303

TARM USA INC

Installation and Operation Manual

TARM 303

Coal-Fired Boiler

TARM USA INC

HS TARM MULTI-FUEL SYSTEMS
FIVE MAIN STREET, PO BOX 285
LYME, NEW HAMPSHIRE 03768
1 (800) 782-9927

HS TARM

Dear Friend,

Congratulations on your wise choice of this [illegible]-efficient HS TARM central heating system. As you know, this boiler was quality-crafted in Denmark to traditionally high standards of excellence, performance, safety and reliability. You have made an intelligent, long-range investment in the comfort of your family and in the value of your home.

To familiarize you with your new HS TARM, we have included this Operation Manual. It includes complete instructions for the installation and operation of your TARM 303 boiler. (Please note: If your TARM 303 is combined with the HS-20 automatic anthracite coal stoker, this Operation Manual must be used in conjunction with the HS-20 Stoker Manual.)

We have referred to specific brands of controls and accessories in this Operation Manual. In certain cases, equivalent makes of these devices may be used as successfully. Your Installing Contractor should determine the specific requirements of your system. However, NO SUBSTITUTIONS SHOULD BE MADE FOR THE STANDARD SAFETY EQUIPMENT (such as the overheat control and relief valves) supplied with the boiler. The proper installation of these devices is absolutely necessary for the safe operation of your TARM 303 boiler and for the protection of your heating system.

We hope that you will find the answers to any questions you have about your new TARM 303 in this Operation Manual. For any additional information, please feel free to contact your HS TARM Distributor, or, if necessary, call our Technical Department direct (TOLL FREE 800-628-9327; in Massachusetts, 800-282-7719.) We will be happy to answer any questions.

Thank you.

Sincerely,

TARM USA, INC.
U.S. Importer-Distributor

Scott Nichols

Main St. Box 285
Lyme, NH 03768
Also: Nichols Hardware Inc.

HS TARM
Makers of High Efficiency
Wood & Multi-Fuel Boilers

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HS TARM
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Wood, Multi-Fuel, Pellet
& Corn Boilers

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IMPORTANT INFORMATION - PLEASE READ THIS PAGE CAREFULLY!

This boiler has a limited warranty, which appears on the inside back cover of this manual. To validate your warranty, detach the card, fill in the information requested and return the card to Tekton Corporation.

The TARM 303 may be converted to an automatically-fired coal-burning boiler by the addition of the HS-20 stoker. The HS-20 is the only stoker certified for use with the TARM 303. The HS-20 manual is designed to be used in conjunction with this manual.

General Information

Please read the literature enclosed by the manufacturer with the various accessory devices. These devices are warranted by the manufacturer, NOT by Tekton Corporation. These accessory devices must be installed and used according to the recommendations of the manufacturer.

All boilers must be installed in accordance with national, state and local plumbing, heating and electrical codes and the regulations of the serving electric, water and gas utilities.

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

Homeowners should read and familiarize themselves with "boiler overheating" and "procedure in event of power failure" (see pages 30-32).

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

WARNING: All coal fires produce large quantities of carbon monoxide, a highly poisonous gas. Exposure to this gas produces drowsiness, sleep and, in some cases, brain damage or death. Please read and re-read carefully the sections in this manual devoted to chimneys and chimney cleaning and the instructions on coal firing before installing and using the TARM 303 boiler.

Installation Information

The boiler must be connected to a tile-lined masonry flue. In some areas, codes require that no other appliance be connected to this flue. Consult your local building inspector for chimney requirements and install the boiler in accordance with all applicable codes.

Boiler should be positioned to provide minimum clearances between combustible surfaces as follows: side-6"; top and rear-18"; front-36". There must be a minimum clearance of 18" between smoke pipe and all combustible surfaces.

Use 5 turns of teflon tape to seal all threaded connections.

When references are made to tapping numbers, please refer to page 5.

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

INTRODUCTION

This manual contains complete installation and operation instructions for your TARM 303 boiler. If the boiler is combined with the HS-20 automatic anthracite coal stoker, use this manual in conjunction with the HS-20 manual.

While both the homeowner and installer will benefit from reading the entire manual, this booklet is organized in sections for handy reference and convenience.

The INSTALLATION section is intended primarily for use by the heating, electrical and plumbing contractors who assemble and install your TARM 303 boiler.

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

The TROUBLESHOOTING AND MAINTENANCE section contains information helpful to homeowner and installer alike in identifying and correcting problems and in maintaining the heating system.

The WARRANTY appears on the inside back cover. The homeowner should detach and fill out the card and, to validate the warranty, mail it to Tekton Corporation.

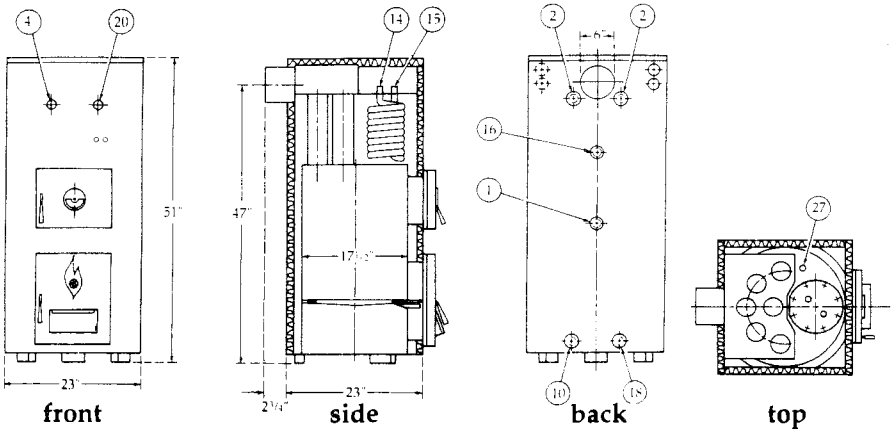
TABLE OF CONTENTS

specifications

		303
Gross Output – Coal	Btu/hr	120,000
Max. Hot Water Output	GPM	2.4
Weight (inc. jacket)	lbs.	645
Water Volume	gal.	21
Pressure Test	psi.	60
Pressure Test-Hot Water Coil	psi.	250
Dimensions		
Width	in.	23
Depth	in.	23
Height (top of jacket)	in.	51
Height (center of flue)	in.	47
Height (top of flue)	in.	na
Firebox Width	in.	17½
Firebox Depth	in.	17½
Coal Capacity	lbs.	135
Loading Door Opening	in.	7½x10
Ash Door Opening	in.	10x12

		303
Tapping Numbers		
1 Return	in.	1¼
2 Supply	in.	1¼
4 Tridicator	in.	½
10 Boiler Drain Tapping	in.	1¼
14 Hot Domestic water	in.	¾
15 Cold Domestic water	in.	¾
16 Extra Tapping	in.	1
18 Extra Tapping	in.	1¼
20 Draft Regulator	in.	¾
27 Vent Tapping	in.	⅜
Flue Pipe Diameter	in.	6
Minimum Chimney Draft	in/w	.05
Minimum Flue Size	in.	8x8
Minimum Chimney Height	ft.	20

TARM 303



TARM 303 BOILER

PLEASE UNPACK THE CONTENTS OF THE BOILER BODY AND THE JACKET, DOOR AND CONTROLS BOXES CAREFULLY, AND CHECK OFF THE ITEMS ON THE FOLLOWING LIST:

JACKET BOX

__ Jacket panels (four sides and one top)
__ Preformed strips (4) for joining jacket panels
__ Door gasket pack

DOOR BOX

__ Firing door
__ Ash door with swinging grate
__ Studs (8) and nuts (8) for door mounting
__ 2 Bakelite handles

BOILER BODY

__ Flat steel plate with semicircular cutout (slides into slot in ash door opening)
__ Circular coal grate
__ Metal tube (handle for coal grate)
__ Cleaning brush
__ Shovel

CONTROLS BOX

__ SAMSON 5D Automatic Draft Regulator
__ Boiler Pressure Relief Valve - WATTS 174A, 30 psi
__ Boiler High Temperature Limit (overheat control) - HONEYWELL L4006B with immersion well
__ Domestic Coil Pressure Relief Valve - WATTS 3L, 125 psi (boilers with tankless coil only)

Please contact your dealer immediately if any of the above items are missing!

I. BOILER SETUP

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

NOTE:
All threaded fittings must be wrapped with 5 turns of teflon tape to seal properly.

A. Initial Assembly

1) Unpack the items in the boiler body and the jacket, door and controls boxes, and check off the items enclosed against the parts checklist, page 6.

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

3) Be certain that the boiler is installed in a location where there is an adequate amount of combustion air for coal firing. If the location is tightly-sealed and well-insulated, install a cold air duct (minimum opening one square foot) from the outside.

4) Install the circular cast-iron coal grate through the ash door opening. The grate rests on top of the support pieces welded to the steel ring in the firebox Make certain that the side of the grate with the projection for the grate handle faces down.

5) Insert the flat steel plate with the semi-circular cutout into the slots on either side of the ash door opening.

6) Where required by law, install an ASME fusible plug in the 3/4" tapping inside the firebox. This tapping, located on top of the firebox, is accessible through the firing door.

B. Jacket Assembly

The boiler comes equipped with a five-piece enameled jacket. The sections of the jacket are assembled by sliding the preformed steel strips down over the folded, vertical edges of the panel.

NOTE:
The boiler body, front jacket panels and the door frames form a three (3) layer sandwich in final assembly. The door openings must be fitted with gaskets between the boiler body and the jacket panel as well as between the panel and the door frames to insure an airtight seal. Gaskets have been provided for this purpose (see diagram on next page).

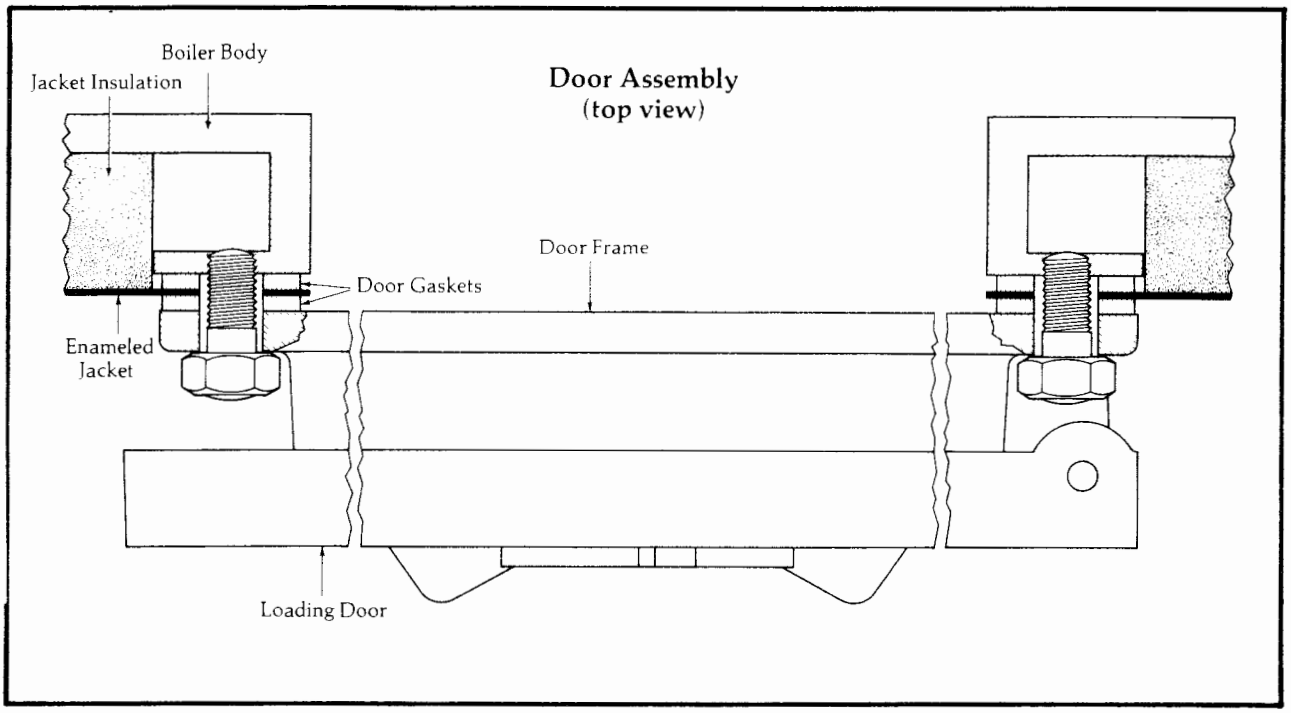
1) Before installing the jacket panels, screw studs into door mounting flange, and place door gaskets over the studs on each of the two doors.

2) Check the straightness of the door frame mounting studs by placing each door frame over its studs. The frame should go on easily. If it does not, thread a nut on the end of any misaligned stud and lightly tap with a hammer on the side of the nut to straighten the stud. Recheck the studs for straightness.

3) Join the back panel to one side panel, and the front panel to the other side panel, using the steel strips.

4) Move these two right-angled units into position around the boiler and join them together using the preformed steel strips.

5) Fit the door openings with the second set of gaskets over the enameled jacket. Position the door assemblies on the studs and tighten them down with the nuts.



C. Chimney Connection

NOTE:
THE BOILER MUST BE CONNECTED TO A TILE-LINED CHIMNEY IN GOOD CONDITION. IF THE BOILER IS CONNECTED TO A DIRTY OR INADEQUATE CHIMNEY, IT CAN PRESENT A SERIOUS HEALTH HAZARD FROM CARBON MONOXIDE POISONING (WHEN FIRED ON COAL), OR, WHEN FIRED ON WOOD, A SERIOUS FIRE HAZARD.

1) In some areas, codes require that no other appliance be connected to the flue; consult your local building inspector for chimney requirements and install the boiler in accordance with all applicable codes.

2) A minimum flue size of 8" x 8" and height of 20' (measured from the boiler flue entrance to the chimney top) is necessary for proper operation of the TARM 303. Under certain conditions, large flues and higher chimneys may be required for proper operation of the boiler.

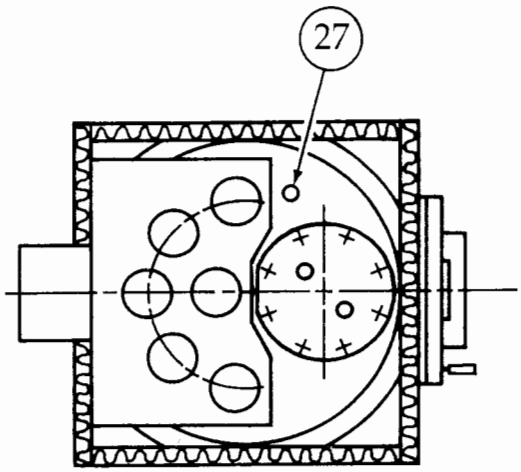
3) The smoke pipe connecting the TARM 303 to the flue must have a minimum thickness of 24 gauge and must rise a minimum of 1/4" per foot run toward the chimney. Smoke pipe sections must be attached to one another with a minimum of three sheet-metal screws.

4) A barometric damper must be installed in the flue pipe between boiler and chimney. IT IS UNSAFE TO ADJUST THE DRAFT HIGHER THAN .1 in/WG! IF THIS VALUE IS EXCEEDED, A POWER FAILURE COULD CAUSE A SOLID-FUEL FIRE TO BURN OUT OF CONTROL!

D. Venting of Boiler Body (please refer to illustration)

The boiler body is vented during filling and operation by an AMERICAN 700 Vent in the 3/8" tapping (#27) on the top of the boiler.

1) Install a 3/8" x 1/8" bushing in tapping #27.



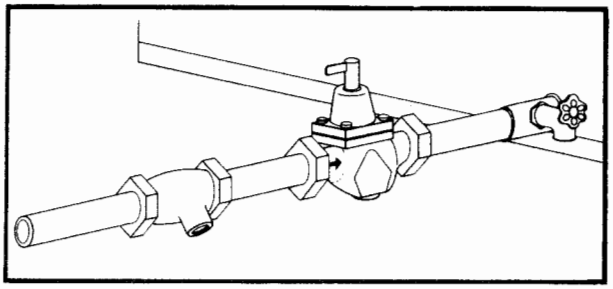
2) Thread an AMERICAN 700 vent into this bushing.

3) BE SURE TO LOOSEN THE VENT CAP 2-3 TURNS BEFORE FILLING THE BOILER WITH WATER.

E. Fill-Valve and Drain

1) Install a 1/2" tee in tapping #18, using a 1" x 1/2" reducing coupling and a 1" nipple. Install a boiler drain on this tee.

2) Install a WATTS S1156F Fill-Valve to provide makeup water for the boiler. Pipe in the makeup water through a 1/2" tee in tapping #18. A backflow preventer must be installed where required by law.



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

F. Install Tridicator (AMETEK PTA-1088 or equivalent) in tapping #4.

G. Install the WATTS 174A Pressure Relief Valve in tapping #16 on the rear of the boiler through a 3/4" street ell and a 3/4" x 1" reducing bushing so that the the discharge line will not interfere with the piping directly below tapping #16.

THE WATTS PRESSURE RELIEF 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! If this valve operates, hot water will be discharged. It should be piped to or near a drain so that this water will not damage the room in which the boiler is located.

NOTE:
Due to the compact size and design of the TARM 303, it is desirable to incorporate some form of constant circulation into the installation of this boiler to prevent overheating. Unlike an oil- or gas-fired boiler that produces heat "on demand," a coal-fired boiler produces heat continuously. The "baseline" heat output continuously generated by a coal fire must be absorbed by the boiler itself when there is no circulation of water through the heating system. Due to the relatively small water jacket volume of the TARM 303, the boiler water temperature can rise excessively when there is no call for heat unless some application of constant flow circulation is made to the installation.

Gravity circulation can provide for constant flow without the use of circulator pumps, but small-sized piping in the distribution system could restrict the flow of water through the boiler. A more efficient way of providing constant flow circulation is by the use of a mixing valve. See page 12 for more information on the HS Auto-Mix system.

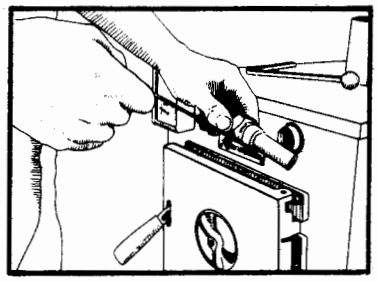
H. SAMSON Draft Regulator

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

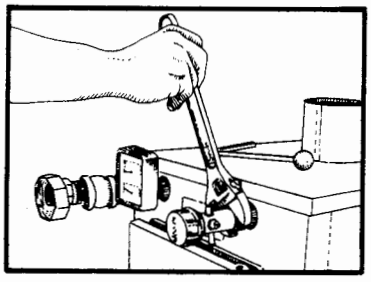
To install the regulator, apply several turns of teflon tape to the threads and screw the control into the tapping securely but not too tightly as the threads may be damaged if the control is turned too far. The hexagonal-head screw must be at the top so that the red figures show. The red figures will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

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

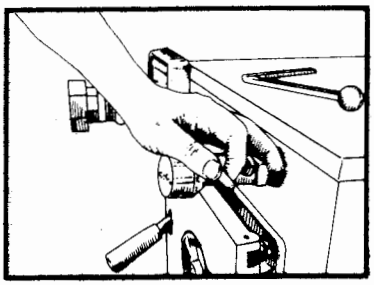
Insert the arm about three inches, so that the chain, when attached, will not interfere with the opening of the firing door. Tighten the screw onto the arm, keeping the arm in a relatively horizontal position. The screw must bear on a flat segment of the arm, not on an edge. Attach the end of the chain with the ring and the hook to the arm of the regulator. Attach the other end of the chain to the hole in the air flap of the ash door. After the ring is attached to the arm of the regulator, all adjustments of the regulator (see page 25) should be made with the hook in this ring; in this way, the chain can be unhooked (thereby closing the draft flap) when fueling the boiler. It is undesirable to close the flap by turning the knob when fueling the boiler, as it causes unnecessary wear on the regulator.



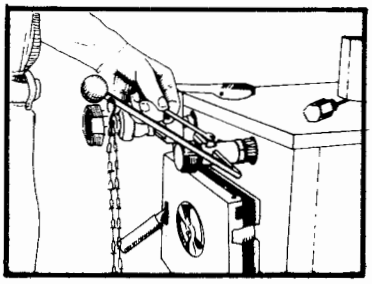
1. Wrap threads on regulator with at least 5 turns of teflon tape. Install regulator in tapping.



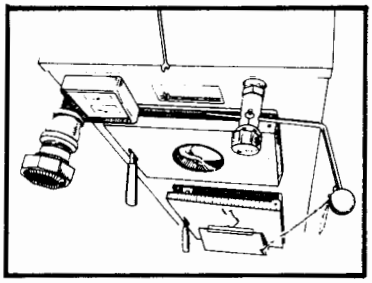
2. Tighten regulator with adjustable wrench - hex bolt should be vertical when complete. Do not over-tighten regulator!



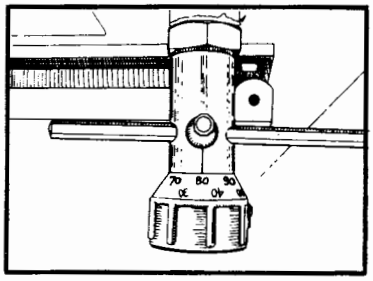
3. Loosen hexagonal bolt and remove wooden dowel from pivot joint. Note correct position of pivot joint when installed.



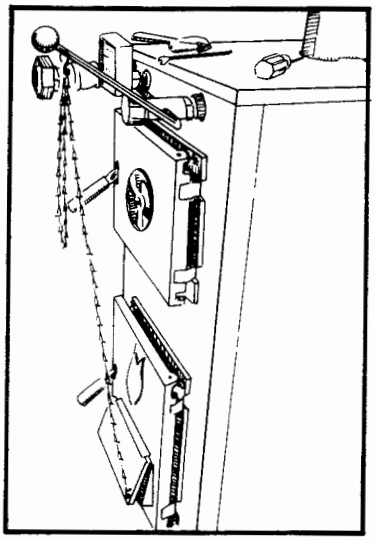
4. Install control arm and tighten hexagonal bolt, making sure it bears on a flat on the arm.



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



6.
Regulator adjusted to 80 on dial.



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

II. DOMESTIC HOT WATER SYSTEM

A tankless coil for heating domestic water is available as an option on the TARM 303 boiler. The coil comes installed in the boiler and is connected easily to the domestic water system.

Domestic hot water piping is led into the boiler through the knockouts in the top rear of the boiler jacket. (The pair of knockouts on either side of the top rear of the boiler jacket can accommodate any piping arrangement.) Pipe the cold water to tapping #15 and the hot water from tapping #14. It is desirable to install unions external to the boiler in both the cold and hot water lines.

Install the Coil Pressure Relief Valve (WATTS 3L, 125 psi) in a tee on the cold water supply to the tankless coil. There must be no shut-off valve or check valve between the relief valve and the tankless coil. THE RELIEF VALVE DISCHARGE MUST BE PIPED TO WITHIN 6" OF THE FLOOR NEAR A DRAIN, AND MUST BE 3/4" PIPE WITH NO REDUCTION! IF THIS VALVE OPERATES, HOT WATER WILL BE DISCHARGED. IT SHOULD BE PIPED TO AN OPEN DRAIN SO THAT THIS WATER WILL NOT DAMAGE THE ROOM IN WHICH THE BOILER IS LOCATED.

NOTE:
In certain areas, existing water supplies may contain a large amount of minerals, which, depending on the mineral content of the water and the amount of water passing through the coil, can cause lime deposits in the coil. When these deposits restrict the flow of water through the coil, the coil must be cleaned. CLEANING THE COIL IS A DANGEROUS PROCEDURE THAT SHOULD BE ATTEMPTED ONLY BY A QUALIFIED AND EXPERIENCED PERSON.

III. CONNECTION TO HEATING RADIATION AND/OR ANOTHER BOILER

The TARM 303 may be used either as the sole boiler or in conjunction with an existing oil-, gas- or electrically-fired boiler by a parallel or Auto-Mix tandem hookup. In the latter combination, the TARM 303 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 accompanying piping schematics when reading the description of each system:

- Only Boiler with HS Auto-Mix: The TARM 303 can be used as the sole heating source for a hot water system. This installation is relatively simple and inexpensive; however, there is no backup system for times when the coal fire will be untended or when it is undesirable to be centrally heating with coal. To install the TARM 303 as the only boiler, see page 14.

- Parallel: When the TARM 303 is connected in parallel with an existing oil-, gas- or electrically-fired boiler, domestic water can always be heated by a coal fire -- regardless of whether the coil is located in the TARM 303 or in the other boiler. Since the parallel connection provides the TARM 303 with a larger effective reserve of water to be heated, the likelihood of boiler overheating is minimized and the system can respond more quickly to heating demand. For instructions on parallel hookup, see page 15.

- HS Auto-Mix: The HS Auto-Mix, when piped as shown in the diagram, provides for the most convenient and economical heating system possible with the TARM 303 boiler.

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

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

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

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

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

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

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

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

  In an Auto-Mix system, however, the circulator runs constantly. Heat is always being drawn from

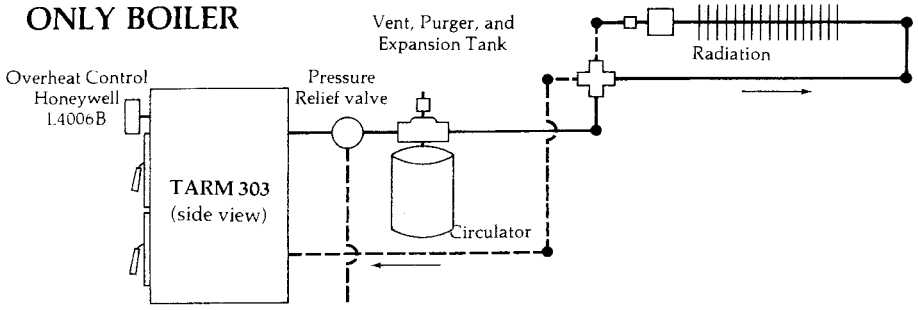
the boiler, thus minimizing the likelihood of boiler overheating and creosote and soot formation. The HS Auto-Mix promotes safer, cleaner and more efficient burning of any solid fuel.

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

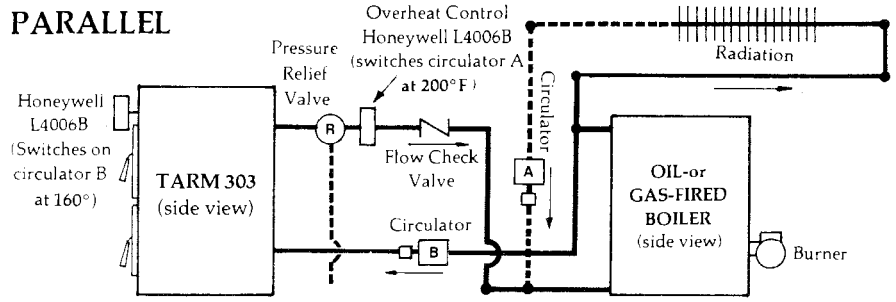
See page 16 and refer to the Installation and Operation Instructions for the HS Auto-Mix for details on the Auto-Mix tandem hookup.

PIPING SCHEMATICS

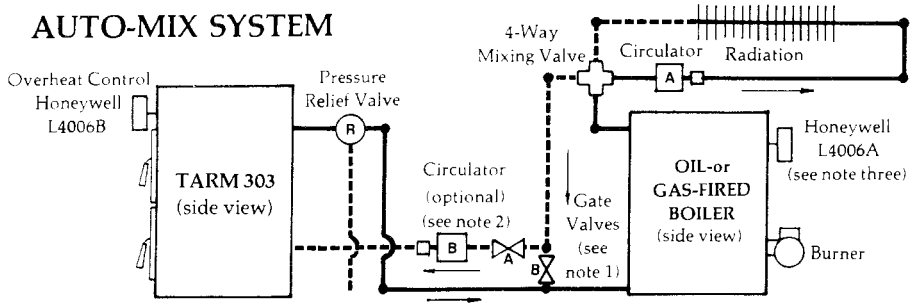
ONLY BOILER



PARALLEL



AUTO-MIX SYSTEM



Note 1:

Optional valves A and B can be used to by-pass the TARM 303 boiler when the oil or gas boiler is fired for extended periods of time.

Note 2:

Optional circulator B may be necessary to maintain proper temperature of domestic hot water supply from the tankless coil in oil- or gas-fired boiler when the mixing valve is closed.

Note 3:

Set Honeywell L4006A to turn on circulator B at least 20° above the temperature at which the burner will come on. (Suggested settings: L4006A at 180°F, burner control at 160°F.)

A. TARM 303 As Only Boiler with HS Auto-Mix

NOTE:
All interconnecting wiring must be completed as per the wiring diagram, page 18.

1) Thread a 1-1/4" x 12" pipe nipple into tapping #2, rear of boiler. Thread an AMTROL #444 air purger, using the inlet tapping "U", onto this nipple, observing the flow direction arrow on the purger.

2) Connect AMTROL #60 tank to tapping "Z" on bottom of purger. (This tank is sufficient for systems up to 86 gal. capacity. For systems with greater capacity, consult your distributor.)

3) Thread an AMERICAN #700 vent into tapping "V" on top of purger. Unscrew cap on top of vent.

4) Connect the other "U" tapping to tapping #1 on the HS four-way mixing valve.

5) Install the circulator in the return line from the heating radiation. Pipe the return into mixing valve to tapping #2.

6) Connect the supply side of radiation to the "UP" tapping of the mixing valve.

7) Pipe the unmarked tapping (opposite the one marked "UP") on the mixing valve to return tapping #1 on the TARM 303 boiler.

8) Wire the circulator to a conventional on-off switch. When the heating season begins and the TARM 303 is fired, the circulator should be turned on manually and left running for the duration of the heating season.

NOTE:
With the circulator running continuously, use of the highly-efficient Grundfos UPS 20-42 three-speed pump is recommended. The pump provides a significant savings in power over conventional circulators and, if the system permits, can be set manually to run at slower speeds and thus further reduce power consumption.

9) The four-way mixing valve is operated automatically by the HS Auto-Mix control head, which is controlled by a conventional thermostat. While the TARM 303 is firing, the mixing valve must be set partially open. Please refer to and follow the minimum setting recommendations in the HS Auto-Mix manual (available from your HS TARM distributor.)

10) Install the 1/2" immersion well supplied with the HONEYWELL L4006B overheat control in the remaining #2 tapping on the upper side of the boiler, using a 1-1/4" x 1/2" reducing bushing.

11) Carefully insert the bulb of the L4006B control into the immersion well and tighten the clamp on the back of the control onto the lip of the immersion well. Set this control to 210 deg. F. with a differential setting of 20 deg.

THE 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 ZONE VALVES IN THE ZONE CONTROLLED BY THE OVERHEAT CONTROL. SUCH VALVES WOULD PREVENT THE OVERHEAT CONTROL SYSTEM FROM COOLING THE BOILER WHEN NECESSARY.

NOTE:
When the TARM 303 is being fired, the possibility of boiler overheating does exist, especially during relatively mild weather. Should this happen, the Hot Water Overheat Control will open the mixing valve, which will dissipate the heat through the heating radiation system.

B. Parallel Hookup

NOTE:
All interconnecting wiring must be completed as per the wiring diagram, page 18.

NOTE:
A second HONEYWELL L4006B aquastat is required for the parallel hookup.

1) Install the 1/2" immersion well supplied with the HONEYWELL L4006B aquastat in either one of the #2 tappings on the upper side of the boiler, using a 1-1/4" x 1/2" reducing bushing.

2) Carefully insert the bulb of the L4006B control into the immersion well and tighten the clamp on the back of the control onto the lip of the immersion well.

3) Remove existing radiation supply and return lines from the oil-, gas- or electrically-fired boiler. Install close nipples and pipe tees on supply and return of existing boiler. Reinstall supply and return lines.

4) Install a 1-1/4" x 8" nipple in supply tapping #2. Thread a 1-1/4" x 1/2" x 1-1/4" elbow tee onto this nipple and install a 1/2" immersion well and a second HONEYWELL L4006B aquastat into the corner of this elbow. Carefully insert the bulb from this control into the immersion well and tighten the clamp on the back of this control onto the lip of the well.

5) Mount a flow-check valve next in line after the L4006B aquastat. Then join this line to the tee on the return line of the existing boiler.

6) If the addition of the TARM 303 has increased the water capacity of the heating system beyond the rating of the existing expansion system, an additional expansion tank should be added to the system. Consult your distributor if in doubt about the requirements of the heating system.

7) Install a circulator and piping between tapping #1 on the TARM 303 and the tee already installed on the supply tapping of the oil-, gas- or electrically-fired boiler.

8) Wire the L4006B control installed on the TARM 303 boiler to the circulator between the two boilers and set the dial to 160 deg. F. When the TARM 303 reaches operating temperature, this circulator will start and pump heated water to the existing boiler.

NOTE:
The use of the highly-efficient Grundfos UPS 20-42 three-speed pump for the circulator between the two boilers is recommended. The pump provides a significant savings in power over conventional circulators and can be set manually to run at slower speeds, thus further reducing power consumption, if the lower speeds can maintain adequate circulation between the two boilers.

9) Wire the L4006B overheat control (installed on the tee in the supply line between the two boilers) in parallel with the thermostat that controls circulator "A". Set the control to 210 deg. F. and the differential on the control to 20 deg. The L4006B will turn on this circulator automatically if the water temperature exceeds the control setting of 210 deg. F.

NOTE:
When the TARM 303 is being fired, the possibility of boiler overheating does exist, especially during relatively mild weather. Should this happen, the Hot Water Overheat Control will turn on the circulator pump, causing the heat to dissipate through the heating radiation system. IF MORE THAN ONE ZONE EXISTS, THE OVERHEAT CONTROL MUST BE CONNECTED TO THE CIRCULATOR OR ZONE VALVE THAT CONTROLS THE LARGEST AMOUNT OF HEATING RADIATION. THE OVERHEAT CONTROL SHOULD BE WIRED TO TURN ON THE CIRCULATOR OR ZONE VALVE WHEN THE BOILER WATER REACHES THE TEMPERATURE SET ON THE CONTROL DIAL.

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

NOTE:
In cases where the TARM 303 boiler is not being fired for extended periods of time, standby loss up the flue can be reduced by unhooking the chain on the SAMSON draft regulator so that the air flap on the ash door is closed. The air dial on the firing door should be closed also.

NOTE:
It is desirable to reduce the settings on the aquastat of the existing boiler if the TARM 303 is being operated much of the time. The recommended settings are:

High Limit	165 deg. F.
Low Limit	145 deg. F

The high limit setting of 165 deg. F. prevents the oil or gas burner from starting on a call for heat unless the TARM 303 is unable to maintain this temperature. The low limit setting is the temperature at which the burner turns off when there is no call for heat.

For further information on adjusting the aquastat of your oil- or gas-fired boiler, consult your distributor.

C. Auto-Mix Tandem Hookup

NOTE:
All interconnecting wiring must be completed as per the wiring diagram, page 18.

1) Disconnect supply and return lines from the oil-, gas- or electrically-fired boiler. Reconnect the supply line to tapping #1 on the HS four-way mixing valve.

2) Pipe the return line from the oil-, gas- or electrically-fired boiler to tapping #2 (supply) on the TARM 303. Consider installing a tee in this line to accommodate optional gate valve B (see note on page 13.)

3) If the addition of the TARM 303 has increased the capacity of the heating system beyond the rating of the expansion tank, an additional expansion tank should be added to the system. Consult your distributor if in doubt about the requirements of the heating system.

4) Connect the supply side of heating radiation to the "UP" tapping on the mixing valve.

5) Connect the return side of heating radiation through circulator "A" to tapping #2 on the mixing valve.

6) Wire the circulator to a conventional on-off switch. When the heating season begins and the TARM 303 is fired, the circulator should be turned on manually and left running for the duration of the heating season.

NOTE:
With the circulator running continuously, use of the highly-efficient Grundfos UPS 20-42 three-speed pump is recommended. The pump provides a significant savings in power over conventional circulators and, if the heating system permits, can be set manually to run at slower speeds and thus further reduce power consumption.

7) Pipe the unmarked tapping (opposite the "UP" tapping) on the mixing valve to tapping #1 (return on the TARM 303.)

NOTE:
Consider the installation of optional circulator "B" (see notes 1 and 2 on piping schematics, page 13) and gate valves "A" and "B" in this return line.

8) The four-way mixing valve is operated automatically by the HS Auto-Mix control head, which is controlled by a conventional thermostat. When the TARM 303 is firing, the mixing valve must be set partially open. Please refer to and follow the minimum setting recommendations in the HS

Auto-Mix manual (available from your HS TARM distributor.)

9) Install a 1/2" immersion well supplied with the HONEYWELL L4006B overheat control in either one of the #2 tappings on the upper side of the boiler, using a 1-1/4" x 1/2" reducing bushing.

10) Carefully insert the bulb of the L4006B control into the immersion well and tighten the clamp on the back of the control onto the lip of the immersion well.

11) Connect the contacts on the L4006B in parallel with the thermostat contacts which control the element in the HS Auto-Mix. Set the control to 210 deg. F., with a differential setting of 20 deg.

NOTE:
When the TARM 303 is being fired, the possibility of boiler overheating does exist, especially during relatively mild weather. Should this happen, the Hot Water Overheat Control will open the mixing valve and dissipate heat through the heating radiation system.

THE CONTROL SHOULD BE WIRED TO OPEN THE MIXING VALVE WHEN THE BOILER WATER REACHES THE TEMPERATURE SET ON THE CONTROL DIAL.

12) Do not use zone controls or flow-check valves in the main or largest zone, which will be controlled by the mixing valve. Please refer to the HS Auto-Mix manual (available from your HS TARM distributor) for information on additional zones and their piping.

NOTE:
In cases where the TARM 303 is not being fired for extended periods of time, standby loss up the flue can be reduced by unhooking the chain on the SAMSON draft regulator so that the air flap on the lower (ash) door is closed. The air dial on the firing door should be closed also.

It is desirable to reduce the settings on the aquastat of the existing boiler if the TARM 303 is being operated much of the time. The recommended settings are:

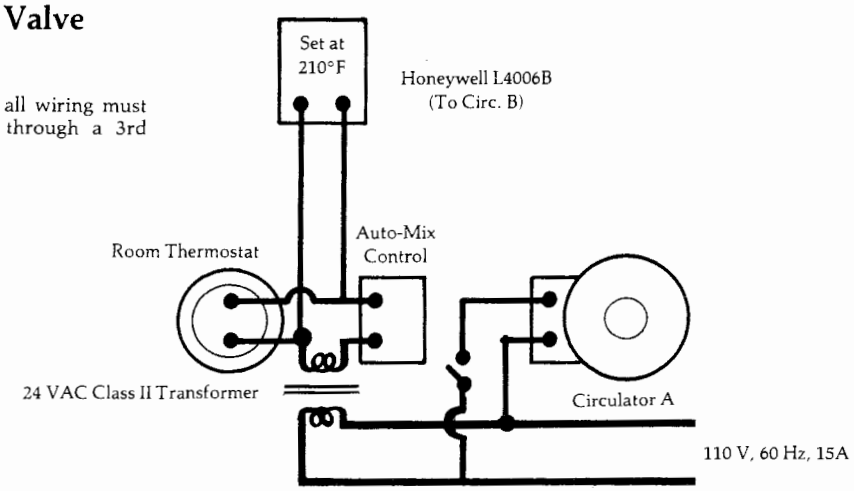
High Limit	165 deg. F.
Low Limit	145 deg. F.

The high limit setting of 165 deg. F. prevents the oil or gas burner from starting on a call for heat unless the TARM 303 is unable to maintain this temperature. The low limit is the setting at which the burner turns off when there is no call for heat. For further information on adjusting the aquastat of the oil-, gas- or electrically-fired boiler, consult your distributor.

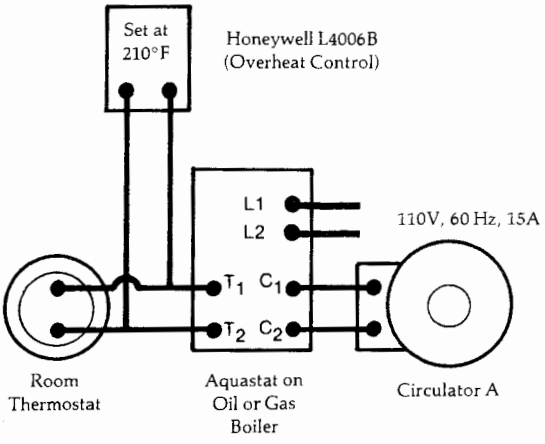
WIRING DIAGRAMS

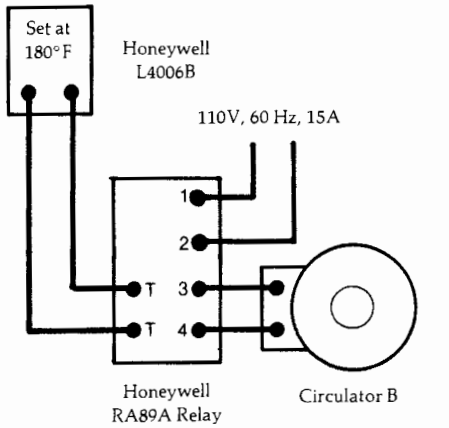
BOILER ONLY with Mixing Valve

NOTE: The boiler and all wiring must be properly grounded through a 3rd wire or metallic sheath.

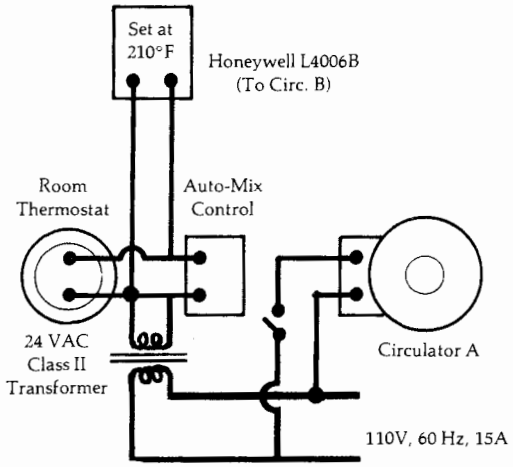


PARALLEL HOOKUP

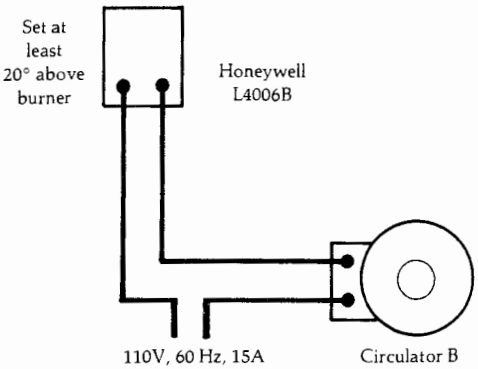




HS AUTOMIX SYSTEM



OPTIONAL CIRCULATOR



COAL VS. WOOD BURNING

Advantages

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

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

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

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

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

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

Disadvantages

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

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

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

Coal cannot be obtained for free whereas firewood often can be obtained at little or no cost.

Coal produces more carbon monoxide gas than wood (see page 21). Also, a coal fire produces sulfur oxides, which cause the "acid rains" that now threaten plant and animal life in many parts of the world.

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

RELATIVE FUEL COSTS

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

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

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

UNIT PRICE x	FACTOR	= COST/million Btu
Coal	.069	
Cord Wood	.088	
Fuel Oil	11.11	(Example: Coal at $105/ton
Natural Gas	15.4	x .069 = $7.24/million Btu)
LP gas	15.4	
Electricity	294.0	

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

Once you know the cost of one million Btu's of any fuel, it is easy to compare costs. For example, let's say you want to know how much you could save by burning coal instead of fuel oil. Your coal would cost $7.24 per million Btu's, and your oil would cost $11.11 per million Btu's. Divide the price of coal by the price of oil:

$$\$7.24/\$11.11 = .65$$

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

IV. COAL-FIRING INSTRUCTIONS

A. Introduction

Coal is fast becoming a popular home heating fuel in many areas of this country. Formerly the most widely used home heating fuel, coal declined markedly in use with the introduction of oil-burning equipment in the 1940's. But with abundant domestic supplies still available, the price of coal has remained stable for many years. Today, coal is cheaper than fuel oil in many areas; the formula outlined on the preceding page will enable you to determine the cost of burning coal relative to the cost of burning other fuels.

Your TARM 303 boiler is designed to burn coal efficiently and reliably. But as with firewood, specific knowledge and experience are essential if coal is to be burned safely and effectively.

> NOTE:
> In order to start a coal fire, you must first build a wood fire. Before attemption to burn coal in your TARM 303 boiler, please read the wood-firing instructions beginning on page 27.

B. Warning About Carbon Monoxide Poisoning from Burning Coal

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

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

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

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

If you have any questions about coal burning, please consult your dealer or call our service department, (413) 369-4367, collect.

C. Chimneys

The chimney is one of the most critical factors in the successful operation of any heating system. A good chimney should provide a continuous and dependable draft. (See specifications, page 5, for draft requirements of the TARM 303 boiler.)

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

Tile-lined masonry chimneys are generally used since they are strong and unlikely to crack from high temperatures. Fire insurance underwriters favor and sometimes require masonry construction for chimneys.

Natural draft in a chimney depends on two variables. Draft is created by the aspirating effect of air currents blowing across the top of the chimney. Natural draft will also result when the temperature of the flue gases is higher than the temperature of the atmosphere around the chimney. Therefore, insulating the chimney flue liner will increase the draft as well as make it more consistent. Insulation also will reduce soot and creosote deposits by reducing the amount of moisture condensation from the flue gases.

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

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

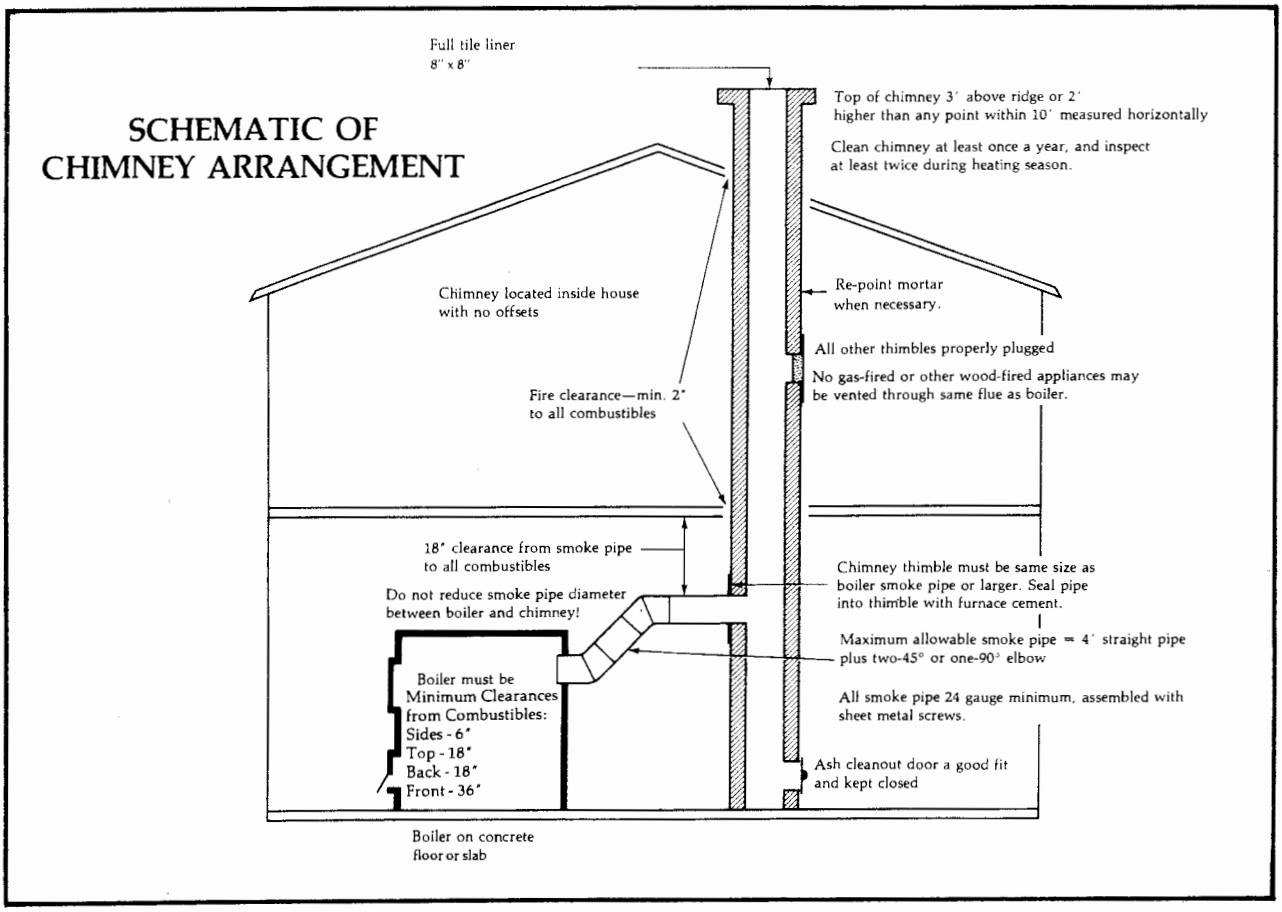
2) The interior surface of the flue should be as smooth as possible to avoid friction and to help decrease the possibility of creosote, soot, and fly ash build-up.

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

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

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

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



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

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

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

D. Chimney Cleaning

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

It is not unusual to have a little smoke come into the room as you open the firing door to add more coal. You can generally avoid this by opening the door slightly for a moment before opening it completely. But if your boiler begins to smoke increasingly as you open the door to add coal, you may have a chimney blockage. To find out what is wrong, look into the chimney from above or below. If either is inconvenient, use a mirror and a flashlight. The cleanout door is a handy place to use a mirror to look up the flue.

Various cleaning methods may be used. Some people favor raising and lowering a bunch of tire chains, attached to a rope, inside the chimney. A ball of chicken wire can be used in the same way. Drop a rope down the chimney to a helper, then pull the ball of wire up and down inside the chimney.

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

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

E. Choosing the Right Coal

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

We generally recommend anthracite (hard) coal of the "nut" size; you may find, however, that different sizes (such as pea coal) or layers of two or more sizes may produce the best results in your particular boiler/heating system/chimney combination. For example, pea coal may produce less output and a longer burn than nut coal. Stove coal is too large for most HS TARM installations.

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

We DO NOT recommend bituminous (soft) coal. Bituminous coal is messy to handle and produces large amounts of pollutants. It also burns hot enough to damage the grate, and produces large clinkers (fused ash), which can jam the grate.

Before ordering any type of coal in large quantities, buy a bag or two of the coal you intend to use

and try it first in your boiler. As you experiment, bear in mind the following points:

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

F. Starting the Fire

NOTE:
Read and understand this entire manual, and be certain that the heating system is fully installed and that all electrical and auxiliary systems have been checked out by your installer BEFORE STARTING A FIRE. The system must be filled with water and vented to remove air.

First set the boiler controls in the proper position:

- secondary air dial on firing door closed
- air flap on ash door wide open (adjust SAMSON draft regulator and chain)

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

To start a coal fire, first build a small wood fire, using lots of dry, softwood kindling and small pieces of dry hardwood (see wood-firing instructions, beginning on page 27). Be sure that the bed of wood is burning well before adding any coal.

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

Keep the primary air inlet flap wide open until the coal fire is burning well; coal fires need a lot of air to get started.

Add coal in thicker layers over shorter intervals until the coal reaches the bottom of the feed door. (Levels of coal higher than this may impair the draft, resulting in lower output and poor performance. Too much coal may also cause the fire to go out.) If you cannot avoid boiler overheating when maintaining this large a fire, you can assume that it is too warm outside to be burning solid fuel; switching from nut to pea coal, however, will allow you to burn coal during the warmer months without boiler overheating.

If the fire starts to die down as layers of coal are added, use a poker, rake or shovel to dig a channel through the coal to the glowing embers.

The SAMSON draft regulator and the secondary air dial should now be adjusted. See the next section for instructions.

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

If the fire starts to die down as layers of coal are added, use a poker, rake or shovel to dig a channel through the coal to the glowing embers.

G. Adjusting the SAMSON Draft Regulator and the Secondary Air Dial

To adjust the SAMSON draft regulator, first turn the black knob to set the red number 80 at the red line. Allow the coal fire to slowly bring the boiler temperature up to about 200 deg. F. on the Tridicator. When this temperature is reached, adjust the chain and then the knob so that the small air inlet flap is barely closed but is still maintaining tension in the chain. The control will open and close the air inlet flap automatically to allow the proper amount of combustion air to enter the firebox to maintain the selected boiler temperature.

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

Many people find that their boilers run better and cleaner when operated at 200 deg. F. In addition, the radiation in many houses is designed to provide adequate heat only at a boiler water temperature of 200 deg. F. If your boiler can maintain a temperature of 180 deg. F., but your house is not getting enough heat when the outside temperature is low, it may help to operate your boiler at 200 deg. F. All that need be done to raise your boiler temperature is to set the SAMSON draft regulator to a higher number. Never adjust the regulator higher than 100 on the dial or so that the boiler operates at over 200 deg. F!

The setting of the secondary air inlet will vary according to chimney draft and other factors. If shut too tightly, an insufficient amount of air will be admitted to burn all the flammable gases, and soot will form more readily. If open too far, too much air will be admitted and the primary draft control will have little effect on slowing the rate of combustion.

If there are blue flames over coal bed when the firing door is opened, there is enough secondary air. However, if blue flames should erupt suddenly when the firing door is opened, adjust the secondary air dial to admit more air.

The primary air inlet must be able to shut the fire down or open it up, according to the heating demands of the house. The secondary air inlet should never be left completely closed as some air over the fire is required for proper combustion. Accurate setting of these inlets will develop quickly with practice if the above instructions are kept in mind.

H. Maintaining the Fire

Once the coal is burning well, the SAMSON draft regulator will maintain a very constant heat output and control the boiler water temperature precisely.

If the fire goes out when the firebox is full of coal, first shake the grate (see instructions in following section). Then clear a small area at the front of the firebox and start a small wood fire with kindling. When the fire is burning well, rake coal up over the burning wood.

I. Reloading the Firebox

Normally, reloading is necessary only at eight-hour intervals. To reload the firebox, add several layers of coal on top of the bed. Wait 10 minutes. Then shake the grate until the ash pit is glowing uniformly.

To shake the grate:
Slide the metal tube extension (provided with the boiler) over the handle on the shaker grate. Move the handle side to side, rotating the grate until live coals just begin to appear coming through the grate with the ash. Since some ash insulating the bottom of the fire is necessary for proper coal firing, do not overshake the grate. Overshaking will also shorten the life of the grate.

When clearing large accumulations of ash (which must be done at least once a day), shake the grate vigorously from side to side.

After removing ashes from the boiler, place them in a metal container with a tight-fitting lid. Place the closed container on a non-combustible floor or on the ground, well away from combustible materials, pending final disposal. Make certain that ashes are cooled thoroughly before burying them in soil or disposing of them by other appropriate means.

Let the coal fire heat up for about 15 minutes before completely filling the firebox with new coal. Watch for any cold spots that may develop.

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

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

Installation of the HS TARM Auto-Mix will promote more uniform burning. See page 12 for more information on the HS Auto-Mix.

J. Overnight Firing

First bring the boiler to operating temperature with the coal fire. When the fire is burning well, shake the grate. Then load the firebox with new coal. Spread a layer of ash or a layer of small-sized coal over the top of the bed to insulate the coal for a long burn, and close or partially close the flue damper.

K. Reviving a Nearly Dead Fire

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

L. Special Coal-Burning Problems

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

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

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

You can add new coal to a large, established fire without danger of putting out the fire. This feature is particularly advantageous at night, when you must provide enough fuel for a long burn and also insulate the burning mass below the new fuel so that the fire will burn evenly when the demand for heat is low.

V. WOOD-FIRING INSTRUCTIONS

A. Introduction

The following information is intended to help both the beginning and advanced woodburner learn how to fire the TARM 303 boiler. Boiler operation is different from woodstove operation, and only experience will produce the best results.

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

B. Starting the Fire

> NOTE:
> Read and understand this entire manual, and be certain that the heating system is fully installed and that all electrical and auxiliary systems have been checked out by the installer BEFORE STARTING A FIRE. The system must be filled with water and vented to remove air.

There are two controls important to start a proper fire in your TARM 303 boiler. These are the air inlet on the firing door and the secondary air inlet on the right side of the boiler.

The primary air inlet is controlled during normal operation by the SAMSON draft regulator.

The regulation of the firing door air inlet and the secondary air inlet is extremely important for the efficiency of boiler operation. As wood is heated in any fire it emits gases which, when burned, yield heat. When they are not burned completely, they can represent a significant loss of efficiency and, in some cases form a tar-like flammable deposit called creosote. Creosote is formed when flue gases condense in the boiler or chimney. The admission of additional air through the secondary air inlet or the air inlet on the firing door allows these gases to be burned rather than having them proceed wastefully up the chimney.

To start your first fire, turn the SAMSON draft regulator control so that the flap on the ash door is wide open. Open the air inlet in the firing door far enough to admit two fingers.

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

C. Adjusting the SAMSON Draft Regulator and Secondary Air Dial

The SAMSON draft regulator and secondary air dial should now be adjusted. The procedure is the same for burning wood as for burning coal; please see page 25 for instructions.

D. Long-Term Firing

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

When refueling the boiler, the air flap on the ash door should be closed by removing the hook from the ring at the top of the chain. The firing door should be opened gradually, so as to build up the draft. These procedures will minimize smoke escaping from the firing door when it is open.

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

NOTE:
After removing ashes from the boiler, place them in a metal container with a tight-fitting lid. Place the closed container on a non-combustible floor or on the ground, well away from combustible materials, pending final dispoal. Make certain that ashes are cooled thoroughly before burying them in soil or disposing of them by other appropriate means. (Unlike coal ashes, wood ashes are suitable for home gardens.)

E. Shaking the Grate

The procedure for shaking the grate is the same for burning wood as for burning coal. Please see page 25 for instructions on shaking the grate.

F. Creosote and Soot

One of the most critical aspects of operating a wood-burning central heating system is the control of creosote and soot. This is especially important when there is a low demand for heat, such as in the fall or spring. A good understanding of the causes and cures for excess creosote or soot formation is essential to the operation of the TARM 303 boiler.

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

When wood burns slowly, it produces acetic and other pyroligneous acids which combine with expelled moisture to form creosote. Highly combustible in its solid and semi-solid states, creosote is present in the gases given off by burning wood. A SERIOUS FIRE MAY RESULT IF A SUFFICIENT CREOSOTE BUILDUP IS PERMITTED. Creosote may build to a considerable thickness on the interior of the chimney, and the draft opening subsequently will be reduced.

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

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

Moisture in the flue gases may be controlled by:

- using properly seasoned firewood
- mixing small pieces (preferably slab wood) with every full load
- never using only large wood (usually less dry) during mild weather when combustion is relatively slow.

The temperature in the stack may be controlled by:

- using as short a length of smoke pipe as possible between the boiler and the chimney
- using an insulated smoke pipe to connect the boiler to the chimney

The amount of draft in the stack may be controlled by:

- having as few bends as possible
- insuring adequate chimney height and preventing air leaks
- eliminating external obstructions in the chimney outlet
- having only one appliance per flue

G. Chimney Fires

Chimney fires are caused when an excessive buildup of creosote in the smoke pipe or chimney is ignited by a racing fire, or when a burning piece of material is swept out of the firebox into the chimney.

If you have a chimney fire, you will hear a roaring sound in your chimney. In addition, sparks may be seen flying from the chimney outside the house.

Chimney fires can set fire to the interior of your house or your roof. They are potentially very dangerous. If you think you have a chimney fire:

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

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

H. Firewood

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

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

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

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

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

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

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

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

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

Use the longest piece that will conveniently fit into the firebox. The wood tends to burn from front to back, especially when the draft is turned low. The longer the stick, the longer the fire will hold.

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

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

AVAILABLE HEAT PER CORD, MILLIONS OF BTU

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

VI. TROUBLESHOOTING

A. Introduction

This section is designed to assist the homeowner and the installing contractor in the care of the heating system as well as in the correction of some of the more common problems encountered in the operation of the TARM 303 boiler.

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

B. Boiler Overheating

NOTE:
The coal or wood fire in the TARM 303 will always produce a certain amount of heat, even when there is no heating demand on the system. This fact makes the behavior of such a system quite different from an oil- or gas-fired boiler, which produces heat "on demand." The "baseline" heat output that is continuously generated by a coal or wood fire must be absorbed by the boiler itself when there is no circulation of water through the system. If the boiler

temperature rises excessively in order to absorb this heat, the overheat control will cause circulation of heated water to the house, even with no call for heat. Such potentially wasteful overheating is most likely to occur during the spring and fall. Before choosing a particular system for your installation, the possibility of using a mixing valve system to avoid such problems should be considered. Such an arrangement (one of the most sophisticated methods of heating system regulation available) can be added to any heating system. We recommend the use of a mixing valve with all TARM 303 boilers. Please see page 12 for more information. Your dealer can help you decide whether such a system is desirable for your installation.

Overheating in the TARM 303 is an occurrence that all homeowners must be familiar with so that it can be corrected when it occurs.

When the boiler temperature rises above a preset limit (usually 200 - 210 deg. F.), causing the overheat control to operate and perhaps eventually the pressure relief valve to open, the boiler is overheated.

The most common causes of this overheating are:

- overfiring the boiler (i.e., putting in too much coal or wood for the heating needs of the house at a given time). For proper firing with coal, see pages 24-26; for wood firing, see page 27-28.
- improper adjustment of the SAMSON draft regulator. See page 25.
- electrical power failure. See page 32.

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

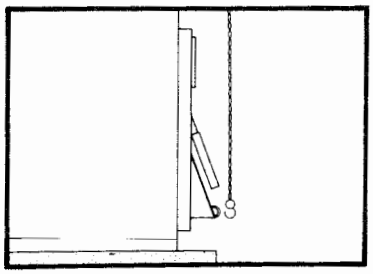
The Overheat Control is wired to circulate excess boiler heat to the house when the boiler reaches a preset temperature of 220 deg. F. The control turns on the circulator and opens either the mixing valve or any zone valves in the largest heating zone. Generally, the overheated boiler can be cooled within 10 minutes.

If the overheating condition is more severe, the temperature will continue to rise. At about 250 deg. 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 303 boilers are pressure-tested to 60 psi at the factory.

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

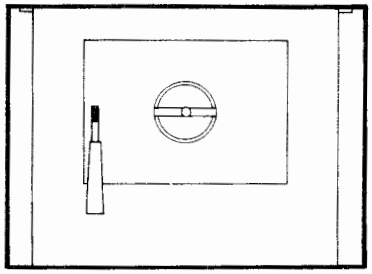
The reason that steam rather than water is discharged is due to the fact that water under pressure can reach temperatures above 212 deg. F. without boiling (as in a boiler), but, when released to the atmosphere by the relief valve, it turns immediately to steam if it is over 212 deg. F.

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

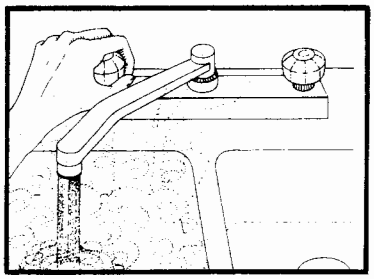


1. Make sure the lower door air flap and all secondary air inlets are closed.

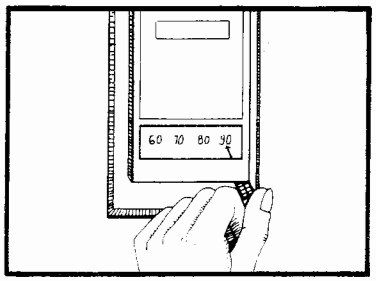
a. (view of flap on door)



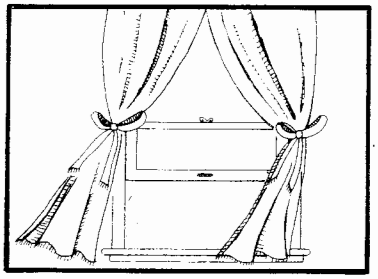
b. (closed secondary air inlet on door)



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



3.
Turn all thermostats up to their highest setting.



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

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

C. Procedure in Event of Power Failure

Should your electricity go off during the heating season, there are several procedures that should be followed in order that you may continue to safely operate your heating system. These procedures apply only to the TARM 303, as the gas-, oil- or electrically-fired boiler, if any, will be completely inoperative.

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 have a mixing valve, open it to the highest setting, then lock it into position.

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

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

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

D. Low Heat Output

There are many possible reasons for low heat output during spells of cold weather. The table on the opposite page is intended to help you and your heating contractor diagnose and correct this problem.

Low Heat Output

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

VII. PERIODIC MAINTENANCE

A. Cleaning

The efficiency of the TARM 303 boiler is affected greatly by the amount of creosote and soot coating the inside of the boiler. Layers of these materials act as an insulator, preventing the coal or wood fire from heating the water and allowing valuable heat to escape up the flue.

The inside of the boiler should be cleaned periodically during the heating season. At least once every two months (more often if burning partially green wood or if firing during periods of low heating demand), allow the fire to die out. BE CERTAIN THAT THE BOILER AND ANY ASHES HAVE COOLED THOROUGHLY BEFORE PROCEEDING FURTHER. Then remove the grates, ash pan, and all ash and unburned coal or wood. Turn off the oil or gas burner. Using a long-handled steel bristle brush (or a wire wheel connected to an electric drill by a flexible shaft) and your boiler scraping tool, clean all accumulated fly ash, soot and creosote from the inside of the boiler. A thorough vacuuming of the firebox will remove any remaining debris. Next, disassemble the smoke pipe connecting the boiler and chimney. Clean and inspect for corrosion; if any section of the pipe is seriously corroded (for example, if a screwdriver can easily be poked through the metal), this section must be replaced. After replacing the smoke pipe, remove the top jacket panel and the cleanout cover over the heat exchanger. Clean the heat exchanger tubes with the round flue brush. Replace the cleanout cover and top jacket panel. When cleaning is completed, turn on the oil or gas burner.

B. Seasonal Adjustments

1) Fall and Spring

One of the more critical aspects of operating the TARM 303 boiler is regulation when the heating season is starting or tapering off. For example, if you build a coal or wood fire on a day when the outside temperature rises to 60 deg. F., you will be faced with a lot of heat being generated and nothing very useful to do with it. (In this case, the overheat control would cause heated water to circulate throughout the house, no matter what the inside temperature was.)

A solution exists if your TARM 303 is hooked up in combination with an oil-, gas- or electrically-fired boiler. By not building fires in the TARM 303 and by unhooking the chain on the SAMSON draft regulator to minimize standby loss, you can heat your house with the other boiler as if the TARM 303 were not in the system.

Domestic water may be heated by a coal fire during the off-season if your TARM 303 either has a tankless coil or is connected to an oil-, gas- or electrically-fired boiler that has a coil. In most cases, pea coal, not nut coal, should be used, and in all cases, these guidelines should be followed carefully:

- set your barometric damper for a draft of .05 in/WG
- use pea coal, and maintain a shallower bed than you would for winter firing
- load coal and shake the grate no more than twice a day unless you're using large amounts of domestic hot water
- make certain that the boiler's safety systems (e.g., overheat control and relief valves) are in good working order
- fire the boiler cautiously until you are familiar with off-season operation

2) Summer

Coal and wood burning invariably produce sulphur deposits in the smoke pipe and boiler firebox. When combined with moisture, these deposits produce sulphuric acid and other corrosive substances, which will corrode and drastically shorten the life of the boiler and stack. Since

summertime humidity will promote condensation, the following steps must be taken to minimize the formation of these corrosive acids.

At the end of the heating season, remove any soot and ash by thoroughly cleaning the boiler firebox and smoke pipe.

During the summer, the TARM 303 must be maintained at a temperature of 140 deg. F. to prevent condensation in the firebox and the smoke pipe.

If it is not possible to maintain this temperature, first remove the smoke pipe. Clean the pipe thoroughly and block it with newspaper; do not reconnect the smoke pipe to the TARM 303 until the heating season begins in the fall. Then, to keep condensation from forming in the firebox, either suspend a 40W bulb inside the firebox OR have the boiler drained for the summer. Boilers should be drained and refilled ONLY by a qualified plumber or heating contractor.

FAILURE TO FOLLOW THESE RECOMMENDATIONS MAY VOID YOUR WARRANTY!