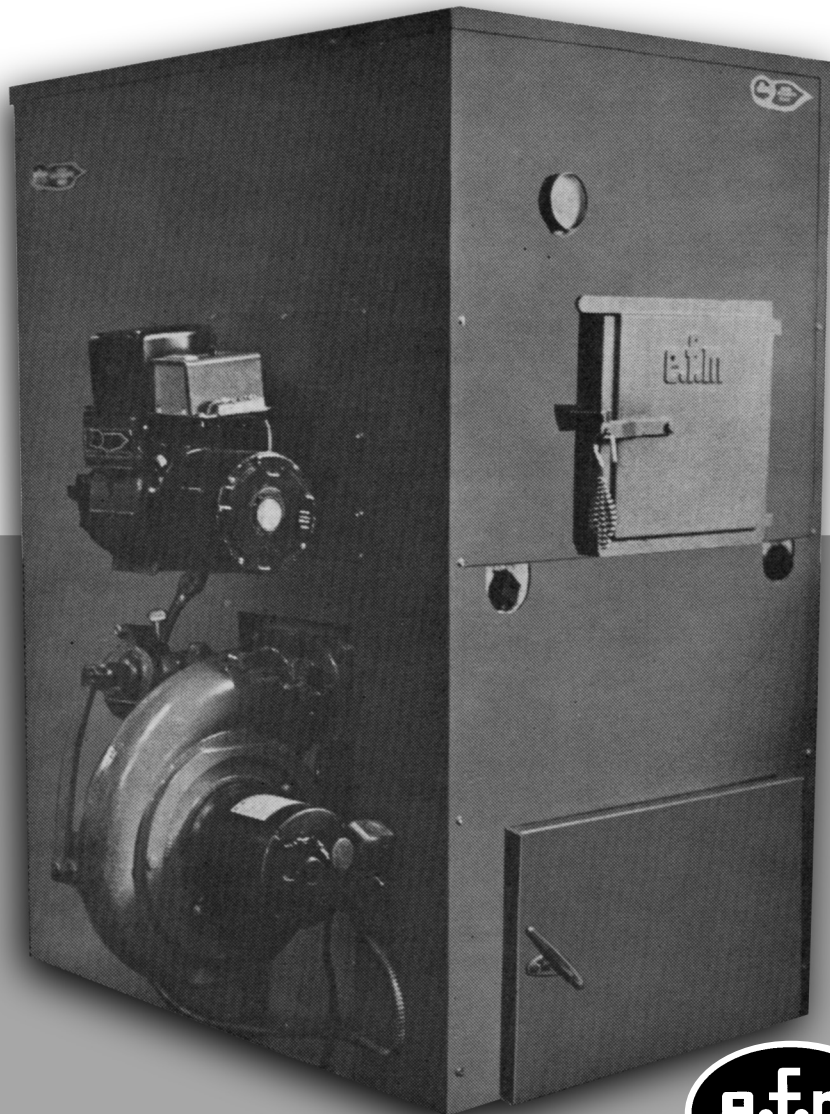


Installation and Operating Manual for the EFM Stoker Boiler Unit



Model DF520



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Installation And Operating Instructions For The Model DF520 Stoker Boiler Unit

This manual contains information for the installation, operation, care and service of the EFM DF520 Stoker Fired Boiler. Be sure to follow these instructions carefully when making the installation. Before proceeding, the installation must be made in accordance with local ordinances, which may differ from this installation manual.

These instructions are to be saved and given to the equipment owner for operation and maintenance information.

The unit is subject to shipping damage during transit or can be shipped with missing parts. Upon receipt, examine all cartons and boiler for possible missing parts or damage. If the unit is damaged, notify the carrier immediately. If parts are missing, notify the factory as soon as possible.

The efm Model S20 Stoker, as furnished with the DF520 boiler, is designed for coal firing only. Use only Pennsylvania Anthracite coal in the size known as "rice coal". Do not burn garbage, gasoline or naphtha.

An optional oil burner package is available, which provides the oil burner, with damper and mounting accessories to oil-fire the DF520 boiler with No. 2 Fuel Oil. This can be done with the stoker remaining in place. The oil burner and stoker **must not** be fired at the same time. See supplementary instructions for the oil burner installation and operation. The DF520 boiler is designed for coal firing. When oil is used, it should be used as a backup fuel and not the primary fuel.

The DF520 boiler is designed for use with hot water heating systems (30 PSI Max.) and steam heating systems (15 PSI Max.).

Do not use or store flammable liquids, especially gasoline, in the vicinity of the boiler.

Coal

1. The coal should contain not more than 10% oversize and not more than 15% undersize. Oversize or undersize coal, in excess of these amounts, will result in poor combustion.
2. Excessively wet coal should not be used, as it will retard combustion. Dust treatment of coal is accomplished either through the application of certain chemicals, or oil. Excess quantities of oil on the coal will result in unsatisfactory operation. It creates a sludge with the fines, which fills the burner air inlet holes and causes poor combustion. The use of some chemicals for dust treatment creates a corrosive action on the stoker feed worms that shortens their life considerably.
3. When securing a supplier for your coal, be sure he is aware of the above conditions and make sure you get clean coal with no foreign materials and a minimal amount of fines. If you are in doubt as to the quality of the coal from your supplier, it is advisable to purchase a small quantity and try it in your unit before filling the coal bin.

Coal Storage

1. An adequate storage bin will have to be provided for the coal storage. This should preferably be located indoors with easy access for a coal truck to deliver the coal with a chute through a cellar window. The storage volume required for one ton of Rice Anthracite coal is 40 cubic feet. The angle of repose of the coal is approximately 45 degrees. Coal will slide down a smooth surface of 20 degrees off horizontal. It is advisable to provide a drain in the bin. Be sure the bin is well supported to withstand the side thrust load of the coal. The use of a Bin Feed Trap (see Fig. 5) is recommended. This will aid in the removal of the bin feed pipe and worm for service and will make the end of the worm accessible for removal

of obstructions.

2. If it is impractical to provide a coal bin close enough to the boiler to reach with the standard bin feed worm, a single section of bin feed worm, 4 feet long, to extend the bin feed, is available on special order. In this case the boiler unit will have to be raised 7", or lower the bin floor by 7", to keep the end of the bin feed a standard height above the floor line. Not more than one 4 foot section of worm may be added, otherwise an overload will be imposed on the motor and drive mechanism.

3. The bin feed worm can be shortened and a storage drum used to store coal over the pick-up end. When doing this, be sure to maintain the original exposure of worm beyond the end of the bin feed pipe, which is 2 ½ flights of the worm. When cutting off the worm, it is advisable to cut at a point directly below a weld holding the worm to the shaft. This is to provide support for the end of the worm. As the bin feed worm is shortened there is an increased risk of coal gas feed-back out of the end of the bin feed pipe. For this reason, the worm should be shortened only as a last resort. In no case should the first section of worm from the burner be shortened. It is also necessary to place a lid with a seal on top of the storage drum to prevent the possibility of carbon monoxide from escaping into the boiler room.

Disposal of Ashes

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

Chimney

1. The chimney must be a type suitable for solid fuel and must provide a minimum draft of negative .05 in./water column, as measured with a draft gauge at the boiler flue exit, to provide for proper operation of the DF520 Stoker-Boiler unit. The chimney should be masonry, with tile lining,

sized 8 X 8 X 15 ft. (minimum) high, or a metal chimney, such as the trade name Metalbestos, 9" diameter inside and 15 ft. (minimum) high. See figures 10, 11, and 12 for situations which can cause poor draft conditions. A stainless steel chimney liner or kit can also be ordered through efm.

Ventilation

1. The area in which the heating unit is located must have an adequate supply of air for combustion. Open basements without storm windows or tight doors will generally permit adequate air infiltration. If the heating unit is located in a separate room with a tight door, ventilation must be provided to an open area within the building or to the outside. If the building is of tight construction with exhaust fans, an outside air supply that is ducted into the boiler room may be required.

To Set Up The Boiler and Base

Refer to Fig. 1. This unit is not to be installed on combustible flooring

1. Make sure that the foundation for the boiler base is level and adequate to support the unit's weight; approximately 1300 pounds.

2. Locate the base so that the ash pit door has ample clearance to open, is in a convenient location for the ash can removal, and that the bin feed pipe will be in the proper position in the bin. Maintain a minimum of 30 inches clearance on the front, rear and stoker side of the boiler to any obstructions or combustible material. Maintain 65 inches minimum clearance to the end of the bin feed trap for worm removal and 30 inches clearance on the bin feed side of the boiler to any obstructions or combustible material. The cabinet and base panels are constructed so that the stoker may be installed on either side of the base.

3. Hang two steel baffles in front of the flue tubes by placing the 4 slots in each baffle on the hooks welded to the flue tubes. The hooks will support and retain the baffles in position. The baffles are furnished as a right and left hand baffle. New boiler units have the baffles installed at

the factory.

4. Hang the cast iron baffle in the boiler by engaging the notches on each side of the baffle with the brackets welded on each side of the boiler interior.

5. If the optional oil burner is to be mounted on this boiler, do the following before the boiler is placed on the base:

Place the insulation on the inside walls of the boiler base, above the ash guide plate.

Refer to the installation instructions shipped with the oil burner kit.

6. You may prefer to mount the stoker on the base before setting the boiler on the base. If so, refer to section "To Install Stoker".

7. Apply boiler putty on the top edges of the base and set the boiler in place. Carefully seal between the boiler and base, including the space between the boiler **and the divider plate in the base.**

8. Plug all boiler openings not used. Insulation must now be installed and is shipped with the cabinet and consists of three pieces. The two smaller pieces cover the front and rear of the boiler and are placed in position with the excess folded over the top of the boiler. The large piece is then placed over the top and sides of the boiler with the steel straps, as furnished, holding all insulation in place. Cut the insulation around the openings in the boiler that are to be used.

9. Install heating supply and return piping. Refer to Figs. 6 and 7.

10. **Steam Boiler:** Install the pressure gauge and limit switch, (use siphon loop as shown on the piping diagram, Fig. 6), the 15# pressure relief valve, and the low limit aquastat. The water gauge and low water cut-off shall be installed as shown in Fig. 1, after the cabinet left side panel is in place. A probe-type low water cut-off is supplied with a new unit.

11. **Hot Water Boiler:** Install the combination pressure gauge and thermometer, and the combination high-low-reverse acting aquastat. If local ordinances require a low water cut-off, use

an external mounted cut-off. Refer to Fig. 13.

To Install Stoker

Refer to Fig. 2

When installing screws, nuts, bolts and pipes, it is always a good idea to use an anti-seize compound to aid in future removal.

1. Remove the stoker mounting side plate from the boiler base and bolt the stoker fan housing and spacer ring to side plate with the (4) 3/8" bolts supplied in the parts kit box. Be sure the spacer ring is assembled with the cabinet retainer tab on top and next to the fan housing.

2. Assemble the air pipe and burner assembly to the stoker fan housing. Be sure that the slots in the ends of the air pipe engage with the pins **and that the air pipe is all the way into the air chamber and fan housing hubs** before tightening the set screws.

3. Install the clean-out lever and rod. Fasten the cast iron eye onto the end of the clean-out rod and secure to the burner pot clean-out cover with a shoulder bolt. The spring is located outside of the base. Refer to the detailed instructions supplied with the stoker for proper set-up.

4. When mounting the stoker to the boiler base, the ash guide plate, with the large round hole and located inside the base, must be removed by pulling it straight out through the ash door pouch. Mount the stoker assembly in position on the boiler base. Be sure the angle on the inside face of the stoker mounting plate hooks over the lower edge of the base opening. Clamp the stoker and plate into position using the two clamp-type screws and nuts.

5. Insert the short length of coal pipe, **with the drilled vent holes, facing upward**, through the hole in the bin side base plate and into the gooseneck. **Be absolutely sure the end of the pipe is against the shoulder inside the gooseneck.** The beveled inside edge of the coal pipe must be toward the coal bin. A slot in the pipe will engage a pin in the gooseneck. Tighten the set screws. Screw the coal pipe collar to the side

of the base using the screws and rope packing provided.

6. Both base side plates and rear plate must be sealed with boiler putty. Work the putty under the bevel on all four sides of each plate.

7. Insert the burner worm, with the long shaft extension, into the pipe and connect to the coupling of the clutch shaft with the cotter pin. Place the bin side cabinet panel into position by tilting it backward and sliding it over the coal pipe. The pipe protrudes through the 4 inch diameter hole in the panel. Allow the panel to rest against the side of the boiler while the remainder of the stoker bin feed is assembled, (worm coupler, pipe coupler, bin feed worm and pipe.) If desired, the cabinet can be completely assembled before the remainder of the stoker bin feed is assembled.

8. Slide the cast iron solid coal pipe coupling over the coal pipe that is in place. Assemble the second, longer coal worm and pipe to the burner worm with the worm coupling. **The worm coupling is left-hand threaded.** Slide the pipe coupling down over the coal worm coupling **and with both coal pipe ends butted together**, center the coupling over the joint and tighten the coupling's 4 set screws to hold the coal pipes in position. See Fig. 4. An optional split coupling is available from efm. Apply boiler putty to the ends of the coal pipe coupling to prevent leakage of coal dust and fines. When positioning the coal pipe and worm into the coal bin, the pipe should terminate inside the coal bin and about 2 ½ flights of worm (about 4 inches) should protrude into the coal bed. Excess worm into the coal bed will increase grinding of the coal and produce excess fines.

To Assemble Cabinet

Refer to Fig. 3

Note: If the oil burner is to be installed, be sure to remove the panel on the left side panel to clear the burner mounting flange. The left hand panel can be installed after the **burner mounting flange** is in place, but has to be installed before the **burner** is mounted.

1. Place cabinet support angles on top of the boiler and approximately five inches from each end of the boiler. On the end of each angle is a tab with a hole. Thread a sheet metal screw into each hole. Turn the screw in as far as possible. The point of the screw will touch the side of the boiler, which holds the support angles in position.

2. Set the front panels in place and screw the two sections together.

3. Locate the cabinet side panel for the side on which the stoker is to be installed. (The edge with ¼" holes is the front edge). Using the appropriate template, cut the panel to provide the large slot to clear the stoker. Place in position and hang from the support angles by placing the flange along the top edge over the ends of the support angles. Be sure the panel is behind the retainer tab on the stoker spacer ring. In the same manner, mount the other side panel.

4. Screw the front edge of the side panels to the front panels.

5. Place the rear panels into position. Fasten to the rear edge of each side panel and along the edge where they overlap, using the sheet metal screws, as required.

6. The cabinet top panel is furnished in two halves. Place into position with the flanges located to the outside of both side panels, upper front and rear panels. The two halves of the top panel lap over each other along the center and are fastened together with sheet metal screws. The pressure relief valve can be installed at this time.

7. A reinforcing angle is to be screwed to the inside lower edge of the cabinet side panel (stoker side) across the stoker opening, to reinforce the panel. Be sure the angle is against the flange on the side panel. Use two sheet metal screws.

8. Bolt the ash pit door in place.

9. Screw the hood support strip to the side panel where the stoker drive is mounted, using

sheet metal screws. Hang the stoker hood into position over the hood support strip.

10. Install the flue pipe from the boiler base flue outlet to the chimney. The flue pipe must be 8 inches nominal diameter and galvanized steel. The flue pipe should be as short as possible, while maintaining the 30 inches of air space to the rest of the unit, with a minimum of elbows and must pitch upward to the chimney connection. Maintain 18 inches clearance, minimum, between the flue pipe and combustible material. Secure each flue pipe joint and boiler base flue outlet connection with sheet metal screws. Seal the opening at the chimney connection with boiler putty. Where fluctuating draft conditions are present, it is advisable to install a Barometric Draft control. Refer to Fig. 1.

Electric Installation

1. All wiring must be in accordance with local codes, or in absence of a local code, must comply with the National Electric Code ANSI CI-1978.
2. Refer to the appropriate wiring diagram, Fig. 8 or 9, when wiring the installation.
3. Provide a fused disconnect switch in the circuit supplying the stoker. The efm Model S20 Stoker operates on 120 VAC 60 Hz with power draw of 2.5 amps.
4. The stoker timer is to be mounted in close vicinity to the boiler. In mounting a steam timer, keep in mind that this timer has an internal relay which will cause an audible thump when energized, which will carry through the house if mounted on a ceiling joist or similar surface.
5. Locate the thermostat where it will sense the natural air circulation within the building. Do not place it in a location where it will be subject to cold drafts from windows or where it can sense the heat from radiation. It is not recommended that a thermostat be installed on an outside wall, in front of a fireplace, above a lamp, or at the base of an open stairwell.

Control Settings

1. Refer to the copy shown in Figure 8 and 9 for proper control settings and operation of the con-

trol system.

Operation – Stoker Firing

Before start-up:

Note: When the stoker is in its final installed position, remove the Allen head plug from the top of the gearbox and put the brass vent plug in its place.

1. The reducing unit has been filled with oil at the factory. It is advisable to verify this fact by removing the oil fill plug/vent from the top of the installed reducing unit and checking the oil level by inserting a dip stick and withdrawing to check the oil level. The normal oil level is to the top of the output shaft. The oil used in the unit is available from the factory in pint cans and is a synthetic gear oil. It is not normally necessary to change the oil.
2. Fill the ratchet oil reservoir with the oil furnished with the unit. Fill and maintain the oil level to approximately 3/8 inch above the bottom of the ratchet gear. If the oil becomes contaminated with dirt and dust, it should be changed.
3. See the instructions on the motor for the lube schedule. Place oil into the holes at each end of the connecting rod, into the hole in the bearing bracket, and to both the drive and check pawl bolts.
4. In a hot water circulating system, be sure the boiler and heating system are full of water and purged of air. In a steam system, be sure the boiler is filled with water to the height of the middle of the gauge glass. After putting water in the boiler of a steam system, prior to its first firing, remove the safety valve and pour in Water Conditioning Compound in accordance with the instructions on the can. This should be repeated each time a steam boiler is drained. Conditioning Compound is available from efm.

Starting the Fire

Note: If desired, the drive pawl can be flipped backward when starting a fire. In this position, the fan will supply combustion air, but no coal will be fed to the burner. Do not forget to return the drive pawl back to its operating position once the

fire is established.

1. Fit the manual coal worm crank, furnished with the unit, over the end of the worm drive shaft. Turn the shaft counter clockwise until coal covers the bottom row of air holes at the bottom of the burner plates.

2. When starting the stoker for the first time, set the feed rate at 3 teeth and the air shutter at 3 ¼. If the stoker is being re-kindled, do not change the established settings, as they are adjusted already for the proper feed rate.

3. Wrap a handful of wood shavings, or a suitable substitute, in a sheet of newspaper and place it on top of the coal inside the burner pot. Ignite the paper and start the blower. This can be done by turning up the thermostat and using a switch nearby to shut down the blower quickly in the event of an emergency.

4. After the wood is ignited, place a small shovel of coal on the fire. When the coal is glowing red, add an additional layer of coal. Operation of the stoker should then be continued under control of the thermostat.

Adjusting the Coal Feed Rate

1. The coal feed rate determines the output of the boiler. This data is shown on Table 1.

2. The coal feed rate is adjusted by changing the number of teeth on the ratchet drum that the drive pawl engages with each stroke. To decrease the feed rate, loosen the thumbscrew on the feed control collar and rotate the collar to the left. To increase the feed rate, rotate the collar to the right. Be sure the drive pawl engages the root of the ratchet drum tooth when the pawl falls off the pawl guide plate. Refer to Table 1 for the feed rate required to achieve the desired output.

3. The check pawl of the drive mechanism, mounted on an eccentric stud, must be adjusted to minimize backlash; the tendency for the worm to rotate backwards on the return stroke of the drive pawl. **Note:** This is done initially at the factory. To adjust, loosen the locking nut and rotate

the stud until the check pawl falls into the ratchet drum tooth, just before the drive pawl finishes its drive stroke. Tighten the locking nut.

4. It is somewhat difficult to check the actual number of teeth feed with the stoker running because of the speed at which the drive pawl engages the ratchet drum. This can be checked by manually turning the motor shaft coupling counterclockwise while counting the number of clicks as the ratchet drum teeth pass under the check pawl. **Disconnect all power to the entire stoker system when doing this check.**

5. In most cases, two feed settings will be required; one for Winter operation and one for Summer operation. During the heating season, the feed rate will have to be raised to provide sufficient heat for load conditions. This feed rate may cause out-fire conditions during the Summer when the burning rate required may be considerable less to maintain domestic hot water temperature only. See the section on Outfire. When using two feed rates, be sure to record both air and coal settings for future reference. These can be marked on your instruction card.

Due to different hardness and quality of coal, the rate of feed may have to be kept at 4 teeth or higher in order to prevent the fire from migrating down into the coal feed tube during long periods of standby due to warm weather or low demand.

If excessive heat is detected on the surface of the aluminum coal pipe outward of the boiler jacket, the rate of feed should be increased immediately to keep from damaging this pipe, worm, or other components of the pot assembly. Also, check the rate of air to avoid possible problems. Checking the temperature of this pipe should be done on a regular basis.

Adjusting the Air Supply

1. Whenever the coal feed rate is adjusted, the air setting must be adjusted also. Refer to Table 2 for the air setting for each feed rate. These are approximate settings and may have to be varied to suit the particular type of coal being used. The numbers on the air indicator plate are not intended to coincide with the number of teeth being used.

2. To adjust the air supply, loosen the thumb-screw securing the indicator pointer and make the appropriate adjustment. It may be necessary to adjust the air supply several times until the desired setting is attained. **With a properly adjusted fire, there will be an ash ring approximately 2" wide around the outside of the burner ring with a small dark circle in the center of the pot.** This is the fresh coal entering into the bottom center of the pot. With too much air, the fire bed will tend to develop cracks, the ashes will clinker and the dark spot at the center of the fire will disappear. With too little air, the ash ring will be very small, hot and dark, falling off the burner ring into the ash pit and the dark spot at the center of the fire will be large.

3. Some unburned coal in the ash is normal and indicates a well adjusted fire for maximum efficiency. This amount must be small. Excess unburned coal indicates poor air/feed adjustment or a poor grade of coal. In some cases, what appears as unburned coal may be slate or other foreign material.

Draft

1. All drafts should be measured with the stoker in operation and with the stack at normal operating temperature.

2. A good draft is essential for proper operation of the stoker. This draft is created by the chimney when it reaches operating temperature. The draft should be checked with a draft gauge at the stack. The gauge is inserted into a 1/4" hole, drilled into the stack at a point within 12" of the boiler base outlet and before the barometric draft control. The draft at the stack should be negative .04 to negative .05 inches of water column. The over-the-fire draft is checked at the 1/4" diameter hole drilled into the fire door and should be negative .02 inches of water column. Adjust the barometric draft control to attain these settings.

3. Too much draft will draw heat up the chimney causing wasted heat (and coal), while too little draft can cause positive pressure in the boiler firebox with resultant coal gas odors in the boiler room.

Fines Cleanout

To prevent fines accumulation in the burner air chamber and costly repairs, the cleanout lever must be pulled back and held in that position, with the stoker operating, for 15 seconds, once every day. Be sure to return the lever to its original position by pushing it in toward the boiler, using force to be sure the cleanout cover is closed.

Ashes

1. Remove the ashes as necessary to prevent overflow of ash into the boiler base.

Outfires

1. A stoker-fired boiler is different from an oil, gas or electric unit in that the fire must be maintained by periodic running of the stoker, even though there is no call for heat by the thermostat or operating aquastat. This is accomplished by the timer. A normal setting on the timer is 2 minutes of stoker operation per 1/2 hour. This is a suggested start and times may have to be varied to suit installation conditions and the time of year. Due to the wide range in the quality of coal available, a timer setting of 2 minutes **per hour** might produce an acceptable burn. It's an experimental process of timer run-times, air and feed settings, with the two main objectives being a proper ash ring (2 inches) and **a fire that does not burn deeply into the bottom of the pot.** If the quality of the coal remains consistent throughout the year, the settings can be recorded. There may be different settings for the warmer months than for the colder months. Record both settings.

2. An outfire in the stoker is a more prevalent condition during the summer months. It can happen even though you find nothing wrong with the stoker mechanism. The following (A thru C) are some conditions which can cause an outfire. These are situations that start to develop where there is no apparent explanation. For other situations, refer to the service check list.

A. Feed rate too high for summer operation:

In this situation, where the stoker is maintaining

boiler water temperature for domestic hot water and there is little domestic water draw, the boiler water temperature can reach the high limit setting. The high limit control overrides the timer, not allowing the stoker to run and results in an outfire. This occurs on a hot water system and can be corrected by dropping the feed rate, raising the high limit setting, lowering the operating setting on the aquastat to create more of a temperature spread between the operating and high limit setting on the aquastat, and decreasing the differential on the operating control.

The bypass piping, as shown in Fig. 7, is very important in helping to alleviate this condition by reducing stratification of the water in the boiler.

Removing insulation from the boiler will also help.

Note when adjusting the aquastat:

The L8124A or L7224A aquastat, furnished with this unit, has three settings.

1. The High Limit Setting: This shuts the stoker "off" when the water temperature reaches the temperature setting. It overrides all other controls.
2. The Operating Setting (Low Limit): This setting maintains the boiler water temperature and shuts off the stoker when the water temperature reaches the setting, but not if there is a call for heat.
3. The Differential Setting: This setting determines when the stoker will be fired, as the boiler water temperature cools. For example: If the operating control is set at 160 degrees, with a 10 degree differential, the stoker will come on at 150 degrees (water temperature) and shut off at 160 degrees (water temperature). The thermostat or timer can override this setting, but cannot override the high limit setting.

B. Loss of draft:

This can occur during hot, humid summer weather, with low fire in the burner. Changing the number of minutes of operation per half-hour, increasing slightly the coal feed and air settings may help. Thoroughly cleaning the boiler, flue

pipe and chimney, to remove fly ash buildup will also help. Be sure the fire and ash pit doors are closed tightly. Check that the clean-out lever is fully pushed back towards the boiler and that the clean-out cover plate openings are fully closed. Check that all openings, where outside air could infiltrate the boiler base, are sealed.

C. Too much draft:

This is most apt to occur during cold, windy weather where there is no barometric draft control in the stack. In this situation, the fire continues to burn, even though the stoker is not running. Addition of a barometric control, or proper adjustment of the barometric control, if present, will help. Exhaust fans can also cause this problem by drawing air down the chimney, through the burner and out of the fan housing inlet. This can be corrected by providing adequate outside air intake openings for both the stoker and the exhaust fan or discontinuing the use of the exhaust fan.

Before Leaving the Installation

Before leaving the installation, instruct the equipment owner on the proper operation and simple maintenance of the unit, such as the coal feed and air settings, replacing the shear pin, removal of obstructions in the coal pickup (auger), use of the clean-out lever, how to build a fire, where and when to lubricate, and use of the coal worm crank.

Explain the information on the instruction card to the user and post it close to the boiler.

Service Check List for Stoker Operation

No Heat

Stoker will not run (See Below)
Outfire (See Below)
Pin sheared
Not feeding coal (See Below)
Circulator failure (Hot Water System)

Not Enough Heat

Thermostat improperly located
Thermostat set too low
Boiler too small for the job
Limit control set too low
Too little coal feed
Insufficient combustion air
Boiler and flue passages dirty
Air chamber filled with fines
Burner plate holes clogged
Poor air admission in the boiler room
Poor grade of coal
Insufficient radiation

Too Much Heat

Thermostat set too high
Thermostat improperly located
Control failure
Control circuit shorted

Not Feeding Coal (Stoker Running)

No coal over the bin worm pick-up
Wet coal, packed, arching over the worm
Feed pawl disengaged
Check pawl disengaged
Pin sheared
Coarse coal riding on the worm pick-up
Bin worm disengaged

Outfire (See Outfire Section)

Timer operates too infrequently
Timer "ON" operation too short
Excessive draft
Too little draft
Too much combustion air
Not feeding coal (See Above)
Stoker will not run (See Below)
Exhaust fan in building
Control failure
Too little coal feed
Air chamber filled with fines

Burner holes clogged
Insufficient combustion air

Stoker Will Not Run

No power supply
Fuse blown
Motor failure
Switch off
Control failure

Stoker Noisy

Check and drive pawls not adjusted properly
Loose or bent fan
Motor needs oil
Reducing unit needs oil
Oversize coal
Loose fan blade
Fan rubbing housing
Coupling slipping or out of alignment
Crank and connecting rod not adjusted
Oil low in oil reservoir

Too Much Fly Ash

Excessive combustion air
Excessive draft
Excessive fines in coal

Poor Draft

Chimney too low (See Fig. 11 & 12)
Chimney or flue pipe obstructed
Boiler passages of flue pipe full of fly ash
Excessive air leaks into the boiler/base
Base of chimney full of fly ash, where the flue pipe enters

Coal Gas Smell

Poor draft (See Above)
Excessive combustion air
Firedoor not closed tightly
Exhaust fan running

Excessive Coal Consumption

Boiler needs cleaning
Building temperature too high
Thermostat improperly located
Too low coal feed
Poor grade of coal
Poor combustion
Excessive air leaks into the boiler/base
Too much combustion air
Faulty distribution system
High stack temperature

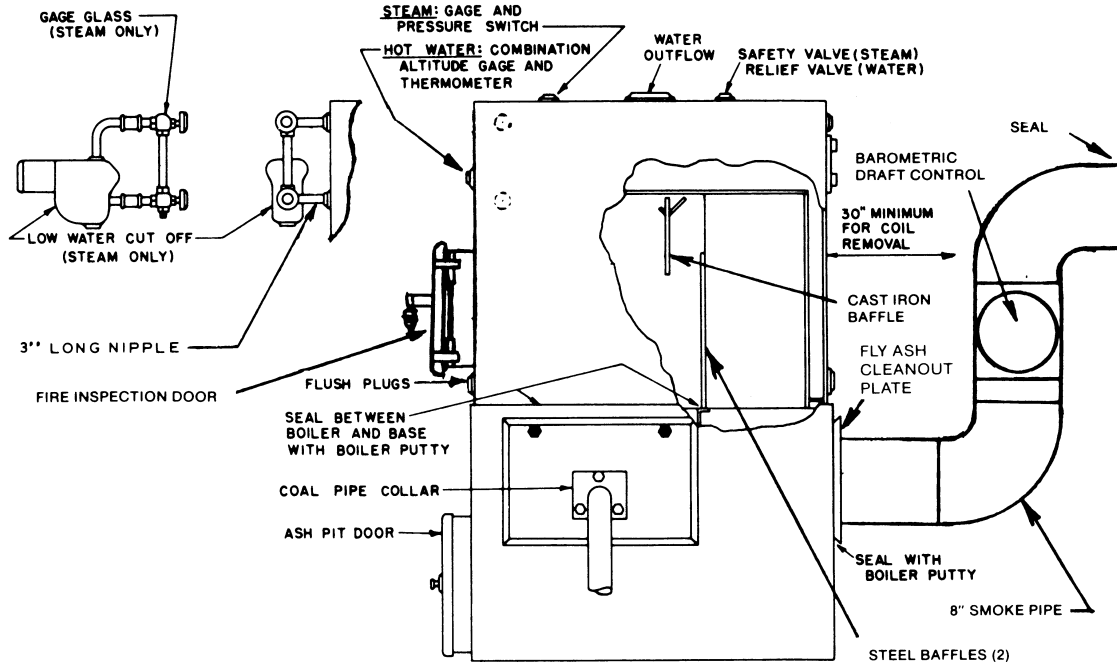


FIGURE 1

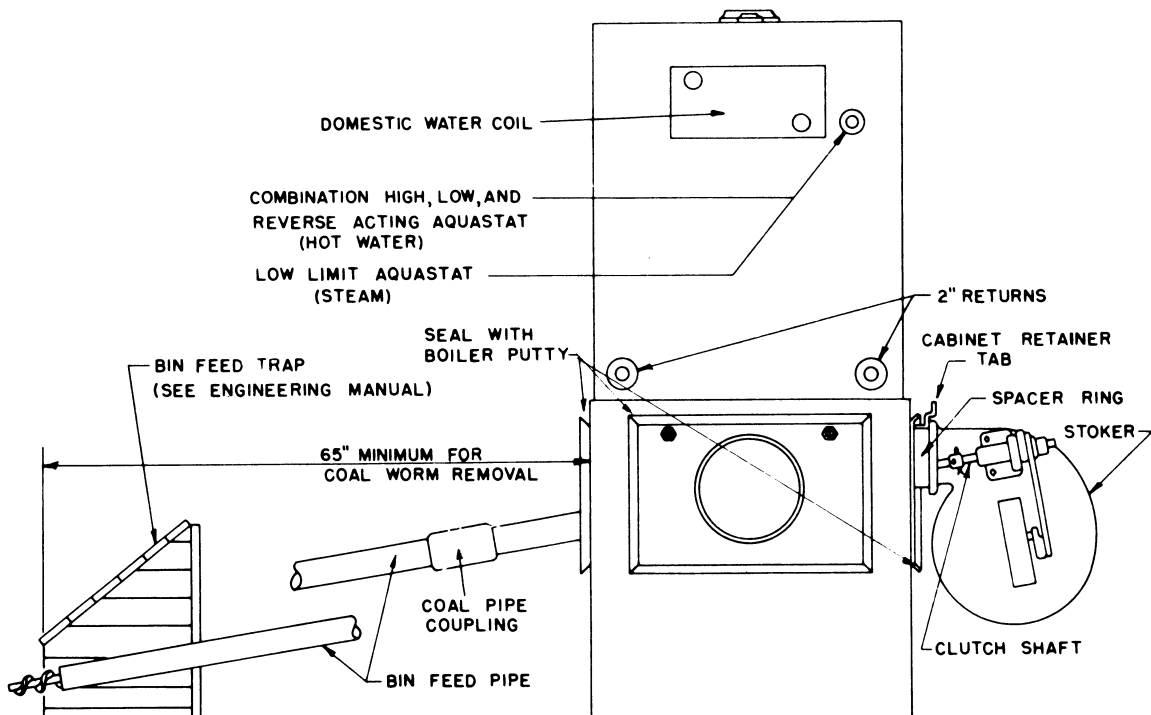


FIGURE 2

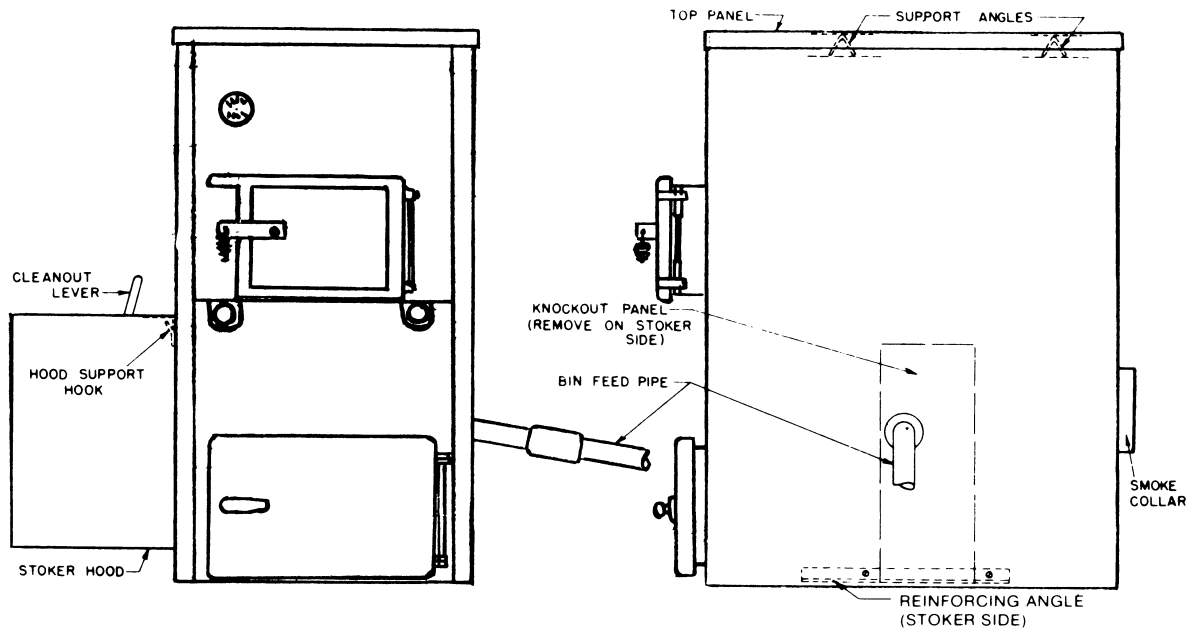


FIGURE 3

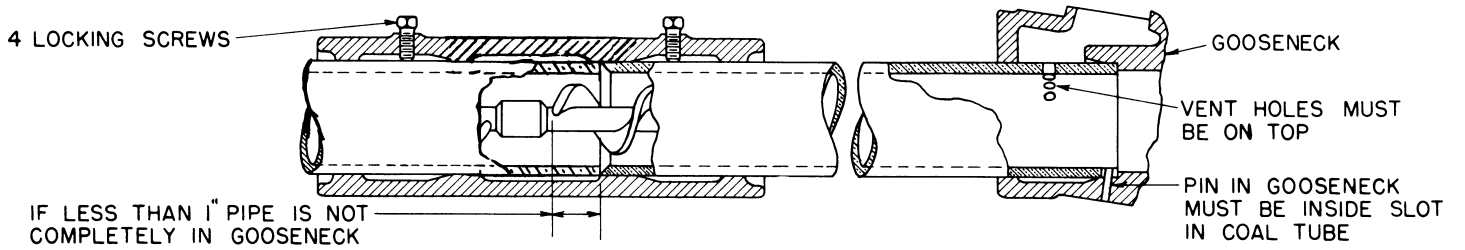


FIGURE 4

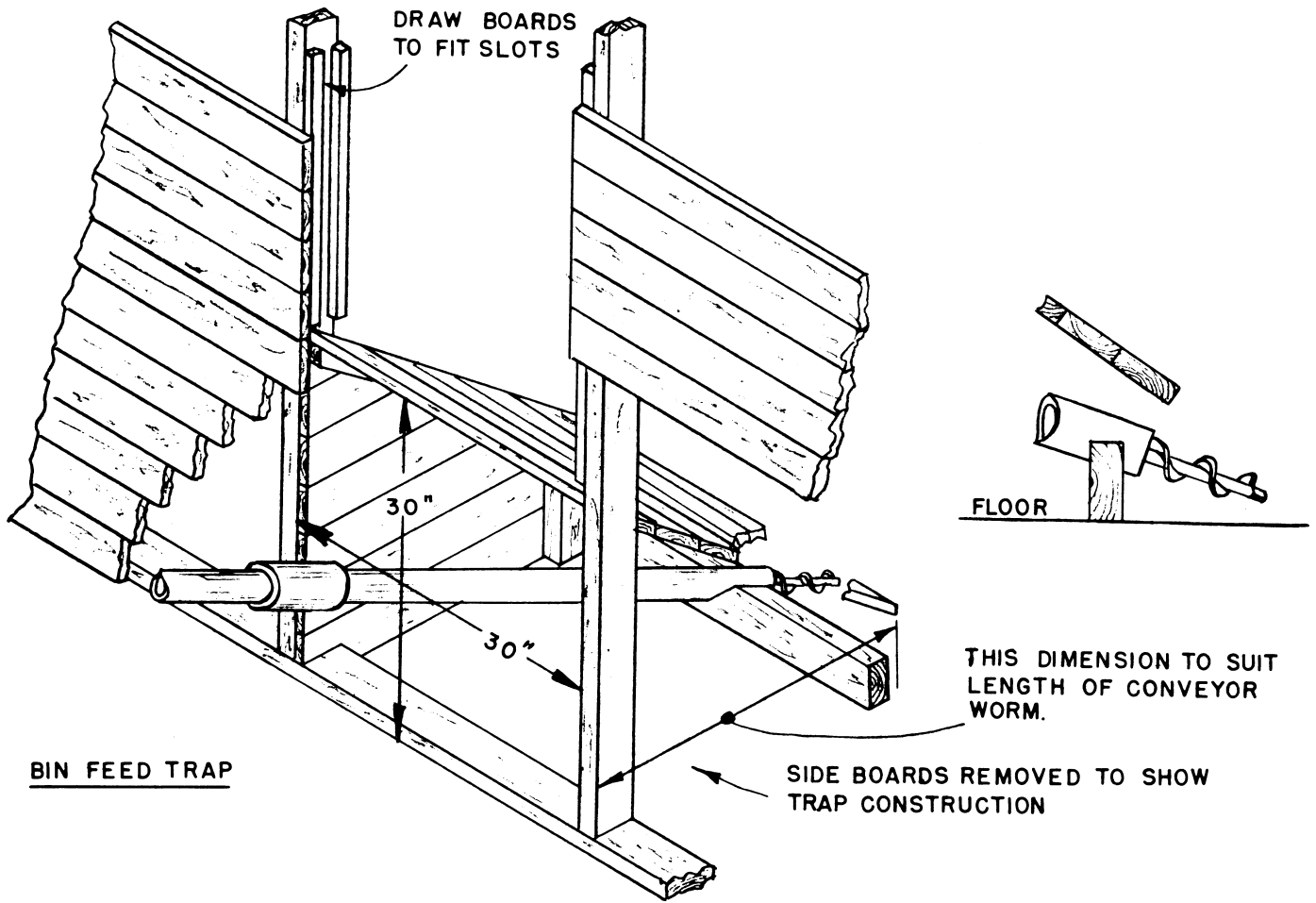
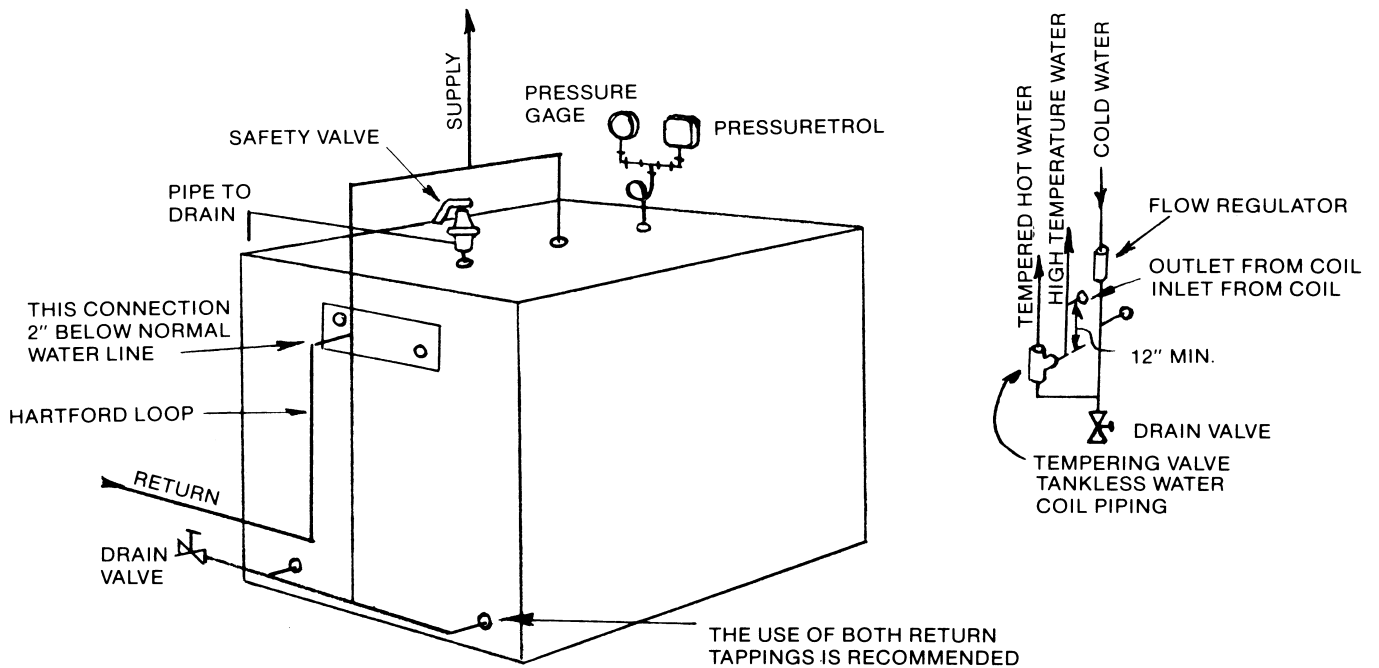


FIGURE 5



STEAM PIPING LAYOUT
FIGURE 6

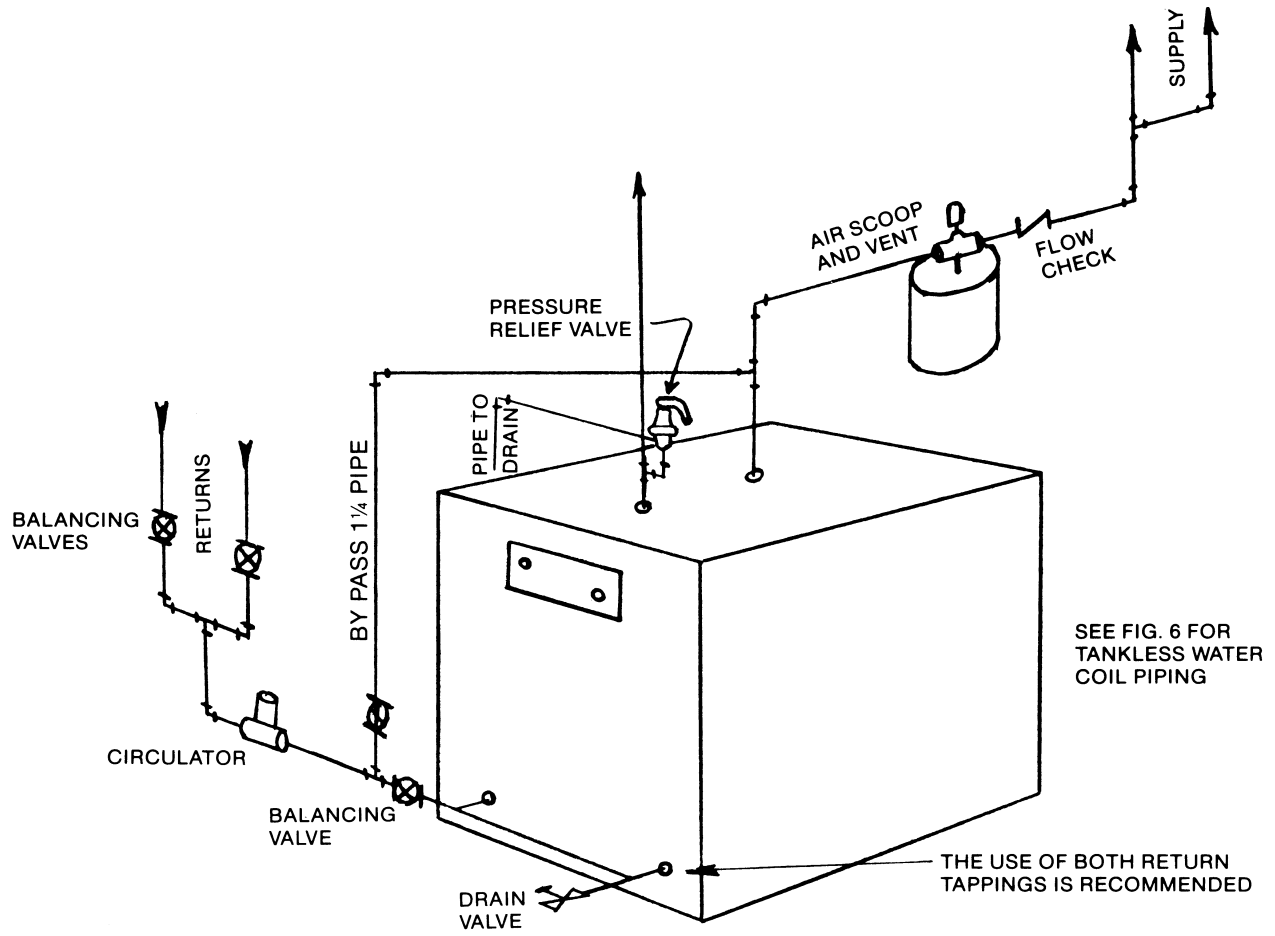


FIGURE 7

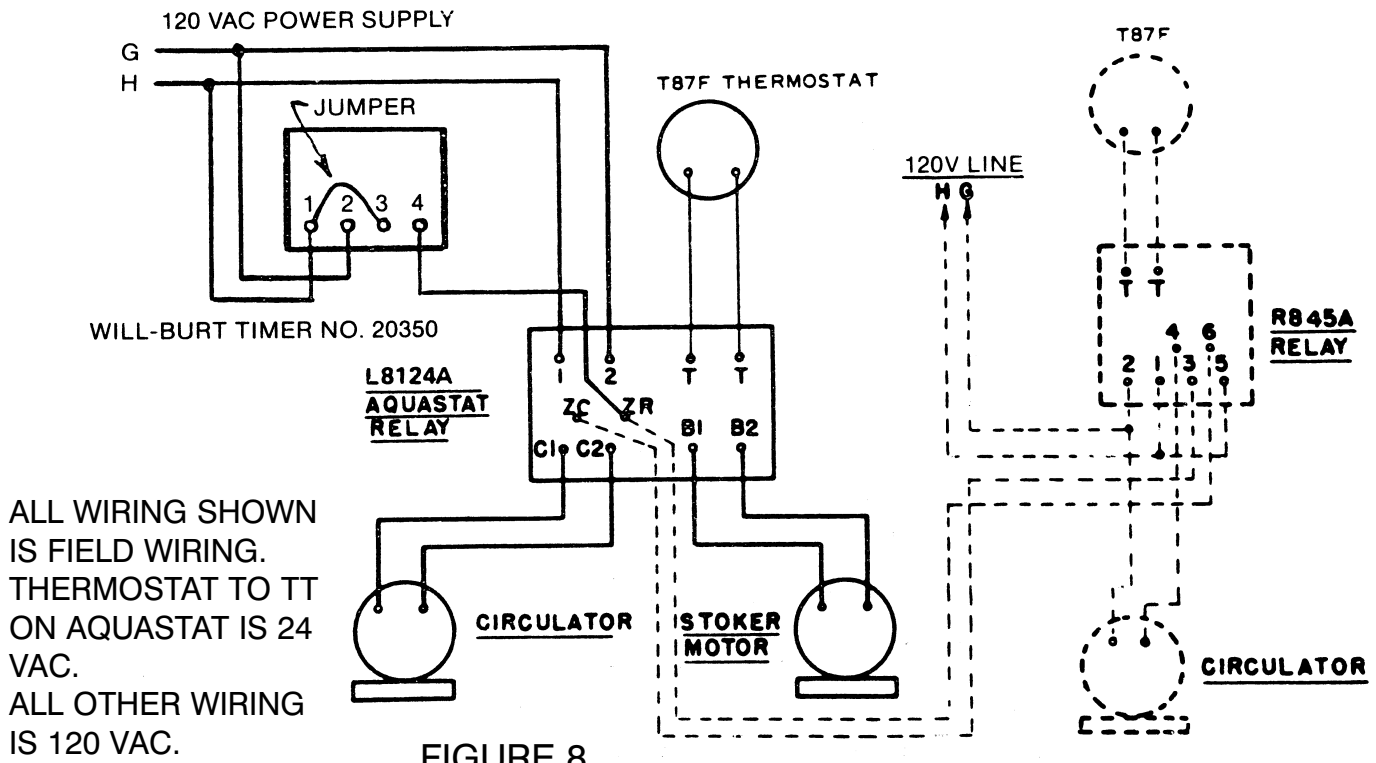


FIGURE 8

ALL WIRING SHOWN IS FIELD WIRING. THERMOSTAT TO TT ON AQUASTAT IS 24 VAC. ALL OTHER WIRING IS 120 VAC.

Stoker Control Package, Including Controls for Forced Circulating Hot Water System with Domestic Hot Water:

Includes controls which permit both the stoker and circulator to start simultaneously when the thermostat calls for heat. This method of operation is sometimes preferred, as it eliminates a possible lag in boiler water temperature pickup if the stoker operates only on a low water temperature setting. The L7224A, L8124A are a combination control consisting of a relay for circulator and stoker operation and a triple function aquastat serving as a high limit controller to shut down the stoker if the boiler water temperature exceeds the setting of the high limit control. It also has a low limit controller for maintaining a minimum boiler water temperature for domestic hot water service and a circulator controller to prevent circulator operation when the boiler's water temperature is too low to provide both domestic hot water and house heating. The relay starts the circulator and the stoker when the thermostat calls for heat, provided the boiler water temperature is above the low limit setting. The high limit is usually set at 200 degrees or higher to ensure a high enough temperature of hot water for the radiation. The low limit is set at 160 degrees. If varying from these settings, there must never be less than 40 degrees between the high and low limit for proper operation. The reverse acting aquastat setting (differential setting) is for shutting off the circulator to preserve the domestic hot water temperature. This is usually set at 10 when the house is heated by copper baseboards and, depending upon the layout of the system, 15, when cast iron radiators are present. A

NOTE: DOTTED PORTION IS FOR ADDITIONAL ZONE IF DESIRED

setting of 15 allows warm water to reach distant radiators.

The Stoker Timer is set for two (2) minutes of operation every 1/2 hour. (See language in "Outfires"). One side of the scale is for "per hour" timing and the other side of the scale is for "1/2 hour" timing. The arrow or screw in the top center of the wheel is the set point. Each line to the right or left of the screw or arrow is one minute. Loosen the screw and move the wheel to obtain the desired number of minutes. The timer comes into play often during the warmer months. Unless the feed and air settings are very high, it isn't necessary to reduce them for Summertime use of the boiler. However, if the boiler is overheating frequently and is shut down on the high limit, causing outfires, it may be necessary to lower the feed and air settings or change the timer settings. Any feed/air setting below 4 teeth/4 air should be closely monitored to ensure that the fire is not burning deeply into the bottom of the pot and possibly down the coal pipe. Some stoker owners have success with setting the timer to several minutes *per hour*. Before changing any settings, be sure to record the settings that worked well in the cooler/colder months of the year, so they can be returned to at that time of year.

The dotted portion of this wiring diagram shows the use of an additional thermostat and an R845A relay, to operate a separate circulator when zoning a system. One or more of these additional zone sets may be used and still retain the functions of the L8124A, L7224A.

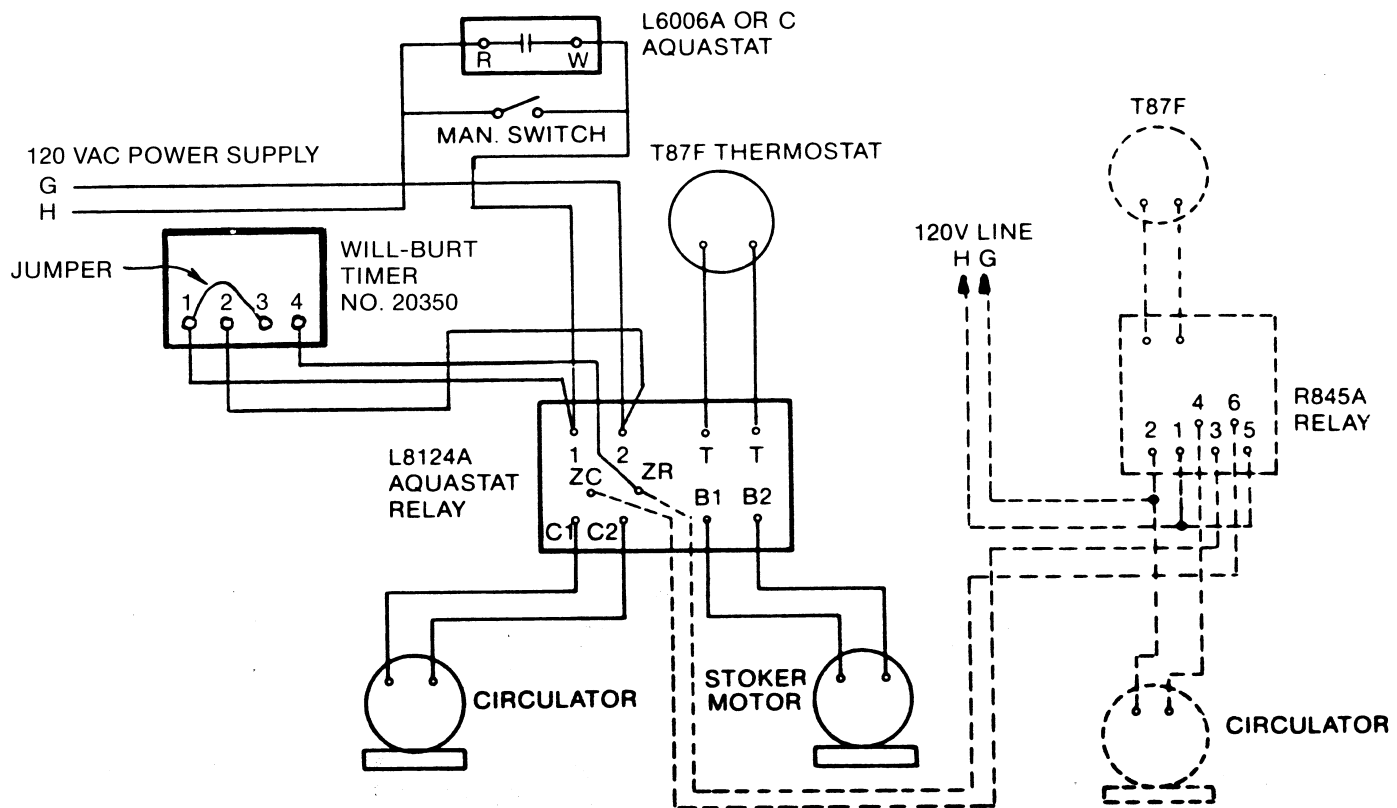


FIGURE 8A

NOTE: DOTTED PORTION IS FOR ADDITIONAL ZONE IF DESIRED

ALL WIRING SHOWN IS FIELD WIRING.
THERMOSTAT TO TT ON AQUASTAT IS 24 VAC.
ALL OTHER WIRING IS 120 VAC.

Stoker Control Package, Including Controls for Forced Circulating Hot Water, with Domestic Hot Water, Utilizing an Outfire Control:

This alternate wiring is to use a Honeywell L6006A or C Aquastat to sense water temperature drop to shut off the stoker in an outfire condition. Set the temperature setting 20 degrees below the L8124A, L7224A operating control (low limit) setting. The differential setting on the L6006A should be 5 degrees. The manual switch is used to start the cold boiler and bring it up to operating temperature. To start a cold boiler, the switch is set to the "ON" position (closed contacts). Once the boiler is up to operating temperature, the switch position is moved to the "OFF" position (open contacts). With the switch in the "OFF" position, the stoker is in the outfire-protection mode.

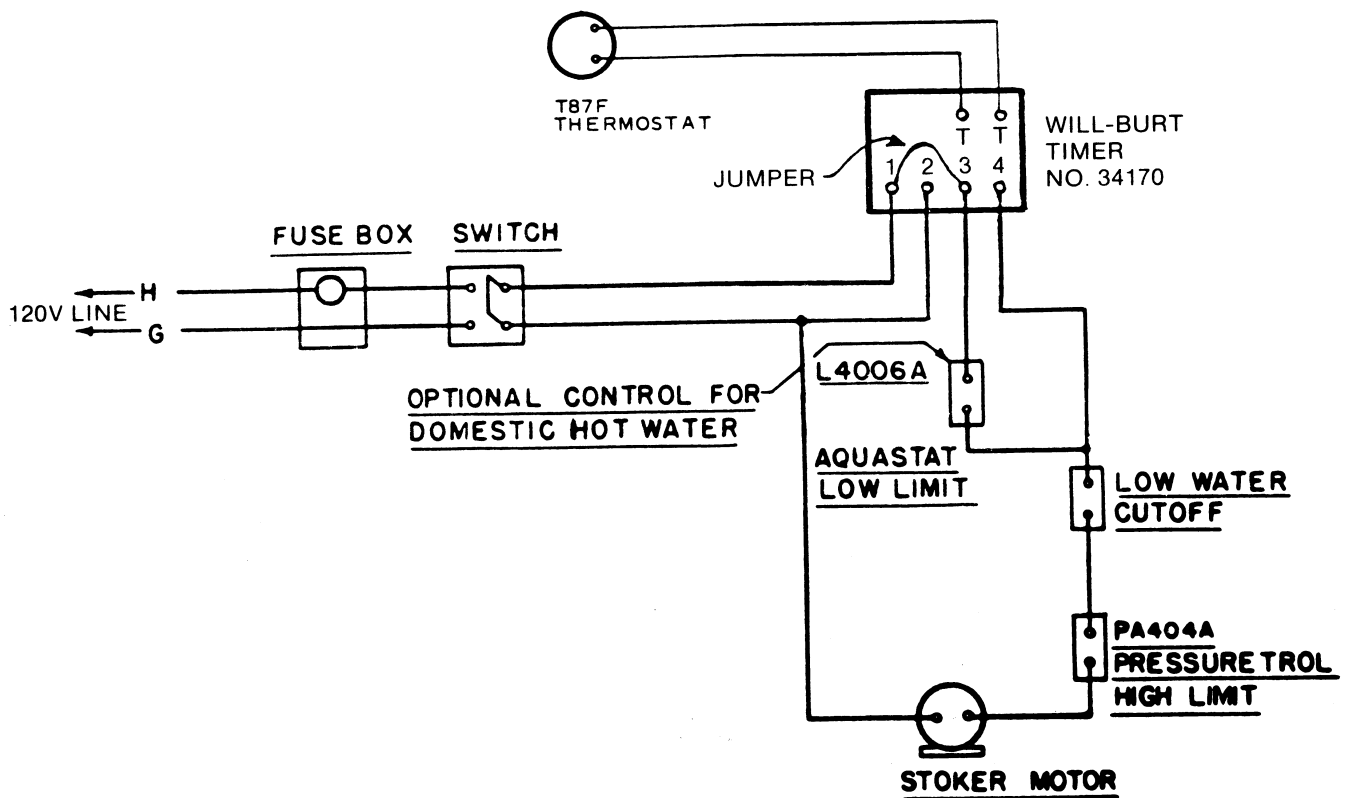


FIGURE 8B

Stoker Controls for a Steam System, with or without Domestic Hot Water

ALL WIRING SHOWN IS FIELD WIRING. THERMOSTAT TO TT ON THE RELAY IS 24VAC. ALL OTHER WIRING IS 120 VAC.

The wiring diagram of the Stoker Controls for a Steam System consists of a thermostat, timer relay, low water cutoff, low limit aquastat, Pressuretrol and stoker motor. The timer is set for two (2) minutes of operation per half hour. (See language in "Outfires"). This may vary to suit the coal feed and air setting for the hold-fire operation. The low limit aquastat is set for 150 to 160 degrees to maintain a minimum boiler water temperature for domestic water supply. The high limit Pressuretrol PS404A is set for 1-3 lbs. maximum on a typical domestic heating system.

Set the differential of this control to suit the job, as per M-H (Minneapolis-Honeywell) instructions. The low water cutoff should be installed in accordance with the manufacturer's instructions.

UTILIZING AN OUTFIRE CONTROL WITH THE OIL/COAL BOILER, WITH DOMESTIC WATER COIL.
 (MANUAL SWITCH CAN BE TURNED TO THE ON POSITION DURING OIL FIRING ONLY)

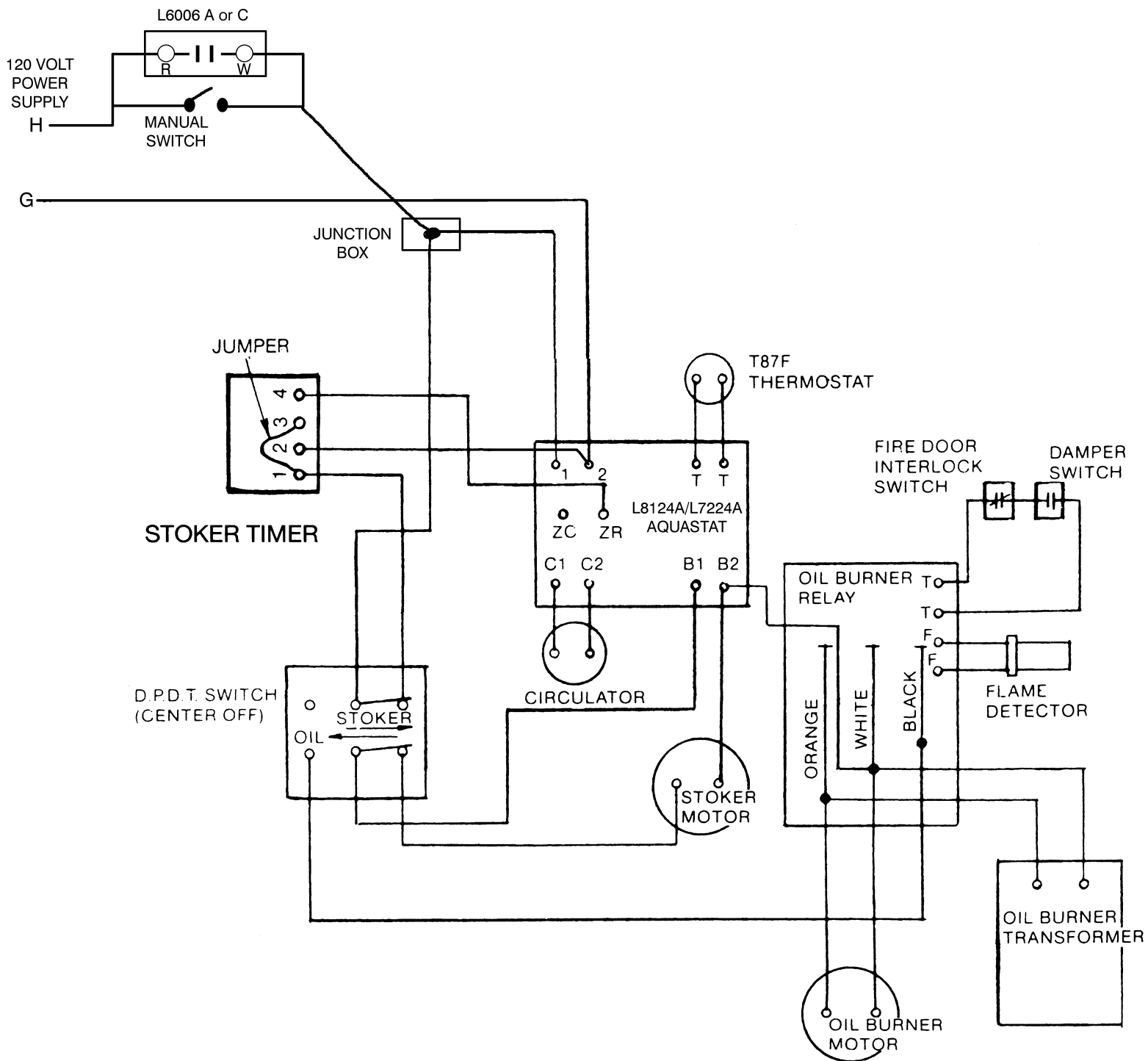


FIGURE 9

**PARTIAL WIRING DIAGRAM
UTILIZING PRIMARY CONTROL R7184B**

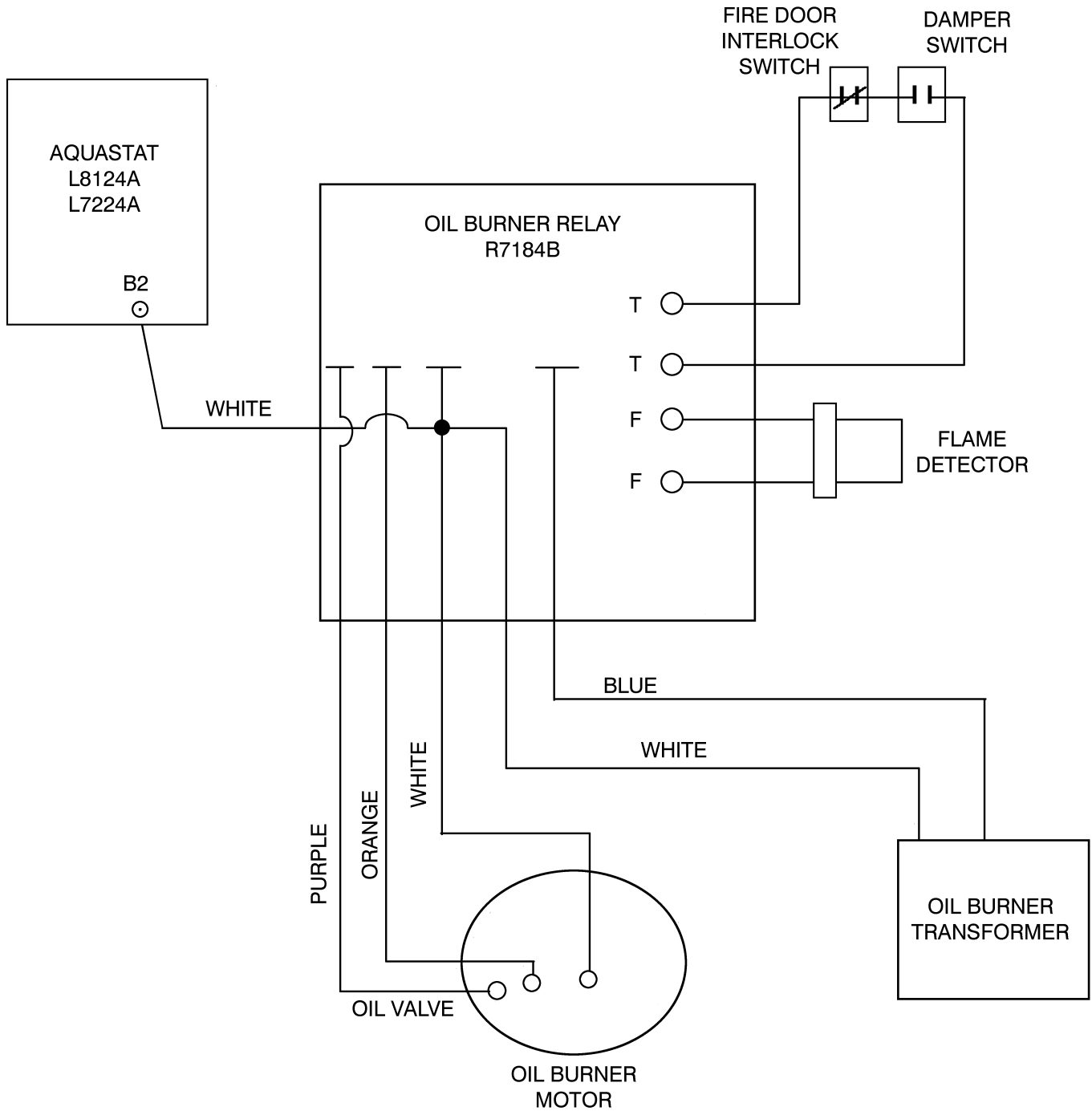
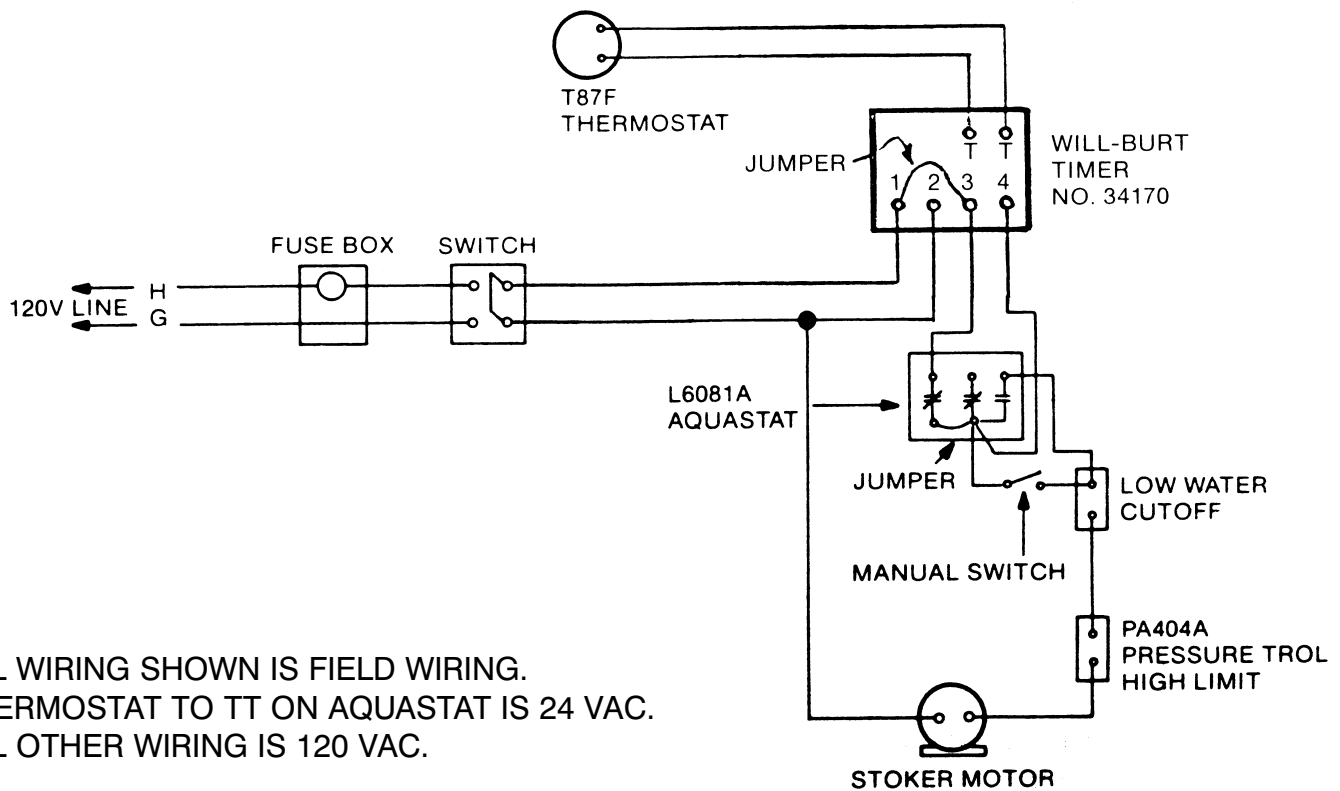


FIGURE 9B



ALL WIRING SHOWN IS FIELD WIRING.
THERMOSTAT TO TT ON AQUASTAT IS 24 VAC.
ALL OTHER WIRING IS 120 VAC.

FIGURE 9C

Stoker Controls for a Steam System with or without Domestic Hot Water Alternate Wiring and Control

An alternate wiring to use the Honeywell L6081A Aquastat to sense a water temperature drop and shut off the stoker on an outfire condition. Set the temperature setting on the low side of the aquastat at 30 degrees below the setting on the high side. Set the low side differential at 10 degrees. The high side of the aquastat is used to maintain boiler water temperature for domestic hot water. This outfire control will not apply where boiler water temperature is not maintained. The manual switch is for start-up and is to be thrown in the open position after the boiler is up to temperature.

TYPICAL CHIMNEY CONDITIONS APT TO RESULT IN BACK-DRAFTS

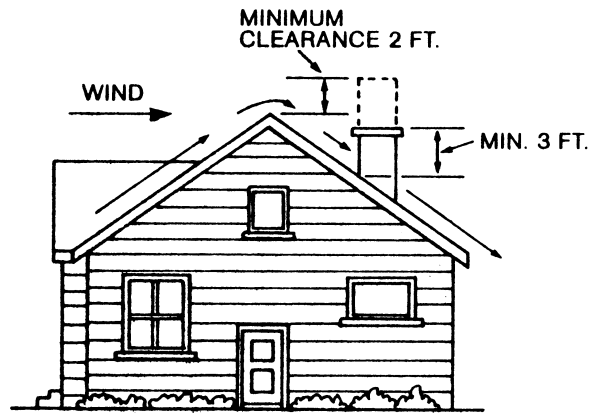


FIGURE 10

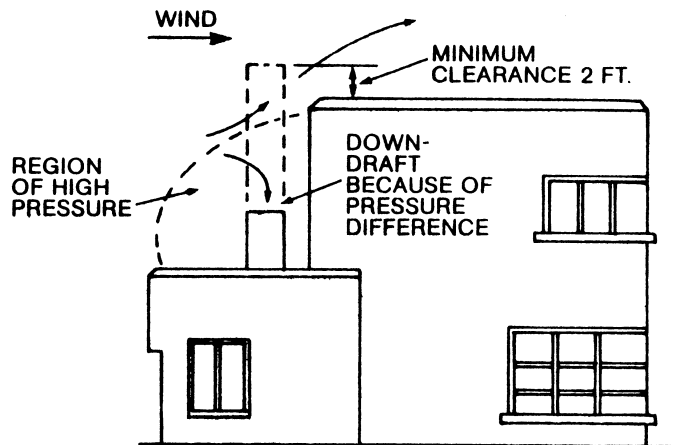
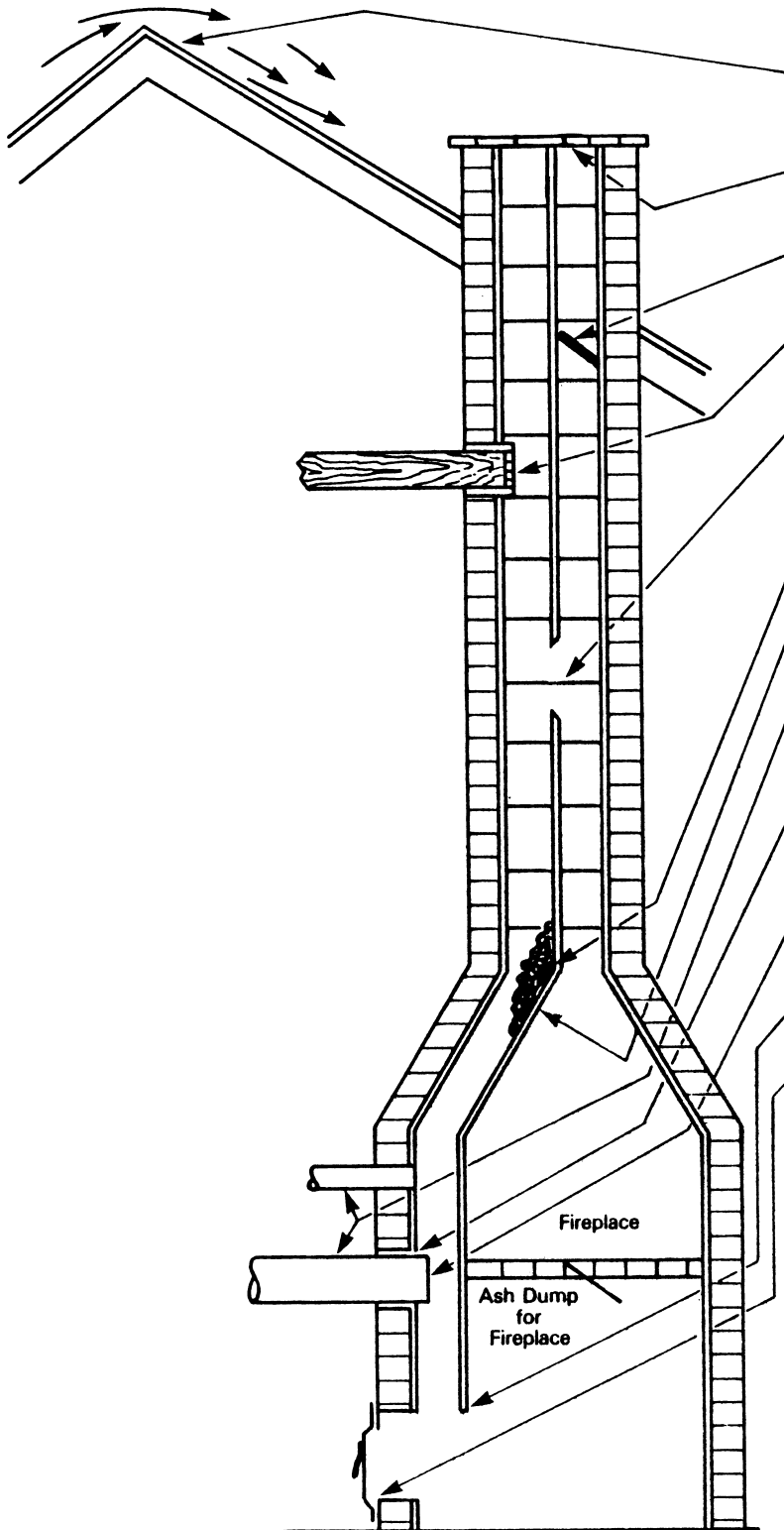


FIGURE 11

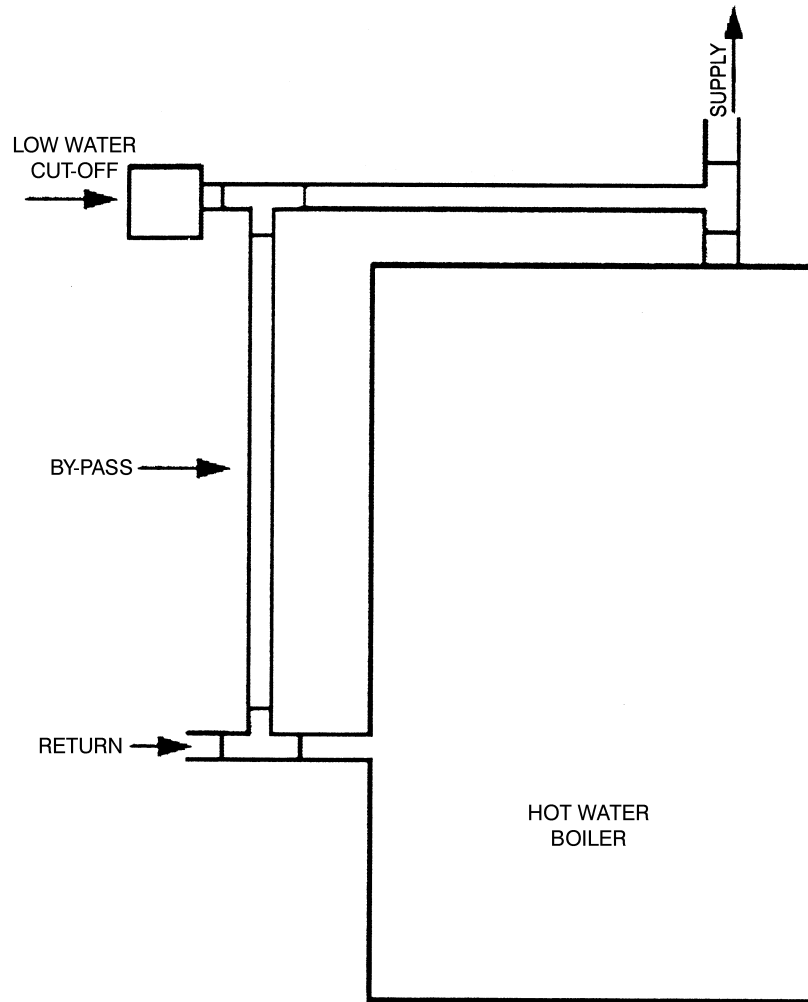
COMMON CHIMNEY TROUBLES AND THEIR CORRECTION



Troubles	Examination	Corrections
Top of chimney lower than surrounding objects	Observation	Extend chimney above all objects within 30 feet
Coping restricts opening	Observation	Make opening as large as inside of chimney
Obstruction in chimney	Can be found by light and mirror reflecting conditions in chimney	Use weight to break and dislodge
Joint projecting into chimney	Lowering a light on extension cord	Must be handled by a competent brick contractor
Break in chimney lining	Smoke test-build smudge fire blocking off other opening, watching for smoke to escape	Must be handled by a competent brick contractor
Collection of soot at narrow space in flue opening	Lowering a light on extension cord	Clean out with weighted brush or bag of loose gravel on end of line
Offset	Lowering a light on extension cord	Change to straight or to long offset
Two or more openings into same chimney	Found by inspection from basement	The least important opening must be closed, using some other chimney flue
Loose fitted pipe in flue opening	Smoke test	Leaks should be eliminated by cementing all pipe openings
Smoke pipe extends into chimney	Measurement of pipe from within or observation of pipe by means of lowered light	Length of pipe must be reduced to allow end of pipe to be flush with inside of tile
Failure to extend the length of flue partition down to floor	By inspection or smoke test	Extend partition to floor level
Loose fitted cleanout door	Smoke test	Close all leaks with cement

FIGURE 12

INSTALLATION OF LOW WATER CUT-OFF ON HOT WATER HEATING BOILERS



WIRING DIAGRAMS

Low Water Cut-Off Must Be Ahead Of All Controls In Control Circuit

FIGURE 13

DF520 SPECIFICATIONS

OUTPUT PER HOUR						HT. SUR. SQ.FT.	OUTPUT SIZE	RETURN SIZE	RECOM. CHIMNEY SIZE	COIL GPM	APPROX. SHIPPING WEIGHT
STOKER TEETH FEED	POUNDS COAL PER HR.	GROSS OUTPUT BTUH	NET OUTPUT BTUH	FT. STEAM NET	FT. WATER NET						
3	7½	64400	56000	233	373	28.3	3	2	8 x 8 x 30	5	1250
4	10	85870	74670	311	498						
5	12½	107340	93340	389	622						
6	15	128810	112010	467	747						
7	17½	150280	130680	545	871						
8	20	171750	149350	622	996						
9	22½	193220	168020	700	1120						
10	25	214690	186690	778	1245						
OIL	1.5 GPH	157000	137000	571	913						

TABLE 1

APPROXIMATE AIR SETTING FOR STOKER								
Coal Feed Teeth	3	4	5	6	7	8	9	10
Points on Air Indicator	3¼	4	4½	5¼	6	6½	7¼	8

TABLE 2



610-965-9041
Emmaus, PA 18049