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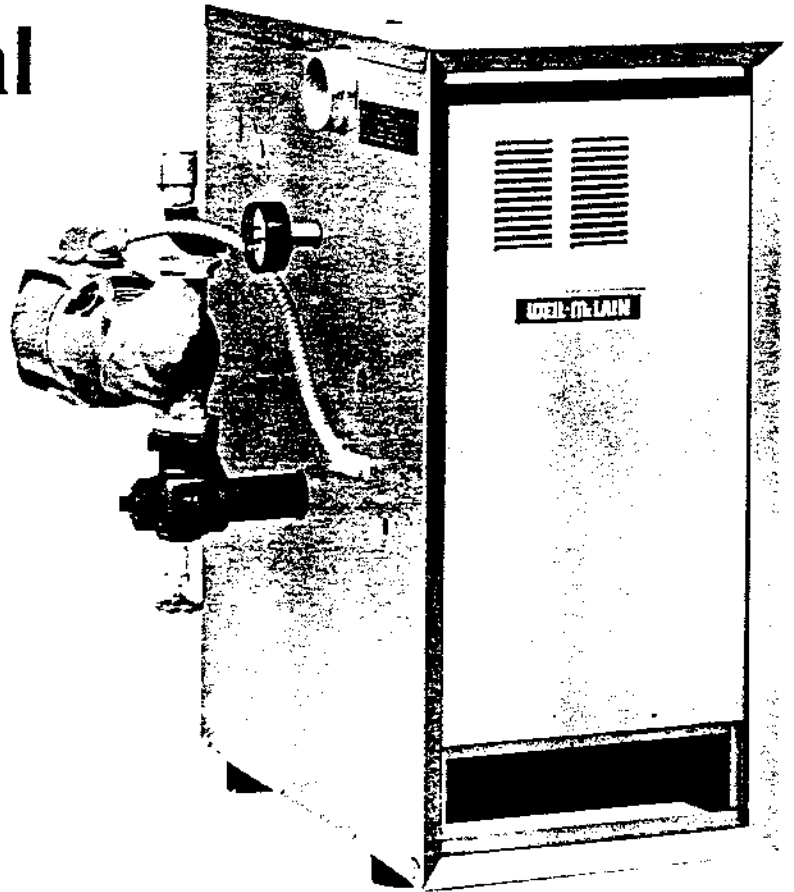
# WEIL-McLAIN

MODEL HE (Series 2)

NATURAL GAS-FIRED  
INDUCED DRAFT BOILERS

## Boiler Manual

- Installation
- Operating Instructions
- Service
- Parts



**Read all instructions and warranty before starting**

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Part No. 550-141-322

# Nameplate and Major Components Locations MODEL HE (Series 2)

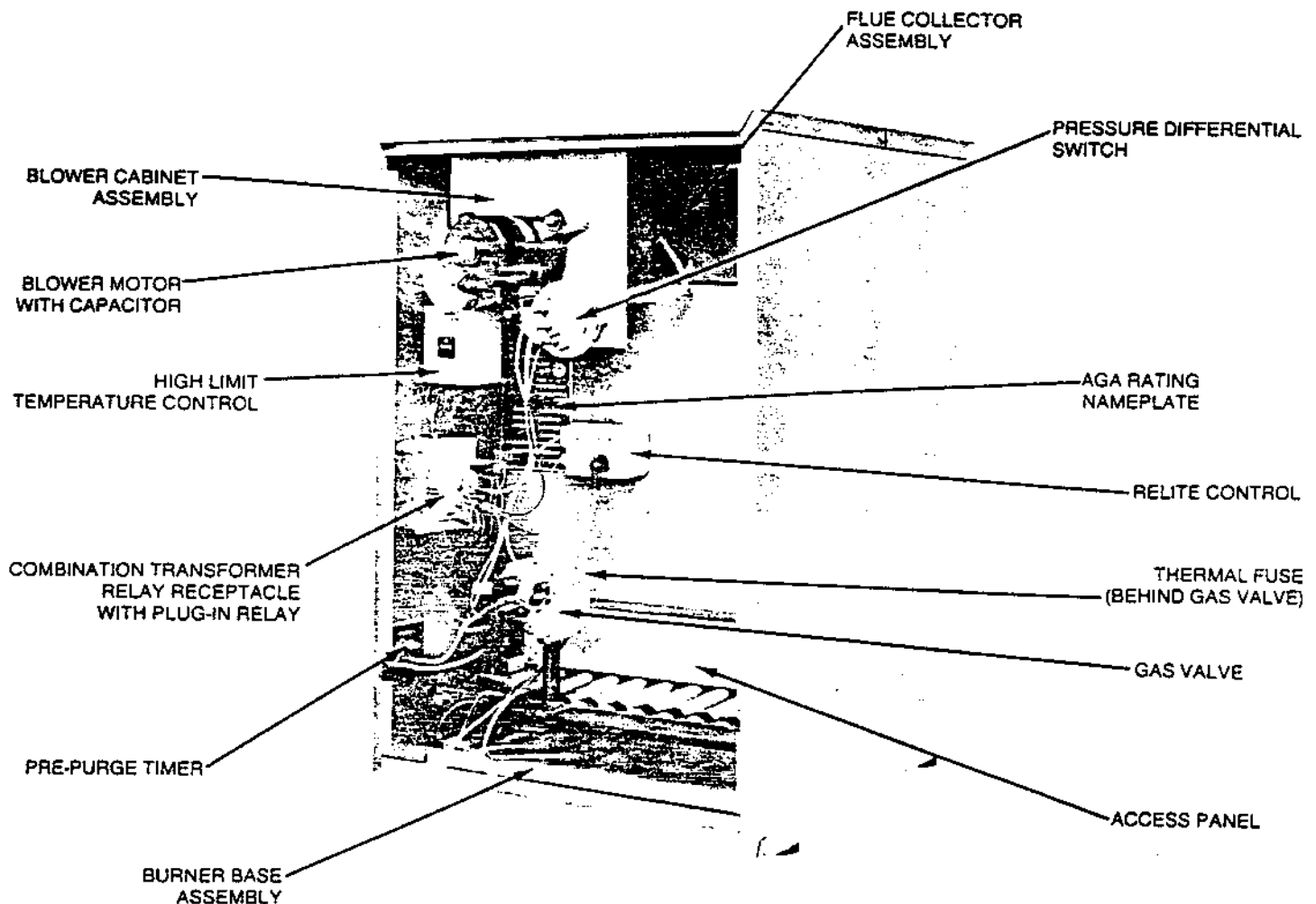


FIGURE 1

**IMPORTANT:** When calling or writing about the boiler, PLEASE GIVE THE MODEL, SERIES, AND C.P. NUMBERS, located on the boiler as shown above.

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## STANDARD EQUIPMENT

Insulated Extended Jacket  
Flue Collector Assembly  
Transition Assembly with Internal Vent Damper  
Blower Cabinet Assembly  
Relite Control Unit  
Gas Control Valve (Includes Main Valve, Redundant Valve, Pressure Regulator, Pilot Filter) 24 Volt  
Supervised Safety Pilot Burner with Ignition Electrode  
Pressure Switch  
Pre-purge Timer  
Electrical Junction Box  
Thermal Fuse  
Aluminized Steel Burners

Combination Relay Receptacle and 40 VA Transformer  
Plug-in Circulator Relay  
High-Limit Temperature Control  
Circulator  
Built-in Air Eliminator  
ASME Pressure Relief Valve, side outlet type  
Combination Pressure-Temperature Gauge  
Drain Valve  
Fill-Trol System (compression tank, fill and check valve, automatic air vent and fittings—No. 109 Sizes 3 through 5; No. 110 Size 6) For P-HE only

In the interest of continual improvement in products and performance, Weil-McLain reserves the right to change specifications without notice.

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**WEIL-McLAIN**

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Michigan City, Indiana 46360 ■ A Marley Company





## HE BOILER (Series 2)

Water Boiler Number	A.G.A. Input BTU/Hr.	DOE Heating Capacity BTU/Hr. <sup>†</sup>	Net I-B-R Ratings-Water BTU/Hr. <sup>*</sup>	% DOE Seasonal Efficiency AFUE	Chimney Size <sup>**</sup>
HE-3	67,000	55,000	47,800	82.4	4" I.D. x 20'
HE-4	100,000	82,000	71,300	82.3	5" I.D. x 20'
HE-5	133,000	109,000	94,800	82.2	5" I.D. x 20'
HE-6	167,000	137,000	119,100	82.2	5" I.D. x 20'

<sup>†</sup>Based on standard test procedures prescribed by the United States Department of Energy.

<sup>\*</sup>Net I-B-R ratings are based on net installed radiation of sufficient quantity for the requirements of the building and nothing need be added for normal piping and pick-up. Ratings are based on a piping and pick-up allowance of 1.15. An additional allowance should be made for unusual piping and pick-up loads. Consult Application Engineering Department.

<sup>\*\*</sup>In special cases where surrounding conditions permit, chimney height may be reduced to 10 feet. HE boiler may be vented directly outside using 3" dia. vent pipe.

††Add "P-" to designator for boiler with Fill-Trol system (Example P-HE-3).

## DIMENSIONS

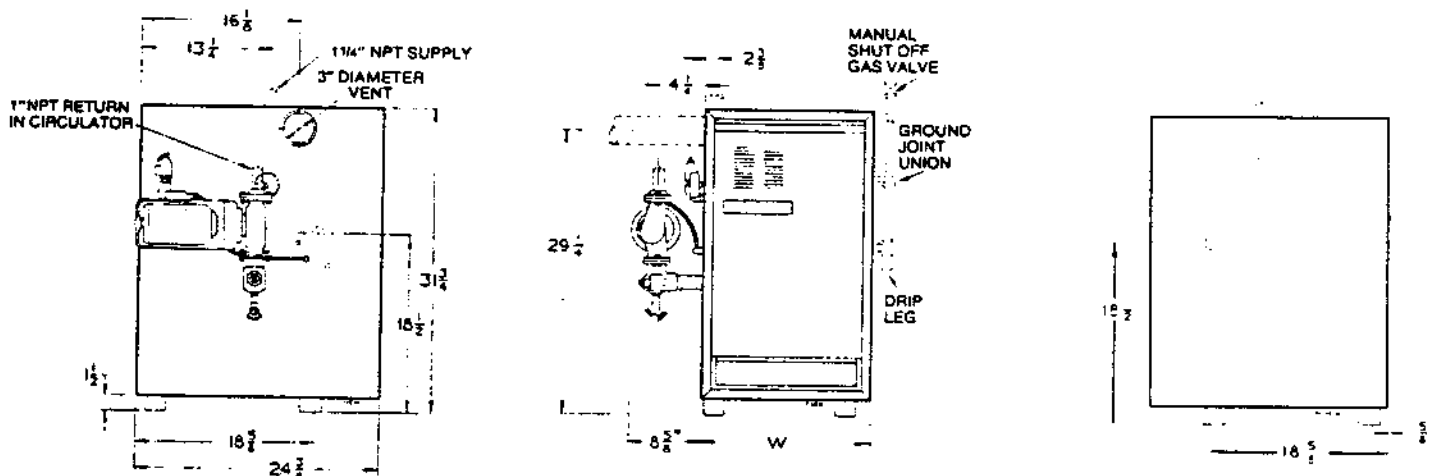


FIGURE 2

\*With Fill-Trol tank (P-HE), add 4 1/4"

Water Boiler Number	Supply	HE Return (in circulator)	Boiler Width W	Natural Gas Connection Size	Crate Dimensions (outside measurements—in.)			Approx. Shipping Wt.—Lbs.	
					Length	Width	Height	HE	P-HE
HE-3	1 1/4" N.P.T.	1" N.P.T.	11 1/4"	1/2"	28	28	35	203	228
HE-4	1 1/4" N.P.T.	1" N.P.T.	14 1/4"	1/2"	28	28	35	246	271
HE-5	1 1/4" N.P.T.	1" N.P.T.	17 1/4"	1/2"	28	34	35	289	305
HE-6	1 1/4" N.P.T.	1" N.P.T.	20 1/4"	1/2"	28	34	35	334	351

Gas piping from meter to be sized according to local utility requirements.

## Section I: Installation

READ ALL INSTRUCTIONS *BEFORE* STARTING

FAILURE TO COMPLY WITH INSTALLATION INSTRUCTIONS CAN VOID WARRANTY

## SAFETY RULES

1. Installations must comply with all local codes, laws, regulations and ordinances. Also United States National Fuel Gas Code, obtain from: American Gas Association, 1515 Wilson Boulevard, Arlington (Rosslyn), Virginia 22209.
2. Provide adequate combustion and ventilation air to the boiler room.
3. Follow Venting Instructions.
4. Fire on natural gas only.
5. NEVER test for gas leaks with an open flame—BUBBLE TEST.
6. Follow a regular service and maintenance schedule.
7. Before servicing: Allow boiler to cool, disconnect electrical and gas service.

8. NEVER use petroleum based stop-leak compounds or chemical cleaning compounds in the HE boiler.
9. Provide ample clearance around the boiler.
10. Follow wiring diagram on the inside of the jacket door.
11. Check to see if burners are properly seated in their slots with openings up.
12. Inlet gas pressure to gas valve in boiler should be 5 to 7 inches water column.
13. Check for proper orifice sizing from chart below.

ORIFICE DRILL SIZES		
Type of Gas	Heating Value, BTU/cu. ft.	Std. Orifice Drill Size
Natural	1000	47

### AIR SUPPLY FOR COMBUSTION

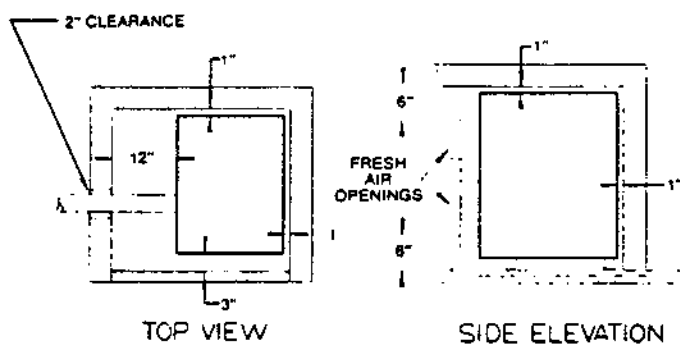
In buildings of conventional frame, masonry or metal construction, leakage will normally provide enough combustion air in unconfined rooms.

If the building is unusually tight, combustion air for unconfined spaces must be provided for. This air shall come from outdoors or from spaces directly connected to the outdoors. Openings must be provided with a total area of not less than one square inch per 5000 Btuh boiler input.

When boilers are placed in confined rooms within conventional buildings two permanent openings must be provided. One opening must be less than 12 inches from the floor and the other less than 12 inches from the ceiling. Each opening must provide one square inch per 1000 Btuh boiler input. These openings must be unblocked to get air from normal leakage.

When all outside air is provided to the confined space, two openings placed just like above must be provided. Ducting to the outside or spaces like crawls or attics will provide this air as follows:

- a) For vertical ducting or ducting through outside walls—one square inch per 4000 Btuh boiler input.
- b) For horizontal ducting—one square inch per 2000 Btuh boiler input.
- c) Ducting and its opening must be the same size. Rectangular ducts must be no smaller than 3 x 3 inches.



MINIMUM CLEARANCE  
FOR CLOSET INSTALLATIONS  
HE BOILER

FIGURE 3

### SELECT THE BOILER LOCATION—CLEARANCES

CONSIDER ALL CONNECTIONS TO THE BOILER BEFORE SELECTING A LOCATION.

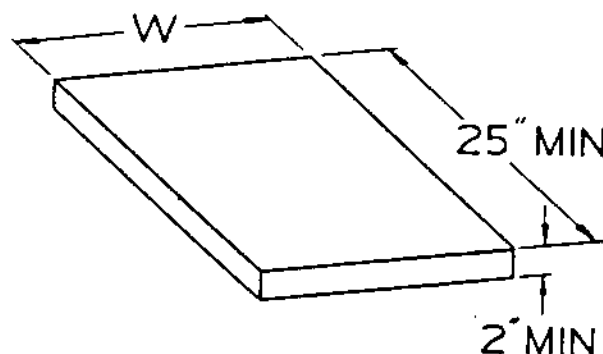
GIVE SPECIAL ATTENTION TO LOCATION OF VENT—THE EXHAUST GASES WILL FORM A WHITE PLUME IN COLD WEATHER. THE VENT SHOULD BE INSTALLED WHERE THE PLUME DOES NOT OBSTRUCT FAVORITE WINDOW VIEWS. CONDENSATION COULD CAUSE DAMAGE TO PLANTS. REFER TO SECTION ON VENTING.

### Suggested clearances for easy servicing

- 24 inches for cleaning and servicing, left side.
- 18 inches for access to controls and components, front.
- 36 inches from top for cleaning flueways.
- 6 inches on remaining sides.

Screw driver clearance for removal of jacket screws should be provided. If not, unions and shut-off valves should be installed in system to move the boiler for servicing.

HE boilers are approved for use on combustible flooring but MUST NOT BE INSTALLED ON CARPETING. Concrete or brick LEVEL foundations are required where water could flood the floor or non-level conditions are found. Refer to Figure 4 for minimum foundation size.



MINIMUM BOILER FOUNDATION SIZES		
Number of Boiler Sections	Foundation Width "W"	Foundation Length
3	12"	25"
4	15"	25"
5	18"	25"
6	21"	25"

FIGURE 4

### RESIDENTIAL GARAGE INSTALLATION (ANSI Z223.1)

Install boiler so burners are at least 18 inches above the floor.

### PLACING THE BOILER

Leave the boiler in the crate and on the pallet until the installation site is ready.

1. After moving the entire crate and pallet next to the selected location, remove the crate.

2. Remove the boiler from the pallet as follows:
  - a. Tilt the left side of the boiler up and place a board under the left legs.
  - b. Tilt the boiler the other way and place a board under the right legs.
  - c. Slide the boiler backward off the pallet and into position.

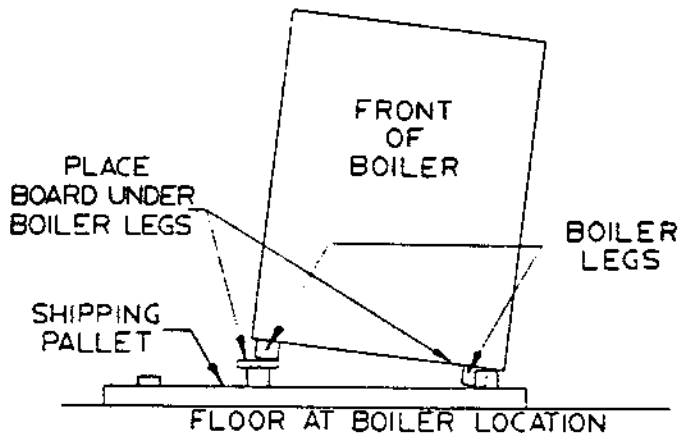
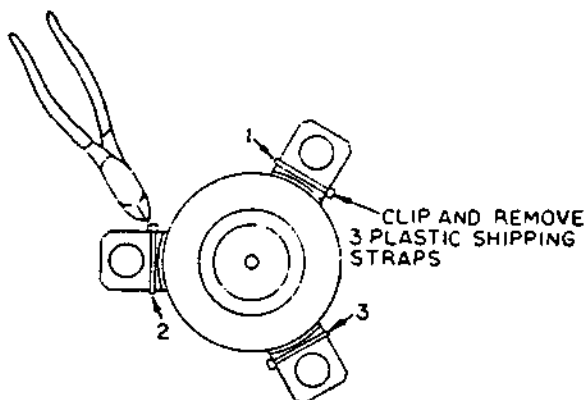


FIGURE 5

3. DO NOT DROP THE BOILER OR BUMP JACKET ON FLOOR OR PALLET.
4. After placing the boiler in its permanent location, check level. Shim legs, if needed; but do not alter the legs.
5. Check burner tubes for placement in their slots at the back. Make sure the gas orifices inject down the center of the burner tubes.  
Burner access is gained by removing the jacket door (it lifts up and then out). Next remove the access panel (Figure 1). Loosen (do not remove) the two screws at the outside edges of the panel. Then lift the panel up and off these two screws.
6. Remove blower shipping plastic straps.



SHIPPING STRAP REMOVAL  
FIGURE 6

## HYDROSTATIC PRESSURE TEST

Pressure test before attaching piping or electrical supply.

1. Remove the shipping nipple from the supply outlet and plug tappings including the compression tank tapping.
2. Connect the water supply. Fill the boiler and purge all air. DO NOT EXCEED 45 PSIG.

### TEST FOR MORE THAN 10 BUT LESS THAN 30 MINUTES

3. After 10 minutes check to make sure gauge pressure has been maintained. Check the entire boiler for leaks.
4. Leaks must be repaired at once.

### DO NOT USE PETROLEUM BASED STOP-LEAKS

5. Drain the boiler and remove testing plugs.

## PIPING

### WARNING

FAILURE TO PROPERLY PIPE  
AND WIRE BOILER MAY  
RESULT IN DAMAGE TO  
BOILER—BUILDING—AND  
PERSONS.

Connect supply and return piping as shown in Figure 7. Refer to I=B=R Installation and Piping Guides for additional recommendations.

The circulator provided is adequate for most systems. For high capacities refer to circulator manufacturer's operation curves.

## EXPANSION TANK GUIDELINES

For boiler using closed type expansion tanks, connect as shown with 1/2 inch NPT pipe. Horizontal piping must pitch upward 1 inch for 5 feet of run. Follow the manufacturer's sizing procedure for expansion tank selection.

Where a closed diaphragm prepressurized type compression tank is used, connect the cold water fill supply piping to the union on the combination automatic fill valve and manual shut-off valve. Before making this connection, refer to the separate instructions on the tag attached to the handle of the valve.

## FILL-TROL AND EX-TROL COMPRESSION TANK SIZING\*

Number of Boiler Sections	*Fill-Trol Tank—Adequate for Series Loop Piping Systems with Convactor Baseboard	Additional Ex-Trol Tank Required for One Pipe Systems with Convactor Baseboard	Additional Ex-Trol Tank(s) Required for Cast-Iron Radiators	Additional Ex-Trol Tank(s) Required for Cast-Iron Baseboard
3	No. 109	—	No. 15	No. 15
4	No. 109	No. 15	No. 15	No. 30
5	No. 109	No. 15	No. 15	No. 30
6	No. 110	—	No. 15	No. 30

\* Tank selections based on 220°F. average system water temperature.

Connect the cold water fill supply piping to the union on the combination automatic fill valve and manual shut-off valve.

**NOTE:** When additional expansion tank capacity is required, do not replace the tank supplied. Instead, additional tank(s) should be connected to a tee(s) in the system piping near the boiler.

## RECOMMENDED BOILER AND SYSTEM PIPING FORCED HOT WATER

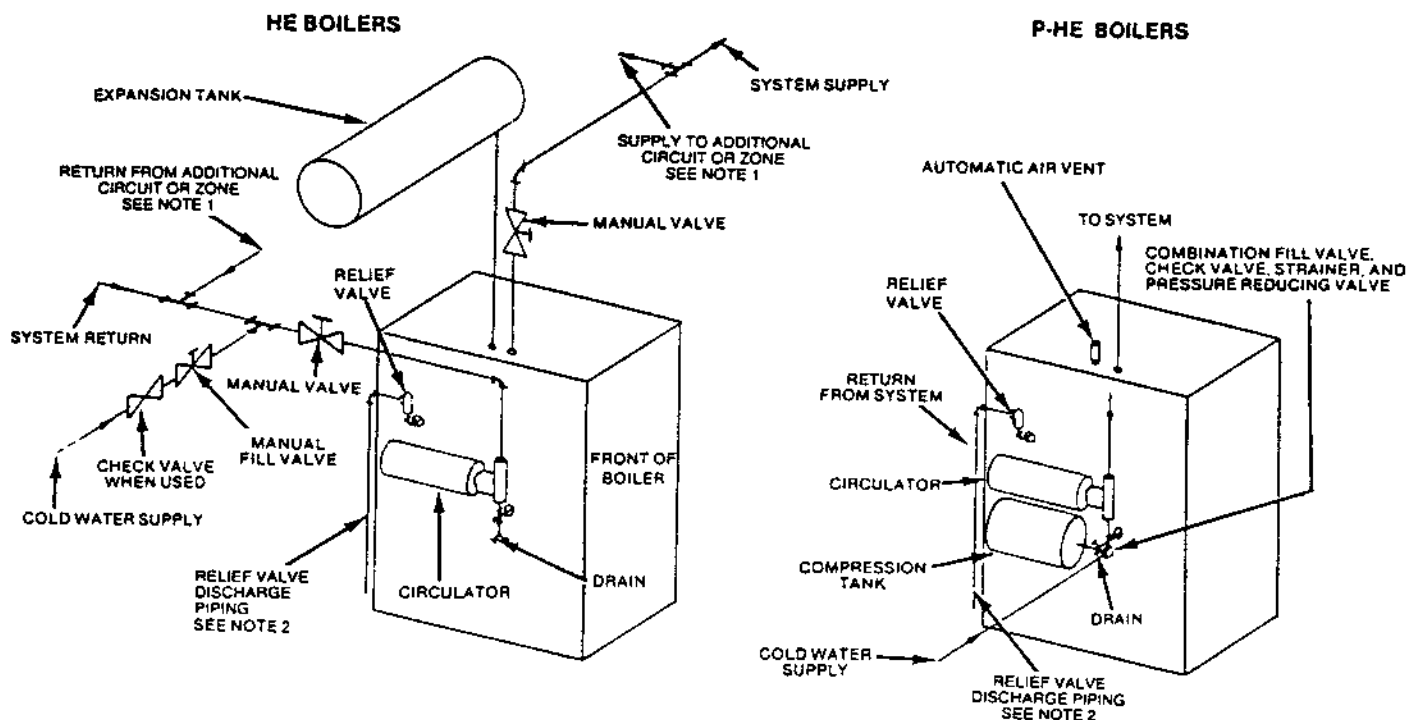


FIGURE 7

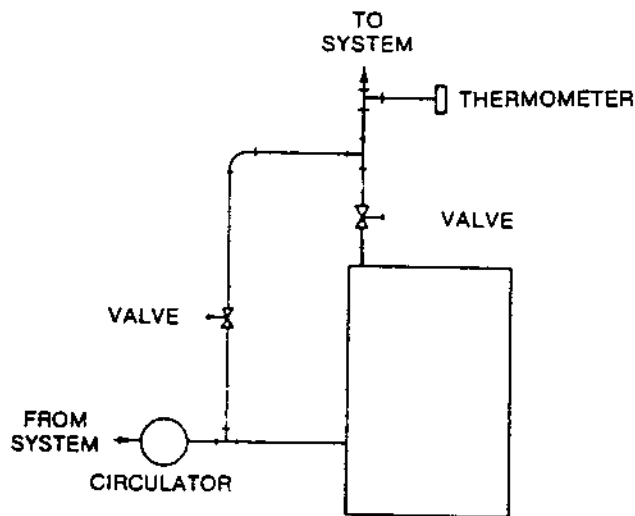
### NOTES:

1. Use balancing valves or zone valves in each circuit for multiple circuit applications.
2. Relief valve discharge piping must be piped near to the floor or to a floor drain. Do not pipe the relief valve discharge to any area where freezing could occur.

## ADDITIONAL EQUIPMENT

### By-Pass Piping—Low Water Temperature Applications

Bypass piping should be used for low water temperature application. Refer to Figure 8 for piping details. Adjust the valves to maintain boiler temperature greater than 120°F.



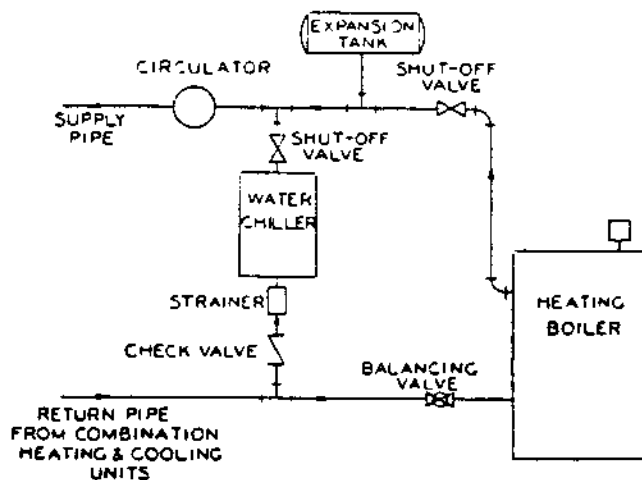
BY-PASS PIPING  
FIGURE 8

tional high temperature limit is needed. Purchase and install the control in the supply outlet piping to the boiler.

### Use With Refrigeration System

The boiler must be installed so that chilled medium is piped in parallel with the heating boiler. Consult I=B=R Installation and Piping Guides.

If the boiler is connected to heating coils where they can be exposed to refrigerated air, gravity circulation must be prevented.



RECOMMENDED PIPING FOR COMBINATION  
HEATING & COOLING (REFRIGERATION) SYSTEMS  
FIGURE 9

### Low Water Cut-Off

Should a low water cut-off be required, follow the manufacturer's instructions. Locate the unit in the supply piping above the boiler.

### Additional High Temperature Limit

If the system is to be ASME inspected and approved, an addi-

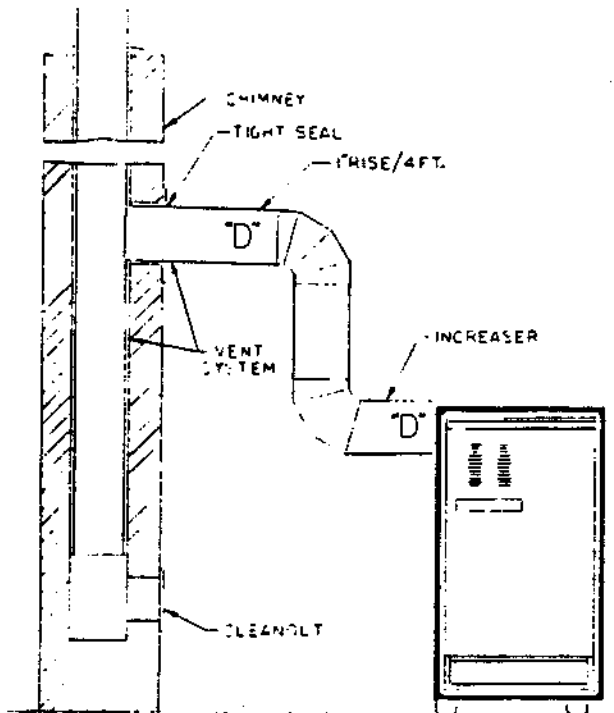
## HE FLUE VENTING

1. Venting to an outside masonry chimney requires a 3 inch 304 stainless steel pipe run up through the entire chimney.
2. Long direct vent runs through unheated spaces require 304 stainless steel 3 inch vent pipe. (Figure 16)
3. Follow the National Fuel Gas Code, ANSI Z223.1, and any additional local codes.

## VERTICAL VENTING TO EXISTING CHIMNEY

HE boilers can be connected to conventional chimneys or vents (with or without an atmospheric gas-fired water heater).

1. Increase the 3 inch blower outlet immediately to the breeching size in Figure 10.
2. Do not use chimney with an open fireplace.
3. Inspect and clean chimney if needed.
4. Where boiler and another appliance share a vent or chimney, the area should be equal to area of large vent flue plus one half additional vent area.



HE BOILER, VERTICAL VENTING	
BOILER NO.	MINIMUM BREECHING SIZE "D"
HE-3	4" Dia.
HE-4	5" Dia.
HE-5	5" Dia.
HE-6	5" Dia.

VERTICAL VENTING  
TYPE HE BOILER  
FIGURE 10

5. Make horizontal runs as short as possible.
6. To prevent blockage do not vent into bottom of chimney.
7. Vent pipe must not go beyond inside wall or chimney.
8. Vent passing through floors or ceilings must be fire stopped.

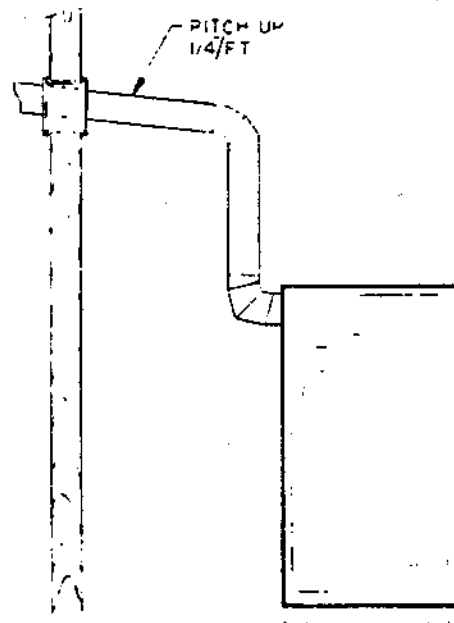
## DIRECT VENTING

1. HE boilers may be vented through 3 inch diameter vent pipe (pitch up from boiler). Do not connect other appliances to this vent. See Figures 11 and 12.
2. Vent Pipe Material
  - a) For normal installation use galvanized 3 inch vent.
  - b) For extended runs through cold areas. Refer to Figure 16.
3. Seal all joints with approved silicone sealant (400° F).
4. Determine the venting method easiest to use. Decide the entire length and number of elbows.

## MAXIMUM VENTING SYSTEM LENGTH VS. NUMBER OF ELBOWS

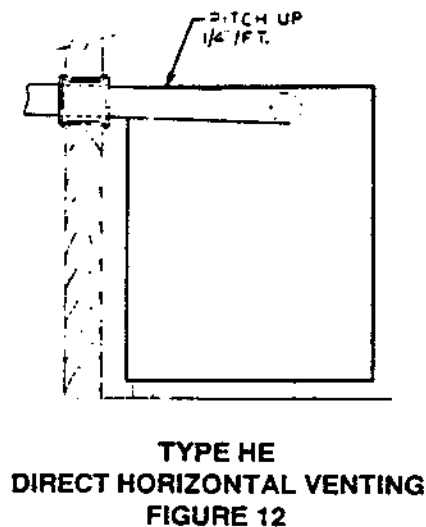
Maximum Venting System Length—Feet	48	41	34	27	20
Maximum Number of Elbows	2	3	4	5	6

5. Termination of the vent must be at least 12 inches above grade and more than 7 feet above a public walkway. Also 12 inches from any opening where exhaust could enter the building.
6. Put vent on a wall away from prevailing winter wind, if possible. Locate or guard the vent to prevent accidental contact with people or pets.



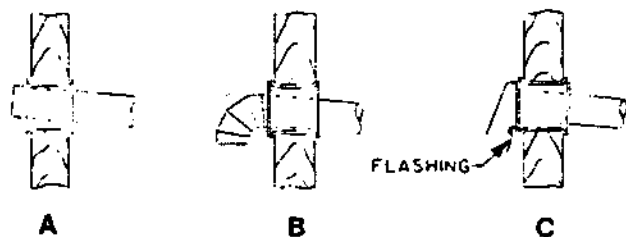
TYPE HE BOILERS  
HORIZONTAL VENTING WITH  
VERTICAL RISER  
FIGURE 11



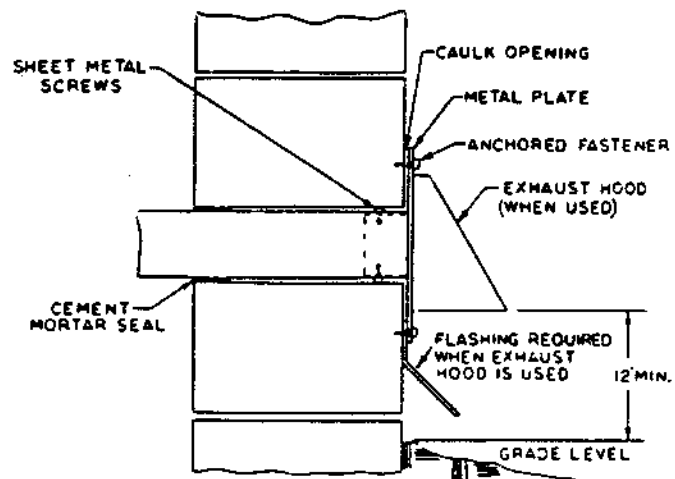
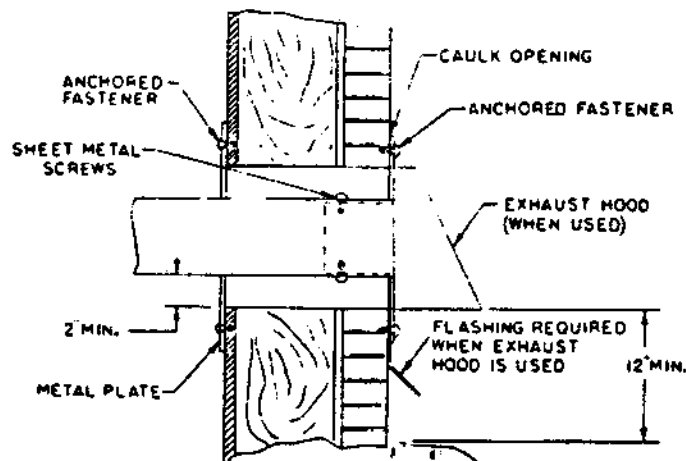


7. Vent Termination (See Figures 13, 14, 15)
- In masonry walls make a hole  $3\frac{1}{2}$  to 4 inches in diameter.
  - Combustible material will require a 7 inch hole to cover the opening in the wall.
  - Basement windowpanes can be replaced with sheet metal plates.
  - Another location is to run the vent between ceiling joists and through the wood sill.

**MAINTAIN TWO INCH CLEARANCE FROM  
COMBUSTIBLE MATERIALS TO VENT PIPE**



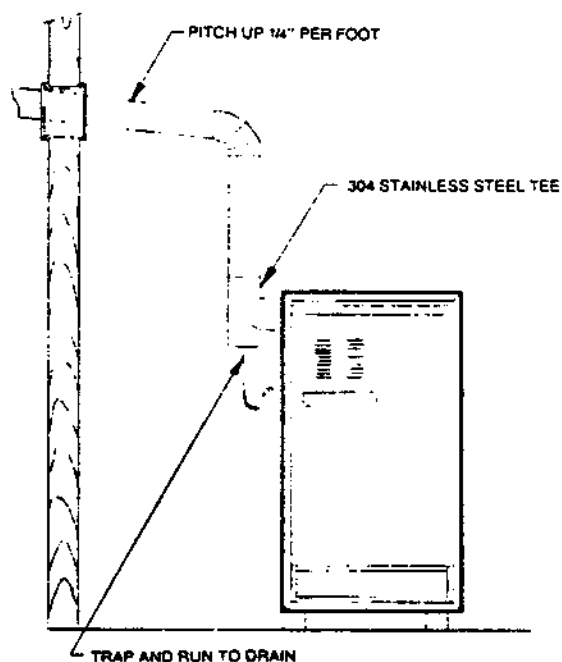
**FIGURE 13**



### VENTING THROUGH COLD AREAS

Extended runs through cold areas could cause condensation which must be drained away. Three inch 304 stainless steel must be used as shown and follow Direct Venting instructions.

- Crimped ends of flue pipe must point toward boiler.
- Do not install seams of vent pipe on bottom of runs.
- Tee and trap kit can be ordered from Weil-McLain, Part No. 382-930-210.
- Attach 304 Stainless Steel Tee by drilling  $\frac{5}{32}$ " hole through  $\frac{1}{4}$ " hole in tee and attach with screw provided.
- Attach drain trap to stainless steel tee with silicone sealant.



## GAS PIPING

1. Size gas piping from the following table.

**PIPE DELIVERY SCHEDULE**

Length of Pipe in Feet	*CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR				
	1/2"	3/4"	1"	1 1/4"	1 1/2"
10	132	278	520	1050	1600
20	92	190	350	730	1100
30	73	152	285	590	890
40	63	130	245	500	760
50	56	115	215	440	670
75	45	93	175	360	545
100	38	79	150	305	460
150	31	64	120	250	380

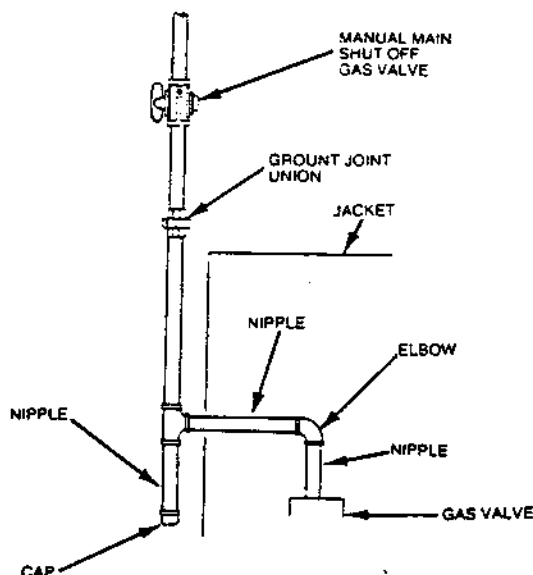
\* Flow determined by Dr. Pole's Formula—0.60 Specific Gravity, 0.30 inches water column pressure drop.

### ADDITIONAL LENGTH OF PIPE TO BE ADDED FOR EACH ELBOW OR TEE BEND IN THE LINE

Pipe Size, Inches	Additional Length, Feet
1/2	1.3
3/4	1.7
1	2.2
1 1/4	2.9
1 1/2	3.3

To obtain the cubic feet per hour, divide the input (Btu per hour) by the heating value (Btu per cubic foot).

2. Remove the jacket door and refer to Figure 17 for gas piping.
3. Follow good piping practices.
4. Purge all air from the supply piping.
5. Check all connections for leaks with solution. **DO NOT CHECK FOR LEAKS WITH OPEN FLAME—BUBBLE TEST.**



**GAS SUPPLY PIPING  
FIGURE 17**

## WIRING

### TURN OFF POWER BEFORE MAKING CONNECTIONS.

All control components come completely wired.

A separate circuit should be used with a fused disconnect switch.

Wire the electric supply to supply leads in the junction box as shown on the diagram inside the jacket door.

All wiring must meet codes that apply. Safety circuit wiring must be N.E.C. Class 1. Boilers must be electrically grounded per National Electrical Code, ANSI/NFPA No. 70-1978. Use 90°C. thermoplastic wire, or equivalent, to replace any wiring.

## MULTIPLE ZONING

Adjust the flow so it is about the same in each zone. Refer to zone valve manufacturer's literature for wiring and application. A separate transformer is required to power zone valve.

Zoning with circulators requires a relay for each circuit.

## ROOM THERMOSTAT

Install room thermostat on an inside wall away from drafts or heat sources. Allow for free air movement.

Heat anticipator in thermostat must be properly set. Refer to wiring diagram on jacket door.

## CHECK OUT SEQUENCE

1. No primary air adjustment is necessary.
2. Be sure the boiler and heat distribution systems are filled with water.
3. Check for and purge air from system.
4. Follow operating instruction label on boiler for start-up.
5. If boiler is equipped with low water cut off or additional safety controls, test for operation as outlined by manufacturer while burners are operating. The burners should go off. When safety devices are restored burners should reignite.
6. While burners are operating, move the indicator of the high limit control below actual boiler water temperature. The blower and electrically operated main gas valves should go OFF. Raise the limit control indicator above the boiler water temperature. The blower will start, and the main burners should ignite after timed pre-purge.
7. Test the operation of all additional safety controls using procedures given in steps 4 or 5 above.
8. Set the high limit control to the design temperature requirements of the heating systems. Maximum high limit temperature control setting—220°F.
9. Set the room thermostat to the desired room temperature.
10. Turn thermostat to lowest setting. The pilot and main flames should go OFF and the blower stop.
11. Turn thermostat to highest setting and boiler should go through normal start-up cycle.

### BEFORE LEAVING THE JOB

Observe several boiler operating cycles and make sure the unit operates properly. Be sure the room thermostat is set to the desired room temperature and that the limit control is set according to the requirements of the heating system. For additional information on controls refer to the manufacturer's instructions supplied with the controls. This boiler installation is not complete until all instructions shipped with this boiler are returned to their envelope and given to owner or displayed near the boiler.

### MEASURE GAS INPUT

#### Procedure

1. After boiler has been operating for about 10 minutes, check gas input rate to be sure boiler is operating at design capacity. During this period, turn off all other appliances served by gas meter, including gas stove, pilot lights and gas yard lights.
2. At natural gas meter, with stopwatch, measure the time in seconds required to use one cubic foot of gas.

3. Divide the number of seconds into 3,600 to get the number of cubic feet the boiler would use in one hour.
4. Multiply the cubic feet per hour by the heating value of the gas to obtain the BTU per hour input capacity. Result will be the actual input capacity which should correspond to the published input listed on the rating plate or on page 4.

**NOTE:** The average heating value of natural gas is 1000 BTU per cubic foot. Adjust the formula according to the BTU gas content furnished by the local utility.

If the actual input is not the same as the rated input, adjust the gas pressure regulator to obtain the required gas flow. The gas pressure regulator is located on the main gas valve body. To adjust the gas input, remove the regulator adjustment screw cap and turn the adjustment screw clockwise to increase or counter-clockwise to decrease the gas flow.

**NOTE:** For proper aspiration, the manifold gas pressure should be 3½ inches water column for natural gas.

## Section II: Operation, Wiring Diagrams, Trouble Shooting

### HE (Series 2) With White-Rodgers Cycle-Pilot®

#### BOILER EQUIPMENT COMPONENTS

##### BLOWER MOTOR

120/60/1, 3450 RPM Permanent Split Capacitor Motor with capacitor start and internal overload protection provides rotation of induced draft fan.

##### FAN (BLOWER WHEEL)

Develops induced draft to supply combustion air to boiler.

##### PRE-PURGE TIMER

Provides 30 second pre-purge prior to pilot ignition.

##### HIGH TEMPERATURE LIMIT CONTROL

In the event of high boiler water temperature, shuts down fan and burners but allows circulator to run as long as there is a call for heat from thermostat.

##### PRESSURE SWITCH

Detects pressure differential across fixed metering orifice to prove air flow through boiler.

##### COMBINATION PRESSURE AND TEMPERATURE GAUGE

Provides readings of boiler water pressure and temperature.

##### COMBINATION RELAY RECEPTACLE, JUNCTION BOX AND TRANSFORMER

120/24 VOLT 40 VA transformer provides low voltage for control circuit. Relay receptacle for plug-in circulator relay. Terminal strip for control circuit wiring.

##### PLUG-IN CIRCULATOR RELAY

Provides contact to energize circulator and fan and contact to prove operation of pressure switch.

##### ASME SAFETY PRESSURE RELIEF VALVE

Provides safety discharge in the event boiler water pressure exceeds 30 PSIG.

##### FILL-TROL SYSTEM (TYPE P-HE ONLY)

Includes compression tank with permanent air cushion and combination manual shut-off valve, check valve, pressure reducing valve and strainer for automatic filling and maintaining minimum system pressure.

##### AUTOMATIC AIR VENT (TYPE P-HE ONLY)

Vents air from boiler built-in air eliminator tapping.

##### GAS VALVE

Includes mercury flame sensor, gas cock, main automatic gas valve, pilot automatic gas valve, and gas pressure regulator.

##### RELITE CONTROL

Provides spark to light pilot.

##### PILOT BURNER ASSEMBLY

Spark ignition pilot with mercury flame sensing probe.

##### THERMAL FUSE ELEMENT

Provides safety shutdown of burners and pilot if flame is not contained in firebox.

##### DRAIN VALVE

Used to drain boiler if necessary.

##### CIRCULATOR

Provides forced water circulation to hot water heating system.

#### SEQUENCE OF OPERATION

Referring to Ladder Diagram, Page 14

1. Thermostat closes, activating relay CR (through pressure switch). Contacts CR1 and CR2 close:
  - a) CR2 activates circulator.
  - b) Blower is activated through limit switch.
  - c) CR1 provides a bypass around pressure switch to prove its operation.
2. When adequate draft is proven by pressure switch, the 30 second pre-purge timer starts.
3. After a 30 second delay, 24 VAC is provided to terminals:
  - a) T2 on relite control which starts spark.
  - b) L on gas valve which opens pilot valve.
4. Pilot ignites:
  - a) Flame conduction stops spark from relite.
  - b) Mercury flame sensor opens main gas valve and pressure switch in gas valve holds pilot open.
5. After thermostat is satisfied, CR is deactivated:
  - a) CR2 opens turning off blower and pump.
  - b) CR1 opens turning off gas flow.
6. As air flow from blower reduces pressure, switch changes to normally closed position.
7. Boiler is now in "off" cycle.

#### TROUBLE SHOOTING PROCEDURE

- A. Before starting the trouble shooting procedure, be sure of the following:
  1. You have a voltmeter capable of checking 120 Volts AC, 24 Volts AC.
  2. That 120 Volt AC power supply is available to the boiler (minimum 102 VAC, maximum 132 VAC).
  3. That there is 24 Volt AC at the secondary side of the control transformer.
  4. You have an inclined manometer with a range of 0-2.0" W.C.

### CHECKING THE PRESSURE DIFFERENTIAL SWITCH

**Note:** Make sure boiler water temperature is 100°F or cooler before beginning procedure.

1. Remove the sensing tube at the front of the pressure switch (closest to you as you face the boiler). Refer to Figure 18.
2. Install a "T" into the sensing tube and another piece of tubing from the "T" to the pressure switch.
3. Attach the third leg of the "T" to the suction side of an inclined manometer.
4. Remove the sensing tube at the rear of the pressure switch.
5. Install a "T" into the sensing tube and another piece of tubing from the "T" to the pressure switch.
6. Attach the third leg of the "T" to the pressure side of the manometer.
7. Close the manual main gas valve and set thermostat to call for heat. Blower will run but pilot and main burners will not ignite.
8. Check for 24 Volt A.C. between normally open terminal on pressure switch and terminal C on transformer (Figure 19 and 20).
9. If the reading on the manometer is at least 1.8 inches water column pressure, but there is not 24 V across N.O. terminal on pressure switch and terminal C, replace the pressure switch.
10. If the reading is lower than 1.8" W.C. look for the following causes:
  - a. Blockage in sensing tube.
  - b. Obstruction in the blower housing outlet.
  - c. Loose blower wheel on motor shaft.
  - d. Blower motor not at proper R.P.M.
  - e. Blower back plate not sealed properly.
  - f. Blockage in the block assembly.
11. When pressure reading is proper and pressure switch is operating properly, remove "T"'s and re-install sensing tubes to the pressure switch.

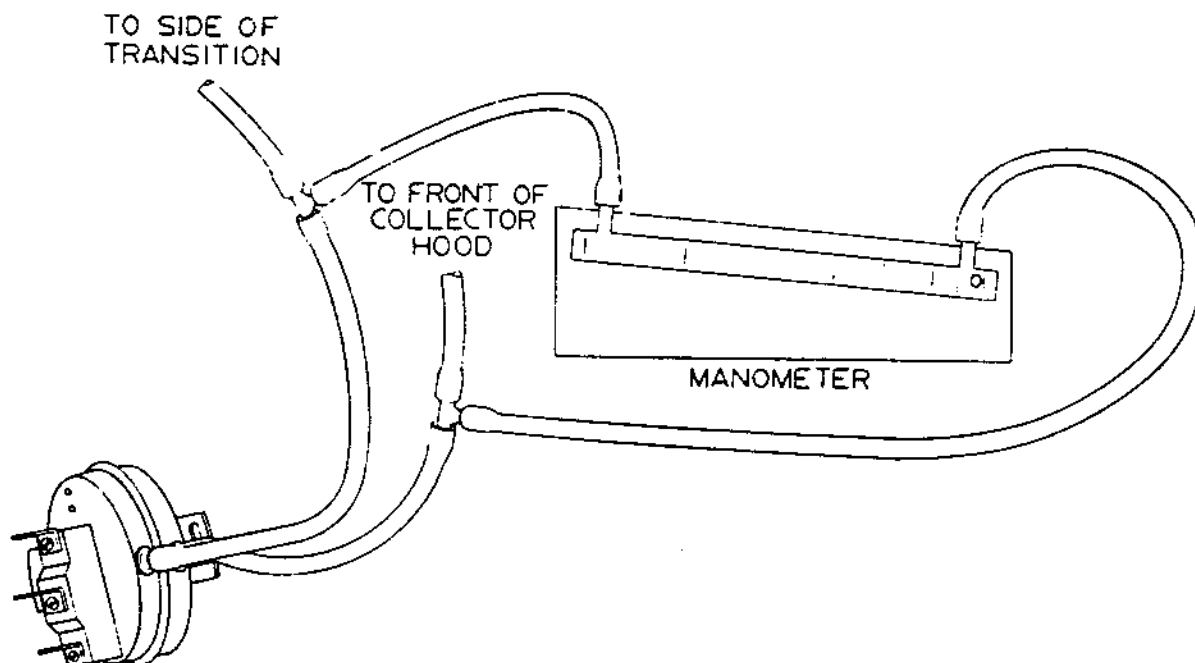
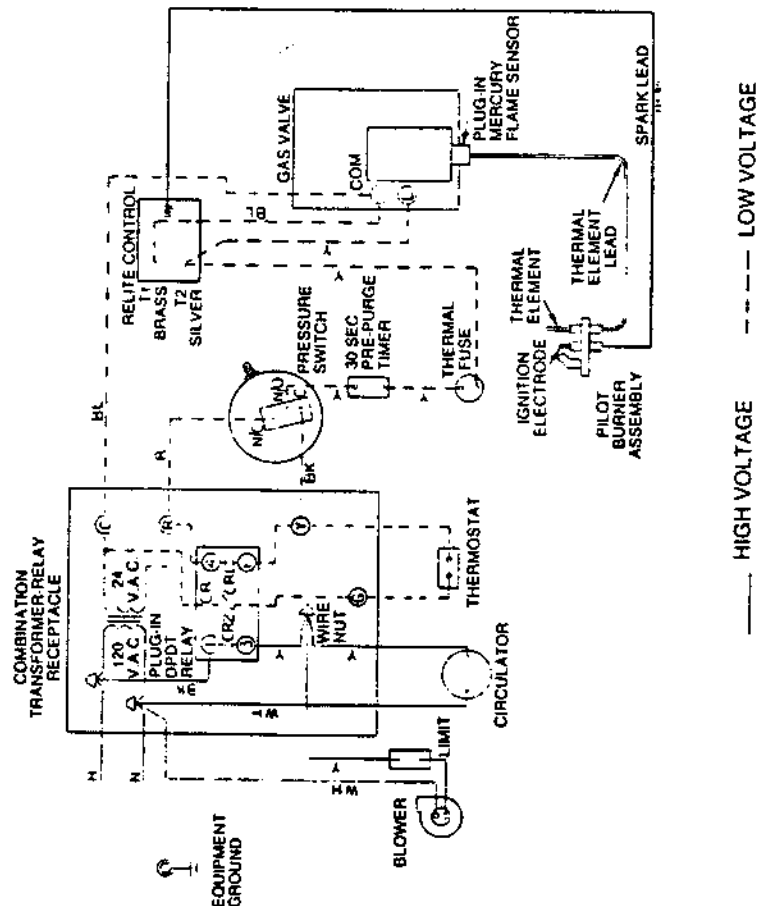


FIGURE 18

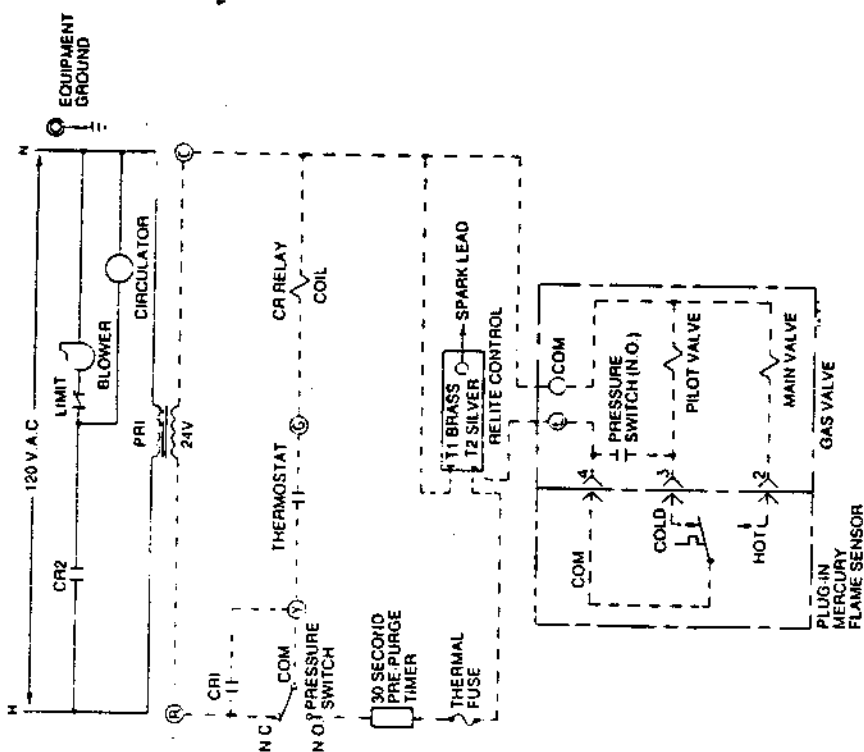
## LADDER WIRING DIAGRAM



**DISCONNECT POWER SOURCE BEFORE INSTALLING AND/OR SERVICING UNIT.**

**NOTES:**

1. All wiring must be installed in accordance with the requirements of the National Electrical Code and any additional national, state, or local code requirements having jurisdiction.
2. All safety circuit wiring must be N.E.C. Class 1.
3. Refer to Control Components Instructions Sheets packed with the boiler for application information.
4. Use only 90° C. Thermoplastic Wire, or equivalent, if any of the original wire must be replaced.



\_\_\_\_\_ HIGH VOLTAGE  
----- LOW VOLTAGE

THERMOSTAT HEAT ANTICIPATOR SETTING	
SYSTEM	HE
WATER	0.40 AMPS

He Series 2—White-Rodgers Cycle-Pilot<sup>®</sup>—Boiler Schematic and Ladder Diagrams. Applicable for forced hot water boilers.

**WELL-McLAIN**  
Michigan City, Indiana 46360  
A Marley Company

TABLE I—BLOWER AND CIRCULATOR WILL NOT OPERATE

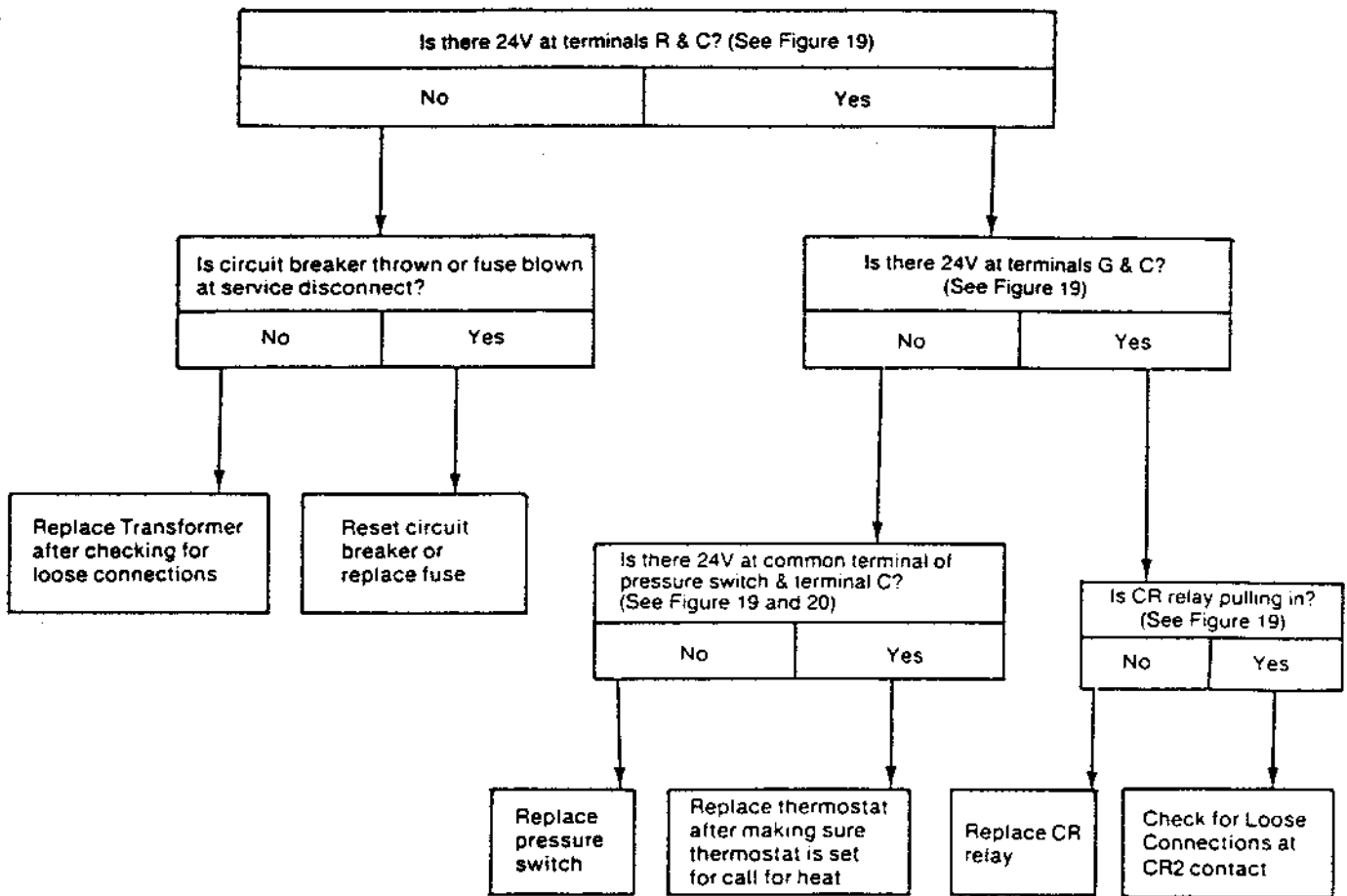
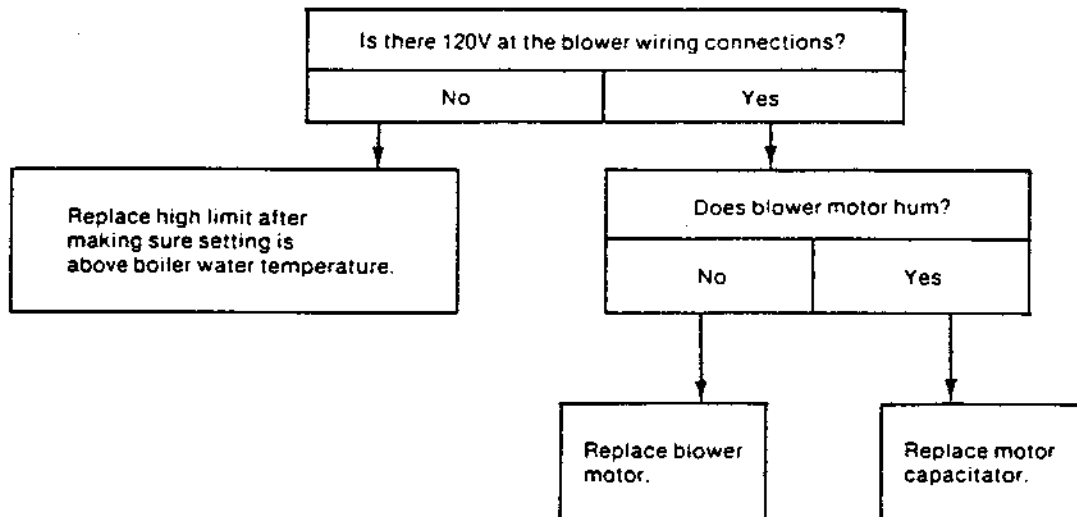
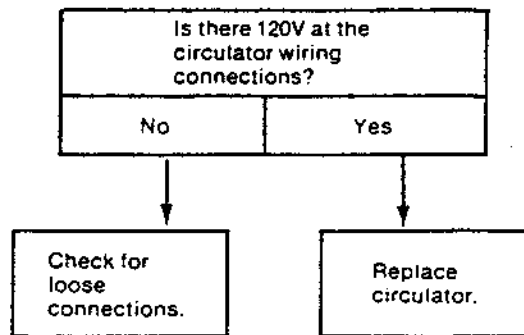


TABLE II—BLOWER WILL NOT OPERATE, BUT CIRCULATOR DOES OPERATE

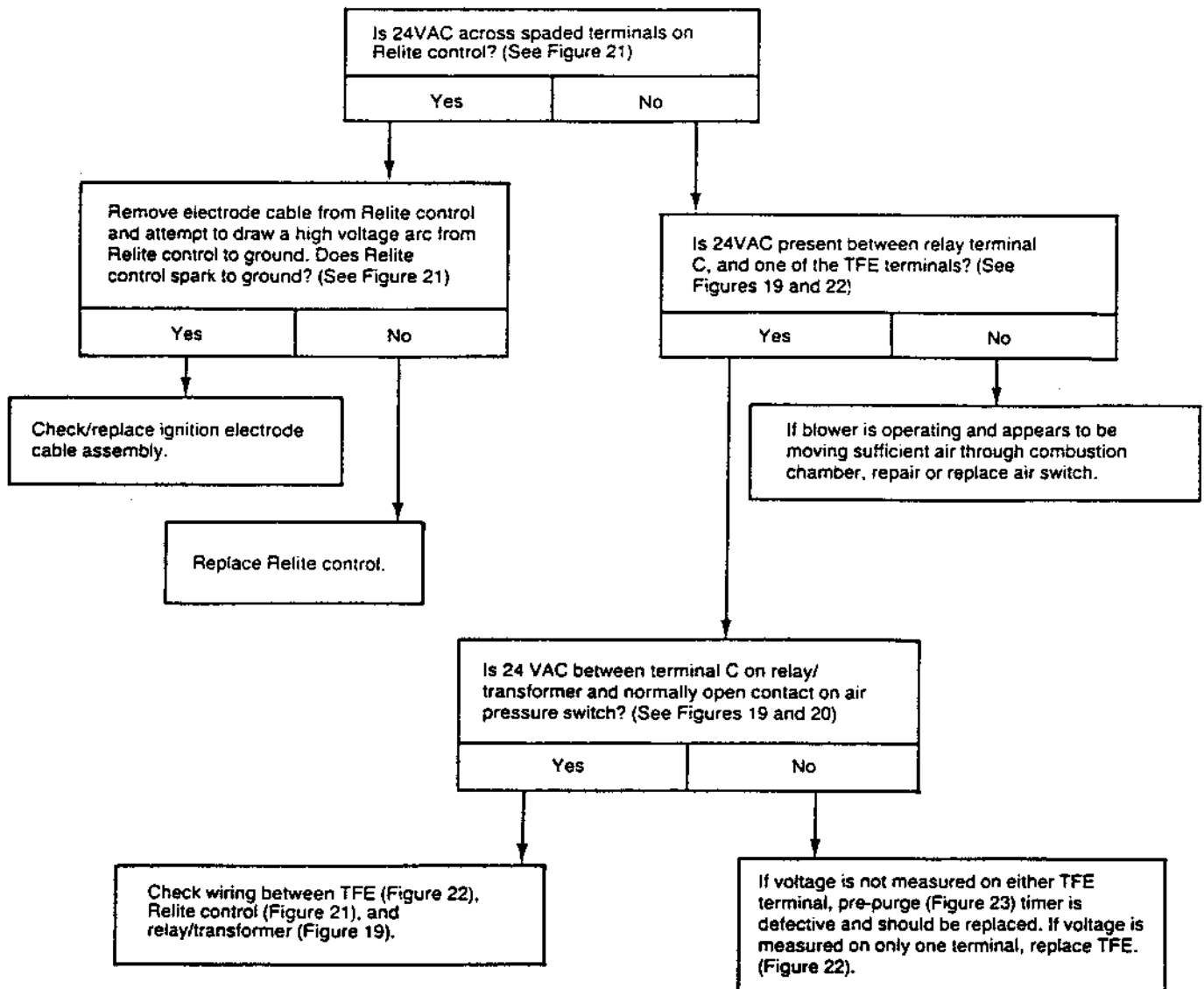


# HE (Series 2) with White-Rodgers Cycle-Pilot®

**TABLE III—CIRCULATOR WILL NOT OPERATE, BUT BLOWER DOES OPERATE**



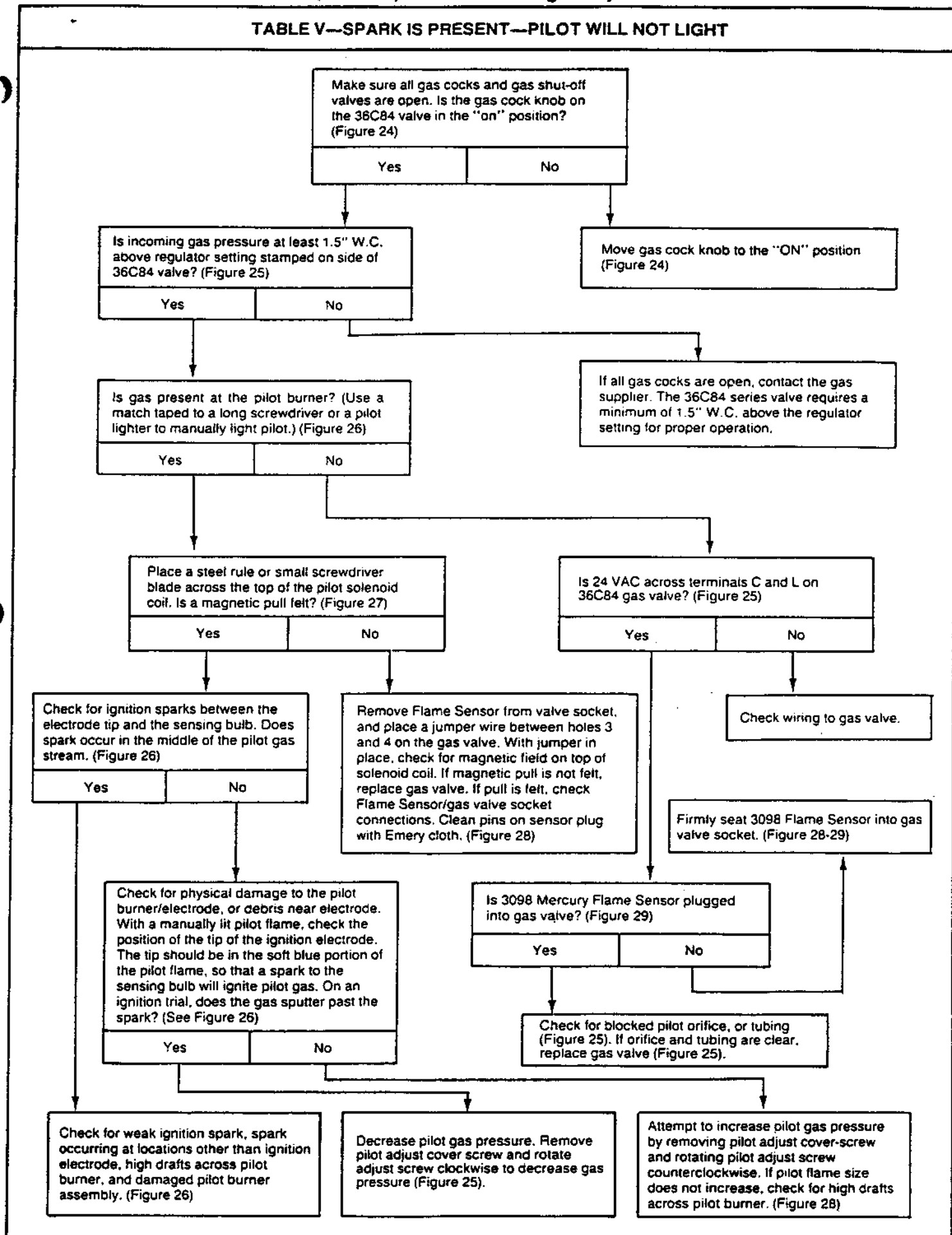
**TABLE IV—NO SPARK AT PILOT—BLOWER & CIRCULATOR BOTH OPERATE**





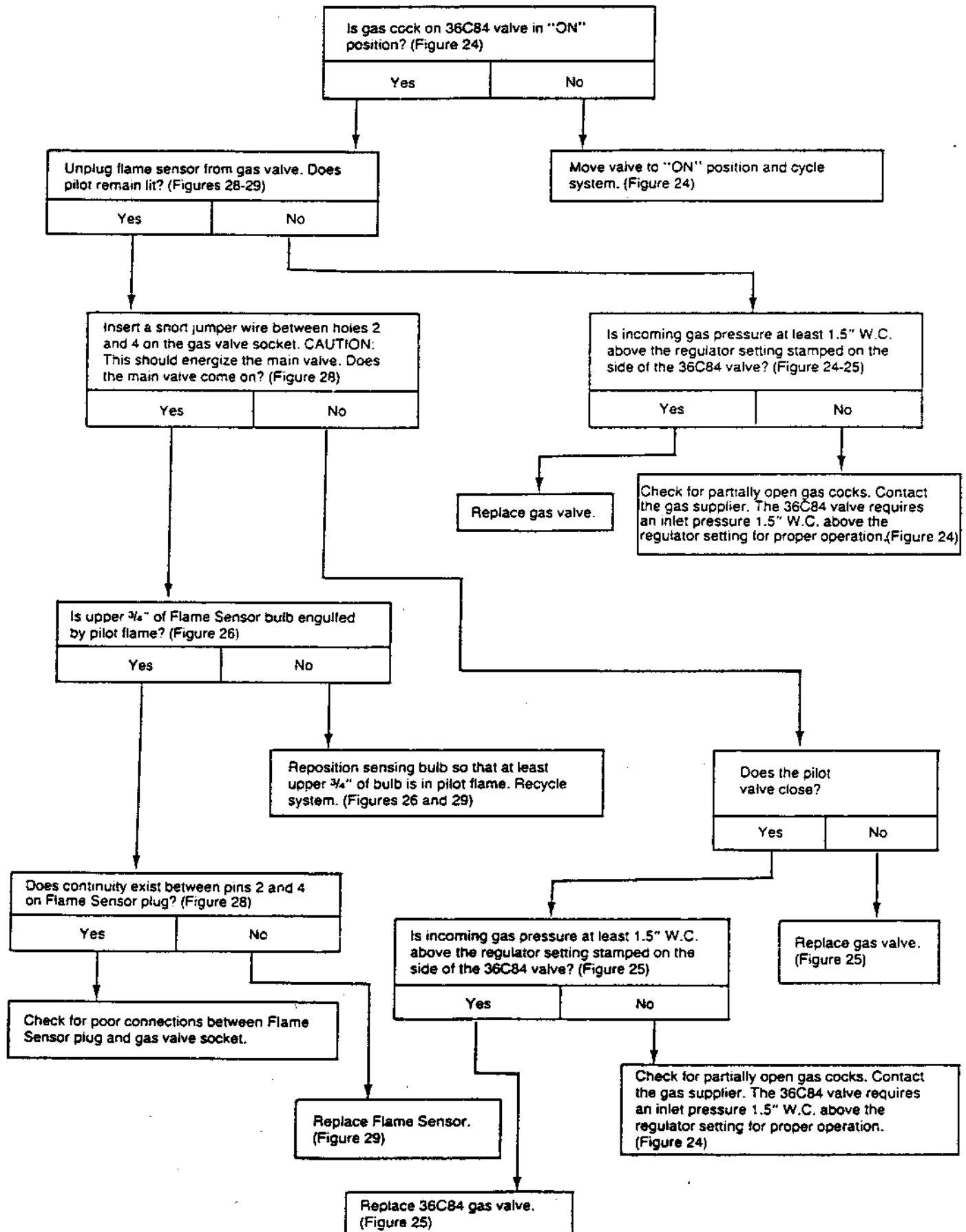
# HE (Series 2) with White-Rodgers Cycle-Pilot®

**TABLE V—SPARK IS PRESENT—PILOT WILL NOT LIGHT**

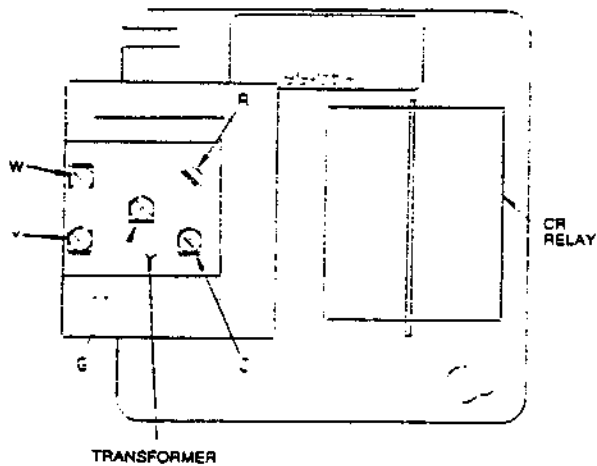


# HE (Series 2) with White-Rodgers Cycle-Pilot®

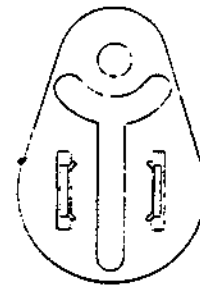
## TABLE VI—PILOT LIGHTS—NO MAIN BURNER IGNITION



HE (Series 2)  
WHITE-RODGERS CYCLE-PILOT® IGNITION SYSTEM COMPONENTS



TRANSFORMER  
FIGURE 19



THERMAL FUSE ELEMENT  
FIGURE 22

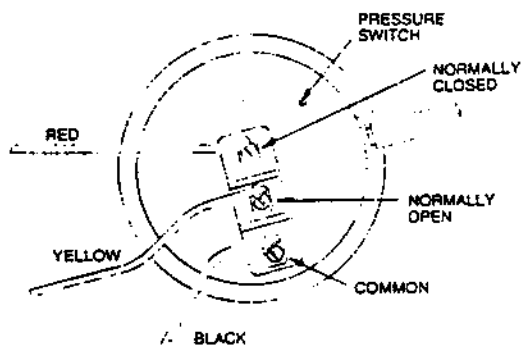
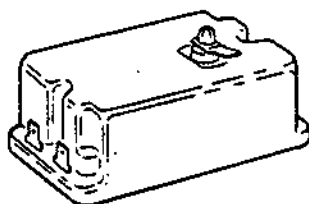


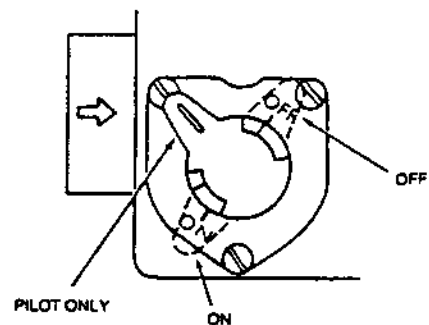
FIGURE 20



PRE-PURGE TIMER  
FIGURE 23



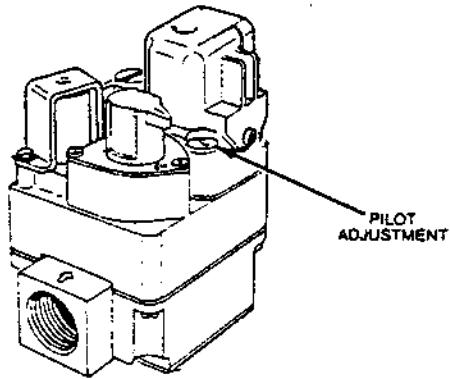
5059 RELITE CONTROL  
FIGURE 21



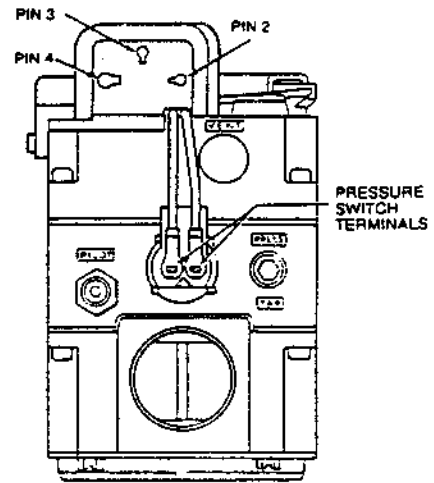
NOTE: When gas cock is positioned over black line on collar around knob, pilot will cycle on and off, but main burner gas will not flow.

36C84 GAS COCK KNOB  
FIGURE 24

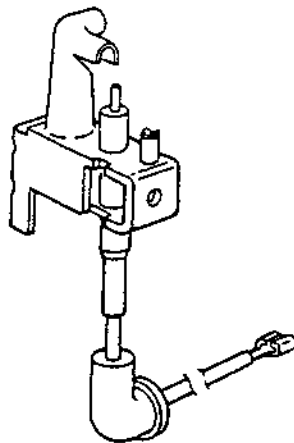
**HE (Series 2)**  
**WHITE-RODGERS CYCLE-PILOT® IGNITION SYSTEM COMPONENTS**



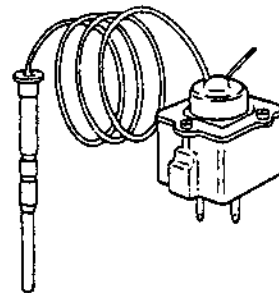
**36C84 GAS VALVE**  
**FIGURE 25**



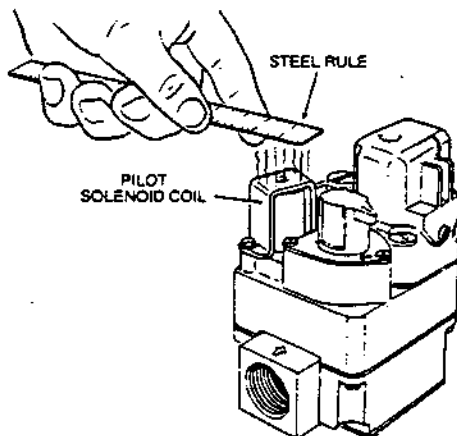
**FLAME SENSOR SOCKET**  
**FIGURE 28**



**E50 PILOT BURNER ASSY.**  
**FIGURE 26**



**3098 MERCURY FLAME SENSOR**  
**FIGURE 29**



**CHECKING FOR ENERGIZED PILOT SOLENOID COIL. MAGNETIC PULL MEANS COIL IS "ON".**  
**FIGURE 27**

**HE (Series 2)**

**Section III:  
Parts Lists  
Component-Assemblies Replacement**

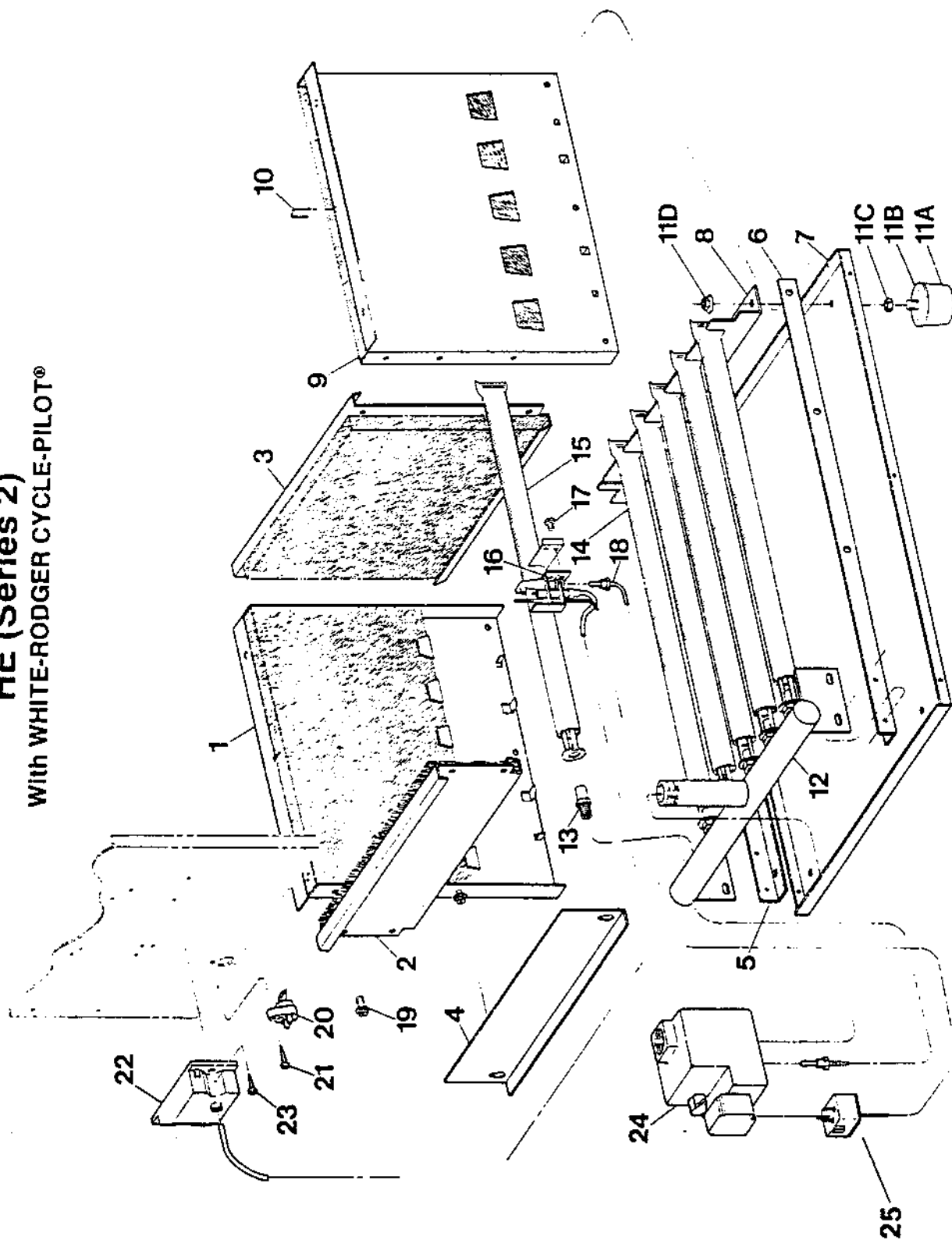
**COMPONENT REPLACEMENT INSTRUCTIONS**

**Before replacing any parts on the boiler:**

- 1. Turn off power**
- 2. Shut off gas supply**

**Refer to the appropriate exploded diagram for parts replacement.**

**Base Assembly  
HE (Series 2)**  
With WHITE-RODGER CYCLE-PILOT®



# HE (Series 2) Base Assembly Parts Description With White-Rodger Cycle-Pilot®

MODEL NO.		HE 3		HE 4		HE 5		HE 6	
NO.	PART DESCRIPTION	QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.
1	Base Side Panel	2	460-003-710	2	460-003-710	2	460-003-710	2	460-003-710
2	Base Front Cross Tie	1	450-030-458	1	450-030-459	1	450-030-460	1	450-030-461
3	Base Back Cross Tie	1	450-030-462	1	450-030-463	1	450-030-464	1	450-030-465
4	Base Access Panel	1	450-030-070	1	450-030-071	1	450-030-072	1	450-030-073
5	Base Pan Angle—Left Hand	1	450-030-475	1	450-030-475	1	450-030-475	1	450-030-475
6	Base Pan Angle—Right Hand	1	450-030-474	1	450-030-474	1	450-030-474	1	450-030-474
7	Base Pan	1	450-030-454	1	450-030-455	1	450-030-456	1	450-030-457
8	Burner Rest	1	450-030-466	1	450-030-467	1	450-030-468	1	450-030-469
9	Base Insulation Set	1	591-222-070	1	591-222-071	1	591-222-072	1	591-222-073
10	Base Insulation Staple	2	—	2	—	2	—	2	—
11	Leg, Screw on Assembly*	4	590-424-250	4	590-424-250	4	590-424-250	4	590-424-250
11a	Leg	4	—	4	—	4	—	4	—
11b	Washer, No. 30	4	—	4	—	4	—	4	—
11c	Nut, 5/16"	4	—	4	—	4	—	4	—
11d	Nut, 5/16"-18 Whiz Lock Plated	2	—	2	—	2	—	2	—
11e	Screw, Machine Flat Head Phillips 5/16"-18 x 2"	4	—	4	—	4	—	4	—
12	Manifold	1	591-126-560	1	591-126-561	1	591-126-562	1	591-126-563
13	Orifice, Main Burner Natural Gas No. 47 Orill	4	560-528-992	6	560-528-992	8	560-528-992	10	560-528-992
14	Burner, Steel**	3	512-200-025	5	512-200-025	7	512-200-025	9	512-200-025
	Burner, Steel**	3	512-200-035	5	512-200-035	7	512-200-035	9	512-200-035
15	Burner, Steel w/Pilot Brackets**	1	512-200-040	1	512-200-040	1	512-200-040	1	512-200-040
	Burner, Steel w/Pilot Brackets**	1	512-200-045	1	512-200-045	1	512-200-045	1	512-200-045
16	Pilot Burner Assembly	1	511-330-116	1	511-330-116	1	511-330-116	1	511-330-116
17	Screw, Machine Round Head Phillips 10-32 x 3/16"	2	—	2	—	2	—	2	—
18	Pilot Tubing 1/8"	1	560-742-860	1	560-742-860	1	560-742-860	1	560-742-860
19	Screw, STP Type D Hex Wash Head Slot 10-32 x 3/16"	20	—	20	—	20	—	20	—
20	Thermal Fuse Element	1	512-050-230	1	512-050-230	1	512-050-230	1	512-050-230
21	Screw Phillips, 8 x 3/4 Pan Hd.-A.	1	—	1	—	1	—	1	—
22	Relife Control	1	511-330-111	1	511-330-111	1	511-330-111	1	511-330-111
23	Screw Phillips 6 x 1/2 Pan Hd.-A.	2	—	2	—	2	—	2	—
24	Gas Valve Assembly	1	551-044-288	1	551-044-288	1	551-044-288	1	551-044-288
25	Mercury Flame Sensor Assembly	1	511-724-262	1	511-724-262	1	511-724-262	1	511-724-262

■ Standard hardware item, purchase locally.

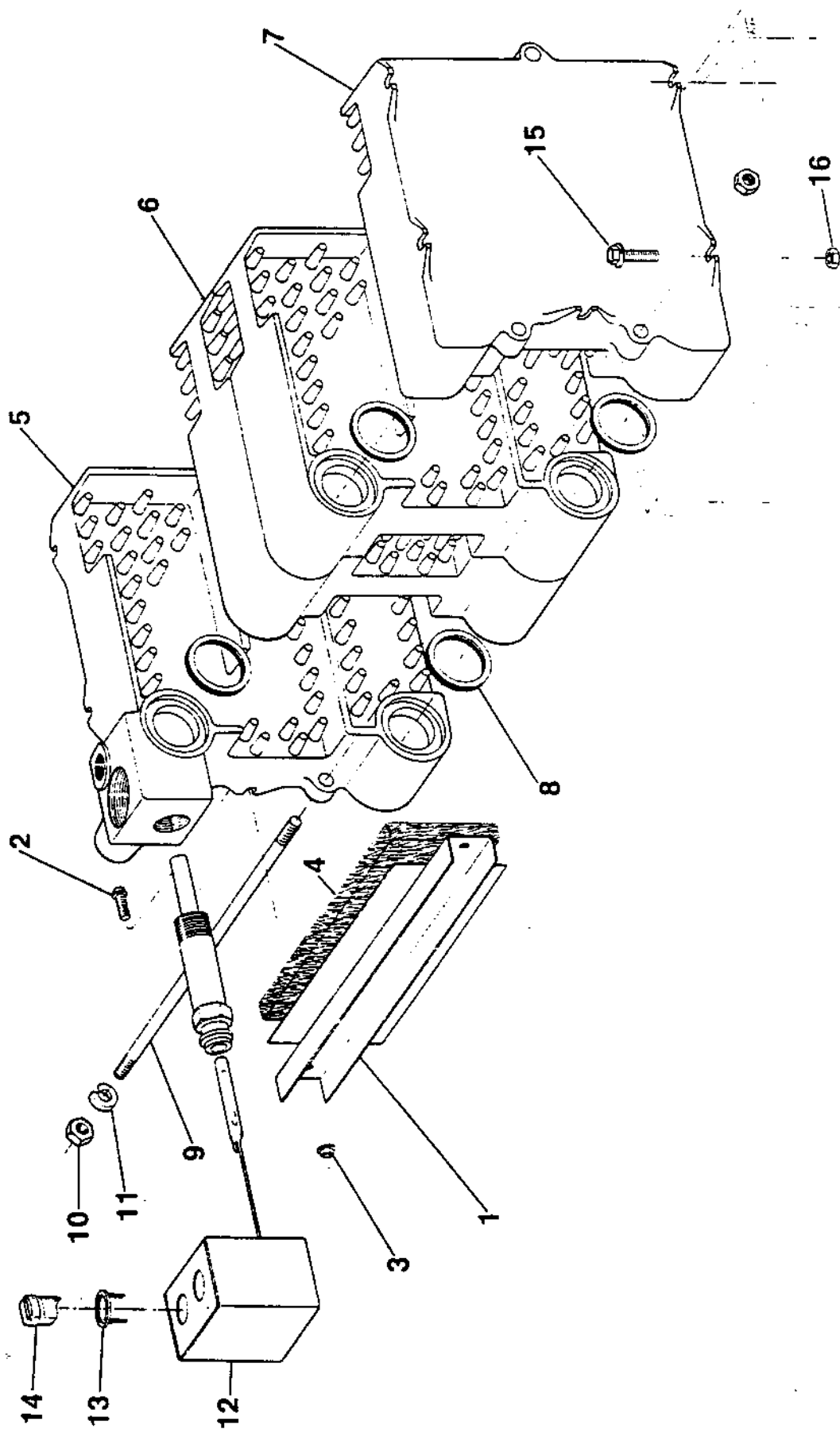
\* Sold as assembly only.

\*\* Interchangeable parts.

\*\*\* Not shown on drawing

— Part of assembly.

Section Assembly  
HE (Series 2)





# HE (Series 2) Section Assembly Parts Description

MODEL NO.		HE 3		HE 4		HE 5		HE 6	
NO.	PART DESCRIPTION	QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.
1	Cleanout Plate	1	450-030-450	1	450-030-451	1	450-030-452	1	450-030-453
2	Screw, Whiz Lock 1/4" x 1 1/4"	2	■	2	■	2	■	2	■
3	Nut, Whiz Lock 1/4"-20	2	■	2	■	2	■	2	■
4	Cerablanket Insulation	1	591-221-280	1	591-221-281	1	591-221-282	1	591-221-283
5	Left End Section 2914	1	312-900-000	1	312-900-000	1	312-900-000	1	312-900-000
6	Intermediate Section 2915	1	312-900-003	2	312-900-003	3	312-900-003	4	312-900-003
7	Right End Section 2918	1	312-900-006	1	312-900-006	1	312-900-006	1	312-900-006
8	Square Cut Seal 2"	4	592-800-011	6	592-800-011	8	592-800-011	10	592-800-011
9	Tie Rod	3	560-234-500	3	560-234-501	3	560-234-502	3	560-234-503
10	Nut, Hex 7/16"-14	6	■	6	■	6	■	6	■
11	Washer, Helical Spring Lock 7/16"	3	■	3	■	3	■	3	■
12	High Limit Control w/Well and Stop at 220°	1	510-312-010	1	510-312-010	1	510-312-010	1	510-312-010
13	Strain Relief Bushing	1	■	1	■	1	■	1	■
14	Strain Relief Adapter	1	■	1	■	1	■	1	■
15	Screw, Whiz Lock 5/16"-18 x 1"	4	■	4	■	4	■	4	■
16	Nut, Two Way Lock 5/16"-18	4	■	4	■	4	■	4	■

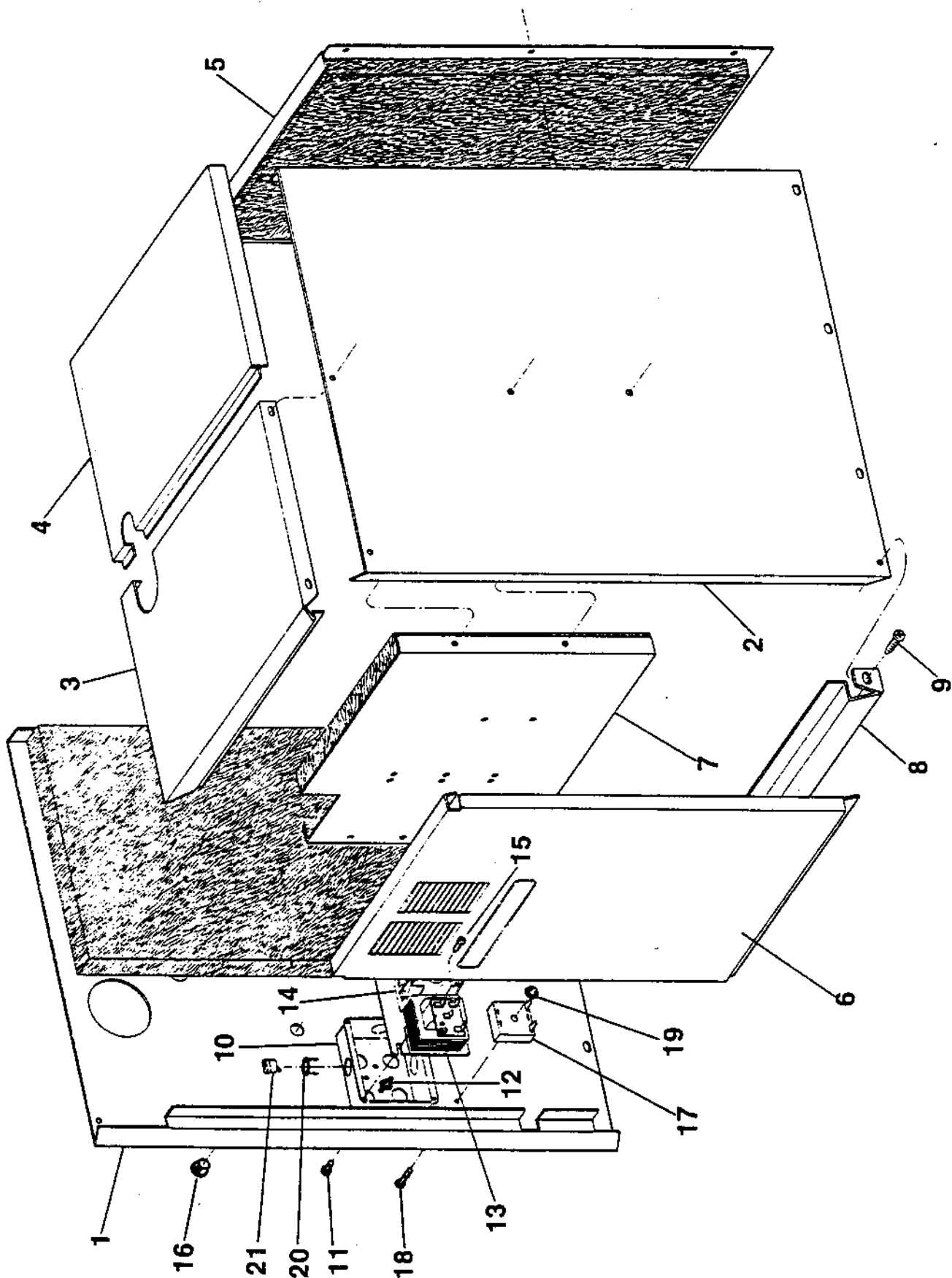
■ Standard hardware item, purchase locally.

\* Sold as assembly only.

\*\* Interchangeable parts.

\*\*\* Not shown on drawing.

# Jacket Assembly HE (Series 2)

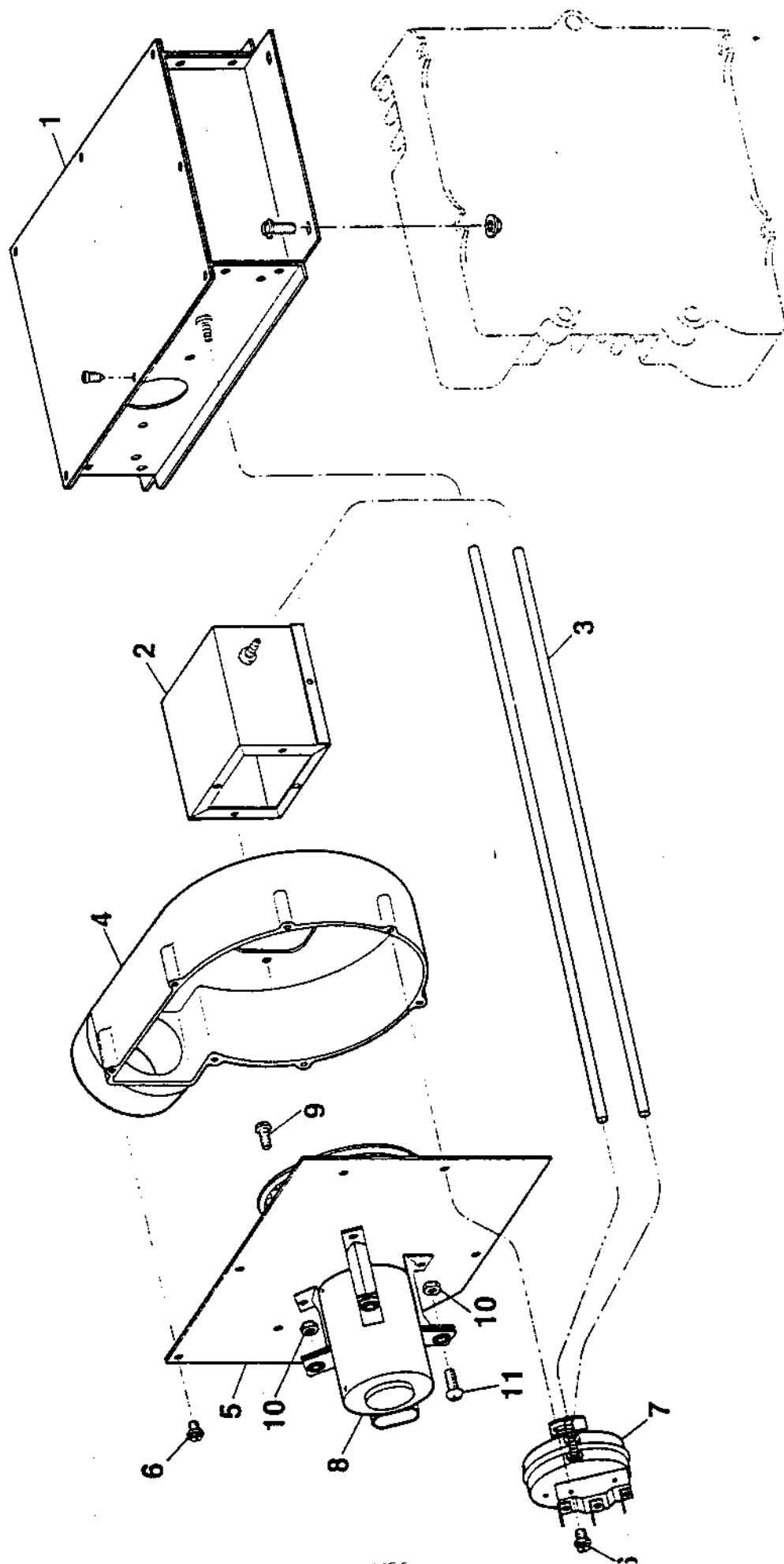


# HE (Series 2) Jacket Assembly Parts Description

MODEL NO.		HE 3		HE 4		HE 5		HE 6	
NO.	PART DESCRIPTION	QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.
1	Jacket, Left Hand Side Panel	1	422-901-161	1	422-901-161	1	422-901-161	1	422-901-161
2	Jacket, Right Hand Side Panel	1	422-901-160	1	422-901-160	1	422-901-160	1	422-901-160
3	Jacket, Front Top Panel	1	422-901-100	1	422-901-101	1	422-901-102	1	422-901-103
4	Jacket, Rear Top Panel	1	422-901-110	1	422-901-111	1	422-901-112	1	422-901-113
5	Jacket, Rear Panel	1	422-901-120	1	422-901-121	1	422-901-122	1	422-901-123
6	Jacket Door	1	422-901-130	1	422-901-131	1	422-901-132	1	422-901-133
7	Jacket, Interior Panel	1	422-901-140	1	422-901-141	1	422-901-142	1	422-901-143
8	Jacket, Front Bottom Cross Tie	1	422-901-150	1	422-901-151	1	422-901-152	1	422-901-153
9	Screw, Sheet Metal Type A Pan Head Phillips #10 x 1/2"	22		22		22		22	
10	Junction Box 4" x 4" x 1 1/2"	1		1		1		1	
11	Screw, Machine Pan Head Phillips 10-32 x 1/2"	1		1		1		1	
12	Nut, Hex Green Plated 10-32	1		1		1		1	
13	Transformer w/Plug In Receptacle and Bale Wire	1	510-312-165	1	510-312-165	1	510-312-165	1	510-312-165
14	Relay	1	510-350-223	1	510-350-223	1	510-350-223	1	510-350-223
15	Screw, Sheet Metal Type AB Pan Head Phillips 8 x 1/2"	2		2		2		2	
16	Bushing, Thermostat Wire (furnished with jacket)	1		1		1		1	
17	Timer, 30 Second Pre-Purge	1	510-350-369	1	510-350-369	1	510-350-369	1	510-350-369
18	Screw, Machine Rd Head Slot 10-32 x 1 1/4"	1		1		1		1	
19	Nut, Hex 10-32	5		5		5		5	
20	Strain Relief Bushing	1		1		1		1	
21	Strain Relief Adapter	1		1		1		1	

■ Standard hardware item, purchase locally.  
• Sold as assembly only.

**Flue Collector Assembly, Transition Assembly  
and Blower Cabinet Assembly  
HE (Series 2)**



# HE (Series 2) Flue Collector Assembly, Transition Assembly and Blower Cabinet Assembly Parts Description

MODEL NO.									
NO.	PART DESCRIPTION	HE 3		HE 4		HE 5		HE 6	
		QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.
1	Flue Collector Assembly * Screw, Whit Lock 1/4"-20 x 1 1/4" (For Flue Collector Assembly to Sections) Nut, Whit Lock 1/4"-20 (For Flue Collector Assembly to Sections) Screw, Sheet Metal Type A Pan Head Phillips No. 10 x 1/2" (For Flue Collector Top Panel)	1 4 4 17	450-030-570 ■ ■ ■	1 4 4 19	450-030-571 ■ ■ ■	1 4 4 19	450-030-572 ■ ■ ■	1 4 4 21	450-030-573 ■ ■ ■ ■
2	Flue Collector to Blower Housing Transition Assembly w/Damper and Hose Barb *	1	450-030-514	1	450-030-514	1	450-030-514	1	450-030-514
3	Tubing, Silicone 1/4" ID x 12"	2	■	2	■	2	■	2	■
4	Blower Housing Screw, Sheet Metal Type A Pan Head Phillips No. 10 x 1/2" (For Blower Housing to Transition Assembly)	1 4	591-126-700 ■	1 4	591-126-700 ■	1 4	591-126-700 ■	1 4	591-126-700 ■
5	Blower Cabinet Assembly (blower wheel, cover plate, blower motor with capacitor, standoff, shock mounts, nuts and bolts) *	1	510-312-300	1	510-312-300	1	510-312-300	1	510-312-300
6	Screw, STP Type D Hex Wide Head SLT, No. 10-32 x 3/8" (For Blower Housing Cover Plate)	6	■	6	■	6	■	6	■
7	Pressure Switch	1	511-624-541	1	511-624-541	1	511-624-541	1	511-624-541
8	Replacement Motor Kit (motor, shock mounts, 4 mfd, 360 v capacitor)	1	382-930-220	1	382-930-220	1	382-930-220	1	382-930-220
9	Round Head Phillips Mach. Screw 10-21 x 3/4 ZP	3	■	3	■	3	■	3	■
10	10-32 Hex 2-way Lock Nut	6	■	6	■	6	■	6	■
11	Round Head Phillips Mach. Screw 10-32 x 3/8 ZP	3	■	3	■	3	■	3	■

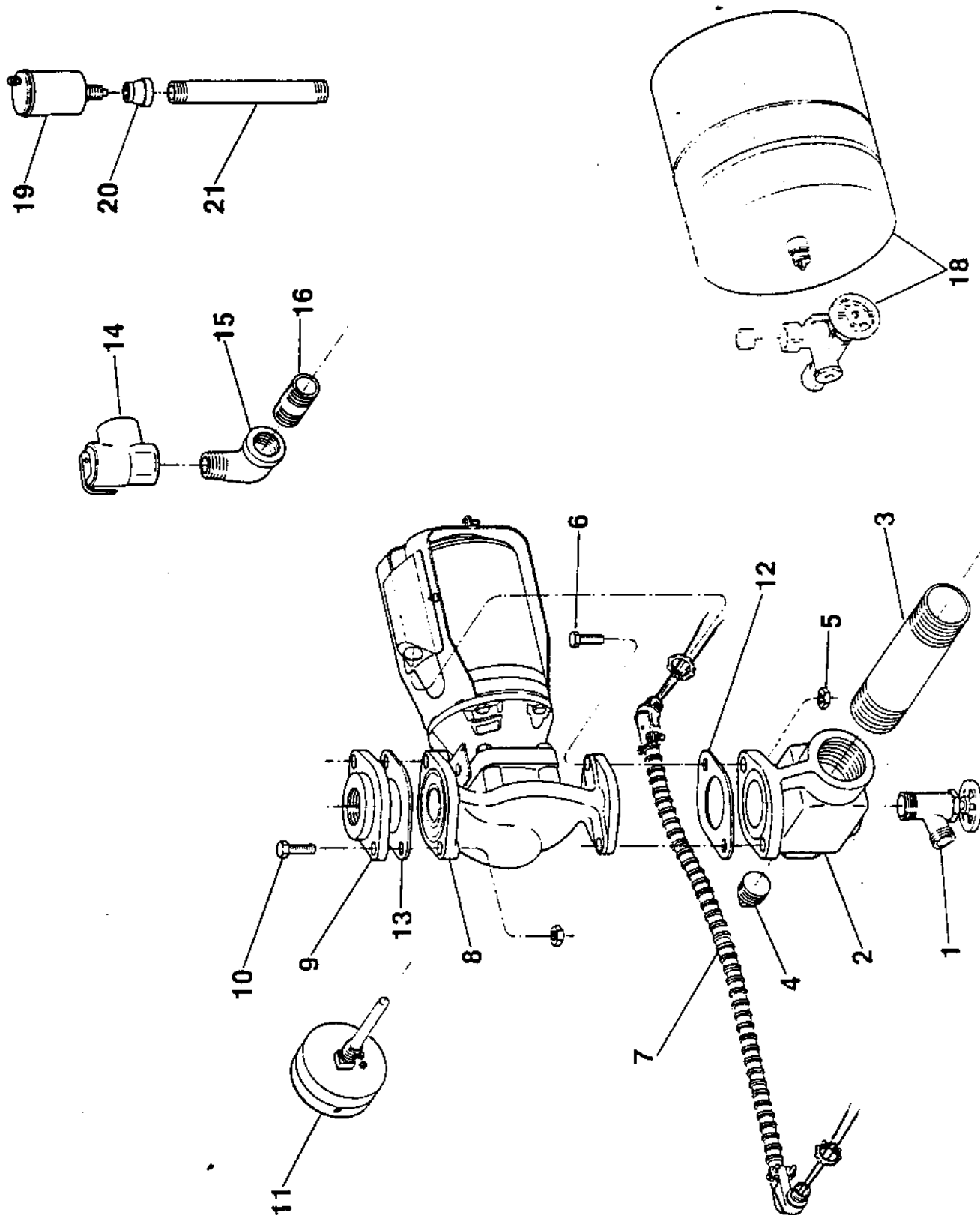
■ Standard hardware item, purchase locally.

\* Sold as assembly only.

\*\* Interchangeable parts.

... Not shown on drawing.

# Boiler Trim Assembly HE (Series 2)



# HE (Series 2) Boiler Trim Assembly Parts Description

MODEL NO.		HE 3		HE 4		HE 5		HE 6	
NO.	PART DESCRIPTION	QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.	QTY.	PART NO.
1	Drain Valve 3/4"***	1	511-210-423	1	511-210-423	1	511-210-423	1	511-210-423
	Drain Valve 3/4"***	1	511-210-424	1	511-210-424	1	511-210-424	1	511-210-424
2	Pump Flange Return Elbow	1	330-050-830	1	330-050-830	1	330-050-830	1	330-050-830
3	Nipple 1 1/4" x 5"	1	■	1	■	1	■	1	■
4	Plug 3/4" NPT	1	■	1	■	1	■	1	■
5	Nut, Hex 7/16"-14	4	■	4	■	4	■	4	■
6	Screw, Hex Head 7/16"-14 x 1 1/4"	2	■	2	■	2	■	2	■
7	Wiring Harness, Box to Pump	1	591-319-792	1	591-319-792	1	591-319-792	1	591-319-792
8	Circulator Pump B&G**	1	511-405-115	1	511-405-115	1	511-405-115	1	511-405-115
	Circulator Pump TACO**	1	511-405-116	1	511-405-116	1	511-405-116	1	511-405-116
9	Pump Flange 1" B&G	1	563-910-010	1	563-910-010	1	563-910-010	1	563-910-010
	Pump Flange 1" TACO	1	563-910-011	1	563-910-011	1	563-910-011	1	563-910-011
10	Screw, Hex Head 7/16"-14 x 1 1/2"	2	■	2	■	2	■	2	■
11	Pressure-Temperature Gauge**	1	510-218-096	1	510-218-096	1	510-218-096	1	510-218-096
	Pressure-Temperature Gauge**	1	510-218-097	1	510-218-097	1	510-218-097	1	510-218-097
12	Gasket for Return Elbow	1	590-317-535	1	590-317-535	1	590-317-535	1	590-317-535
13	Gasket 1" B&G	1	590-317-542	1	590-317-542	1	590-317-542	1	590-317-542
	Gasket 1" TACO	1	590-317-543	1	590-317-543	1	590-317-543	1	590-317-543
14	Relief Valve Female	1	511-546-924	1	511-546-924	1	511-546-924	1	511-546-924
15	Elb, 3/4" Black for Female Valve	1	■	1	■	1	■	1	■
16	Nipple, 3/4" x 2" Black	1	■	1	■	1	■	1	■
18	Fill-Trol System #109 (P-HE only)	1	510-632-086	1	510-632-086	1	510-632-086	1	510-632-086
	Fill-Trol System #110 (P-HE only)	1	510-632-086	1	510-632-086	1	510-632-086	1	510-632-086
19	Auto Air Vent (P-HE only)	1	510-148-562	1	510-148-562	1	510-148-562	1	510-148-562
20	Reducer 1/2" NPT x 1/4" NPT (P-HE only)	1	■	1	■	1	■	1	■
21	Nipple 1/4" x 6" (P-HE only)	1	■	1	■	1	■	1	■
***	Silicone Sealant (400°F—Seals Collector to Sections)	1	■	1	■	1	■	1	■
***	Retort Cement	1	591-602-913	1	591-602-913	1	591-602-913	1	591-602-913

■ Standard hardware item, purchase locally.

\* Sold as assembly only.

\*\* Interchangeable parts.

\*\*\* Not shown on drawing.