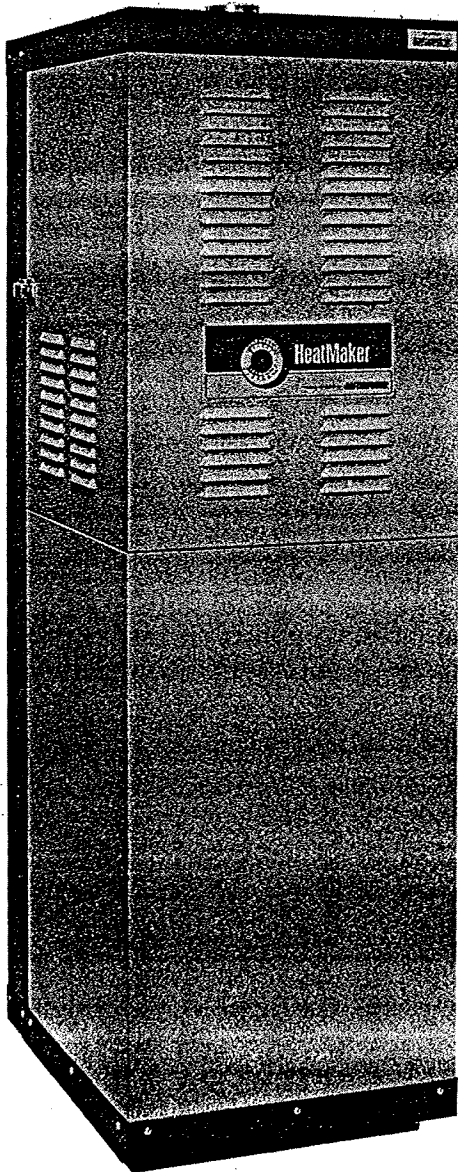


SERVICE MANUAL

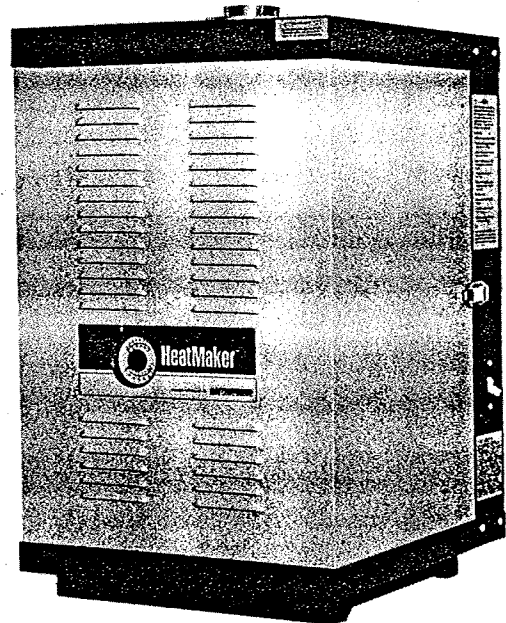
HW-SERIES

Model 130HW, 100HW, 60HW
Integrated Hydronic Heating
and Domestic Hot Water Appliance
for Natural or Propane Gas



H-SERIES

Model 130H, 100H, 60H
Hydronic Heating Only
For Natural or Propane Gas



To the Installer: After installation these instructions must be given to the homeowner or left on or near the boiler.

To the Homeowner: This booklet contains important information that will help you in maintaining and operating this boiler. Please retain it for future reference.



**(SERIAL NUMBERS X86-XXXX AND ALL
NEWER H AND HW-SERIES BOILERS —
TROUBLESHOOTING SECTION COVERS
H, HC, HW & HWC SERIES BOILERS)**

INTRODUCTION

**HW-SERIES — Integrated Appliance,
Heating and Domestic Hot Water
Model BGP-130HW, BGP-100HW, and BGP-60HW**

**H-SERIES — Heating Only
Model BGP-130H, BGP-100H, and BGP-60H**

The HeatMaker is a direct vent, low pressure, hot water boiler. It has a forced draft, pre-mixed combustion system. All the air for combustion and about 30% excess air is supplied with the gas to the burner (flameholder). The air is drawn into the system through the intake duct which surrounds the vent pipe. The intake air is metered through an air orifice and then mixed with gas before entering the combustion air blower. The blower is mounted directly below the burner (flameholder) and forces the air/fuel mixture through the flameholder and into the combustion chamber. The mixture is ignited and burns on the flameholder. The hot gases are forced out through the heat exchanger and into the flue collector. From the flue collector they enter the vent pipe and are discharged to the outside atmosphere through the vent terminal.

TABLE OF CONTENTS

	Page
INTRODUCTION	1
PARTS LIST AND ORDER INFORMATION	6
START UP AND CHECK OUT PROCEDURE	8
ADJUSTING BURNER/INPUT	8
CLEANING	8
OPERATING CONTROLS	9
TROUBLE SHOOTING SECTION	
BOILER CONTROL AND BURNER CONTROL	12
SEQUENCE OF OPERATION	13
TROUBLE SHOOTING DIAGRAMS	16
APPLICATION NOTES	30
HEATMAKER TECHNICAL	31
INSTALLATION & OPERATING INSTRUCTIONS	32
SPECIFICATION SHEETS (HOT WATER DELIVERY)	44
SPARE PARTS KITS	48
WIRING & LADDER DIAGRAMS	28,39

INTEGRATED — HEAT AND HOT WATER HW-SERIES

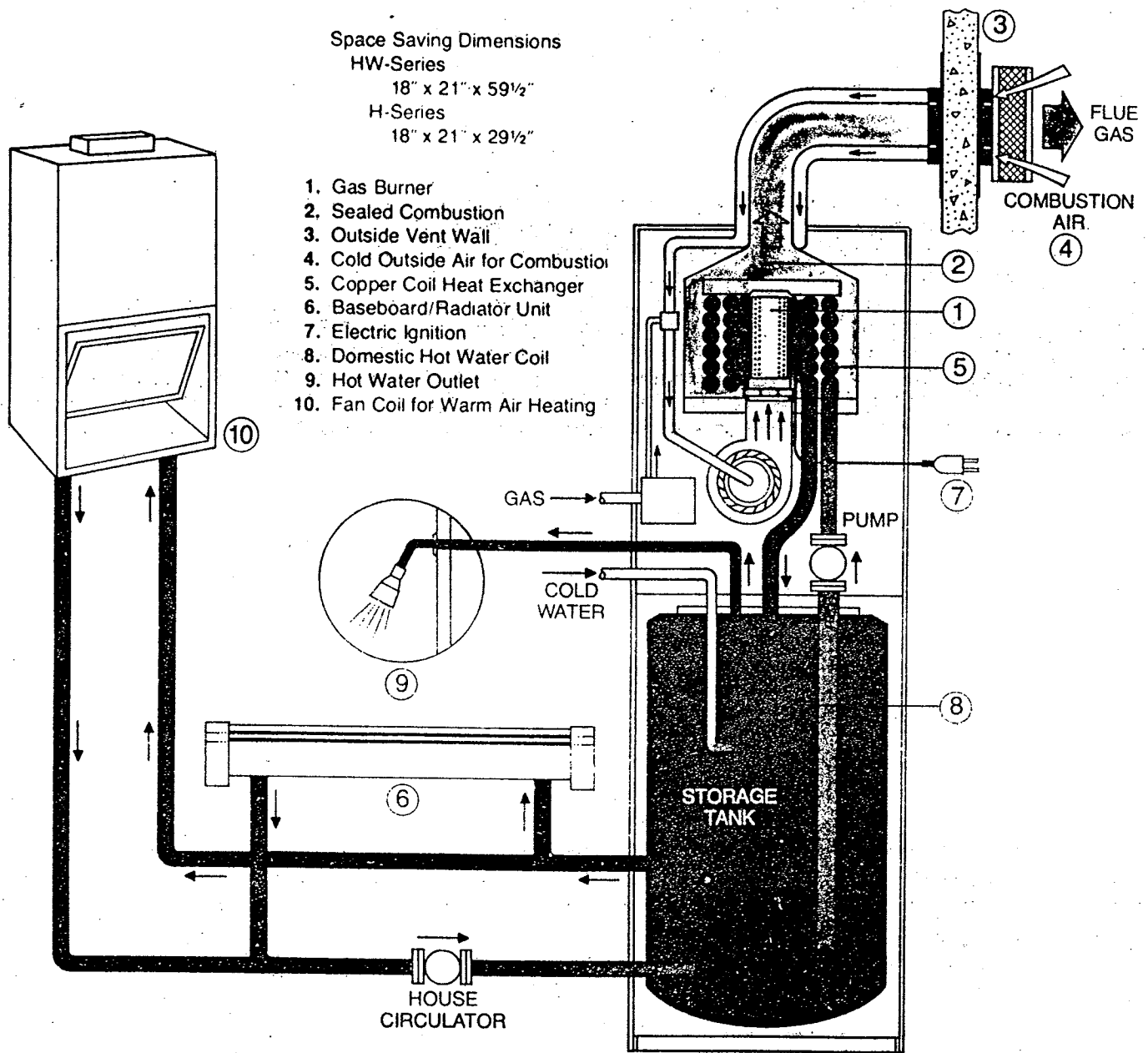


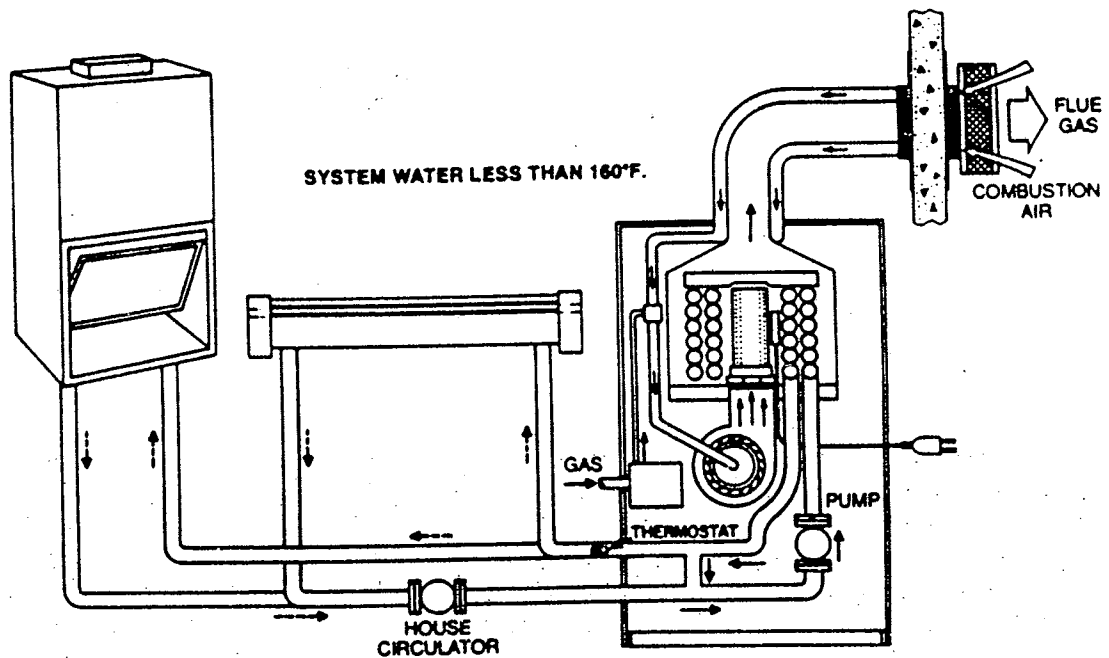
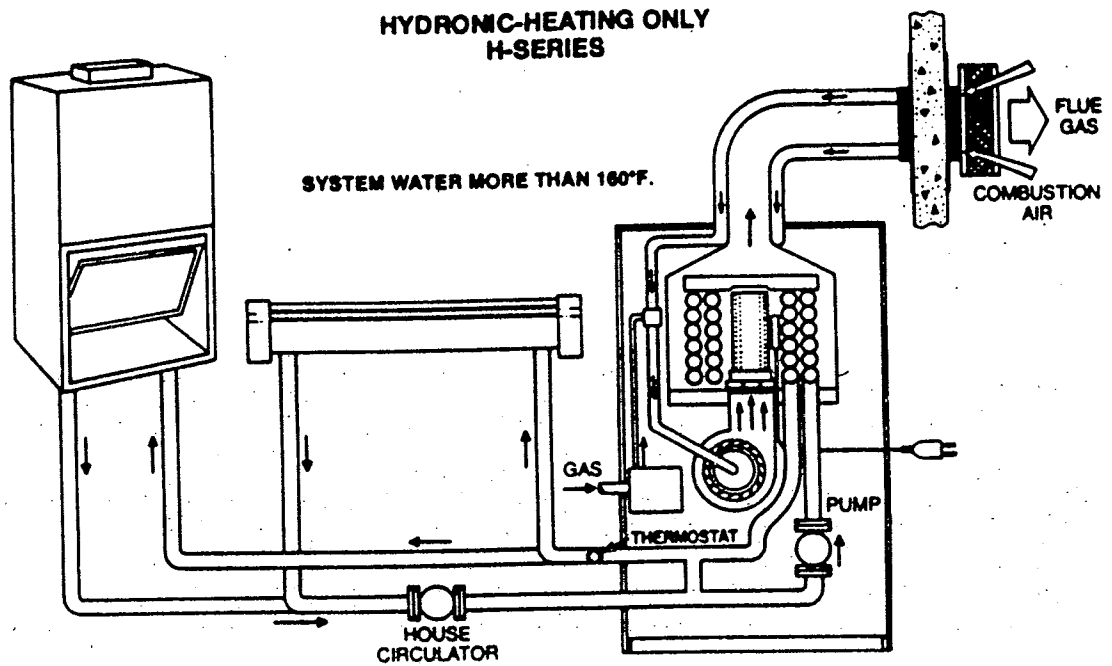
Fig. 3 Simplified Schematic Diagram

SIMPLIFIED SCHEMATIC DIAGRAM

HW-SERIES

The HW-Series has domestic hot water heating as well as hydronic space heating. To do this it has a storage tank through which boiler water is circulated. A heat exchanger within the tank absorbs heat from the boiler water and transfers it to the domestic hot water. The domestic hot water is circulated through the heat exchanger and the boiler water is circulated around it.

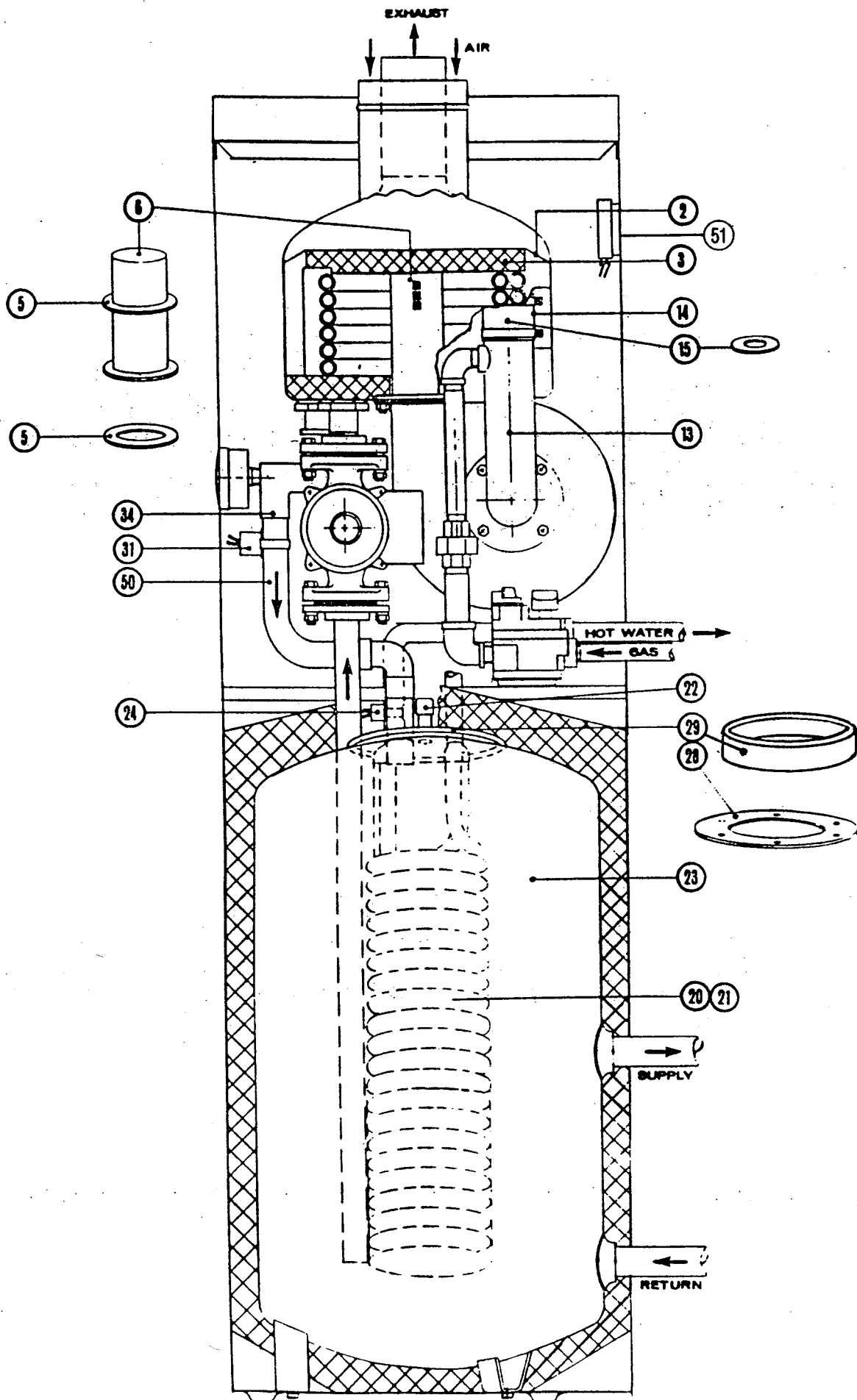
HYDRONIC-HEATING ONLY H-SERIES

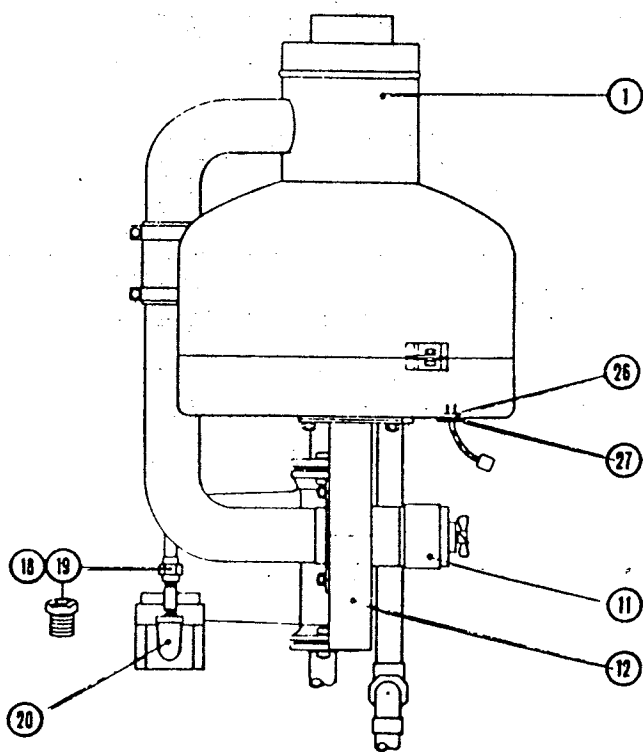
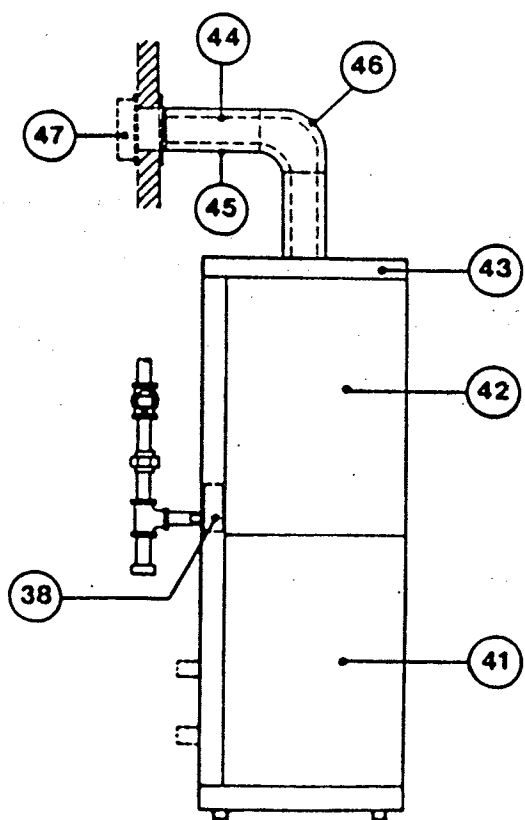
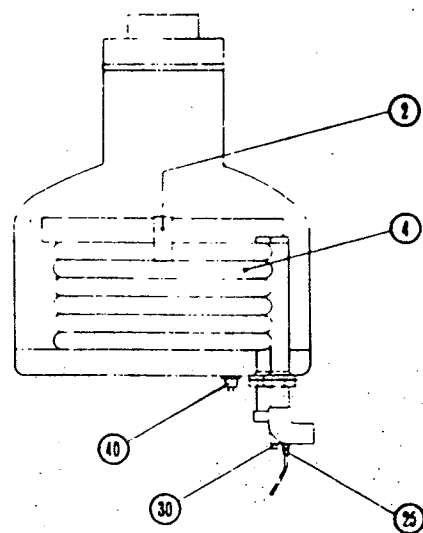
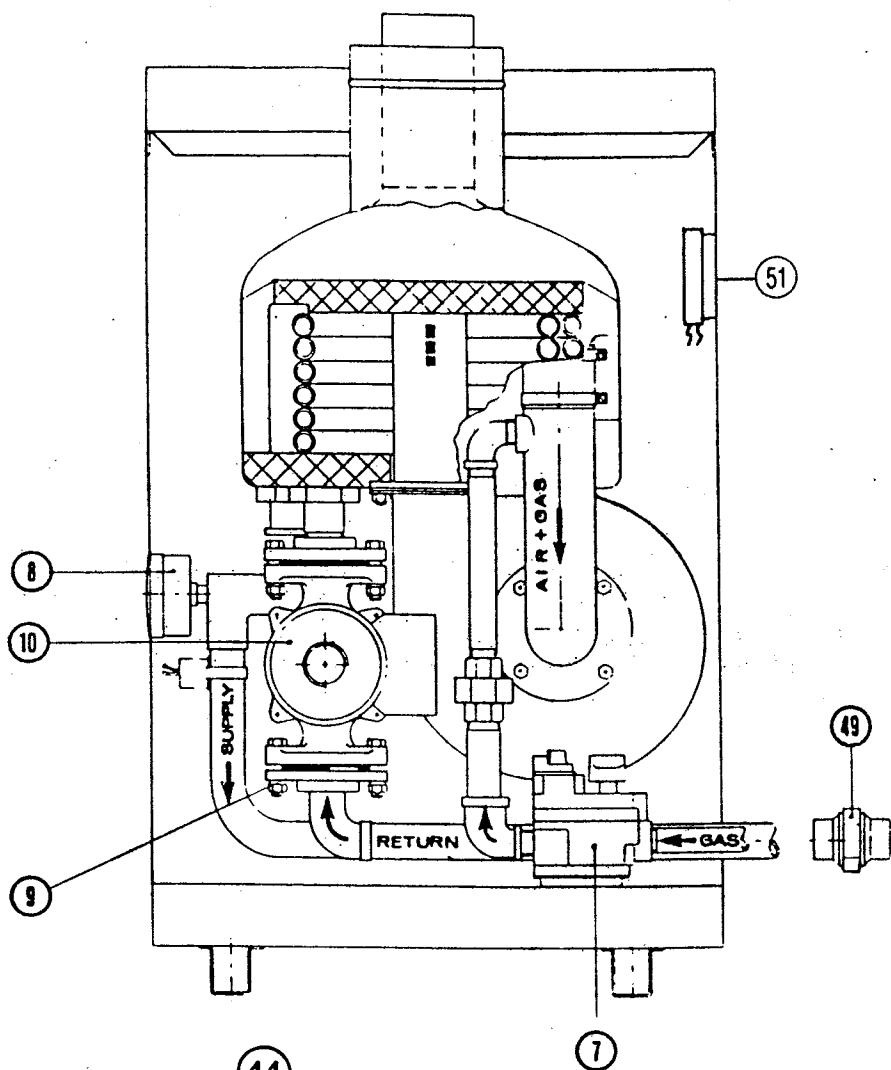


BASIC SCHEMATIC

H-SERIES

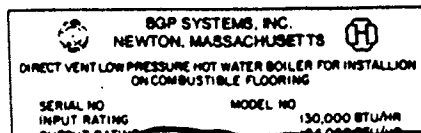
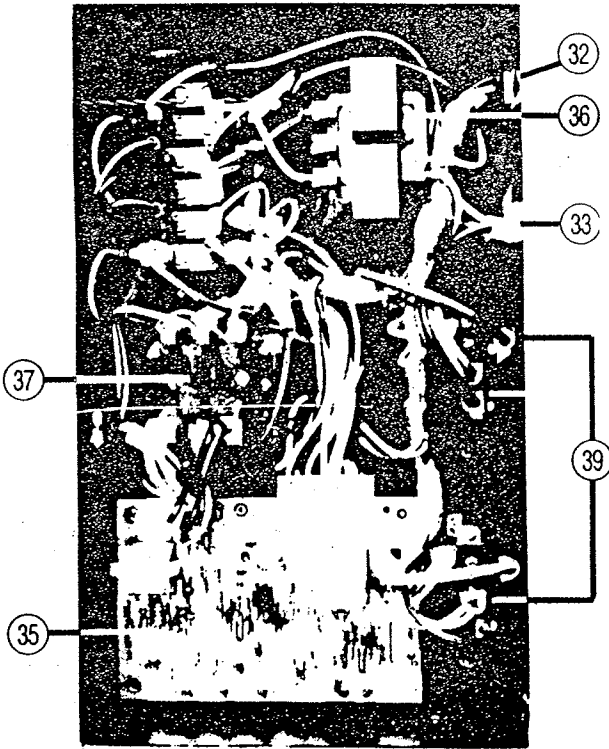
The H-Series is designed to supply only hot water for space heating. It has a unique system to prevent cold water from entering the boiler and causing the condensation of water vapor from the products of combustion. In this system a thermostat prevents the water from leaving the unit at less than 160°F and forces the cooler water through the bypass back into the boiler.





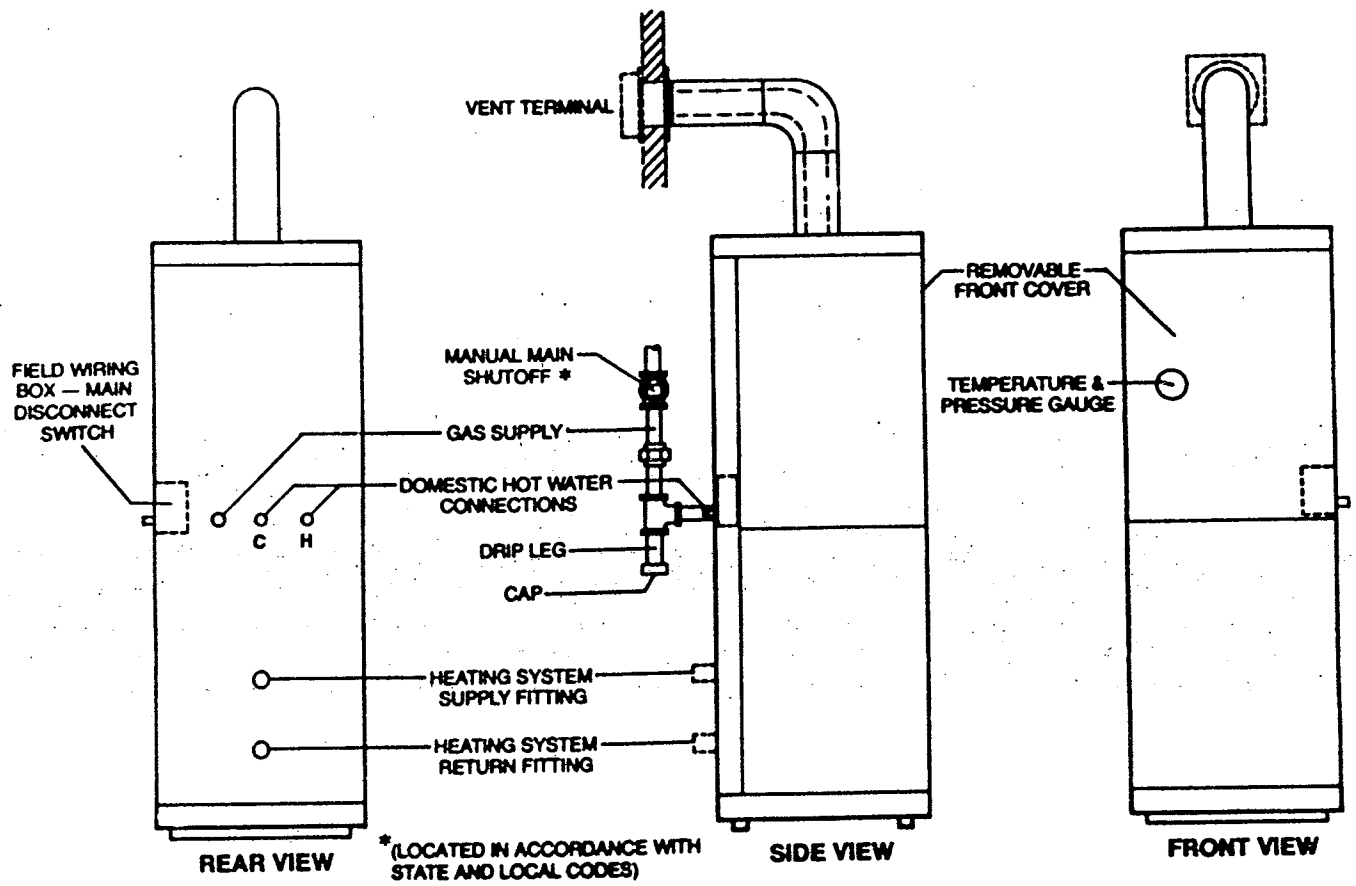
PARTS LISTING

NUMBER	PART NUMBER	PART NAME
1	2601-001	Assembly, combustion chamber top
2	2600-402	Retainer, insulation
3	2600-026	Insulation, coil cover
4	2601-002	Assembly, combustion chamber coil
5	2600-055	Gasket, flameholder/blower
6	2602-003	Flameholder (burner)
7	2600-264	Gas valve, Robertshaw/White Rodgers
8	2600-463	Gauge, press/temp back mount
9	2600-057	Gasket, pump
10	2600-051	Pump, unit
11	2600-049	Blower/motor
12	2600-056	Gasket, blower intake
13	2600-220	Assembly, blower intake duct
14	2600-506	Coupling, air duct
15	*	Orifice, air
16	2600-066	Tubing, balance line
17	2600-046	Nut and ferrule
18	2600-044	Union, orifice
19	*	Orifice, gas
20	2601-353	Coil, single wall D.W.H.
21	2601-283	Coil, double wall D.W.H.
22	2600-493	Air vent
23	2601-287	Assembly, storage tank
24	2601-041	Control, low limit
25	2601-458	Control, safety limit
26	2600-359	Igniter
27	2600-355	Gasket, igniter
28	2600-279	Gasket, D.W.H. coil (flat type)
29	2600-491	Gasket, D.W.H. coil (w/o holes)
30	2600-324	Vent, coin, boiler coil bleed
31	2601-457	Control, operating
32	2600-507	Harness, wiring (load)
33	2600-084	Harness, wiring (line)
34	2600-444	Fitting, boiler discharge
35	2600-263	Flame safety, Fenwal
36	2601-260	Transformer, 120/24 VAC, 30 VA
37	2600-261	Relay (R1)
38	2600-111	Switch, 120 volt
39	2600-262	Relay (R2 and R3)
40	2600-361	Thermal Cut-Off (TCO)
41	2600-126	Lower panel, jacket
42	2600-452	Access panel, jacket
43	2600-432	Top panel, jacket
44	2600-118	Pipe, 3" vent
45	2600-116	Pipe, 5" air
46	2600-119	Elbow, combination vent and air
47	2600-102	Termination, vent
48	2600-313	Extended Termination, vent
49	2600-129	Thermostat, supply water
50	2600-473	Tube, boiler discharge
51	2600-598	Stack switch

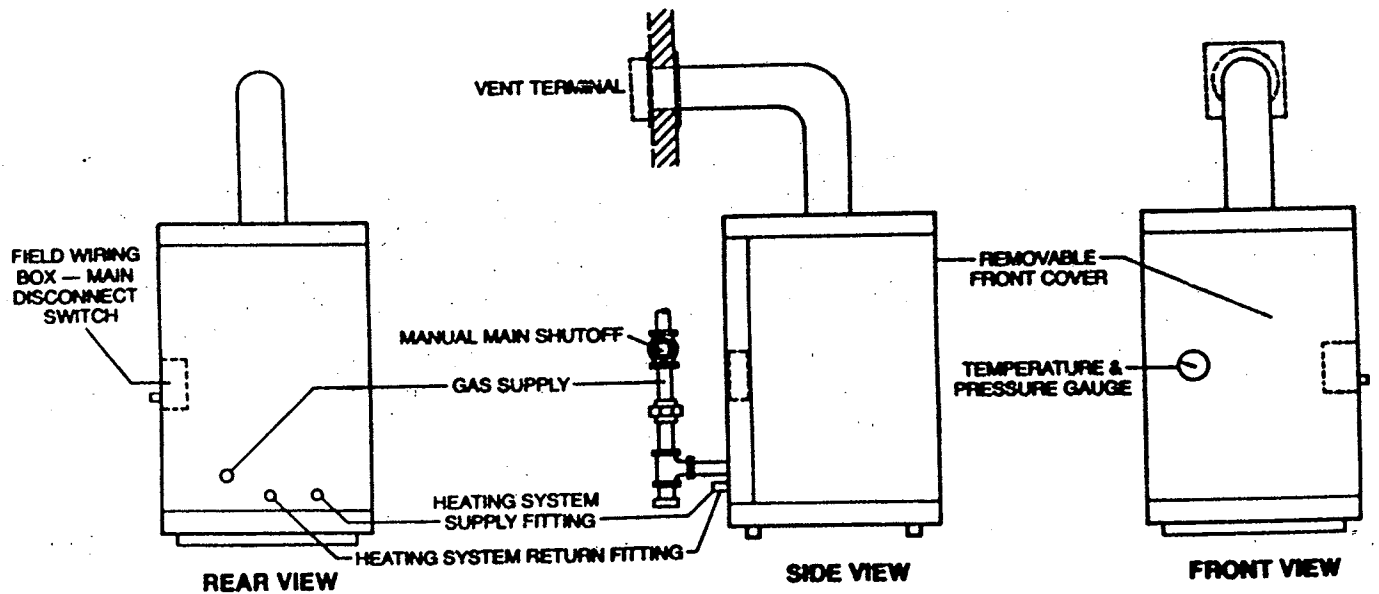


When ordering parts, be sure to include the following information:
Unit Model Number Part Number
Unit Serial Number Part Description

* NOT SOLD SEPARATELY - ORDER ORIFICE KIT
FOR DESIRED INPUT AND TYPE OF GAS



HW-SERIES (Integrated Appliance)



H-SERIES (Hydronic Heating Only)

NEW INSTALLATION

STARTUP AND CHECKOUT PROCEDURE:

1. Be sure system and unit are filled with water.
2. Bleed air from combustion chamber coil.
3. Open gas cock(s).
4. Turn gas valve control to 'ON' position.
5. Set thermostat to call for heat.
6. Turn on electrical switches.
7. The unit pump will start immediately and the igniter will be energized.
8. In approximately 1/2 minute, the blower and gas valve will be energized and ignition will take place. If there is air in the gas line and ignition is not obtained, the blower and gas valve will shut off on flame safety. Reset control by momentarily switching off disconnect switch.
9. **Check Burner Input**
Unit should be in operation 15 minutes before checking input. The input should be within +2% of rating plate rating. If the firing rate is in this range, proceed to step 10. Because of altitude and other minor variances, it is possible the input will not fall within this range and the gas orifice will have to be replaced. See adjusting burner/input. Do not attempt to adjust the input by adjusting the regulator on the gas valve.
10. It is recommended that the unit be checked with a standard CO₂ or O₂ tester after checking input. Insert tester probe at least 6" into the exhaust pipe through the outside vent terminal. Readings should be:
CO₂ — 8% to 9.25% natural gas,
 9.2% to 10.8% propane
O₂ — 6.75% to 4.5%
If readings do not fall within the above ranges, refer to adjusting burner/input.
11. **Check Limit Operation**
 - a. **HW-Series Operating and Low Limit Control**
 1. When water temperature reaches low limit set-point (180°F) with no call for heat, HeatMaker will shut down.
 2. Turn up room thermostat. Unit pump (inside jacket) will run.
 3. If water temperature is below the operating control cut-out temperature burner and system circulator will operate.
 4. When operating control cut-out temperature is reached, about 200-210°F, burner will go off and unit pump and system circulator will continue to run until thermostat is satisfied or operating control cut-in temperature (170°F) is reached. At 170°F burner will come on again if thermostat is not satisfied.
 5. If boiler water temperature drops below 150°F, thermostat and system circulator will be de-energized and burner will continue to run.
 - b. **H-Series Operating Control**
 1. Burner will run until operating control cut-out temperature is reached (200-210°F). Unit pump and system circulator will operate until thermostat is satisfied. If thermostat is not satisfied burner will come on again at 170°F.
12. **Safety Operation**
 - a. **Safety Limit**
If, for any reason, the operating control does not stop burner operation the Safety Limit will interrupt power to the gas valve at 240°F.
 - b. **Thermal Cut-Off (TCO)**
If there is no water in the boiler or the unit pump is not operating the TCO will interrupt power to the gas valve.
Operation of the Safety Limit or the TCO will cause burner control lockout. **DO NOT RESET WITHOUT DETERMINATION OF THE CAUSE OF THE SAFETY OPERATION.**

ADJUSTING BURNER/INPUT

The HeatMaker burner system is a pre-mixed, forced combustion system. Outside air is drawn through the air orifice (located in the air induction system) and mixed with the gas drawn in downstream of the air orifice. The gas is metered through an orifice located in the gas orifice union. All the air required for complete combustion, plus some excess air, comes into the system in this manner. There is no secondary air for combustion and the burner (flame-holder) cannot be observed.

Adjusting the input is limited to changing the gas orifice to achieve the proper input. The air orifice cannot be altered and the gas valve pressure setting cannot be changed.

Before changing the gas orifice to correct input, service representatives should make the following checks:

1. The pressure on the inlet side of the gas valve is between 4" and 14" water column.
2. The pressure on the outlet side of the gas valve is between negative .05 and negative .35" water column with the unit operating.

To increase the input, install larger diameter gas orifice. To decrease the input, install smaller diameter gas orifice. Each size will change the input approximately 5 C.F.H. Once the correct input has been achieved, the burner should be checked with an oxygen (O₂) or carbon dioxide (CO₂) gas analyzer.

The unit should be in operation 15 minutes before adjusting input or taking CO₂ or O₂ readings. This time will allow for good pre-heating of the intake air.

Insert the probe of the O₂ or CO₂ tester at least 6" into the vent through the vent terminal. If CO₂ is being measured, the readings should be between 8.0 and 9.25 for natural gas and 9.3 and 10.7 for propane. If O₂ is being measured, the readings should be between 6.75 and 4.5.

Measuring CO₂*

Readings below 8 generally indicate a lean mixture (not enough gas). Readings above 9.5 generally indicate a rich mixture (too much gas). Inputs should be increased or decreased to correct lean or rich mixtures.

NOTE: If the mixture is very rich (not enough air for complete combustion), it is possible to get low readings on a CO₂ analyzer. This situation does not occur often but it can be detected if reading continues to go lower as the input is increased. If this condition is suspected, a CO test should be taken at the vent outlet. Inputs must be reduced to correct high CO reading and to bring CO₂ readings to proper levels.

Measuring O₂

Readings above 6.75 indicate a lean mixture (not enough gas). Readings below 4.5 indicate a rich mixture. Inputs should be increased or decreased to correct lean or rich mixtures.

*When operating on natural gas

CLEANING COMBUSTION CHAMBER COIL

(Refer to Page 5)

1. Turn off electric and gas supplies and remove the jacket.
2. Remove the vent assembly and top cover.
3. Remove the top half of the combustion chamber by removing the 3 screws and nuts that clamp the top half to the bottom half, the clamp on the induction tube and the 1/8" diameter balance line.
4. Remove the top insulator cap by spreading the retainer.
5. Remove the igniter.
6. Clean the finned tubing with a wire brush and vacuum all loose material from the combustion chamber.
7. Replace all parts in the reverse order in which they were removed.
8. Restart the unit as indicated by the operating instructions plate.

UNIT PUMP

The unit pump operates whenever there is a call for heat or when the boiler low limit is not satisfied.

It is a wetted-rotor type pump and should always be filled with water when it is operating so that it will cool properly. On new installations, the rotor cavity should always be bled before operation. The pump is fitted with a bleed cap at the motor end. The cap is used for bleeding and also for access to the screwdriver slot on the end of the rotor. This slot can be used to turn the rotor if it has become stuck with sediment after long shutdowns. Note: It is not unusual for this to happen with this type of pump. If the rotor can be freed and the pump runs quietly after a minute or two, it is not necessary to change the pump.

If a pump change is required for any reason, valve off the boiler and drain approximately 1 or 2 gallons of water from the unit. Turn off the main disconnect switch, remove pump junction box cover, disconnect pump wires, remove electrical connector and pump motor. The pump housing need not be removed. The replacement pump motor should be installed in the reverse order from which the old pump motor was removed. After filling the system be sure to bleed the pump and coil before operation.

PUMP RELAY (R2)

The pump relay accepts 24 VAC signal from the control circuit and provides 120 VAC power to the pump.

GAS VALVE

The gas valve is a solenoid operated, negative pressure regulated valve. The outlet pressure is regulated at minus .2 inches w.c. It is designed to operate with supply pressures of 4-14 inches w.c. Within that range of supply pressures, the regulated discharge pressure may vary from minus .05 to minus .35 inches w.c. The regulator is not adjustable and the effect of this variation in discharge pressure is not significant. Because of the fixed regulator setting, gas flow must be adjusted by changing the gas orifice.

To remove the gas valve shut off master gas cock in gas line, loosen the nut on the gas orifice union and remove the orifice union plus piping to the gas valve. Turn off the main disconnect switch and disconnect the wires from the gas valve. The valve may now be unscrewed from the inlet piping. It may be necessary to deflect the inlet piping somewhat in order to clear the boiler jacket. After the valve has been removed, replace with a new valve in the reverse order in which the old valve was removed. Do not over tighten the fittings into the valve body as this may cause damage to the valve.

SAFETY LIMIT SWITCH

The safety limit switch has a fixed set point of 240°F. It has a differential of 45°F, therefore, it cuts out at 240°F and makes contact again at 195°F.

To replace the switch, shut off the main electrical disconnect switch and valve off the boiler, drain 1 or 2 gallons of water from the boiler and remove the nut which holds the safety limit bulb in the boiler discharge fitting. Remove the bulb from the fitting and remove the 2 screws which hold the switch assembly to the electrical control box.

Disconnect the 2 wires from the quick connects on the switch and remove the safety limit assembly. To replace, perform the same operations in reverse. Fill the boiler and be sure to bleed the pump and coil. Turn on disconnect switch and check boiler operation.

OPERATING CONTROL

The operating control maintains boiler discharge temperature between 170°F and 210°F during the space heating cycle. It has a fixed set point of 210°F and a differential of 40°F, therefore, its contacts open at 210°F and they reclose at 170°F.

If replacement is necessary, shut off the main disconnect switch, remove the clip which holds the sensor to the boiler discharge fitting and disconnect the wires in the control box. Remove sensor and replace in the reverse order. Check boiler operation after installation of new operating control.

THERMAL CUT-OFF (TCO)

The TCO is a safety device which prevents boiler operation with inadequate water flow. It is located between the first and second passes of the boiler heat exchanger coil and senses the presence of uncooled high temperature flue gases resulting from low water or air in the coil. It is accessible through the bottom of the boiler chamber.

If replacement is necessary, shut off the main disconnect switch, remove the two wires from the TCO and unscrew the control from the bottom of the chamber. Replace with a new control in the reverse order. Check boiler operation after installation.

IGNITER

The igniter is a "glow bar" type silicone carbide unit. It is energized whenever there is a call for boiler operation and is deenergized after startup (during normal boiler operation).

If the igniter fails and must be replaced, always install a new igniter gasket with the replacement igniter.

LOW LIMIT THERMOSTAT (HW-Series)

The low limit thermostat performs two functions. It controls the temperature of the water in the storage tank and it prevents the house circulator from operating when insufficient tank water temperature causes the domestic hot water delivery temperature to drop below 140°F. The low limit thermostat has a fixed differential of 15°F and is set to turn the burner on at 140°F tank water temperature and to turn it off when the sensor reaches 155°F. Because of the thermal lag in the sensor, the tank water temperature will reach about 180°F before the burner actually is turned off.

If replacement is necessary, shut off the main disconnect switch, remove the clip which holds the sensor to the domestic hot water outlet fitting and remove the low limit thermostat wires from the barrier strip. Replace in the reverse order being careful to attach the low limit thermostat wires to the correct terminals.

BLOWER

The combustion air blower is a high head centrifugal blower. It is designed to provide about 2" w.c. of suction at 30 CFM. This performance is necessary to operate the gas valve reliably, to overcome induction system friction losses and to eliminate any sensitivity to wind striking the vent terminal. It is powered by a 120 volt motor which draws about 1.3 amps at rated load.

It is controlled by the flame safety. Whenever there is a trial for ignition or a flame is being sensed, the blower and gas valve should be energized.

If a blower change is required, turn off the main disconnect switch and unplug the power wires from the blower motor. Remove the three nuts from the blower discharge flange and the four nuts from the blower inlet flange. The blower may now be deflected enough to permit its removal.

Replace the new blower using new gaskets, in the reverse order from which the old blower was removed. The four inlet flange nuts, however, should only be finger tight initially and then tightened with a wrench after all other operations have been completed.

The combustion should be checked for correct air-fuel ratio whenever the blower is replaced (see Burner Adjustment).

BLOWER RELAY (R3)

The blower relay accepts 24 VAC signal from the burner control and provides 120 VAC power to the combustion air blower.

THERMOSTAT RELAY (R1)

The thermostat relay is a double pole relay which accepts a 24 VAC signal from the room thermostat and provides 120 VAC power to the system circulator through one set of contacts and 24 VAC power to the boiler control through the other set of contacts.

BURNER CONTROL

The burner control is a hot surface ignition system control and flame monitor. When energized it provides 120 VAC power to the igniter for ignition. After ignition it functions as a flame sensor, using the igniter as a probe.

TRANSFORMER

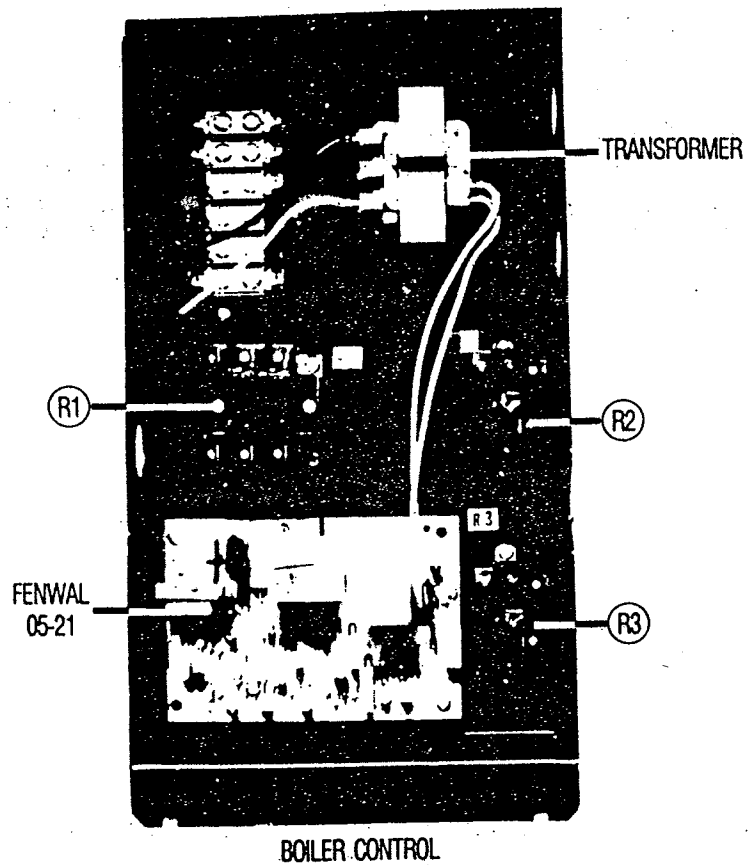
The control transformer accepts 120 VAC power and provides 30 VA of 24 VAC power for the boiler control only. It is not capable of supplying control power for external devices such as zone valves. They must have their own separate power supply.

STACK SWITCH

The stack switch is a normally open single pole switch which is operated by the pressure difference across the air orifice. It is set to close when a static pressure difference of 1 in. w.c. is generated by the combustion air blower. Its function is to prove air flow and to inhibit burner operation in the event of flue or chimney stoppage. The switch is wired in series with one of the gas valve solenoid, the TCO and the safety limit switch. It is located on the inside of the jacket back panel adjacent to the boiler bracket.

TROUBLE SHOOTING

RELAY CONTROL SYSTEM/FENWAL 05-21



TROUBLE SHOOTING RELAY CONTROL SYSTEM/FENWAL 05-21

BOILER CONTROL

Boiler control is accomplished by the use of field replaceable relays. They are responsible for maintaining storage tank temperature (HW-Series) and responding to a call for heat (on all models).

Storage Tank Temperature Control (HW-Series)

When the storage tank temperature drops below the setpoint of the low limit switch and the low limit contacts close (RED-BLK), the burner control and unit pump will be energized. After 45 seconds the burner will operate under the supervision of the burner control. When the tank temperature reaches the setpoint of the low limit switch, the contacts will open (RED-BLK) and close (RED-BRN) and the burner will stop. If there is a call for heat the circulator will run. If, however, there is a call for heat before the low limit contacts close (RED-BRN), the circulator will be prevented from running.

Control on a Call for Heat

When there is a call for heat the low limit switch (HW-Series) is shunted and the unit pump, system circulator*, and burner control are energized. After 45 seconds the burner will operate under the supervision of the burner control.

*The system circulator may be prevented from running as described in the above paragraph.

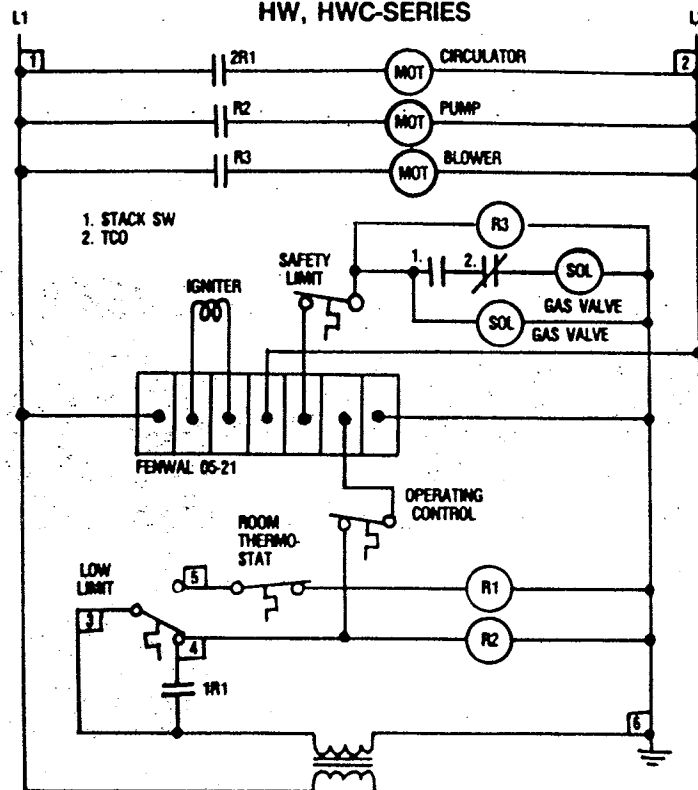
BURNER CONTROL

The burner control is a flame rectification type control. It passes a very small direct current to ground through the flame when there is combustion. If for any reason there is a loss of flame in the combustion chamber, the gas valve closes and another complete trial for ignition is initiated. If there is no ignition during this new trial for ignition the burner will lock out. Once lockout has occurred, the control must be reset by momentarily switching off the unit electrical disconnect switch. When the disconnect switch is again in the 'on' position, a normal trial for ignition will occur.

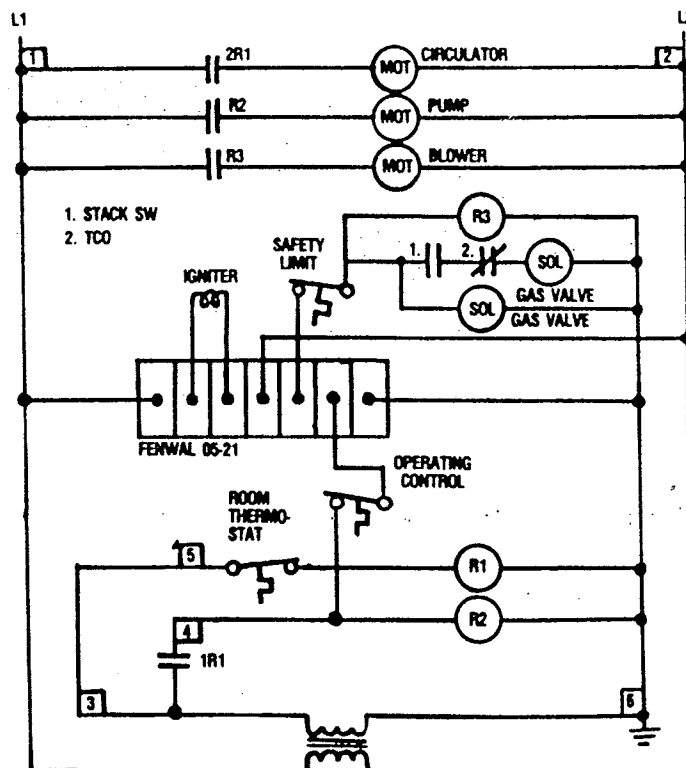
When the burner control is energized, it energizes the igniter for 45 seconds. At the end of the 15-second interval the igniter is switched off and becomes the flame sensor. Once the igniter makes that transition the gas valve and blower will only remain energized if a flame is sensed by the direct current flow to ground described above. To replace the burner control, remove the screws from the four (4) corners of the board, lift the board out and unplug the edge connectors. Replace the new board in the reverse order.

IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH APPLIANCE WIRE HAVING 4/64" THICK INSULATION AND 105°C TEMPERATURE RATING.

ELECTRICAL DIAGRAM
HW, HWC-SERIES



ELECTRICAL DIAGRAM
H, HC-SERIES



TROUBLE SHOOTING

RELAY CONTROL SYSTEM/FENWAL 05-21

The unit will continue to operate until the low limit is satisfied. Once the low limit is satisfied, contacts (RED-BRN) will close and contacts (RED-BLK) will open. The pump relay R2 and the burner control (through the operating control contacts) will be deenergized and the burner will shut off. (Figure D).

CALL FOR SPACE HEATING

When the room thermostat contacts close, if the low limit is satisfied, relay R1 is energized and the unit will operate through relay contacts 1R1 in the same sequence as for domestic water heating. (Figure E). Because the low limit is shunted by contacts 1R1, the unit will be controlled by either the room thermostat or the operating control. The house circulator is energized through contacts 2R1. If the low limit is not satisfied the room thermostat and relay R1 will be deenergized and the house circulator will not operate.

SEQUENCE OF OPERATION H-SERIES

CALL FOR HEAT

When the room thermostat contacts close, relay R1 is energized. The unit pump and the house circulator will be energized through contacts R2 and 2R1, respectively. The burner control is energized through the operating control contacts. The igniter is energized through the burner control. (Figure F).

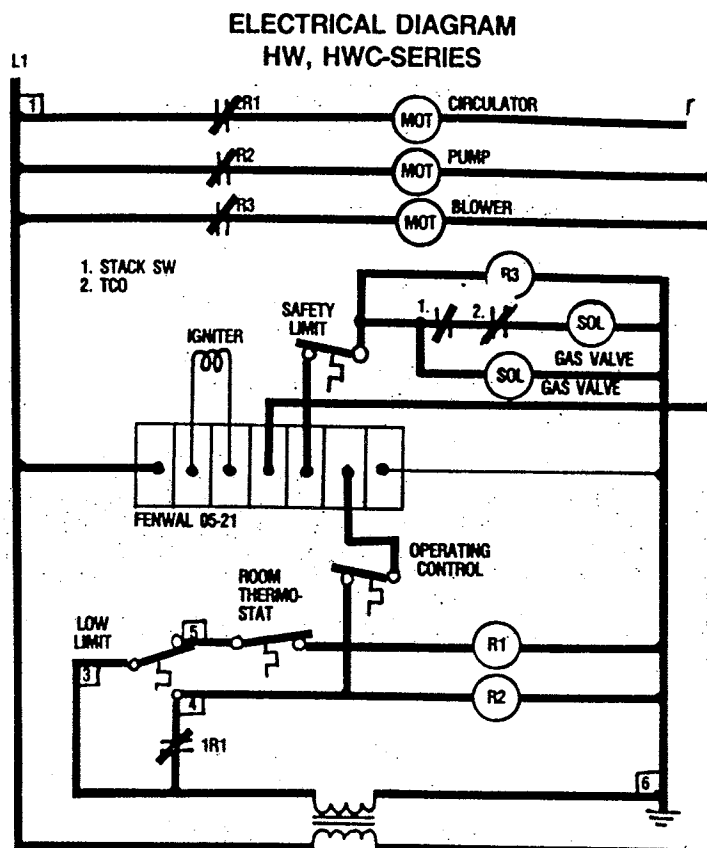


FIG. E

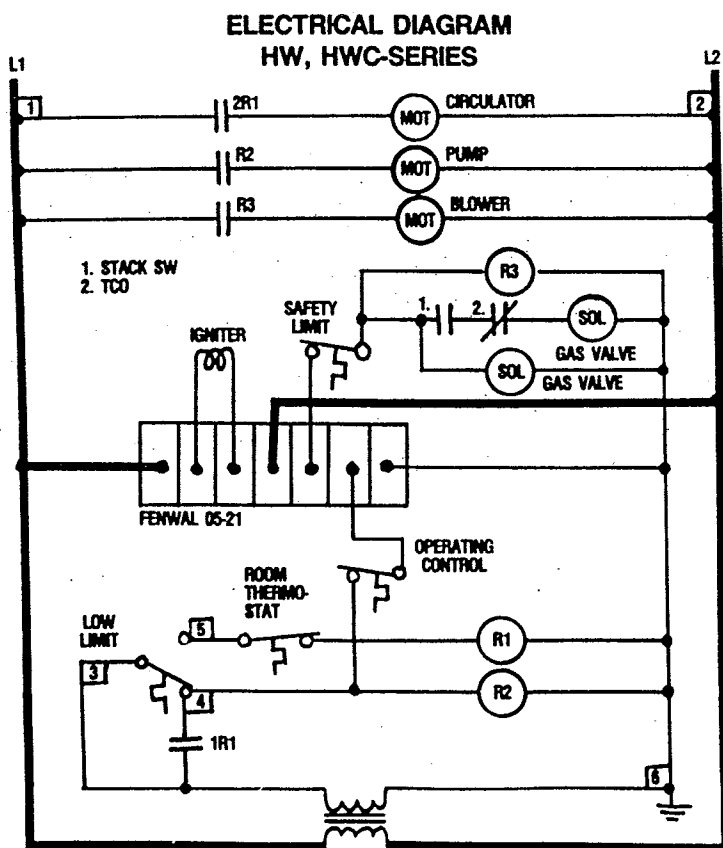


FIG. D

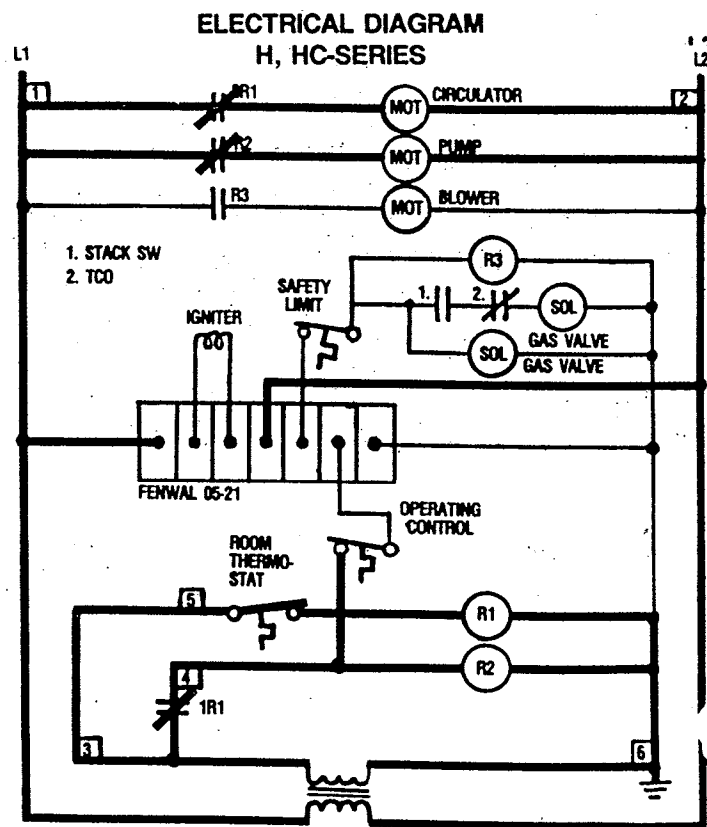


FIG. F

TROUBLE SHOOTING **RELAY CONTROL SYSTEM/FENWAL 05-21**

After 45 seconds the gas valve and the blower relay R3 will be energized by the burner control. They will remain energized for a 15-second trial for ignition period. (Figure G).

After the trial for ignition period the igniter is de-energized and becomes the flame sensor. The gas valve and the blower are then supervised by the burner control. (Figure H). They are deenergized in the event of a flame failure and the system returns to the original condition. (Figure F). The sequence will be repeated one more time and if the flame fails again the burner control will go into lockout. The control is reset by momentarily switching off the main electrical disconnect switch.

The burner will continue to operate until the operating control contacts open. The unit pump and the house circulator relay will remain energized until the room thermostat is satisfied. (Figure 1).

SAFETY OPERATION **ALL MODELS**

The safety controls are wired to interrupt the power to the gas valve in the event of an abnormal condition in the boiler. The safety limit switch is wired in series with both gas valve solenoid and relay R3 coil. The TCO and stack switch are wired in series with the low pressure solenoid only. Safety limit operation will prevent both gas flow and burner operation. TCO or stack switch operation will interrupt power to the low pressure solenoid of the gas valve only (Ref. ladder diagrams). Operation of the safety limit, TCO or stack switch will cause lockout. DO NOT RESET WITHOUT DETERMINATION OF THE CAUSE OF THE SAFETY OPERATION.

ELECTRICAL DIAGRAM **H, HC-SERIES**

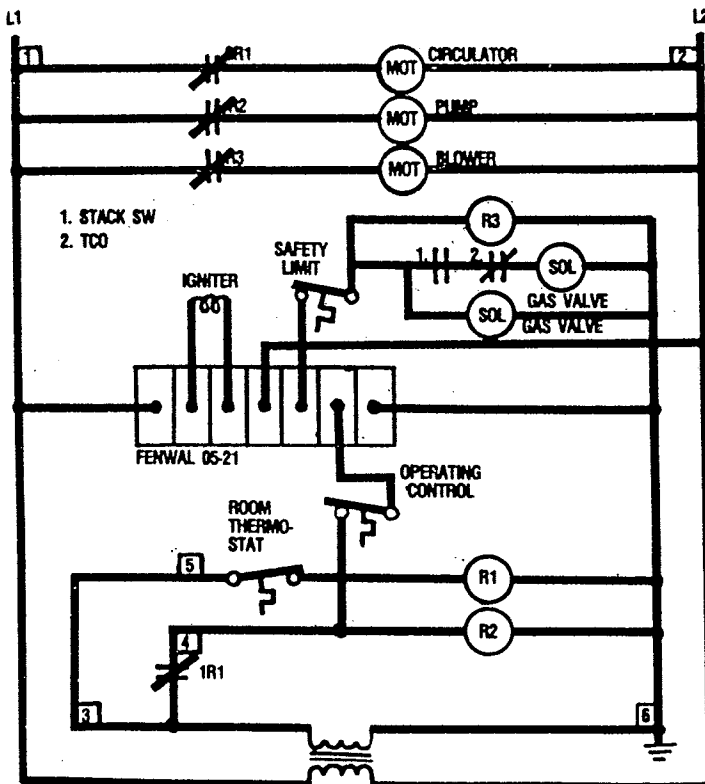


FIG. G

ELECTRICAL DIAGRAM **H, HC-SERIES**

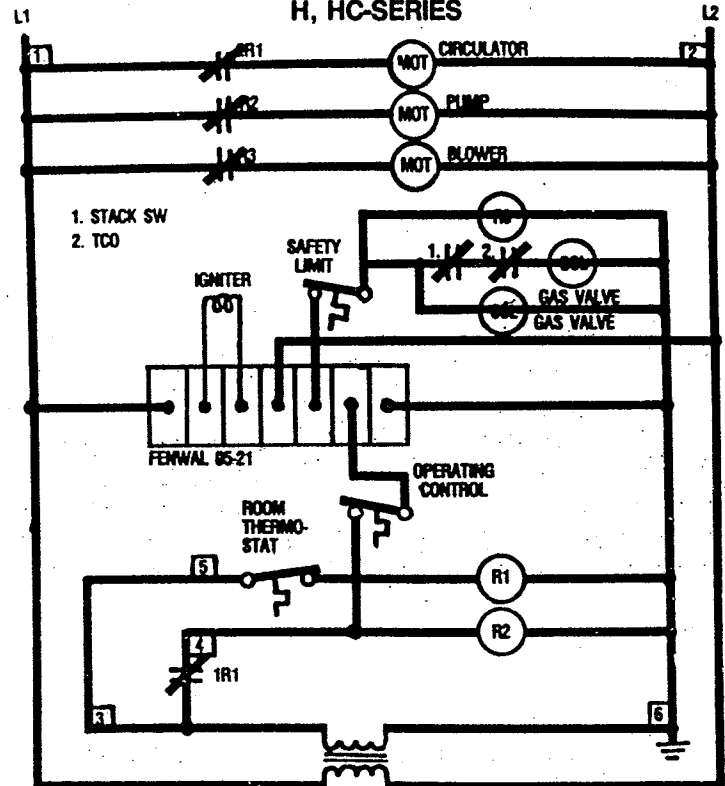


FIG. H

ELECTRICAL DIAGRAM **H, HC-SERIES**

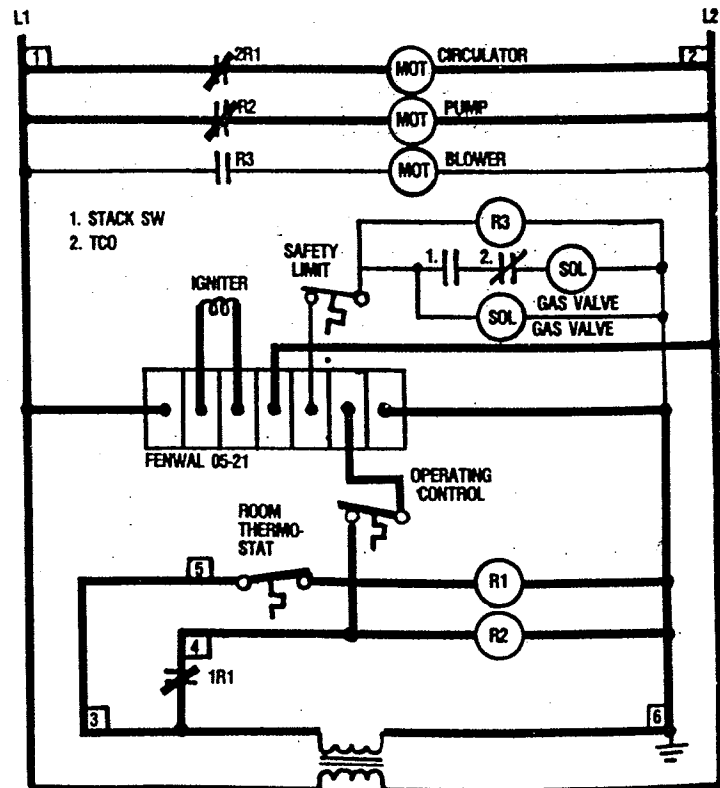
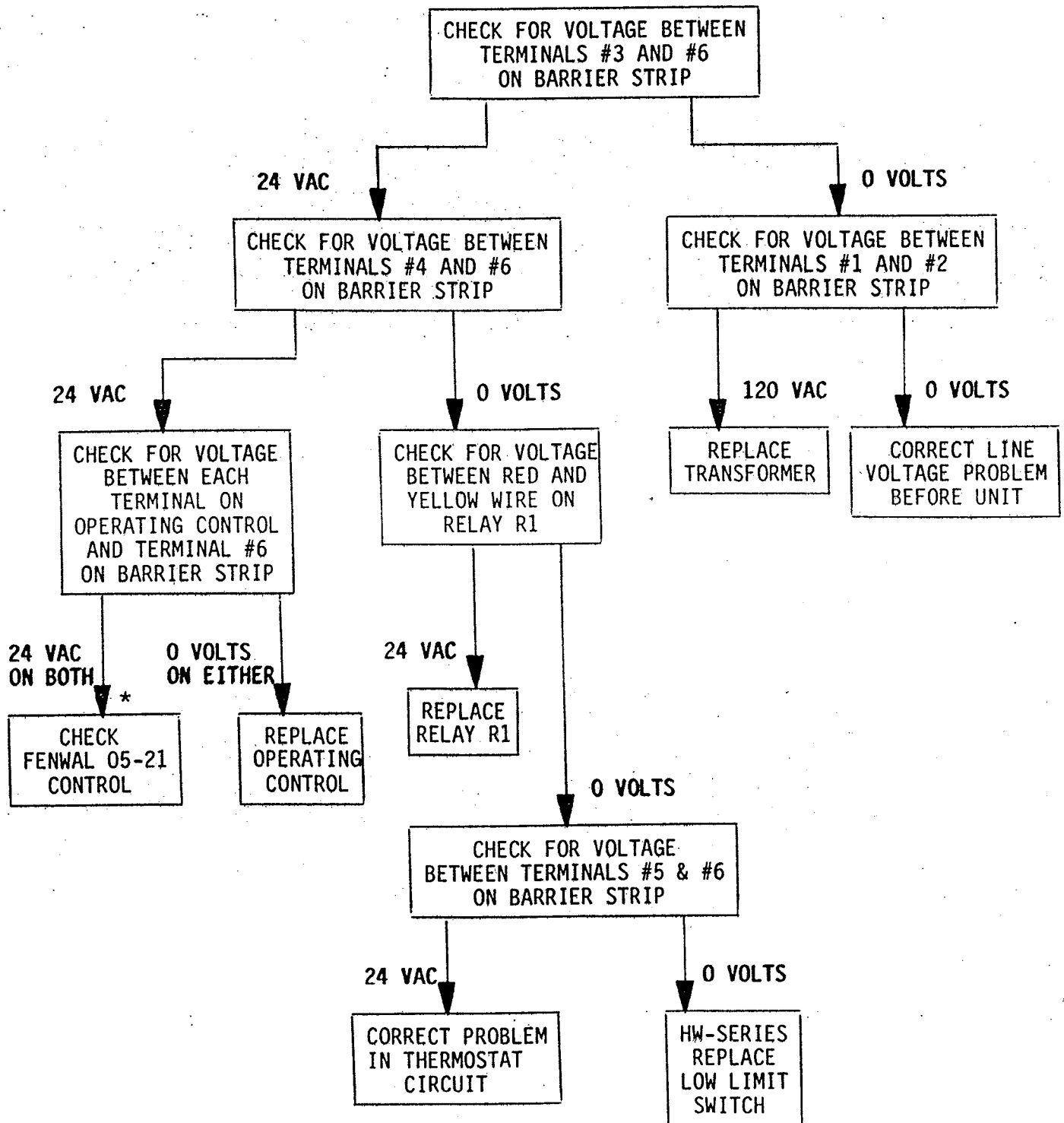


FIG. I

TROUBLE SHOOTING
RELAY CONTROL SYSTEM/FENWAL 05-21

UNIT DOES NOT START — THERMOSTAT SET TO CALL FOR HEAT
(BOILER TEMPERATURE BELOW 170°F)



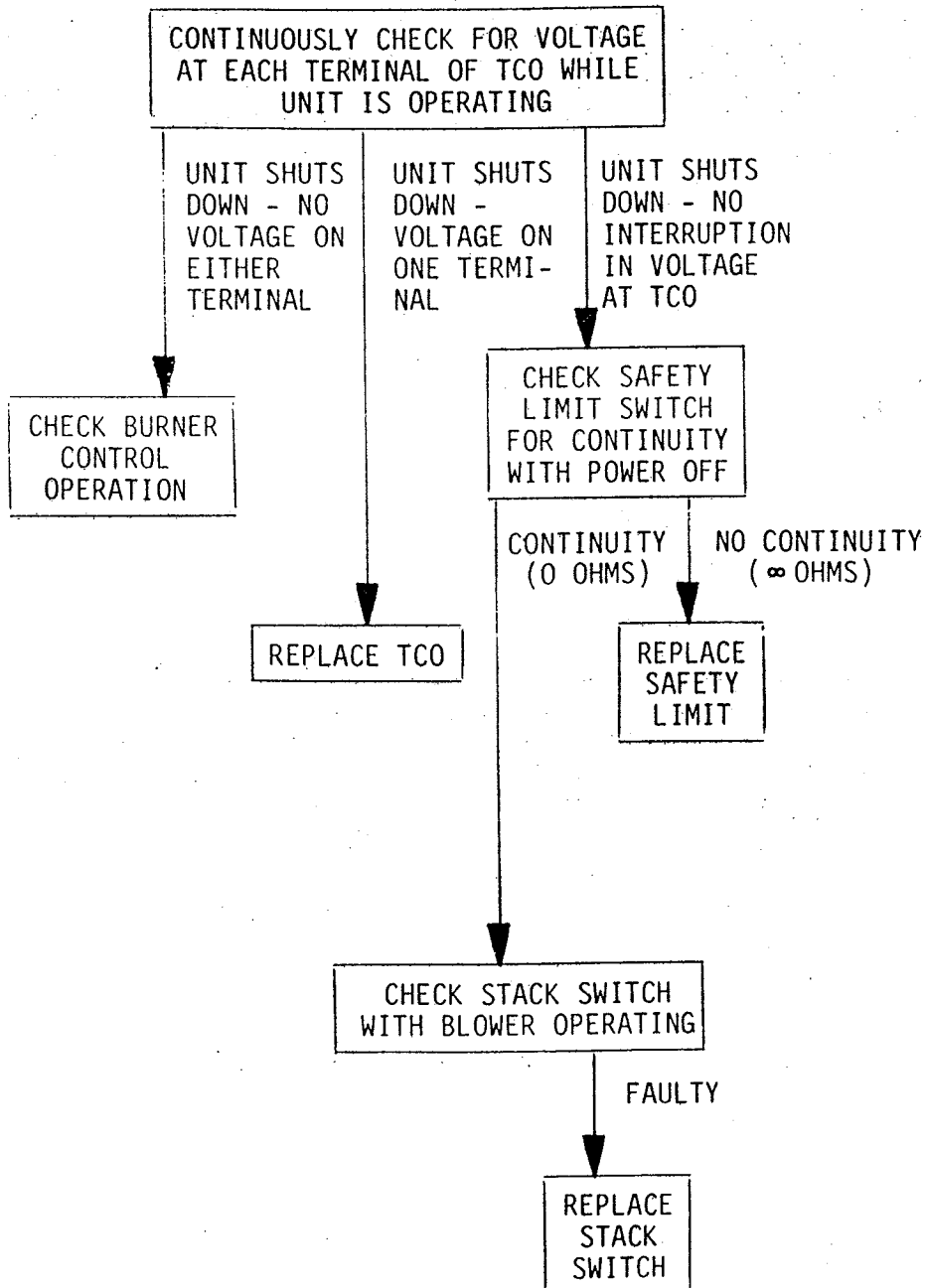
* CHECK SAFETY LIMIT ALSO BECAUSE AN OPEN SAFETY LIMIT WILL PROHIBIT BLOWER OPERATION AND THE UNIT WILL NOT APPEAR TO BE GOING THROUGH A TRIAL FOR IGNITION.

HW-SERIES

UNIT PERFORMS PROPERLY ON A CALL FOR HEAT
BUT FAILS TO MAINTAIN TANK TEMPERATURE

REPLACE LOW LIMIT SWITCH

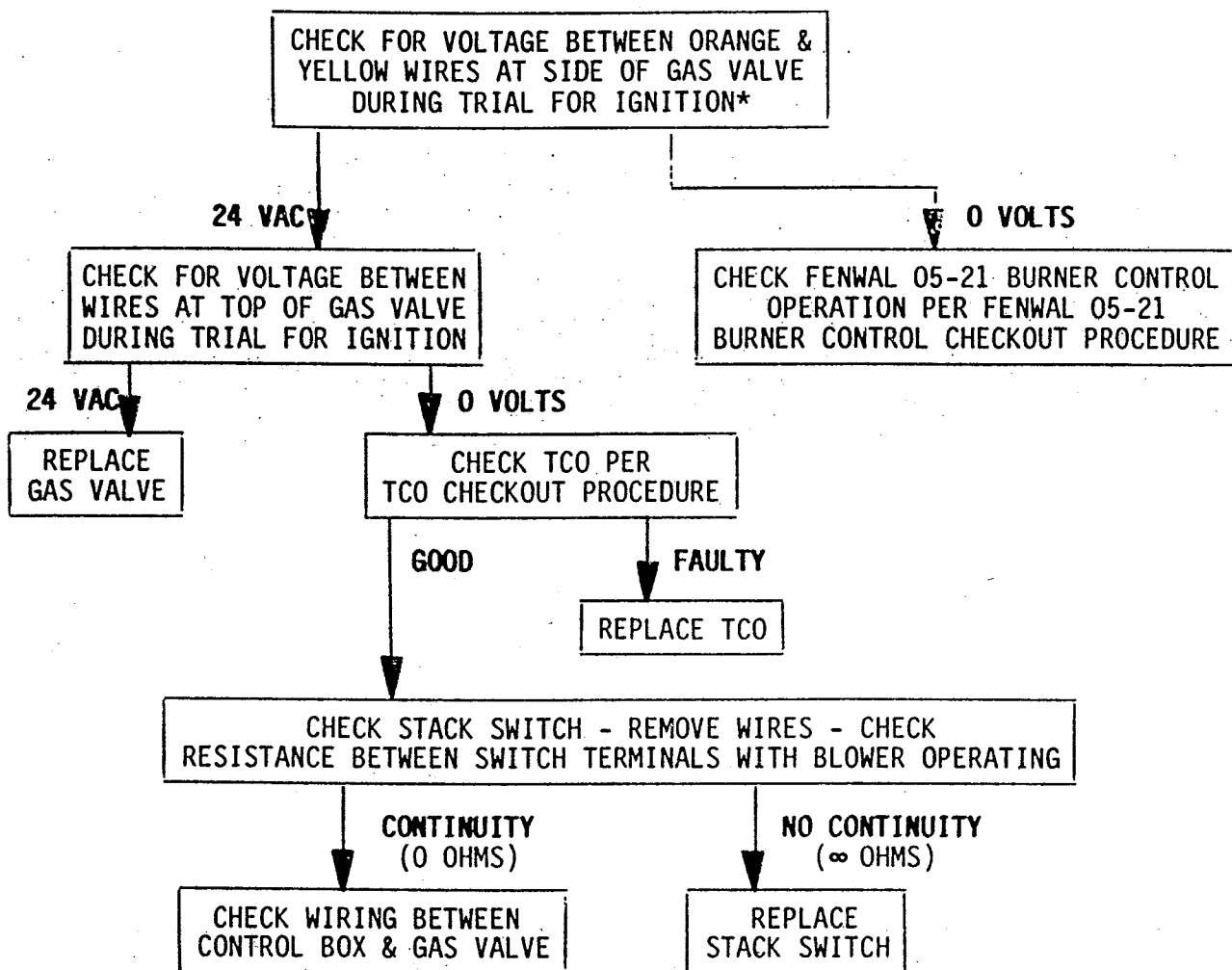
UNIT SHUTS OFF FOR NO APPARENT REASON BEFORE
ANY CONTROL CUT-OUT TEMPERATURE IS REACHED



TROUBLE SHOOTING
RELAY CONTROL SYSTEM/FENWAL 05-21

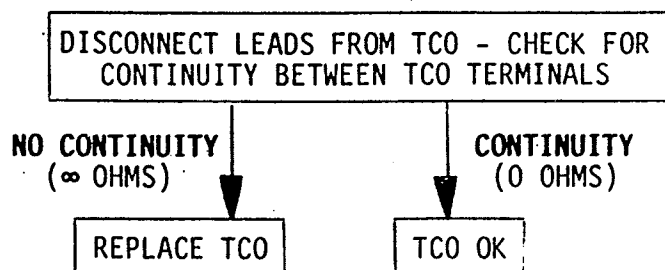
GAS VALVE

**NO GAS FLOW — BLOWER FUNCTIONING PROPERLY, ALL GAS
COCKS OPEN, NO OBSTRUCTIONS AT VENT ASSEMBLY**



* TRIAL FOR IGNITION PERIOD IS APPROXIMATELY FIFTEEN (15) SECONDS. RESET BURNER CONTROL BETWEEN MEASUREMENTS BY MOMENTARILY SWITCHING OFF DISCONNECT SWITCH.

THERMAL CUT-OFF (TCO) SWITCH

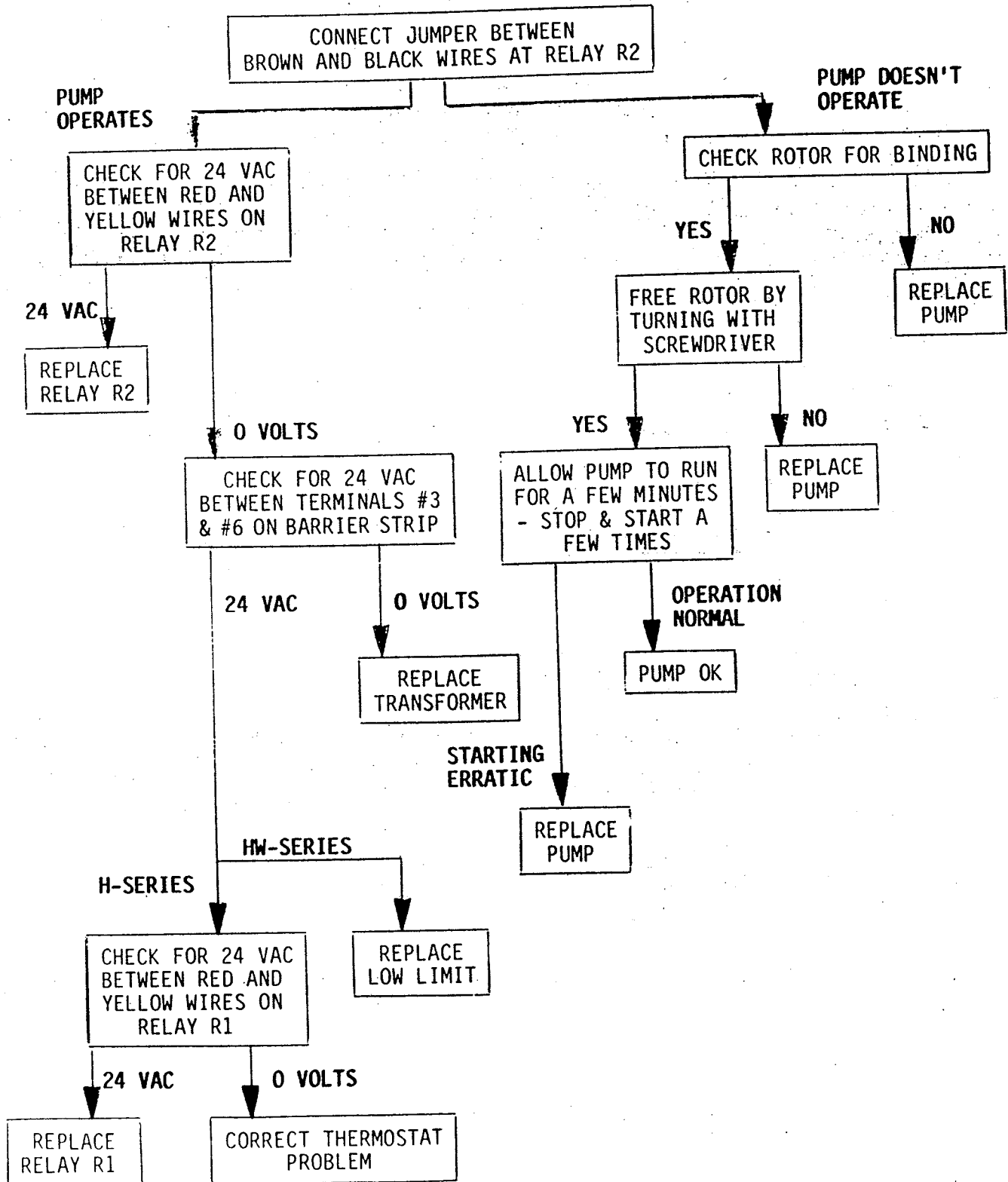


NOTE: INTERMITTENT TCO OPERATION CAN BE DETECTED MOST EFFECTIVELY BY BYPASSING THE TCO AND MONITORING ITS CONTINUITY WHILE THE SYSTEM IS RUNNING - DO NOT ATTEMPT TO DO THIS UNTIL IT HAS BEEN DETERMINED THAT THERE IS ADEQUATE WATER AND WATER FLOW (SYSTEM PUMP IS RUNNING).

UNIT PUMP

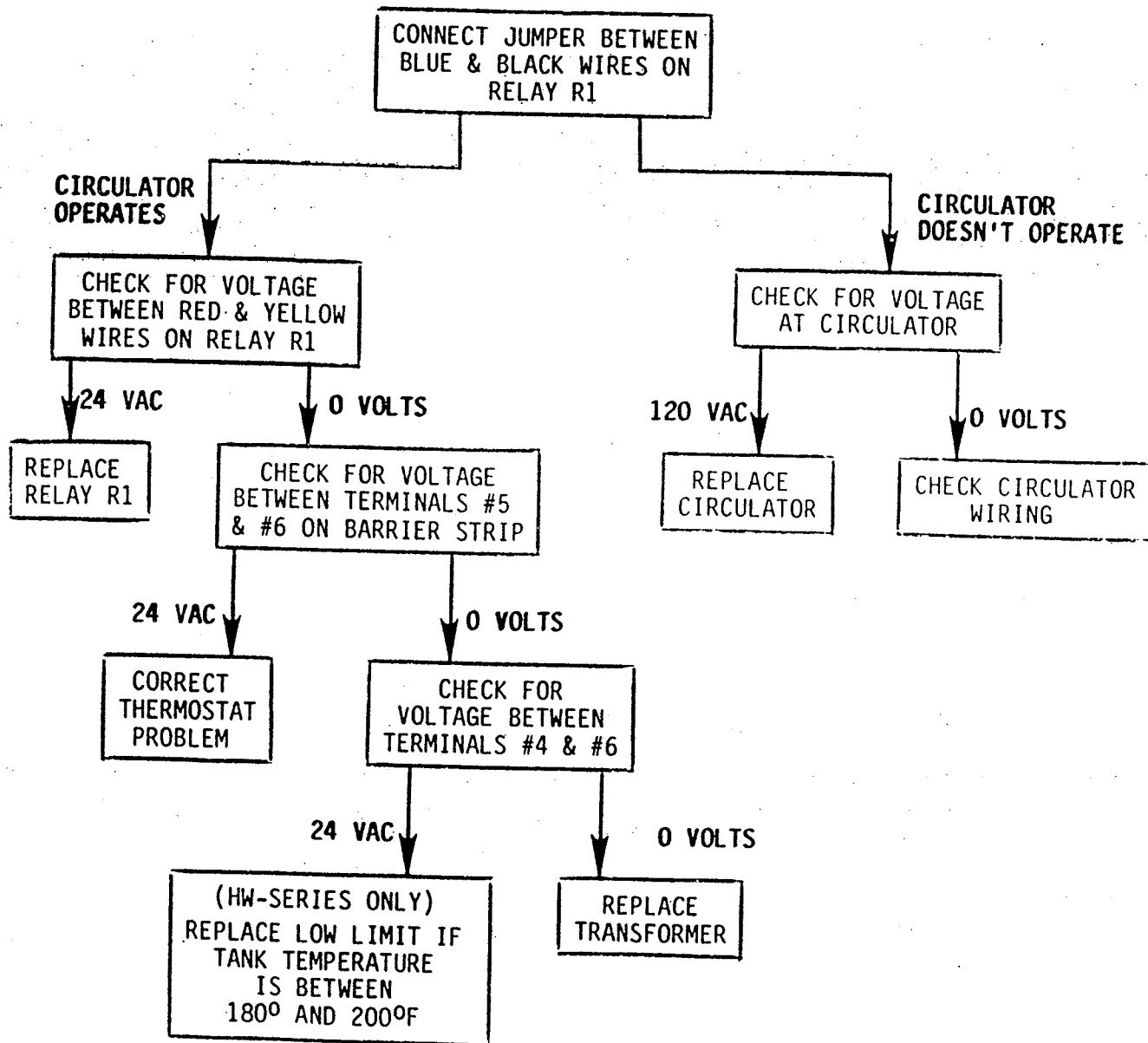
PUMP DOESN'T OPERATE

(TEMPERATURE BELOW 140°F - THERMOSTAT CALLING)



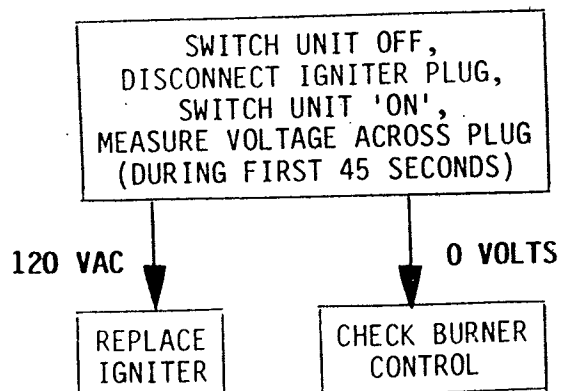
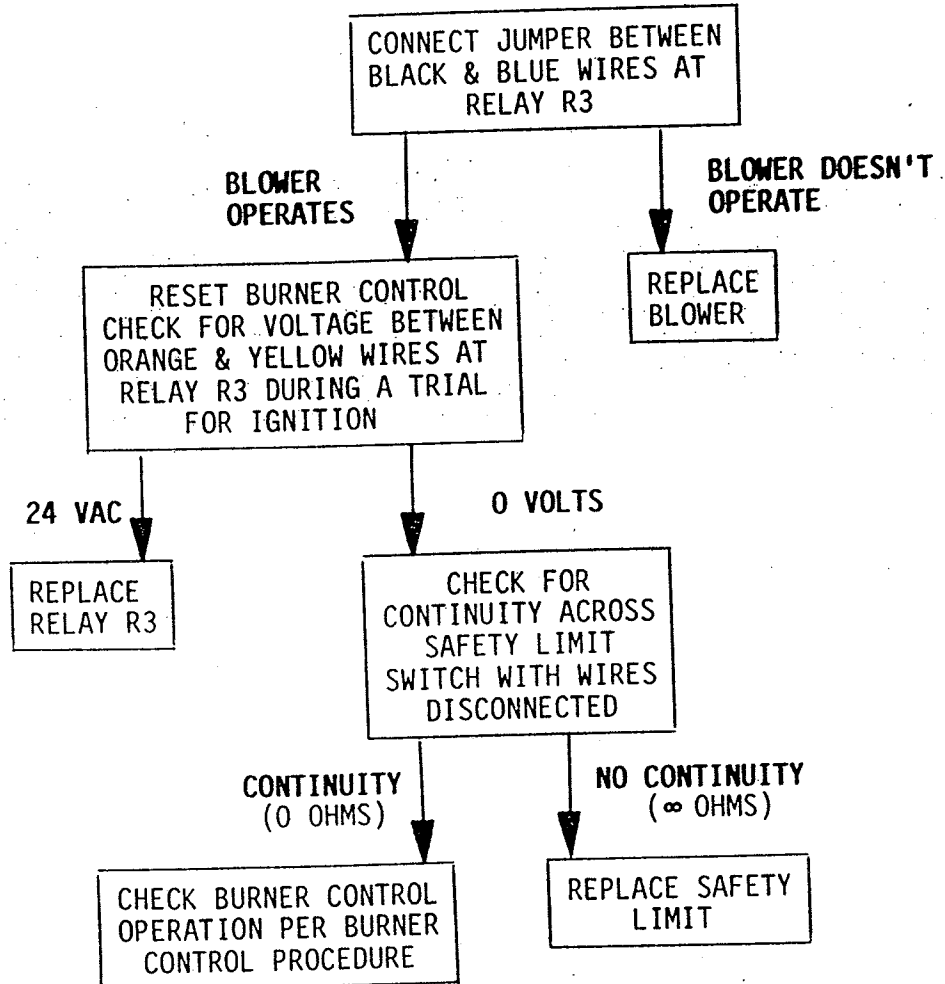
SYSTEM CIRCULATOR

CIRCULATOR DOESN'T OPERATE WITH A CALL FOR HEAT



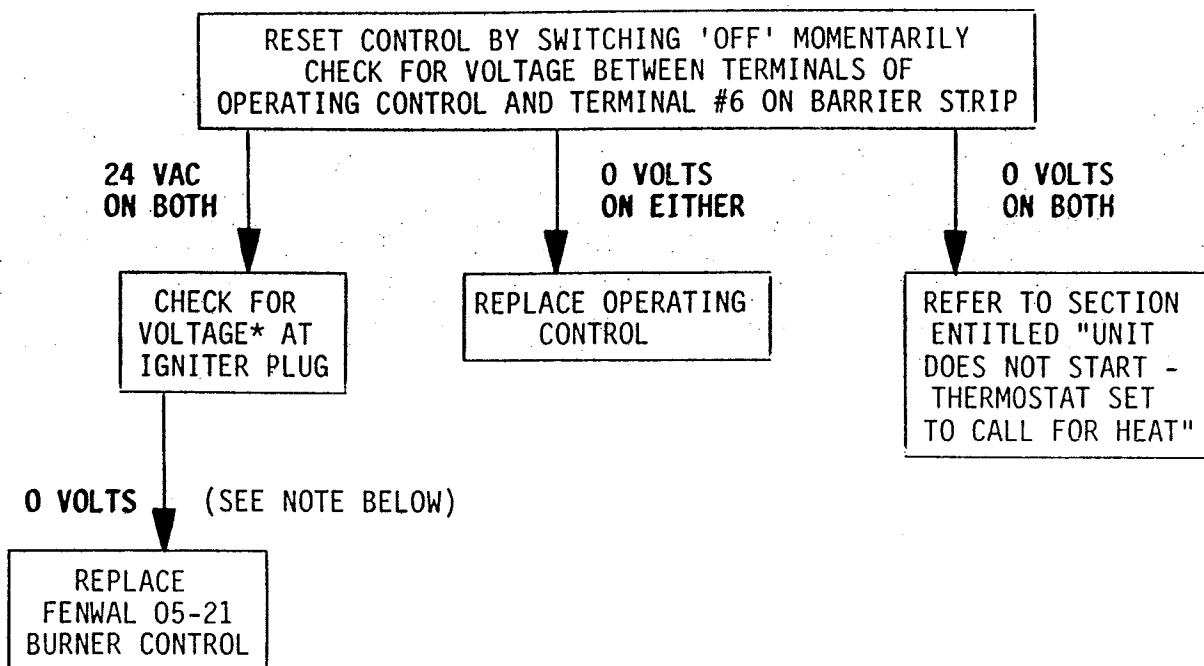
BLOWER

BLOWER DOESN'T OPERATE DURING A TRIAL FOR IGNITION



FENWAL 05-21 BURNER CONTROL

**NO VOLTAGE TO IGNITER — 120 VAC BETWEEN
TERMINALS #1 & #2 ON BARRIER STRIP**

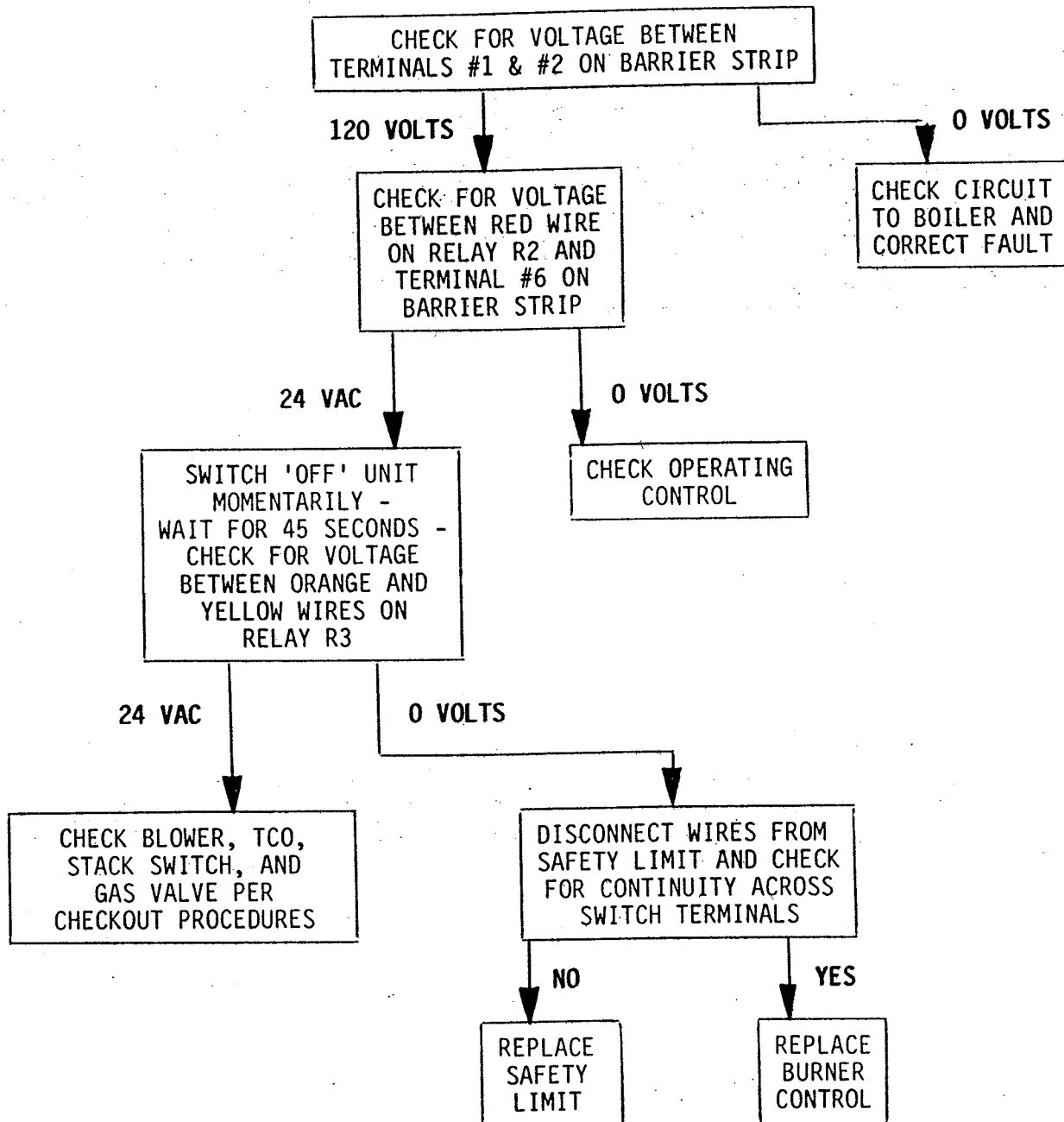


***VOLTAGE MUST BE CHECKED WITHIN 45 SECONDS AFTER RESET**

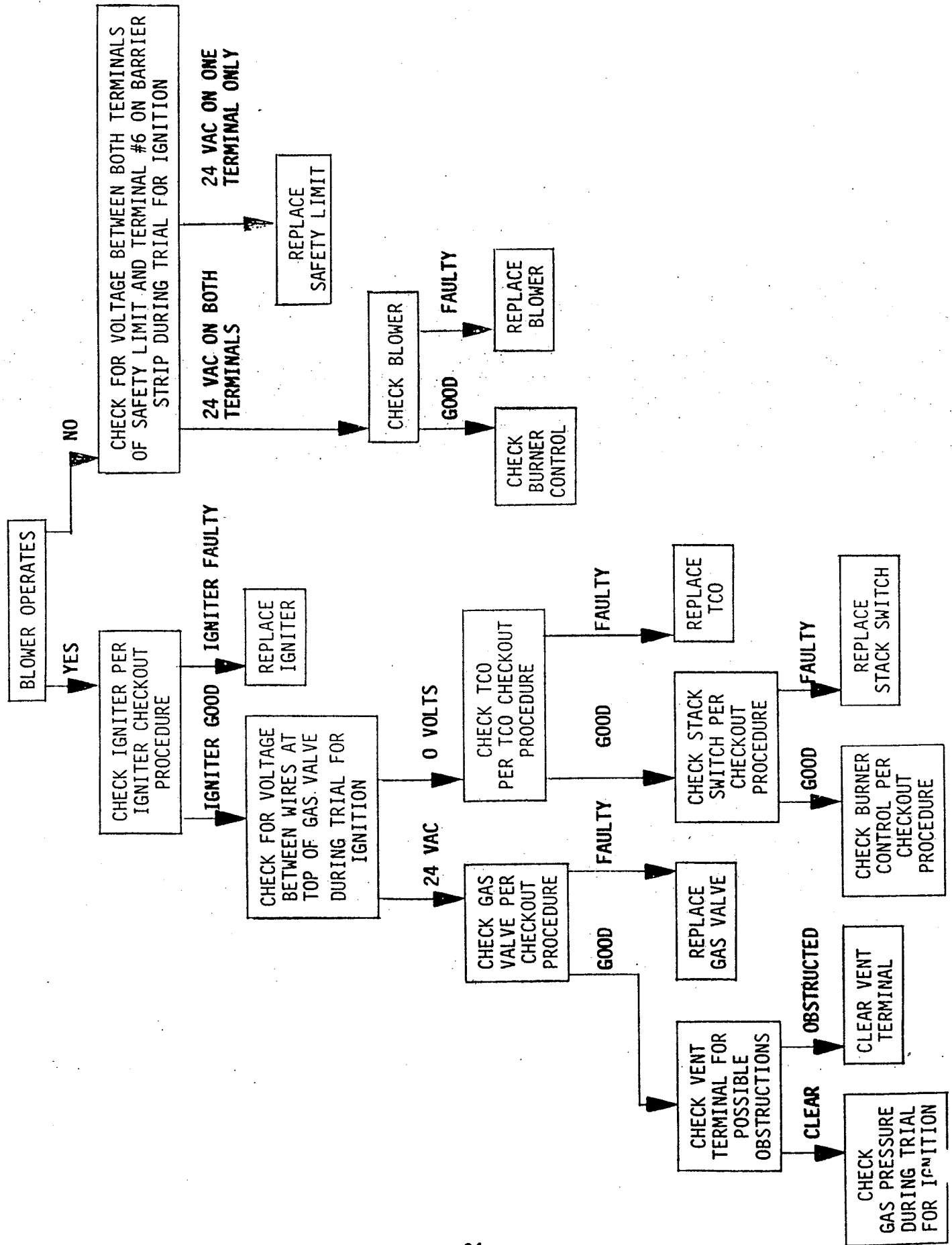
NOTE: THERE HAVE BEEN SOME INSTANCES OF BURNER CONTROL CONNECTOR FAILURE. IF THIS CONDITION IS SUSPECTED, REMOVE MOUNTING SCREWS, REMOVE AND UNPLUG CIRCUIT BOARD. TURN BOARD OVER AND INSPECT CONNECTOR MATING SURFACE. BLACK LINES ACROSS ANY OF THE CONTACT AREAS ARE EVIDENCE OF THE PROBLEM. WITH A SMALL SCREWDRIVER RETENSION THE CONNECTOR CONTACTS IF POSSIBLE AND INSTALL NEW BURNER CONTROL. IF CONNECTOR IS BEYOND REPAIR IT MUST BE REPLACED.

FENWAL 05-21 BURNER CONTROL (Continued)

BURNER MAKES NO ATTEMPT TO START

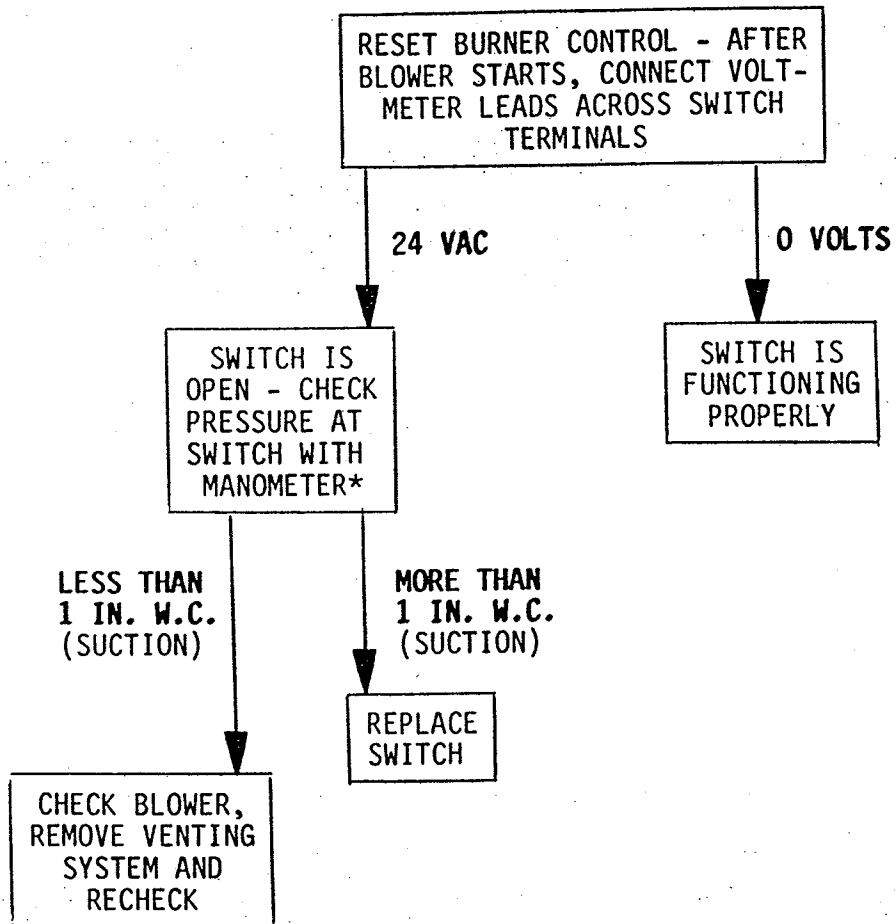


UNIT GOES THROUGH TRIAL FIRE IGNITION BUT DOESN'T START



STACK SWITCH

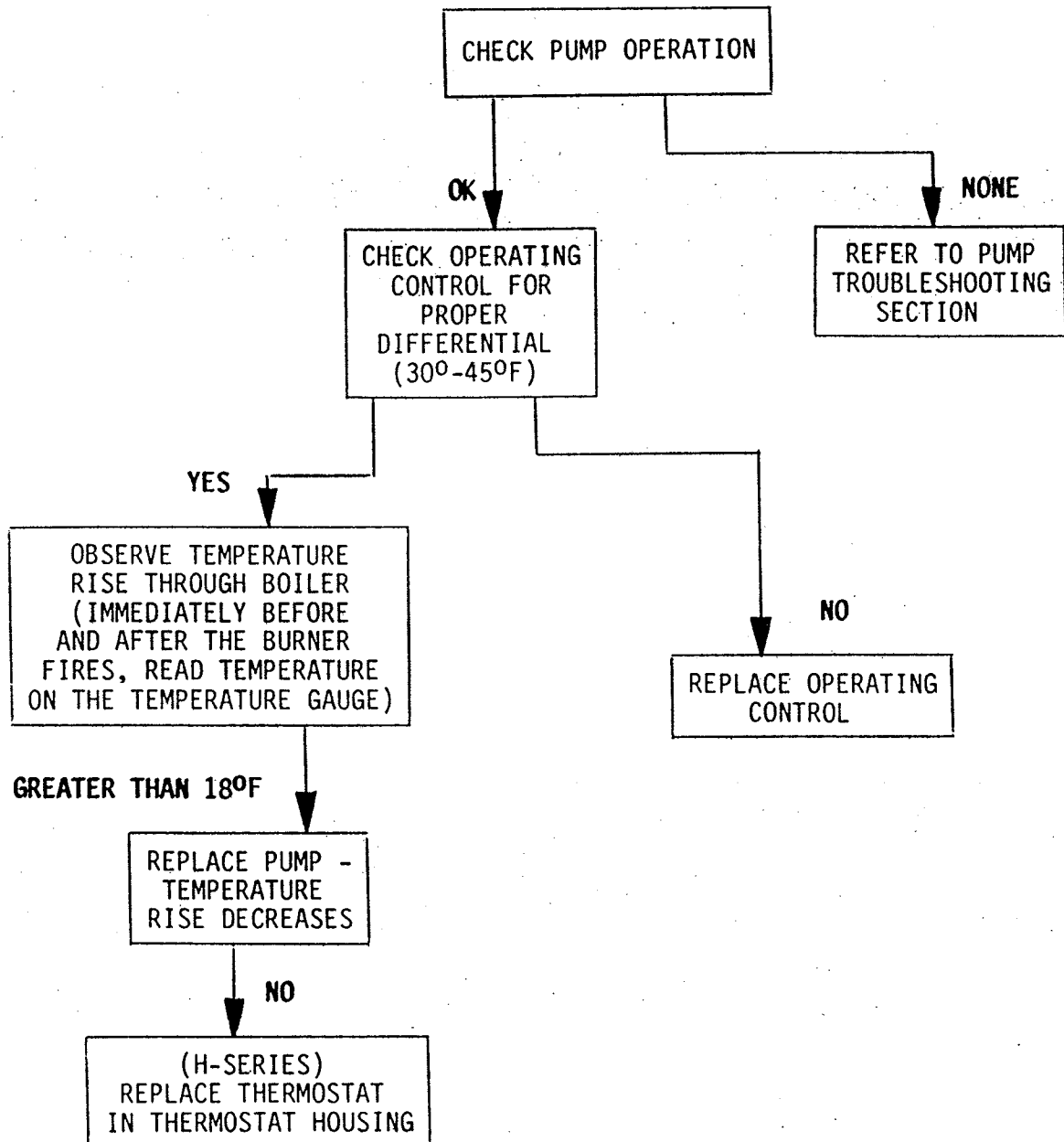
BEFORE STARTING THIS PROCEDURE CHECK THE VENTING SYSTEM TO ENSURE THAT THERE ARE NO OBSTRUCTIONS. THE SWITCH SET POINT IS 1 IN. W.C. DIFFERENTIAL.



* THIS MUST BE DONE WITH THE BLOWER OPERATING

TROUBLE SHOOTING
RELAY CONTROL SYSTEM/FENWAL 05-21

SHORT CYCLING



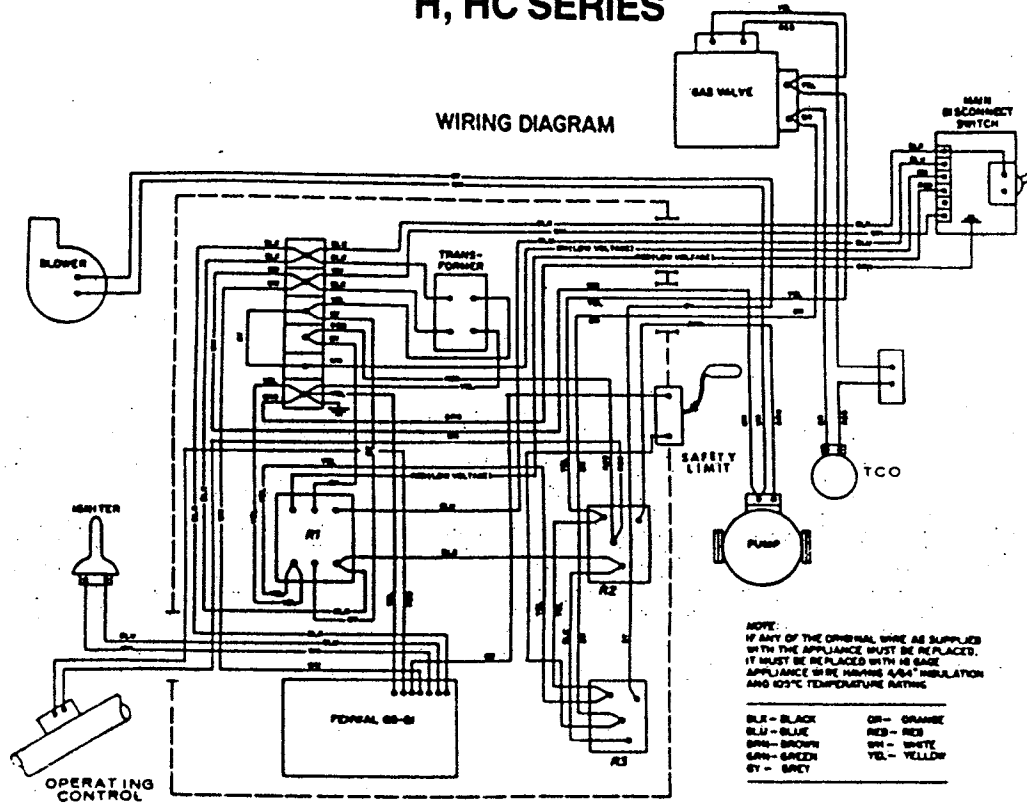
NOTE: THE MOST COMMON CAUSE OF SHORT CYCLING WITH H-SERIES BOILERS IS INSUFFICIENT WATER FLOW OR HEATING LOAD IN THE HEATING CIRCUIT. IF SHORT CYCLING EXISTS AT STARTUP (NEW INSTALLATIONS) CHECK FOR SYSTEM RESTRICTIONS OR IMPROPER CIRCULATOR SIZING.

SAFETY LIMIT

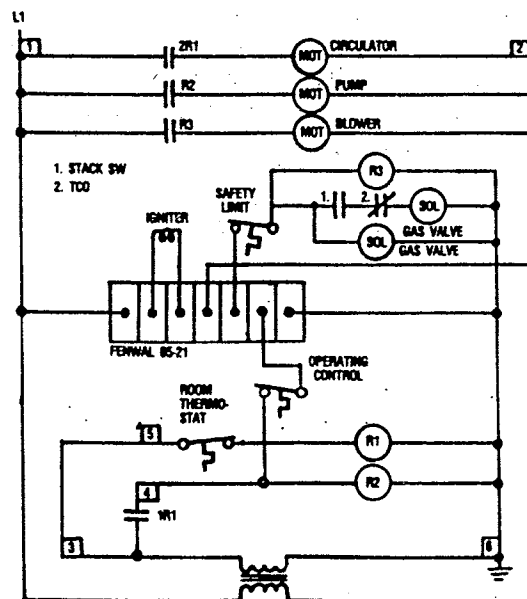
THE SAFETY LIMIT IS IN THE LOCKOUT CIRCUIT. IF IT FAILS IT WILL INTERRUPT POWER TO THE BLOWER RELAY AND THE GAS VALVE. THIS SOMETIMES IS MISLEADING BECAUSE THE UNIT DOES NOT APPEAR TO BE GOING THROUGH A TRIAL FOR IGNITION WHEN THE BLOWER DOESN'T OPERATE. IF THERE IS ANY DOUBT REMOVE THE LEADS FROM THE SAFETY LIMIT AND CHECK FOR CONTINUITY ACROSS ITS TERMINALS. THE SAFETY LIMIT SHOULD OPEN ON A RISE IN TEMPERATURE AT $240^{\circ}+15^{\circ}\text{F}$ AND IT SHOULD CLOSE ON A TEMPERATURE DECREASE AT $195^{\circ}+15^{\circ}\text{F}$. IF THE SYSTEM TEMPERATURE IS BELOW 180°F AND THE LIMIT CONTACTS ARE NOT CLOSED, REPLACE THE SAFETY LIMIT. IF THE LIMIT CONTACTS OPEN BEFORE 225°F , REPLACE THE SAFETY LIMIT. THIS IS IMPORTANT BECAUSE THE SAFETY LIMIT CAN CAUSE A NUISANCE SHUTDOWN IF IT OPERATES BEFORE THE OPERATING CONTROL OPERATES.

H, HC SERIES

WIRING DIAGRAM

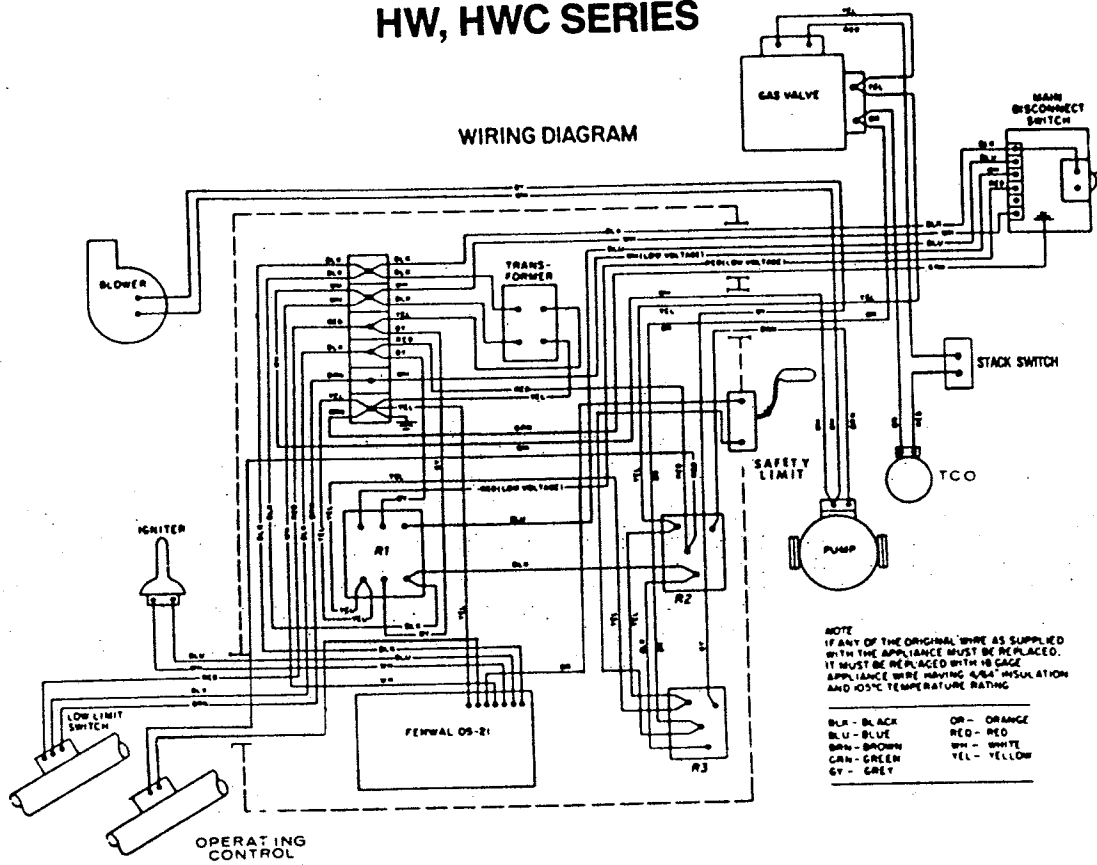


ELECTRICAL DIAGRAM H, HC-SERIES

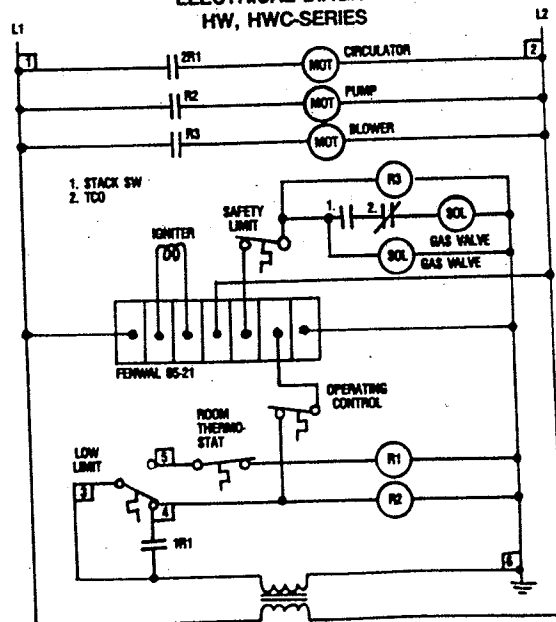


HW, HWC SERIES

WIRING DIAGRAM



ELECTRICAL DIAGRAM HW, HWC-SERIES



APPLICATION NOTES

Over the past two or three years our service department has dealt with a number of problems which were the result of application irregularities. This section is intended to pass along some of the information that we have gained through exposure to these problems.

HW-SERIES BOILERS

ITEM #1 SYMPTOM: UNIT DELIVERS DOMESTIC HOT WATER FOR ONLY A SHORT PERIOD OF TIME BEFORE THE WATER TURNS COLD.

CAUSE: NO HYDRONIC CHECK-VALVE INSTALLED IN HEATING WATER SUPPLY. (THIS CAN ALSO HAPPEN IF THE OPERATING LEVER ON THE HYDRONIC CHECK-VALVE IS LEFT IN THE MANUAL POSITION)

ITEM #2 SYMPTOM: NO DOMESTIC HOT WATER UNLESS THERE IS A CALL FOR HEAT.

CAUSES: (1) POSSIBLE MALFUNCTION OF LOW LIMIT SWITCH
(2) SAME AS ITEM #1 CAUSE

ITEM #3 SYMPTOM: UNIT RUNS OUT OF HOT WATER OR THE TEMPERATURE DECREASES SIGNIFICANTLY DURING A LONG DRAW (ESPECIALLY BATHTUB DRAWS).

CAUSE: NO FLOW RESTRICTOR IN DOMESTIC WATER SUPPLY TO BOILER (OR POSSIBLY AN OVERSIZED FLOW RESTRICTOR WHICH ALLOWS A FLOW RATE WHICH IS TOO HIGH FOR THE SIZE OF THE HEATMAKER.

H-SERIES BOILERS

ITEM #4 SYMPTOM: WHEN THE BOILER STARTS THE TEMPERATURE RISES VERY RAPIDLY AND THE BOILER SHUTS DOWN (SOMETIMES CANNOT RESPOND FAST ENOUGH).

CAUSE: INSUFFICIENT SYSTEM FLOW BECAUSE OF A SYSTEM RESTRICTION, AIR IN SYSTEM, OR AN INADEQUATELY SIZED SYSTEM PUMP.

ITEM #5 SYMPTOM: BOILER RUNS AT LOW TEMPERATURE FOR LONG PERIODS OF TIME (LESS THAN 145°F) AND SOMETIMES SWEATS OR LOCKS OUT.

CAUSE: NO THERMOSTAT INSTALLED.

H- AND HW-SERIES BOILERS

ITEM #6 SYMPTOM: BOILER GOES THROUGH A TRIAL FOR IGNITION, STARTS AND RUNS FOR ONLY A FEW SECONDS AND THEN IT FLAMES OUT (YOU CAN HEAR THE COMBUSTION TAKE PLACE BUT THEN IT SOUNDS LIKE IT RUNS OUT OF GAS).

CAUSE: THREE-INCH FLUE PIPE IS NOT JOINED TIGHTLY AT ONE OF THE JOINTS. THE EASIEST WAY TO DETECT THIS PROBLEM IS TO REMOVE THE FIVE-INCH PIPE AT THE BOILER AND OPERATE THE BOILER FOR A FEW MINUTES WITH ONLY THE THREE-INCH PIPE. IF IT RUNS PROPERLY, REDO THE VENT ASSEMBLY WITH CARE TO AVOID LOOSE CONNECTIONS.

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