchanger Tubes |

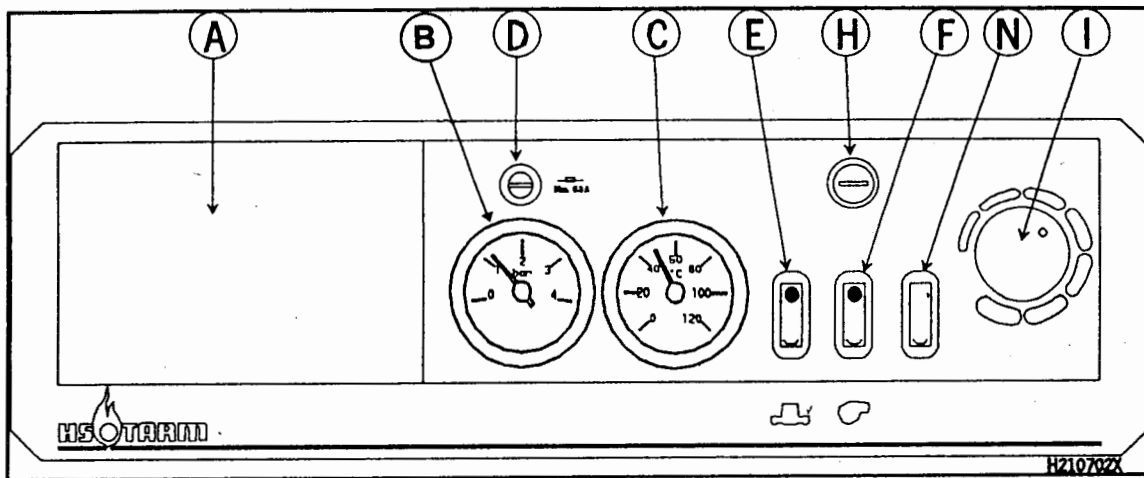
BOILER AND BASIC EQUIPMENT

1. Control panel Regulates the boiler temperature.
Please see page 34 for details.



- | | |
|---|--------------------------------|
| (A) Place for weather compensation system | (E) Switch for pump (not used) |
| (B) Pressure gauge | (F) Switch for draft fan |
| (C) Temperature gauge | (H) Overheat thermostat |
| (D) Fuse | (I) Operating thermostat |
| | (N) Reset switch |

2. Draft fan..... Provides the air necessary for the combustion.
3. By-pass damper..... Used when lighting and loading.
4. Hot water coil..... (Optional equipment)
5. Loading door..... The large loading door makes loading easy.
6. Secondary air preset..... The secondary air supply into the ceramic refractory is adjusted here.
7. Ash door..... The secondary combustion takes place behind this door.
8. Viewing window..... The combustion can be inspected by means of the viewing window.
9. Ceramic refractory The very high temperature secondary combustion of the wood gases occurs here, and ensuring the high efficiency of the boiler.
10. Wood magazine..... Wood supply and primary combustion.
11. Flue Outlet..... Connection point for stove pipe to chimney
12. Cleanout door..... The cleanout door can be removed for cleaning the heat exchanger tubes.
13. Name plate..... Shows the boiler's No. and other information to be used when ordering spare parts.
14. Heat Exchanger Tubes.....For transferring heat to the boiler water.

CONTROL PANEL

ITEM	FUNCTION
A.....	Place for weather compensation control (NOT BEING USED).
B.....	Pressure gauge. Shows the boiler pressure. Normal operating pressure is 10-15 psi.
C.....	Temperature gauge. Shows the boiler temperature. The boiler temperature is adjusted by means of the thermostat (I).
D.....	Fuse max. 6.3 A (5x20 mm).
E.....	Switch for pump. (Not used and not controlled by an Aquastat)
F.....	Switch for draft fan.
H.....	Overheat thermostat. This disconnects the fan at a temperature of 210°F (100°C). In order to reconnect, the protection cap is taken off and the pin which has sprung out is pushed in again, <u>after</u> the boiler temperature has fallen to below approximately 165°F (75°C).
I.....	Operating Thermostat. Recommended temperature 180°-190°F (83°-90°C). In order to ensure that the temperature is adjusted beyond 180°F (83°C) a headless screw has been placed under the control knob.
N.....	Reset switch. The boiler combustion fan stops automatically when the wood burns out and the boiler temperature falls below 140°F (60°C). <ul style="list-style-type: none"> In order to restart combustion of the boiler when the sensor temperature is below 140°F (60°C), the reset switch will need to be pressed "ON" (see page 38, Lighting The Boiler...). You must load enough wood to heat the boiler above 175°F (80°C) to engage the Lo-Limit thermostat. If normal operating temperature is not reached, the draft fan will not shut off even if the wood burns out and the boiler temperature drops below 140°F (60°C).

BEFORE YOU BEGIN

SAFETY NOTICE: READ THIS ENTIRE MANUAL BEFORE YOU INSTALL AND OPERATE YOUR NEW BOILER. FAILURE TO FOLLOW THE INSTRUCTIONS MAY RESULT IN PROPERTY DAMAGE OR BODILY INJURY.

To operate your boiler in disregard of the information provided in this section can cause permanent damage to your boiler and void your warranty.

WARNING: NEVER USE GASOLINE, KEROSENE OR OTHER FLAMMABLE LIQUIDS TO START OR MAINTAIN SOLID-FUEL FIRES IN YOUR BOILER -- SERIOUS BURNS OR PROPERTY DAMAGE MAY RESULT!

NOTE: Do not be alarmed if you smell an unusual odor the first few times you fire the boiler. This smell is due to burning of oil residues in the paint on the boiler and the smoke pipe. Ventilate the boiler room well for the first few hours during the first fire.

STARTING YOUR TARM GASIFICATION BOILER

Before starting your boiler for the first time the installer must check that it is properly filled with water and vented of air. It is also important to vent the boiler again after the boiler is up to the 180° F. operating temperature. It is important also that the installer check all the control functions and settings before leaving the boiler unattended. Check the operating control, the low temperature cut out and the overheat functions.

AQUASTAT CONTROL SETTINGS

Before you start your boiler make certain the aquastat controls are set as follows:

Operating Thermostat (I)

Check to see that the Operating Thermostat (I) knob is set in a clockwise direction beyond the stop under the knob. To turn the knob beyond the stop (the screw under the knob is the stop), pull the knob out until you can turn it past the stop. Push the knob back in and then turn the knob counterclockwise until it hits the stop. This should yield the correct operating temperature of 180°-190°F (85°-90°C). Reposition the screw if necessary.

Lo-Limit Thermostat

Set the Lo-Limit Thermostat (on the back side of the boiler's control panel at end of the terminal strip) at 60°C (140°F), if you are not using heat storage.

Honeywell L4008B Overheat Control Aquastat

Setting	Function
200° F	Back up High Temperature Limit. Activates the Dump Zone circulator and C-3 in the event of a boiler overheat.

USE OF THE BY-PASS DAMPER

The by-pass damper must always be opened before opening the loading door. This will minimize smoking and puff-backs. The by-pass damper should always be locked tightly in the closed position when the boiler is in operation.

INSTALLING THE 339N PROBE THERMOMETER

The 339N Probe Thermometer is to be installed just downstream of the boiler flue collar. Drill a ¼" hole in the side of the pipe and insert the probe all the way in. This thermometer gives you an indication of how well the wood is burning and when it is time to brush the heat exchange tubes. If you are burning dry wood that is well split, you should achieve temperatures of 600°F or more on the probe thermometer. If you are not achieving temperatures this high, check the following things:

1. Is the bypass damper latched tightly closed?
2. Are the vanes of the fan clean and not filled with ash?
3. Are the primary air channels open?
4. Is your wood dry?

In most instances, low stack temperatures are an indication of wood that is not dry. If you have been operating with temperatures of 600° F and then notice the temperatures are higher, it is probably an indication that it is time to brush the dust from the heat exchange tubes.

A WORD ABOUT WOOD FUEL

Wood is an environmentally desirable fuel as it is CO2 neutral.

Your Tarm Gasification boiler is designed to burn natural cord wood with high efficiency and low emissions. If your wood is dry and properly split, you will fully realize the best operation and clean burning potential of you boiler. If you use wet wood, your boiler will be much less efficient and produce less heat. Dry wood gives big returns!

- Log length should be approximately 18” to 20”.
- Pieces over 5” to 6” in diameter should be split.
- Moisture content should be 15% or less for best operation.

To promote faster drying of firewood, it should be cut to length, split and stacked loosely off the ground with maximum exposure to the sun and wind circulation through the stack. Cover only the top of the stack (at an angle to allow moisture to run off) to keep out rain and snow. Aiming a fan at wood stacked in the basement, during the heating season, will facilitate faster wood drying.

Always try to have two years of wood supply on hand so that the wood you are burning has been cut, split and stacked under cover for a year. Some varieties of wood may take 1 ½ years to dry adequately.

If you cut your trees in the spring or summer let them lie for a while, until the leaves wither. They will draw moisture from the wood, drying it more quickly than if you limbed the trees immediately. If you buy your firewood, spring or early summer is usually the best time to purchase it.

You get roughly the same amount of heat from a pound of wood, no matter what 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 best ones to buy because they will give you more pounds per cord.

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

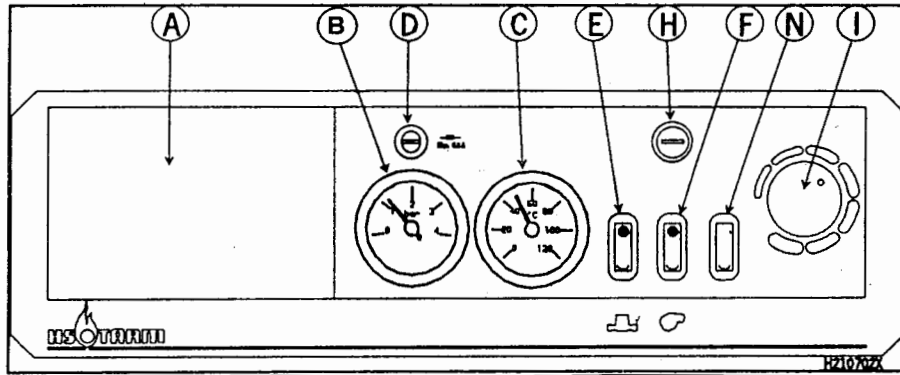
WARNING: DO NOT BURN COAL OR PAINTED, CREOSOTED, OR PRESSURE TREATED WOOD

LIGHTING THE BOILER FOR THE FIRST TIME

Starting Your Tarm Gasification boiler for the first time, or, if the fire is out.

NOTE: THE WOODEN SHIPPING BOARDS HOLDING THE REFRACTORY IN PLACE WILL BURN UP. DO NOT TRY TO REMOVE THEM!

1. Set the by-pass damper lever in the open position by lifting up and pulling the lever fully forward.
2. Turn "ON" the electrical power service switch on the 4" square junction box located at the upper left corner of the right jacket panel.



3. Switch "ON" the draft fan with switch (F) on the control panel (The fan will not start at this time.).
4. Open the loading door and line the bottom of the firebox with several pieces of crumpled newspaper. Place several pieces of kindling and small pieces of dry wood on top of the paper.
5. Place 6 or 8 more crumpled sheets of paper on top of kindling. Light the paper and push the reset switch (N) on the control panel. The draft fan will start at this time.
6. Immediately close the load door.
7. Partially close the by-pass damper leaving it slightly open and unlatched.
8. After 5-6 minutes, open the by-pass fully and turn "OFF" the draft fan switch (F). Immediately open the upper door slowly and carefully to see that the fire is established. If it is, add several more small pieces of dry firewood. Close the upper door.
9. Immediately turn "ON" the switch (F) to start the draft fan. Close and latch the by-pass damper by pushing in and down firmly so that the spring will keep it closed.
10. Wait approximately 5 more minutes, then look through the sight glass in the ash door. You should see a full active flame filling the combustion tunnel. If not, give the fire a few more minutes before loading with larger fuel. When loading wood, place it close together and uniformly front to back and not crosswise.
With experience, you may well develop your own techniques for lighting and loading your boiler, which may be much quicker and easier than described above.

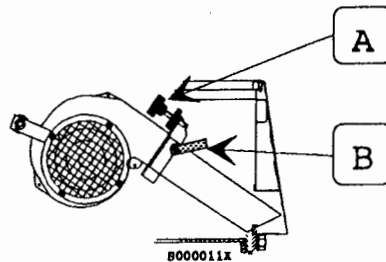
LIGHTING THE BOILER FOR THE FIRST TIME (continued)

WARNING: If there is a fire in the firebox, do not leave the boiler with the main power switch "OFF". This must be "ON" so the overheat circuit can function, if necessary.

CAUTION: The Firing and Ash doors must remain closed except when loading fuel or removing ash. Door gasket seals are very important to the operation of your boiler. They must be maintained in good condition and replaced if necessary in order to maintain an air tight seal.

Primary Air Adjustment

The primary air should be set to open fully when the draft fan is running. However, if you are regularly seeing temperatures at the flue collar of the boiler of over 600°F when the boiler is clean, we suggest decreasing the primary air to lower the flue temperature. Adjust the stop in front of the draft fan under the top front jacket panel. Loosen the locking nut and turn the bolt (A) in for less primary air lowering the flue temperature to approximately 600°F. Tighten the locking nut when adjusted properly.

**Secondary Air Adjustment**

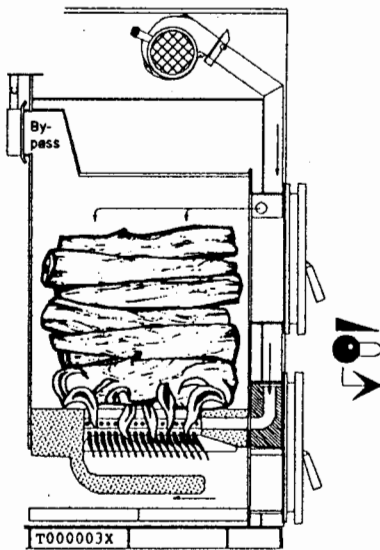
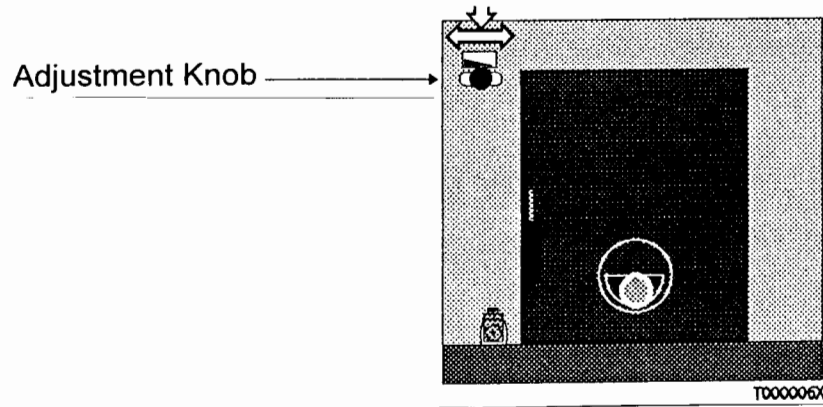
The primary air coming through the holes behind the loading door and the total quantity of air normally should not have to be changed if the boiler is kept clean.

Correct secondary air adjustment is essential for optimum combustion and efficiency. Adjustment is by means of the bakelite knob on the front of the boiler next to the top left corner of the ash door (see diagram at top of page 40). To adjust, pull the knob down and slide left (more air) or right (less air). The drier the wood is, the more secondary air required.

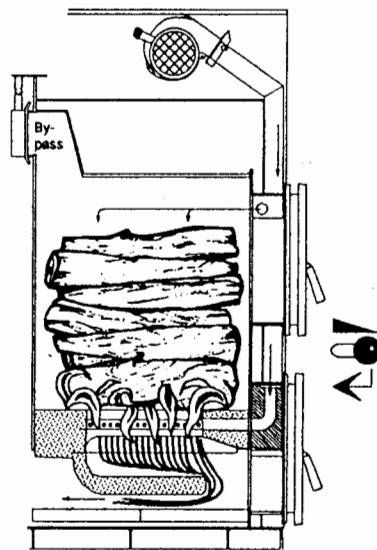
After approximately 45 minutes of operation with a load of wood, the boiler and refractory should be heated. Observe the flame through the observation port or open the lower door carefully while the fan is still running. Adjust the secondary air as needed. Once the proper adjustment has been set, it should only be necessary to re-adjust when changing the type or quality of fuel. Use diagrams on page 40 to help guide you in setting the secondary air.

Until you know your boiler well, you can use the basic rule of "dry wood/more secondary air---- greener wood/less secondary air," or "put it in the middle and forget about it."

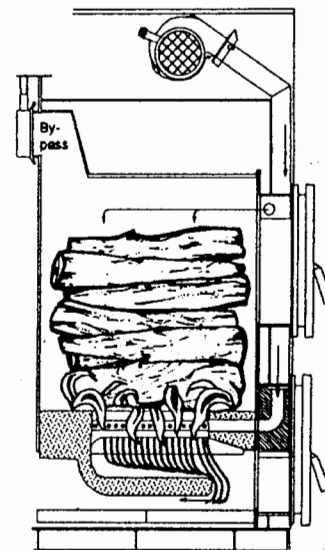
SECONDARY AIR ADJUSTMENT



Too much air.
The flame is blue
and too short.
Adjust knob to
the right.



Too little air.
The flame is too
long and yellow-
red. Adjust knob
to the left.



Correct adjustment.
The flame is yellow
and slightly bluish.

REGULAR STOKING OF THE BOILER

HINT: It is advantageous to have the wood that you are going to load ready and next to the boiler before opening the by-pass damper. This will mean less smoke spillage into the boiler room and less smoke up the chimney.

When restoking the boiler proceed as follows:

If The Draft Fan is OFF: BOILER AT OPERATING TEMPERATURE

CAUTION: RISK OF WOOD GAS EXPLOSION as explosive gases may be present.

1. OPEN THE BY-PASS DAMPER.
2. NEXT, TURN UP THE OPERATING CONTROL on the control panel fully clockwise. this will activate the draft fan, to help prevent the risk of a gas explosion when the door is opened. Let the fan run for 2-3 minutes to vent the hot gases.

NOTE: When you are burning wood in a Tarm Gasification Boiler, the operating aquastat turns off the draft fan when the boiler gets up to temperature. This cuts the supply of oxygen to the fire and the flame goes out. There remains, however, lots of hot coals and a red hot refractory which will continue to bake the wood creating a build up of hot gas in the firebox. Any person dealing with a Tarm Gasification Boiler needs to keep in mind that hot explosive gases may always be present. These gases are hot enough to burn but without oxygen they can't. If the fan is off for 15-20 minutes these gases will start to condense as creosote on the inner surfaces of the firebox. However, if you open the load door when the gases are hot and explosive, you may provide enough oxygen for a sudden back flash or puff (WOOD-GAS EXPLOSION) to occur. This explains why you should **never open the load door unless the fan has been running in the last few minutes** to vent hot explosive gases from the firebox first

3. Turn the draft fan off by switching the power switch "F" to "OFF" on the control panel.
4. Without delay, open the loading door $\frac{3}{4}$ " with your left hand.
5. Wait approximately 20 seconds.
6. Open the loading door slowly, fully and cautiously!
7. Load the firebox if the previous load of wood has burned down to low coals, placing the wood uniformly front to back and tight together, not crosswise. If the wood has not burned down to low coals, do not load more wood.
8. Close the loading door.
9. Turn the draft fan back on by switching the power switch "F" to "ON" on the control panel.
10. Close the by-pass damper.

REGULAR STOKING OF THE BOILER (continued)**If The Draft Fan is OFF: BOILER TEMPERATURE BELOW 140° F**

NOTE: When the boiler temperature is below 140°F the assumption is that the fire has burned out and that hot gases are not present. However, never quickly open the door unless you have tried to vent hot gases from the firebox first.

1. OPEN THE BY-PASS DAMPER.
2. Push the reset switch on the control panel to activate the fan. Let the fan run for 2-3 minutes to vent the hot gases.
3. Turn the draft fan off by switching the power switch "F" to "OFF" on the control panel.
4. Without delay, slowly and cautiously open the loading door with your left hand.
5. If there are sufficient live coals left in the firebox to re-ignite the next load of wood you will not need to use paper to restart the fire. Place several pieces of dry kindling in the center of the firebox over the slot in the refractory and rake the live coals from the sides of the firebox to the center on top of the kindling.
6. Add enough firewood to carry the estimated heat load for the next 8 hours, as per the "Operational Procedures" on page 43, which are very important.
7. Close the load door and immediately turn "ON" the draft fan switch (F). Close and latch the by-pass by pushing in and down forcefully so that the spring will keep it closed.
8. HOWEVER, if you find very few live coals left in the firebox after opening the load door in step #3 above, follow steps #3 - #10 on page 38 to restart the fire.

REGULAR STOKING OF THE BOILER (continued)

If The Draft Fan Is ON:

1. Open the by-pass damper.
2. WAIT, 2-3 minutes with the draft fan running.
3. Turn off the draft fan by using switch (F) on the control panel.
4. Without delay, open the loading door 3/4" with your left hand.
5. Wait approximately 20 seconds.
6. Open the loading door slowly, fully, and cautiously!
7. Load the firebox with wood, placing the wood uniformly front to back and tight together, not crosswise.
8. Close the loading door.
9. Immediately turn the draft fan back "ON" by switch (F) on the control panel.
10. Close the by-pass damper fully and tightly.

HEAT DEMAND ON THE BOILER

In order to achieve the best combustion efficiency and the longest boiler life with the least amount of creosote in the combustion chamber, it is necessary that there be a medium to high demand for heat when operating the boiler.

OPERATIONAL PROCEDURES

The following operational procedures should be followed, especially when the boiler has excess capacity (as it will have during milder weather):

1. **Load the boiler with wood at least 3 times a day.**
2. **Only load the boiler with the amount of wood needed for approximately 8 hours of burning to cover the heating load caused by the weather and the heat loss of the house.** The wood should be totally burned and reduced to low coals so that the slot in the refractory is exposed before you reload. The ability to judge the correct amount of wood for each load can only come from experience. There are many factors to consider and each installation is somewhat unique. Your goal should be to keep the firebox as dry as possible by not overloading the boiler with wood in periods of lower heat demand.
3. If steps 1 & 2 above are followed, the heating surfaces of the wood firebox will have a chance to dry out as you heat with charcoal at the end of burning each load of wood.
4. If steps 1 & 2 above are followed, you will have no problems with smoke spilling out of the loading door because only coals will be present when reloading. The next batch of wood will ignite easily and quickly because of the presence of the coals remaining from the previous load.
5. If steps 1 & 2 above are followed, the by-pass damper will open easily and won't be stuck shut with creosote.
6. Maintain a high boiler temperature of at least 180° - 190°F (83° - 90°C).

OPERATIONAL PROCEDURES (continued)

7. Clean the boiler frequently as per the instructions elsewhere in this manual (see pages 47 and 48). Routine cleaning will help maintain boiler efficiency. Accumulated ash and soot act as an insulator and reduce boiler combustion and heat exchange efficiency.
8. Due to greatly reduced heat demand, it is not wise to fire with wood in the summer. **Therefore, we do not recommend burning wood in the summertime.** Save your wood fuel for colder weather, or equip your boiler with a storage tank system. Contact TARM USA, INC. for more information on storage tank systems.

NOTE: The refractory tunnel must be kept free of ashes and charcoal so that there is enough room for the gasification flame. Use the ash rake to pull the ashes and coals out of the tunnel. Leave the coals on the boiler floor and they will burn up with the next fire.

NOTE: Keep in mind that the refractory bricks are hardest when they are new. They get softer with age. When loading wood and using tools around the refractory areas keep this in mind. Don't break the refractory by 1) throwing wood directly onto the refractory (place the first few pieces into the boiler gently) and/or 2) digging or prying at the refractory in the areas of the slot or tunnel.

COMBUSTION PROCESS

HS-Tarm Gasification boilers have excellent combustion efficiency. Pollution of the boiler (except the firebox), chimney and environment is kept to an absolute minimum.

NOTE: Your firebox will form creosote on the walls. During combustion, when the draft fan is running, gases and smoke are created which make up the main part of the wood's heat value. Formic and acetic acids and other gases are mixed with the right quantity of combustion air at very high temperatures producing boiler efficiency of around 80%. This highly efficient combustion process produces virtually no smoke or creosote.

When the boiler gets up to temperature, the draft fan shuts down and stops the supply of combustion air to the firebox. The fire shuts down due to the lack of oxygen and does not continue smoldering to cause smoke, creosote or overheating. When the boiler temperature drops, the fan will turn on re-igniting the coals which have been resting on the refractory. During the off cycle, the coals stay hot enough to burn but they will be dormant because of the lack of oxygen. The combustion process of the Tarm allows you to burn wood as efficiently, as clean and as controlled as many fossil fuel heating systems.

HEAT OUTPUT

The Tarm Gasification boiler is designed to operate in an output range from as low as 17,000 BTU's per hour. At maximum output, the fan will operate continuously. At lower outputs, the fan and the fire will cycle on and off just as an oil or gas burner does to meet the heating demand. However, trying to operate the Tarm Gasification boilers on wood fuel during periods of lower heat demand can be problematic due to lower chimney draft.

NOTE: The chimney draft must always be strong enough to prevent reversed flow in the boiler's primary and secondary air supply ducts. Otherwise, smoke may be forced backwards through the boiler and emitted out of the fan when it is off. This reversed flow will maintain a smoldering fire in the boiler and can lead to partial or complete blockage of the air supply ducts, causing inefficient and problematic operation. It may also result in an objectionable smell of creosote or smoke in your home. These problems are eliminated entirely when you operate the boiler with enough demand on it as when you have a heat storage system and have a chimney which maintains proper draft.

BURN TIME

Burn time is dependent of the type of fuel, the heat load on the boiler as well as how full you load the firebox. However, the recommended maximum burn time is approximately 8 hours. Remember, only load your boiler with the amount of fuel that will be fully consumed in approximately 8 hours.

OPERATION DURING SUMMER

- **We recommend that you not fire your Tarm Gasification boiler in the summer or other times of low heat demand unless you use a heat storage system.**
- HS-Tarm Gasification boilers will operate at highest efficiency burning wood during the cooler months, but, because of the characteristics of the gasification combustion system, you can operate the boiler through the fall and spring whenever the outside night temperatures require central heating. Your chimney draft and gasket seals are more critical to operation during the times of low heat demand. If you have too high a chimney draft or air leaks around the fan or doors, the boiler may tend to overheat. If your chimney draft is too low, the fire will tend to either go out or smoke will back-up through the fan into your basement. The key to operating the boiler in the warmer months and even through the summer, is to install a heat storage system. Contact TARM USA, Inc for more information on heat storage systems.

NOTE: You will have greater creosote formation in the firebox during operation at lower output. This creosote, if excessive, can lead to shortened boiler life.

SHUTDOWN PROCEDURES

If you are not firing the Tarm Gasifier for extended time periods (such as the summertime) you must maintain the boiler so as to prevent condensation and corrosion. Please protect the boiler by taking the following steps:

1. Clean the inside of the boiler using the scraper and wire brush.
2. Remove all ash deposits from the boiler completely with a vacuum cleaner.
3. Remove and clean the smoke pipe connecting the boiler to the chimney.
4. Do not replace the smoke pipe.
5. Stuff insulation into the flue outlet of the boiler to block off air passing through the boiler.
6. Keep all doors and air dampers closed.

If you still notice condensation forming inside the boiler firebox, hang a 15-25 watt light bulb inside the firebox.

CAUTION: IF YOUR TARM BOILER IS EQUIPPED WITH A DOMESTIC HOT WATER COIL, BE SURE THAT COLD WATER DOES NOT PASS THROUGH THE COIL WHEN THE BOILER IS SHUT DOWN! This can cause excessive condensation on the boiler body and will void your warranty.

Your Tarm boiler requires periodic maintenance and cleaning to work correctly and efficiently. Most of the routine maintenance procedures are usually quick and easy to perform.

WARNING: Failure to properly maintain and inspect your boiler will reduce the performance and life of the boiler, void your warranty and may create hazardous conditions.

ASH REMOVAL

With routine firing, before you add new firewood, work the ashes from the sides of the firebox towards the slot at the center of the refractory. Do not allow a deep build up (more than 2") of ash on the surface of the refractory. If you are not firing the boiler correctly, you may find a buildup of creosote will creep onto the surface of the refractory at the corners. If this buildup occurs, it must be removed.

Most of the ashes will be worked down through the slot in the firebox floor during routine firing, as above. Twice a week, or as needed, remove ash that has accumulated in the combustion tunnel and on the refractory floor through the ash door. Place your ash pan on the floor in front of the ash door and pull the ash in this area into the pan using the ash removal tool. Be sure to remove ash buildup under the heat exchange tubes behind the combustion tunnel. Remember to be careful when working around the refractory.

All ashes should be placed in a steel container with a tightly fitting lid and moved outdoors. Other waste shall not be placed in this container.

SMOKE BOX AND HEAT EXCHANGE TUBE CLEANING

The smoke box, the flue outlet and the heat exchange tube areas should be cleaned twice a month with the boiler brush. Let the boiler cool and shut off the power to the boiler. Remove the clean-out cover plate under the rear top jacket panel. Push the cleaning brush to the bottom and pull back up several times in each heat exchange tube. Remove fly-ash from the smoke box area above the heat exchange tubes. As noted earlier in this manual, elevated flue temperatures may indicate the need to brush the heat exchange tubes.

It is important that the by-pass damper close and seal tightly for optimum boiler efficiency. If you are operating your boiler properly you should not have a problem with the by-pass damper sticking closed. Clean the by-pass and flap each time you clean the smoke box and heat exchange tubes.

DRAFT FAN AND AIR DAMPER CLEANING

Clean the draft fan blades at least once a year. Dust buildup in the fan blades can significantly reduce fan performance. Remove the screen and clean the blades with a soft bristle brush and a vacuum cleaner. If there is creosote on the fan you have a chimney draft reversal problem that needs to be fixed.

DRAFT FAN AND AIR DAMPER CLEANING (continued)

The primary air damper (flapper) in front of the draft fan **MUST move (swing) open and closed freely and easily**. The draft fan should open the primary air damper and the counterbalance should close the damper when the fan turns off. If the damper sticks in either position, operation will be adversely affected. Lubricate the damper with a light graphite oil. Check the damper once or twice a month! Overheating of the boiler can occur if the air damper sticks open!

LOADING DOOR

The primary combustion air inlets are located at the top corners of the boiler loading door opening. Any creosote buildup in these openings must be removed. The doorframe and openings should be cleaned frequently to remove any creosote buildup.

Check the loading door and ash door gaskets regularly to insure that they are sealing well and that there is no smoke spillage into the house or unwanted air leakage into the boiler.

CLEANING THE PRIMARY AIR DUCTS

The primary air ducts on each side of the loading door can very rarely get clogged with creosote due to a reversed chimney draft or improper firing. Although this should not happen, if it does, the boiler will start to perform poorly and it will be necessary to clean the primary air ducts. To clean the air ducts, the load and ash doors, along with the front jacket panel, will need to be removed. Then remove the panel cover between the upper and lower door openings. You now have access to clean the primary air ducts. Make sure you don't let debris block the secondary air ducts. Reposition the secondary air damper and access panel. Apply silicone sealant (caulking) to reseal the access panel. Re-install the jacket panel and doors as done during the original installation.

SMOKE PIPE CLEANING AND INSPECTION

Annually disassemble the stove pipe. Clean and inspect for corrosion. If any pipe is seriously corroded (for example, if a screwdriver can easily be poked through the metal), this section must be replaced.

CHECK FOR CREOSOTE BUILDUP

Check for creosote buildup in the heat exchange tubes, the smoke pipe and the chimney once a month. If you see a buildup of creosote, something is wrong.

NOTE: Creosote buildup, other than in the primary combustion chamber, is generally a sign that there is air leakage into the boiler during the off cycle which is resulting in a low grade fire. Check your door gaskets and the primary air damper near the draft fan.

TROUBLESHOOTING

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 a Tarm Gasification boiler. It is not possible within the scope of this manual to cover all possible service aspects of hydronic heating systems. Your installing contractor or designer are the best source for information to answer questions regarding your heat distribution system. Your HS TARM dealer or TARM USA, INC. are available for further support as to heating system questions and any and all questions regarding HS TARM boilers and how they are integrated into your distribution system.

BOILER OVERHEATING

IN NORMAL OPERATION, Tarm Gasification boilers cycle on and off to meet the heating demand. The heat output from these boilers is very controlled and very seldom is there a problem with overheating. However, the wood fire will always produce a certain amount of heat. When there is no demand for heat on the system, boiler temperature may rise. Usually this extra heat is absorbed in the water of the boiler without causing an overheat condition. The on-off cycling of the boiler is like that of an oil or gas boiler.

Should the water temperature rise excessively, as it absorbs heat, the overheat control will cause circulation of heated water to the house, even though the thermostat is not calling for heat. This potentially wasteful overheating is most likely to occur during the Spring or Fall. Before choosing your heating system design, the possibility of using a mixing valve or a heat storage system to help avoid such problems should be considered. Either of these arrangements can be added to any heating system.

NOTE: Overheating of the boiler is an occurrence that all homeowners must be familiar with so that it can be corrected, if it occurs.

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

CAUTION: NEVER ADD WATER TO AN OVERHEATED BOILER. Wait until the boiler has cooled down before adding water, if it is needed.

The most common causes of overheating are;

- Over-firing the boiler (i.e., putting in too much wood for the heating needs of the house at a given time),
- Improper setting on temperature controls,
- Electrical power failure,
- Air leaks into the boiler (worn door gaskets, worn door latch, primary air damper stuck open), and
- Excessive chimney draft.

BOILER OVERHEATING (continued)

Following the recommendations in this manual will minimize the possibility of overheating. However, even the most experienced person may occasionally overheat his boiler. To cope with this problem, the boiler is equipped with two safety devices-- the Overheat Circuit and the Pressure Relief Valve. The Overheat Circuit is wired to circulate excess boiler heat to the house when the boiler reaches a preset temperature of 200° F. This control turns on the circulator or opens the mixing valve for the largest heating zone. Generally, the overheated boiler can be cooled within 10 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. For your information, all Tarm boilers are pressure tested to 60 psi at the factory.

NOTE: TO PREVENT THE POSSIBILITY OF SERIOUS BURNS OR PROPERTY DAMAGE FROM THIS STEAM, THE DISCHARGE TUBE FROM THE RELIEF VALVE MUST BE PIPED TO A POINT 6" FROM THE FLOOR OR TO A DRAIN!

The reason that 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, water 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. Be sure the loading door and ash door are tightly closed.
2. Be sure the by-pass is in the closed position.
3. Open all hot water faucets in the house if the boiler has a domestic hot water coil.
4. Turn all thermostats up to their highest setting.
5. Open windows as necessary to keep the house cool.

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

OPERATING IN THE 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.

1. Locate any "Flow-check" valves in the system, and unscrew completely the knob on top of each valve. (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.) If you installed Automag automatic zone valves instead of Flow-check valves, they will open automatically with any power failure, giving you maximum protection even when you are not at home. If you have a mixing valve, open it to the highest setting, then lock it into position. If you have a Termovar thermostatic mixing valve you must have an Automag zone valve or comparable by-pass to allow circulation in the event of power failure.

OPERATING IN THE EVENT OF POWER FAILURE (continued)


2. Open the by-pass damper and remove the sight glass cover and the sight glass located on the ash door. It is important to remember that the heating system cannot safely use the heat from a great deal of wood without the circulators running. Under such conditions, extreme caution must be used to avoid over firing. **DO NOT LOAD LARGE AMOUNTS OF WOOD INTO THE BOILER!** Fire the boiler cautiously until you are able to determine how quickly the boiler can consume fuel without overheating. **Re-install the sight glass to slow the fire to maintain the boiler at 180°F or less.**
3. When the power has returned, reset all flow-check and zone valves and resume normal operation of the system.

NOTE: The above procedures do not apply to gravity systems, as they have no flow-check valve and will continue to operate normally without electricity.

This section of the manual is designed to help you to isolate and correct problems that may occur during the operation of your TARM BOILER.

SYMPTOM:	POSSIBLE CAUSE:	REMEDY:
<u>NO HEAT IN HOUSE</u>		
Boiler Temperature is below 150° F while burning wood	No Fuel in Boiler Low Fan Output	Restart or re-light fire Fan wheel dirty—CLEAN Air Ducts Plugged -- CLEAN
	Fan does not operate	Check power and control panel components with multi-meter.
	By-pass damper open, not sealing	Close by-pass damper, CLEAN
	Combustion chamber is obstructed	Clear ash and other obstructions through lower door
	Boiler is dirty	Clean ash off refractory Clear Ash from floor of boiler Brush Heat Exchange Tubes
	Wood is unsplit or unseasoned	Split wood and season to 20% moisture or less
	Fan operates slowly	Bad motor capacitor - replace
Boiler Temperature is below 140° F, wood fan doesn't shut off	Wrong setting on Lo-Limit Thermostat	Set Lo-Limit Thermostat at 140° F (60° C)
	Boiler didn't reach operating temperature on cold start-up	Be sure to fire boiler so it heats to above 175° F (80° C) after a cold start
Boiler Temperature above 150° F	Air in piping	Call Serviceman
	Circulator not operating	Call Serviceman
	Not enough radiation in house	Add radiation as needed
Boiler functions well with good burn times but inadequate on coldest days	Boiler temperature is set too low	Increase boiler water temperature by adjusting the Operating Thermostat to 190° F (90° C)
Excessive heat dumped into over-heat zone	Overheat control set too low	Increase setting on L4008B to 210° F
Short burn times	Wood not seasoned adequately	Season wood for at least 8 months under cover. Cut, split and stacked
	Firebox not filled adequately	Cut wood to full length of firebox
	Poor quality wood	Choose Oak, Hickory, or other dense hardwoods for longest burn
Wood fire goes out before being burned completely	Inadequate Draft	Increase chimney draft
	No demand on boiler for an extended period of time	Burn backup fuels or turn house thermostat up so the boiler fan will operate more often
Excessive smoke out of load door when loading	Too much wood left in firebox from last stoking	Load less wood
	Weak chimney draft	Make chimney higher or warmer Use a stove pipe or chimney draft Inducer. Check with TARM USA
	AUTO-MIX SYSTEMS	
Does not maintain house at set temp.	Locking quadrant set too low for weather conditions	Reset locking quadrant on the mixing valve further to the right
House temp. is above thermostat setting	Locking quadrant set too far to the right	Reset locking quadrant on the mixing valve further to the left

A copy of the O-TL listing label for the HS Tarm Solo Plus Series Gasification Boiler is shown below:

Tested & Listed By 	Beaverton Oregon USA		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: 02/27/2001 - 03/02/2001											
	OMNI-Test Laboratories, Inc. Report #236-S-01-2		Serial #: _____											
<p>Solo Plus MKII WOOD-FIRED GASIFICATION BOILER FOR USE WITH SOLID WOOD FUEL ONLY.</p>														
✓	Model	Fuel	BTUH Output	Electrical Rating	Maximum Overcurrent Protection									
	Solo Plus 30, MKII	Wood	100,000 (29.29 Kw)	120V, 60 Hz, 1.5 A	15 AMP									
	Solo Plus 40, MKII	Wood	140,000 (41.0 Kw)	120V, 60 Hz, 1.5 A	15 AMP									
Clearances to Combustibles														
Side Wall to Appliance			6" (152 mm)	Combustibles to Flue Pipe		18" (457 mm)								
Back Wall to Appliance			18" (457 mm)	Ceiling to Appliance		18" (457 mm)								
Front of Appliance to Combustibles			36" (914 mm)											
2001	2002	2003	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

TARM
1-2919

WARRANTY - FOR USE IN 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 20 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 twenty, 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 Importer'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	60%
7	50%
8	40%
9	30%
10-20	20%

Example #1: Repair costing \$250 in year 7. Importer will pay \$125.00 (50%) of this repair.

Example #2: Boiler (original cost \$4000) needs major repairs in year 9. Importer will pay \$800.00 (30% 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.

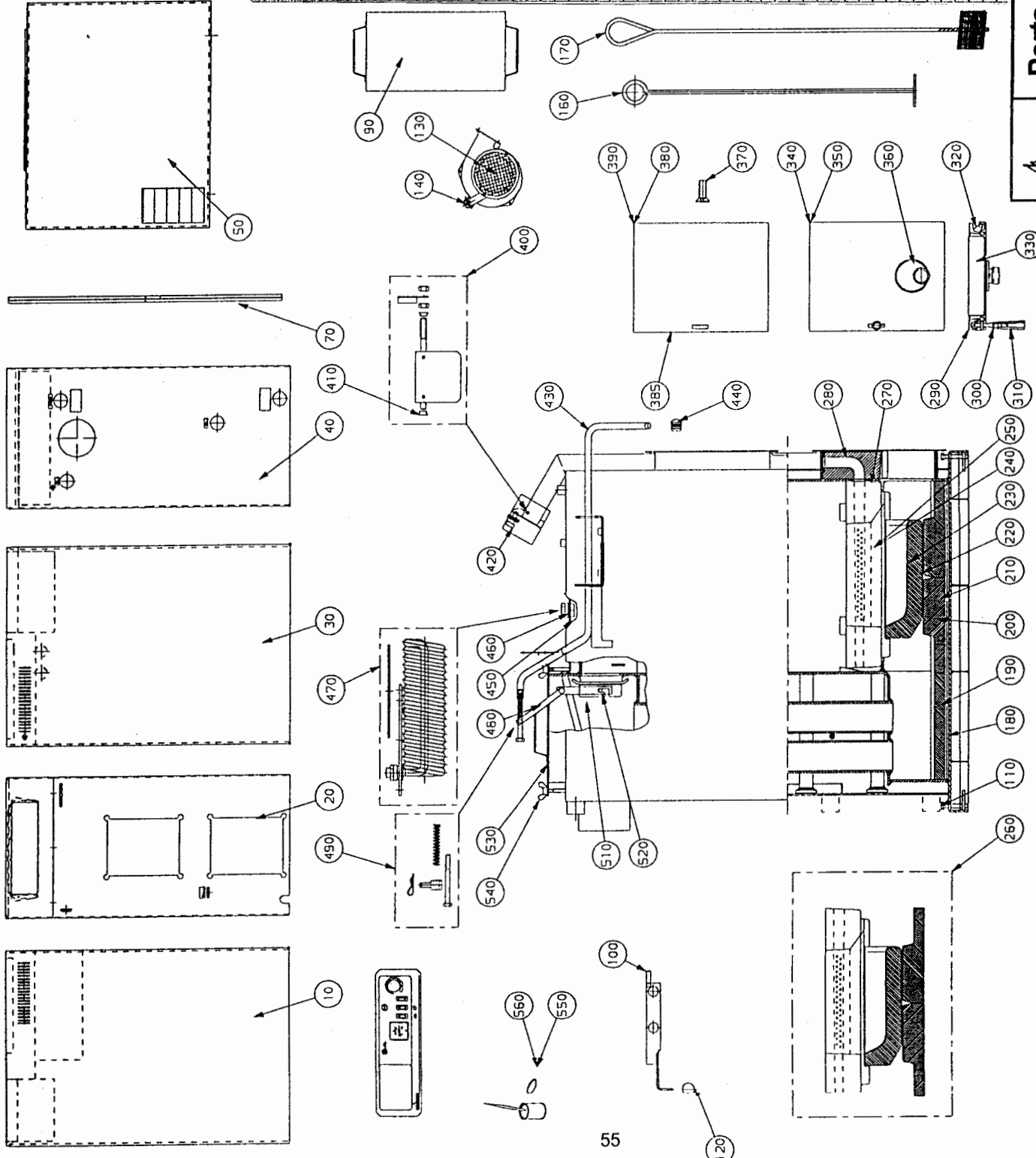
EXCLUSIONS: Expressly excluded from coverage by this limited warranty are the following:

- 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.
- Repairs or replacements caused by thermal shock.

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.



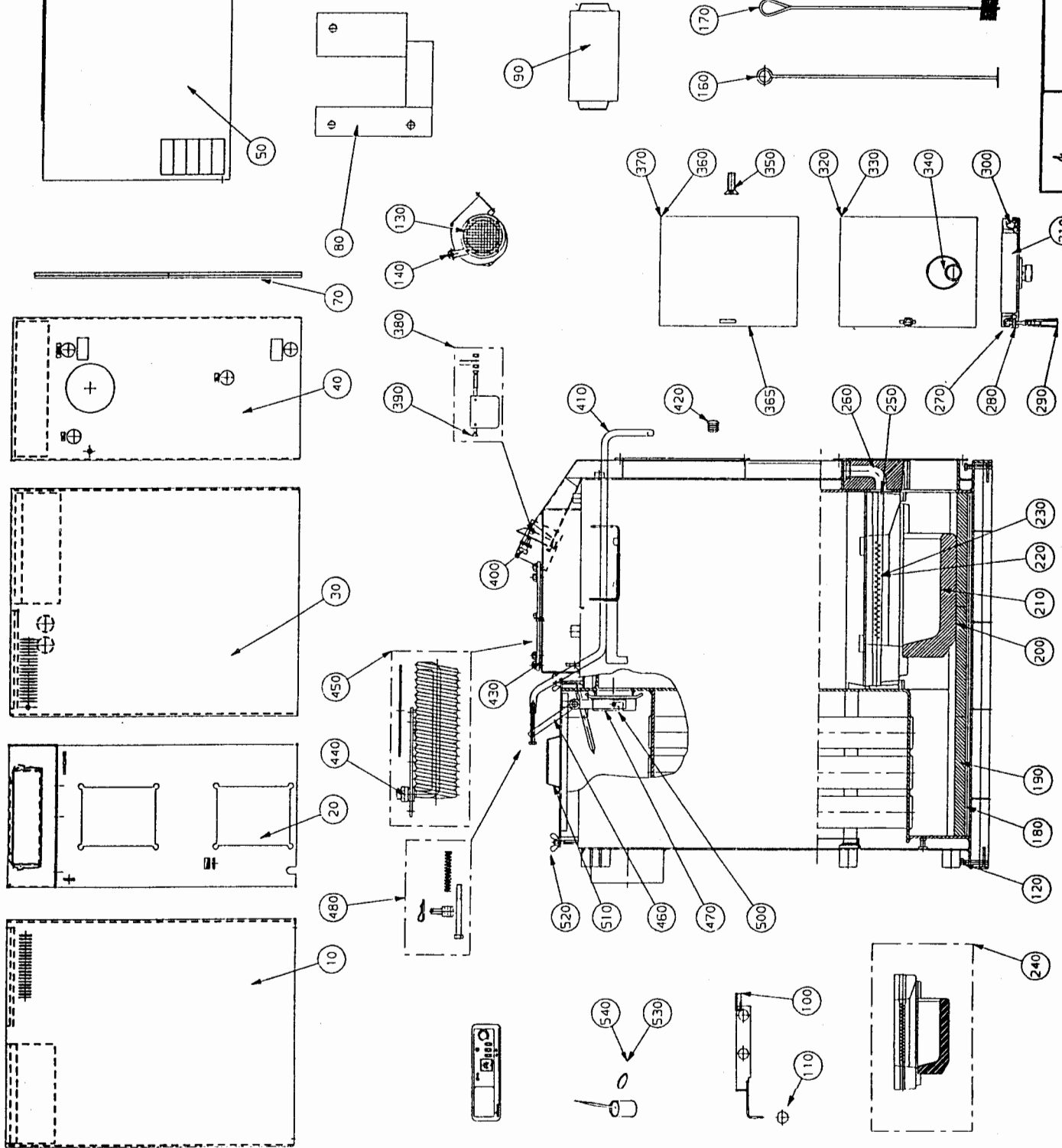
Part No.	Description	Quant.	Unit
540	REPAIR PAINT GRAY/BLACK	1.0	PC
530	REPAIR PAINT BLUE	1.0	PC
520	MICROSWITCH CPL	1.0	PC
510	O-RING Ø26 X5	1.0	PC
500	GASKET RUBBER 26X15X35	1.0	PC
490	SPRINTAL, COVER AND GASKET CPL	1.0	PC
480	PARTS FOR BYPASS 50L0700 PLUS	1.0	PC
470	WING NUT FZB M10	1.0	PC
460	EXHAUST COVER	1.0	PC
450	TENSION PIN Ø10X25	1.0	PC
440	AXLE FOR BYPASS	1.0	PC
430	BYPASS FLAP KPL 280X126X6	1.0	PC
420	BYPASS ARM KPL Ø10X55	1.0	PC
410	ADJUSTING SCREW CPL	1.0	PC
400	HANDLE Ø20X200X115X25 KPL	1.0	PC
390	BAKELITBALL Ø50 M10	1.0	PC
380	BEARING ØØ.5XØ14.0 Lx5.2	1.0	ST
370	DAMPER & DAMPER WEIGHT	1.0	PC
360	GASKET SILICONE	1.0	PC
350	PIPING DOOR 50.0 PLUS/700 PLUS	1.0	PC
340	TEMPERED INSPECTION GLASS	1.0	PC
330	GASKET FOR DOOR	1.0	PC
310	INSULATION STONE & SCREWS	1.0	PC
300	RIVET RH Ø6.50	1.0	PC
290	HANDLE FOR DOORS	1.0	PC
280	HANDLE FOR DOORS	1.0	PC
260	CLOSING FURNITURE F. Ø00R5	1.0	PC
250	INLET STONE	1.0	PC
240	GASKET FIBER Ø60/30X10	1.0	PC
230	FIREBRICK SET SP 30X40 MK 11	1.0	PC
225	STONE L. 540X170X125	1.0	PC
215	GRADE STONE 345X210X110	1.0	PC
190	INSULATION 330-60R2	1.0	PC
180	INSULATION TILE WITH CAP	1.0	PC
170	BOTTOM TILE 340X27X30	1.0	PC
160	INSUL. FIREPROOF 850-350X12.5	1.0	PC
150	CLEANING BRUSH 110X135 Lx1100	1.0	PC
140	SCRAPER L=1100	1.0	PC
130	DRAIN COCK 1" M-F	1.0	ST
120	CONDENSATOR 1.5 MF	1.0	PC
110	FAN 50L0700 PLUS 18/20	1.0	PC
100	BAKELITBALL Ø32 M5	1.0	PC
90	SET SCREW 8.8 FZB M2 X70 MM	1.0	PC
80	SLIDING BOLT FOR SECONDARY AIR	1.0	PC
70	ASH PAN	1.0	PC
60	INSULATION 550X470X80	1.0	PC
50	PREFORMED STRIP L=1220	1.0	PC
40	REAR PLATE 1314x535x50	1.0	PC
30	SIDE PLATE R. 1314x528	1.0	PC
20	FRONT PLATE 1315x535x50	1.0	PC
10	SIDE PLATE L. 1314x228	1.0	PC



Parts - Solo Plus 30 & 40

ORDER FOR PARTS

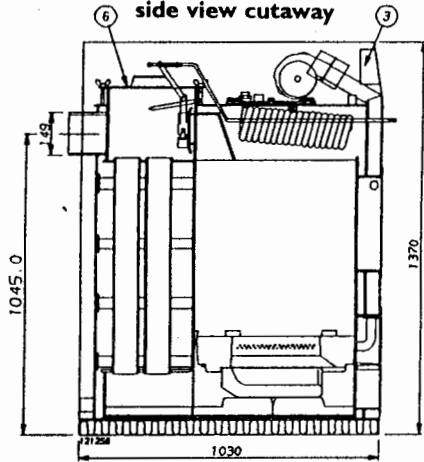
Part No.	Designation	Quantity	Units
500	REPAIR PAINT GRAY/BLACK	1.0	PC
530	REPAIR PAINT BLUE	1.0	PC
520	WING NUT F78 M10	1.0	PC
510	FLUE END COVER	1.0	PC
500	TENSION PIN #10X25	1.0	PC
490	MICROSWITCH CPL	1.0	PC
480	PARTS F. BYPASS SOL/D/O/DQ PLUS	1.0	PC
470	AXLE FOR BYPASS CPL	1.0	PC
460	SPRINKLER COVER AND BASKET CPL	1.0	PC
450	SPRINKLER COVER AND BASKET CPL	1.0	PC
440	SPRINKLER COVER AND BASKET CPL	1.0	PC
430	SPRINKLER COVER AND BASKET CPL	1.0	PC
420	SPRINKLER COVER AND BASKET CPL	1.0	PC
410	SPRINKLER COVER AND BASKET CPL	1.0	PC
400	ADJUSTING SCREW CPL	1.0	PC
390	REPAIRING BRUSH L. 5.2	1.0	ST
380	GASSET SILICONE	1.0	PC
370	FRAME FOR FIRING DOOR	1.0	PC
365	FIRING DOOR SOL/D/O/DQ PLUS	1.0	PC
360	INSEK SCREW B. F78 M10X2.0	1.0	PC
350	TEMPERED INSULATION GLASS	1.0	PC
340	GASSET FOR DOOR	1.0	PC
330	ASH DOOR SOL/D/O/DQ PLUS	1.0	PC
320	INSULATION TILE SP18-60, DP18	1.0	PC
310	RIVET RH 6x50	1.0	PC
300	HANDLES FOR DOORS	1.0	PC
290	CLOSING FURNITURE F. DOORS	1.0	PC
280	WALLET STONE	1.0	PC
270	GASSET FIBER #60/30X10	1.0	PC
260	FIRE BRICK SET SP 50 MK II	1.0	PC
250	STONE L. 540x170x125	1.0	ST
240	STONE R. 540x170x125	1.0	ST
230	CRAGLE STONE 345x210x150	1.0	ST
220	INSULATION 30x60x2	1.0	PC
210	INSULATION 30x60x2	1.0	PC
200	INSULATION 30x60x2	1.0	PC
190	INSULATION 30x60x2	1.0	PC
180	CLEANING BRUSH 110X153 L=1100	1.0	PC
170	SCRAPER L=1100	1.0	PC
160	BALL TAP SQUARE HANDLE 1/2 IN-4	1.0	PC
150	CONDENSATOR 2 PF	1.0	PC
140	FAN SOL/D/O/DQ PLUS 40	1.0	PC
130	SET SCREW B. F78 M12 X70 MM	1.0	PC
120	BACKLIT BALL B32 M6	1.0	PC
110	SLIDING ROLLER FOR SECONDARY AIR	1.0	PC
100	ASH PAN	1.0	PC
90	INSULATION 549 545-0280	1.0	PC
80	PREFORMED STRIP L=1220	1.0	PC
70	COVER REAR 643x524x160	1.0	PC
60	COVER FRONT 643x524x160	1.0	PC
50	REAR PLATE 1315x645x50	1.0	PC
40	SIDE PLATE R. 1314x1038	1.0	PC
30	FRONT PLATE 1315x645x50	1.0	PC
20	FRONT PLATE L. 1314x1038	1.0	PC
10	SLIDE PLATE L. 1314x1038	1.0	PC



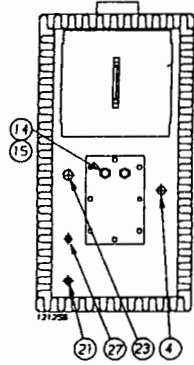
Parts - Solo Plus 60



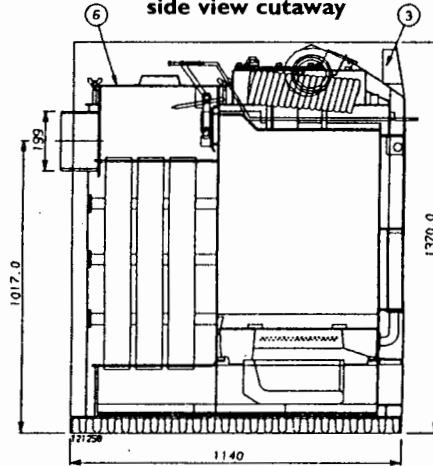
Solo Plus 30-40
side view cutaway



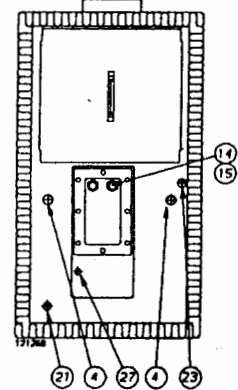
Solo Plus 30-40
seen from above



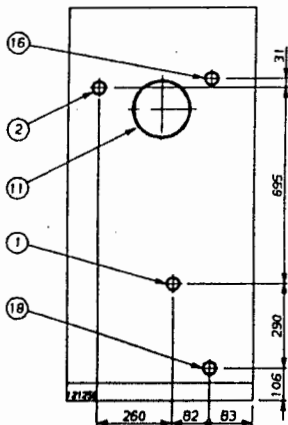
Solo Plus 60
side view cutaway



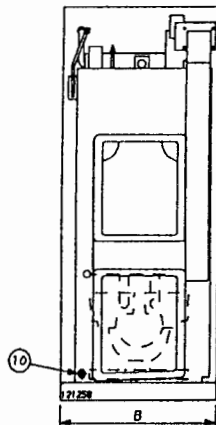
Solo Plus 60
seen from above



Solo Plus 30-40-60
seen from behind



Solo Plus 30-40-60
seen from front



Technical Data:

HS Solo Plus		30	40	60
Maximum heat/output	BTU/hr	100,000 BTU/hr	140,000	198,000
Firebox depth	Inches	21	21	21
Load door	In. x In.	10 x 12	10 x 12	10 x 12
Firebox Volume	Cubic Feet	4.01	5.35	6.02
Maximum wood length	In.	21	21	21
Test pressure, boiler	PSI	65	65	65

Installation Data:

			30	40	60
Length (depth)	A	In.	41	41	45
Breadth	B	In.	21	25	25
Height	C	In.	54	54	54
Height to Center of Flue		In.	41	41	40
Weight, empty	Lb.		1060	1160	1210
Water contents	Gal.		41	54	60
Flue collar, diameter	In.		6	6	8

			30	40	60
1. Return	In.		1-1/4	1-1/4	1-1/4
2. Flow	In.		1-1/4	1-1/4	1-1/4
3. Control Panel	Volts		110	110	110
4. Tapping - Overheat	In.		3/4	3/4	3/4
6. Cleaning cover	4 thumb screws		X	X	X
10. Extra Tapping	In.		1/2	1/2	1/2
11. Flue collar	In.		6	6	8
16. Expansion & extra flow	In.		1-1/4	1-1/4	1-1/4
18. Extra return	In.		1-1/4	1-1/4	1-1/4
21. Tapping - control panel	In.		1/2	1/2	1/2
23. Tapping pressure gauge	In.		3/4	3/4	1/2
27. Vent	In.		3/8	3/8	3/8
Dimension, B2	In.		2-1/2	4-1/4	5
Dimension, B3	In.		3-3/4	6	6
Storage tank, ideal vol.	Gal.		400	600	650

Specifications and Dimensions

CONTROLS AND DRAFT FAN ASSEMBLY (continued)

8. Insert the three copper sensing bulbs attached to the control panel into the immersion well previously installed in tapping #21 on top of the boiler. Secure the sensors in the well with the spring clip provided. Insert the chrome plated sensor in the sensor well that is on the right hand front side of the smoke box.
9. Install the brass diaphragm well for the pressure gauge capillary tube into tapping #23 and then screw the capillary sensor into this well.
10. Mount the L4008B overheat aquastat (provided with your TARM boiler) just below the air intake grill on the right side of the boiler and approximately 12" back from the front of the boiler. Noting the top of the insulation on top of the boiler, cut a 5/8" diameter hole in the boiler jacket approximately 16 1/2" back from the front of the boiler and above the level of insulation. Being careful not to kink the capillary tube of the L4008B aquastat, feed it through the 5/8" hole and insert it into the 3/4" immersion well previously installed in tapping #4.
11. Wire from the L4008B aquastat, using thermostat wire, to the T. T. terminals of the relay controlling the largest heating zone circulator. Set the L4008B aquastat at 210°F. If the boiler reaches this overheat temperature the aquastat will cause the circulator to run to help cool the overheated boiler.
12. Step 13, which follows, describes how to supply electric power to the TARM Solo Plus boiler. Because the control panel is supplied as a prewired assembly, all that is required on-site is to connect to a 110 volt service and to connect the draft fan wiring to the control panel. Refer to electrical drawings on pages 29 and 30.

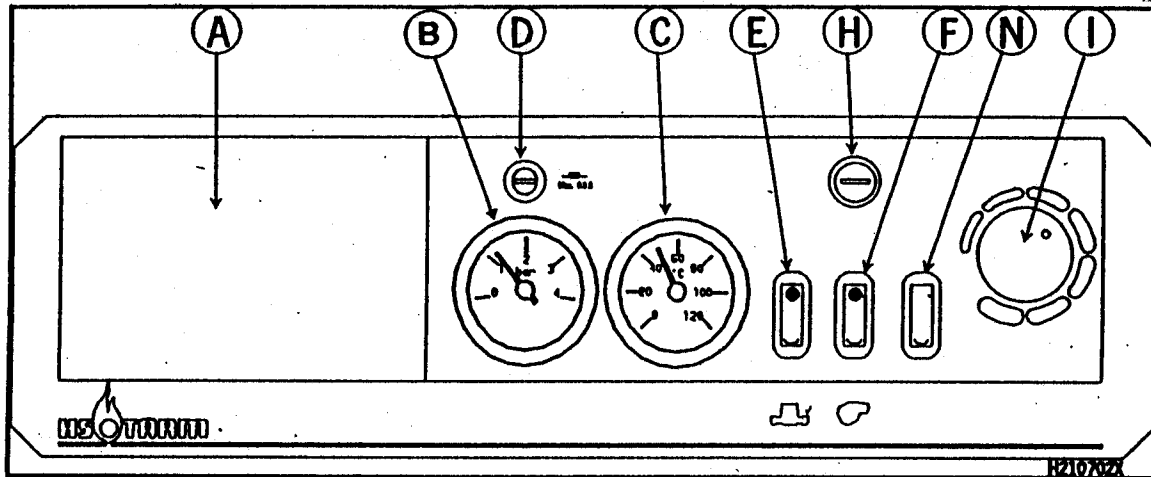
NOTE: The electrical system of the boiler shall be supplied from a single branch circuit. The boiler itself must be grounded in accordance with the requirements of Local, State and National Electric Codes.

13. Remove the knockout in the rear of a 4" square electrical junction box and mount this box with the removed knockout over the plastic grommet located at the top right corner of the right jacket panel. Feed the power supply cord from the boiler's control panel through the grommet into the 4" square junction box and connect to the 110 volt power supply. Provide a service switch mounted in the cover of the 4" square electrical junction box.
14. The draft fan is powered from the boiler control panel. Connect the draft fan electric cord to the control panel terminal strip as follows:

Connect the green striped yellow wire to terminal #7,
Connect the blue wire to terminal # 6 and
Connect the brown wire to terminal #4.

PAGE 34 **DESCRIPTION OF EQUIPMENT (continued)**

CONTROL PANEL



ITEM FUNCTION

- A Place for weather compensation control (NOT BEING USED).
- B Pressure gauge. Shows the boiler pressure. Normal operating pressure is 10-15 psi.
- C Temperature gauge. Shows the boiler temperature. The boiler temperature is adjusted by means of the thermostat (I).
- D Fuse maximum 6.3 A (5x20mm).
- E Switch for pump.
- F Switch for draft fan.
- H Overheat thermostat. This disconnects the fan at a temperature of 210°F (100°C). In order to reconnect, the protection cap is taken off and the pin which has sprung out is pushed in again, after the boiler temperature has fallen below approximately 165°F (75°C).
- I Operating Thermostat. Recommended temperature 180°-190°F (85°-90°C). In order to ensure that the temperature is adjusted beyond 180°F (80°C) a headless screw has been placed under the control knob.
- N Reset switch. The boiler combustion fan stops automatically when the wood burns out and the smoke box temperature falls below 190°F (90°C).

- In order to restart combustion of the boiler when the smoke box sensor temperature is below 190°F (90°C), the reset switch will need to be pressed "ON" (see page 38, Lighting The Boiler...). You must load enough wood to heat the smoke box above 175°F (80°C) to engage the Lo-Limit thermostat. If normal operating temperature is not reached, the draft fan will not shut off even if the wood burns out and the smoke box temperature drops below 175°F (80°C).

BEFORE YOU BEGIN

SAFETY NOTICE: READ THIS ENTIRE MANUAL BEFORE YOU INSTALL AND OPERATE YOUR NEW BOILER. FAILURE TO FOLLOW THE INSTRUCTIONS MAY RESULT IN PROPERTY DAMAGE OR BODILY INJURY.

To operate your boiler in disregard of the information provided in this section can cause permanent damage to your boiler and void your warranty.

WARNING: NEVER USE GASOLINE, KEROSENE OR OTHER FLAMMABLE LIQUIDS TO START OR MAINTAIN SOLID-FULE FIRES IN YOUR BOILER – SERIOUS BURNS OR PROPERTY DAMAGE MAY RESULT!

NOTE: Do not be alarmed if you smell an unusual odor the first few times you fire the boiler. This smell is due to burning of oil residues in the paint on the boiler and the smoke pipe. Ventilate the boiler room well for the first few hours during the first fire.

STARTING YOUR TARM GASIFICATION BOILER

Before starting your boiler for the first time the installer must check that it is properly filled with water and vented of air. It is also important to vent the boiler again after the boiler is up to the 180°F operating temperature. It is important also that the installer check all the control functions and settings before leaving the boiler unattended. Check the operating control, the low temperature cut-out and the overheat functions.

AQUASTAT CONTROL SETTINGS

Before you start your boiler make certain the aquastat controls are set as follows:

Operating Thermostat (I)

Check to see that the Operating Thermostat (I) knob is set in a clockwise direction beyond the stop under the knob. To turn the knob beyond the stop (the screw under the knob is the stop), pull the knob out until you can turn it past the stop. Push the knob back in and then turn the knob counterclockwise until it hits the stop. This should yield the correct operating temperature of 180°-190°F (85°-90°C).

Lo-Limit Thermostat

Set Lo-Limit Thermostat (on the back side of the boiler's control panel at end of terminal strip) at 190°F (90°C).

Honeywell L4008B Overheat Control Aquastat

Setting	Function
210°F	Back up High Temperature Limit. Activates the Dump Zone circulator in the event of a boiler overheat.