

# Chromalox®

## Installation, Operation and RENEWAL PARTS IDENTIFICATION

### Chromalox Horizontal Electric Steam Boiler Catalog Number CHS (0-150 PSI Pressure)

#### SERVICE REFERENCE

DIV. 4	SEC. CHS	NUMBER 3001F
SALES REFERENCE (Supersedes PQ404-5)		PQ404-6
161-048642-001		
DATE	October, 1983	

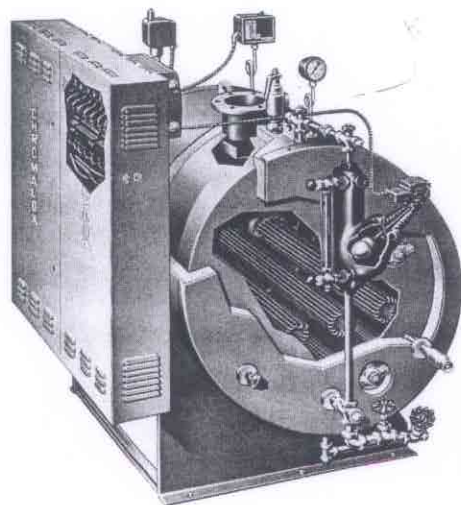
Boiler Serial No. ....	Power Circuit Voltage .....
Model No. ....	No. of Power Circuits ..... Amps .....
Electrical Capacity .....	Control Circuit Voltage .....
National Board No. ....	Total Amps ..... Phase ..... Cy.....

IMPORTANT — This data file contains the National Board Registration Certificate approving your boiler. It must be kept near the boiler at all times.

#### Specifications — 480-volt Boilers\*

Catalog Number	B.H.P. Rating	KW	Con-tactors	Fuse Size	Delta KW	Power CCT Nominal Size (Amps)	Size of 90°C. Wire (M.C.M.)	Amps per Circuit	Elements (KW)	Standard Control System	Output Lbs. per Hr. at 212°F
CHS-150*	15.3	150	5 50A	60A	30	1 300	4/0	181	2 1 60 30	2 P'TROLS	452
CHS-180*	18.4	180	6 50A	60A	30	1 300	250	217	3 60		543
CHS-210*	21.4	210	7 50A	60A	30	1 600	600	253	3 1 60 30		633
CHS-240*	24.5	240	8 50A	60A	30	1 600	400	290	4 60		723
CHS-270*	27.6	270	9 50A	60A	30	1 600	600	326	4 1 60 30	3 P'TROLS	814
CHS-300*	30.6	300	10 50A	60A	30	1 600	600	362	5 60		904
CHS-360	36.7	360	12 50A	60A	30	2 300	250	217	2 3 90 60	SEQUENCER	1085
CHS-420	42.9	420	14 50A	60A	30	2 600	350	254	4 1 90 60		1266
CHS-495	50.5	495	11 60A	100A	45	2 600	500	297	3 1 135 90		1492
CHS-540	55.1	540	12 60A	100A	45	2 600	600	324	4 135		1628
CHS-630	64.3	630	14 60A	100A	45	2 600	700	378	4 1 135 90		1899
CHS-720	73.5	720	16 60A	100A	45	3 600	400	324	5 1 135 45		2170
CHS-810	82.7	810	18 60A	100A	45	3 600	600	324	6 135		2441
CHS-945	96.4	945	21 60A	100A	45	3 600	700	378	7 135		2848
CHS-1080	110.0	1080	24 60A	100A	45	4 600	500	324	8 135		3255
CHS-1215	124.0	1215	27 60A	100A	45	4 600	700	378	9 135		3662
CHS-1350	138.0	1350	30 60A	100A	45	5 600	600	324	10 135		4069
CHS-1485	152.0	1485	33 60A	100A	45	5 600	700	378	11 135		4476
CHS-1620	165.0	1620	36 60A	100A	45	6 600	600	324	12 135		4883

\* 150 kw thru 300 kw Boilers available in 208-v and 240-v. Check Factory.



Chromalox Model CHS-360 Steam Boiler

## INSTALLATION

**CAUTION: To avoid electrical shock hazard, boilers must be suitably grounded to earth.**

**NOTE:** Chromalox boilers are pre-tested before shipment; no internal piping or wiring is necessary. **WARNING:** Substitution of components or modification of wiring without prior consent of Edwin L. Wiegand Div., Emerson Electric Co. voids warranty.

1. Locate unit on level floor or platform.

**NOTE:** A minimum distance of 60 inches from wall, other equipment, etc. must be allowed for removal of the elements.

2. Complete all piping to boiler. Connect water line to tagged fitting on the motor and pump assembly, if used, or to tagged fitting on water control feeder.

3. When any type of feed other than a pump feed is used — the existing water supply must be 10 pounds greater than the boiler operating pressure to assure water supply maintains proper water level in boiler. Otherwise, lack of water can cause heater failure. Keep feed water line valves open at all times.

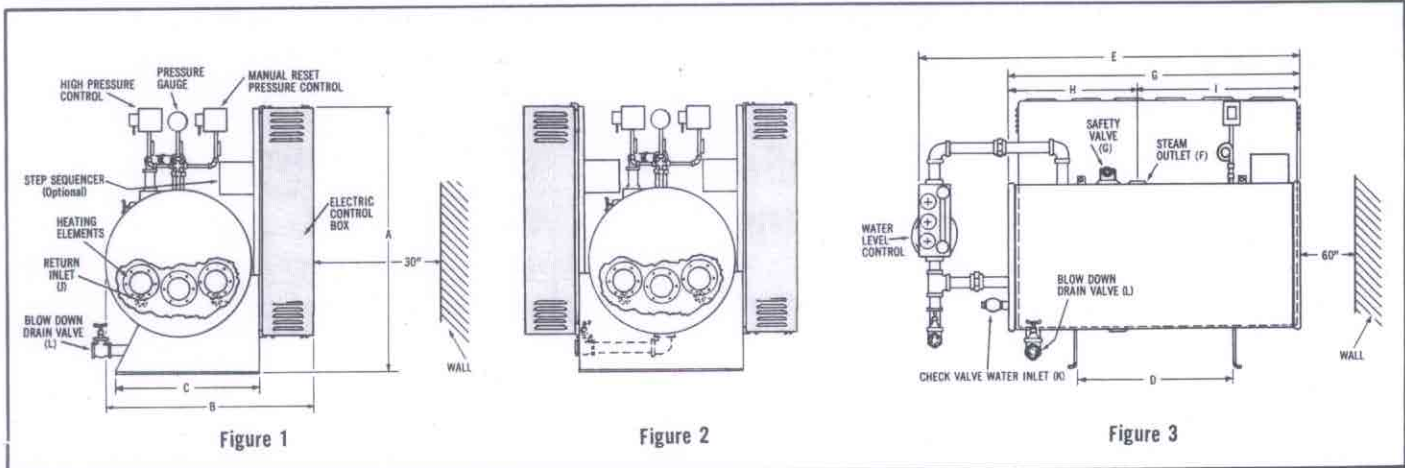
4. All water feed systems are connected to supplied water inlet check valve.

5. Connect steam line (with Globe valve) to boiler steam outlet. Valve should be placed as close as possible to boiler outlet.

6. To insure maximum efficiency of supplied kw, all piping from outlet should be insulated.

7. Drain and relief valve piping should be in accordance with state and local codes.

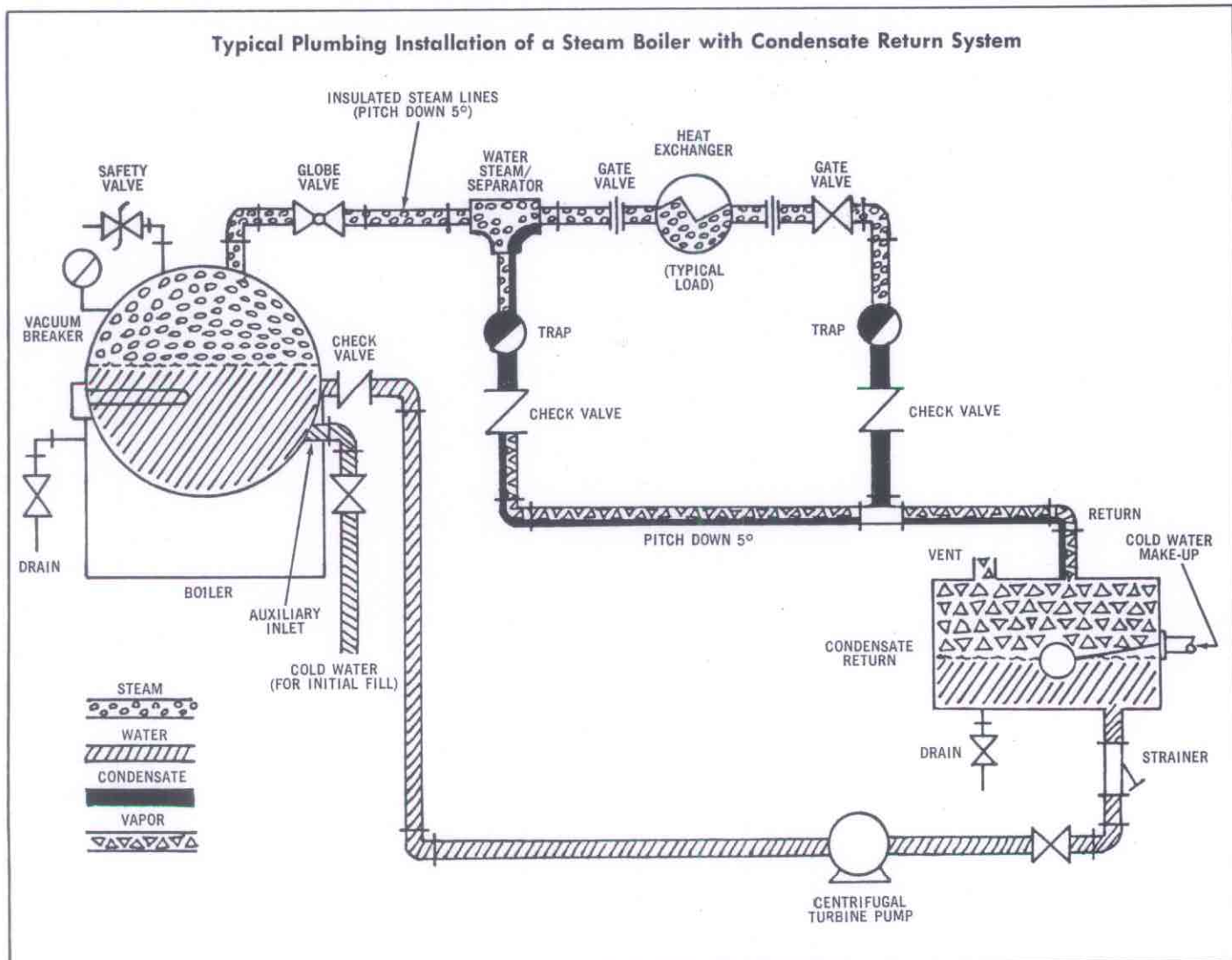
## INSTALLATION (Continued)



† CHS-945 thru CHS-1620 have 2 control boxes. (See Figure 2.) Add 13" to "B" Dimension.

Catalog Number	A	B	C	D	E	F*	G	H	I	J	K	L
CHS-150 thru CHS-300	57"	45"	32"	40"	68"	3" NPT	1"	25"	31"	2" NPT	1" NPT	1" NPT
CHS-360 thru CHS-420	57"	45"	32"	40"	68"	4"	1"	25"	31"	2" NPT	1" NPT	1" NPT
CHS-495 thru CHS-630	57"	45"	32"	47"	86"	4"	1"	34"	40"	2" NPT	1" NPT	1" NPT
CHS-720 thru CHS-810	76"	58"	45"	47"	94"	6"	1½"	38"	44"	2" NPT	1" NPT	1" NPT
CHS-945 thru CHS-1080	76"	68"	45"	47"	94"	6"	1½"	38"	44"	2" NPT	1" NPT	1" NPT
CHS-1215 thru CHS-1620	86"	76"	56"	50"	98"	6"	1½"	40"	46"	2" NPT	1½" NPT	1" NPT

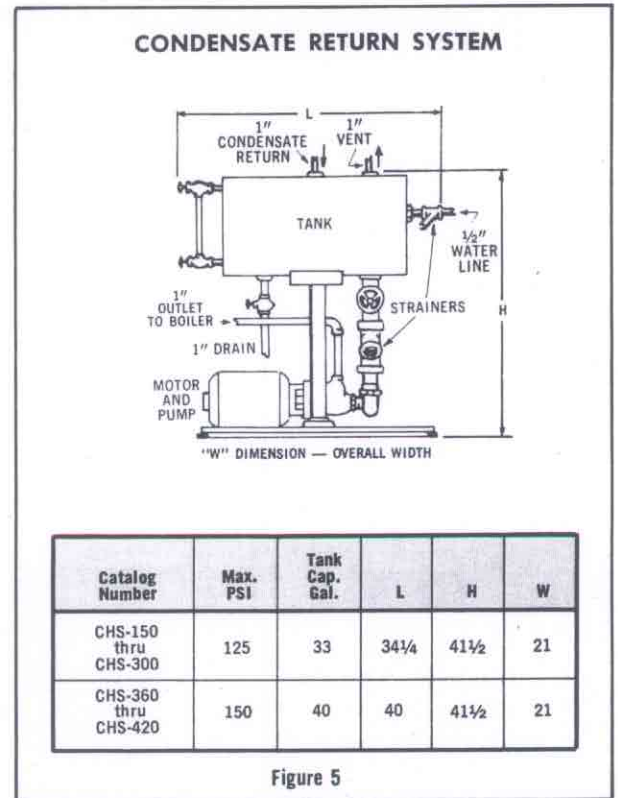
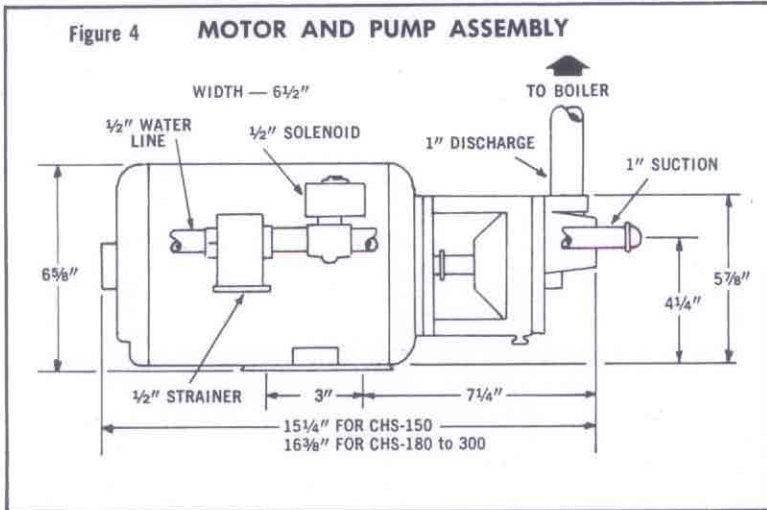
\* 4" and 6" are flanged.



## INSTALLATION (Continued)

### SPECIAL INSTRUCTIONS FOR CUSTOMERS SUPPLYING THEIR OWN CONDENSATE OR PUMP SYSTEMS.

- a. Check the voltage of the motor before making the wiring connection. Some Chromalox boilers are supplied with dual voltage systems. The motor should always match the voltage of the control circuit.
- b. The motor circuit should be wired into the pump control as shown in wiring diagram.
- c. A heavy-duty vacuum breaker is required when condensate system is used. (part number ES-89369)



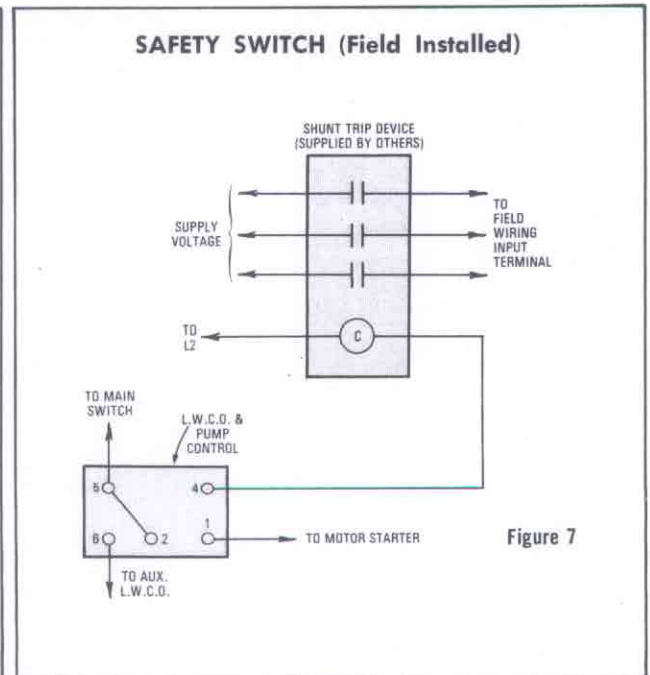
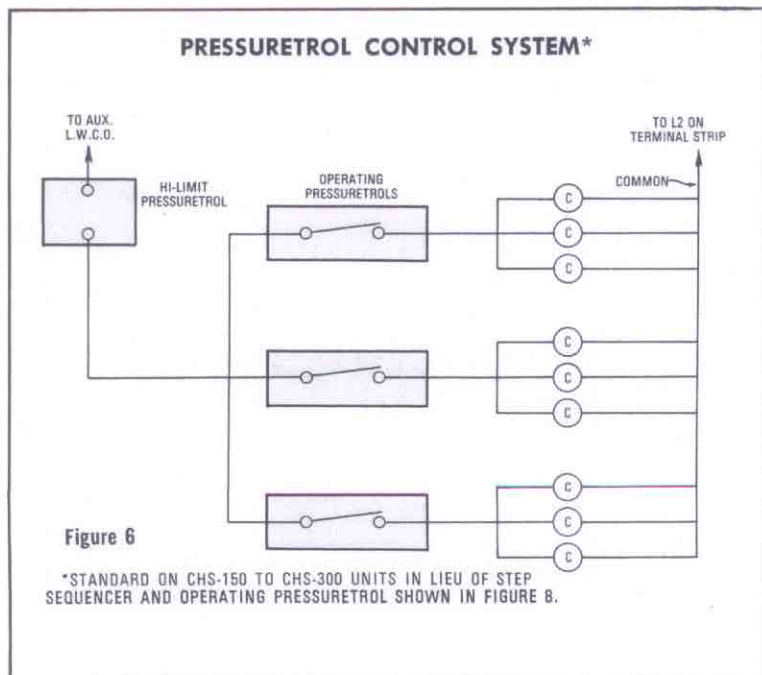
## WIRING

1. Wiring to boiler should be as per appropriate wiring diagram supplied with boiler and in accordance with Local and National Electrical Codes.
2. **SAFETY SWITCHES** — Purchaser should use a safety switch between his main power source and the boiler. The safety switch should use circuit breakers or fuses and be in accordance with NEC and local codes.

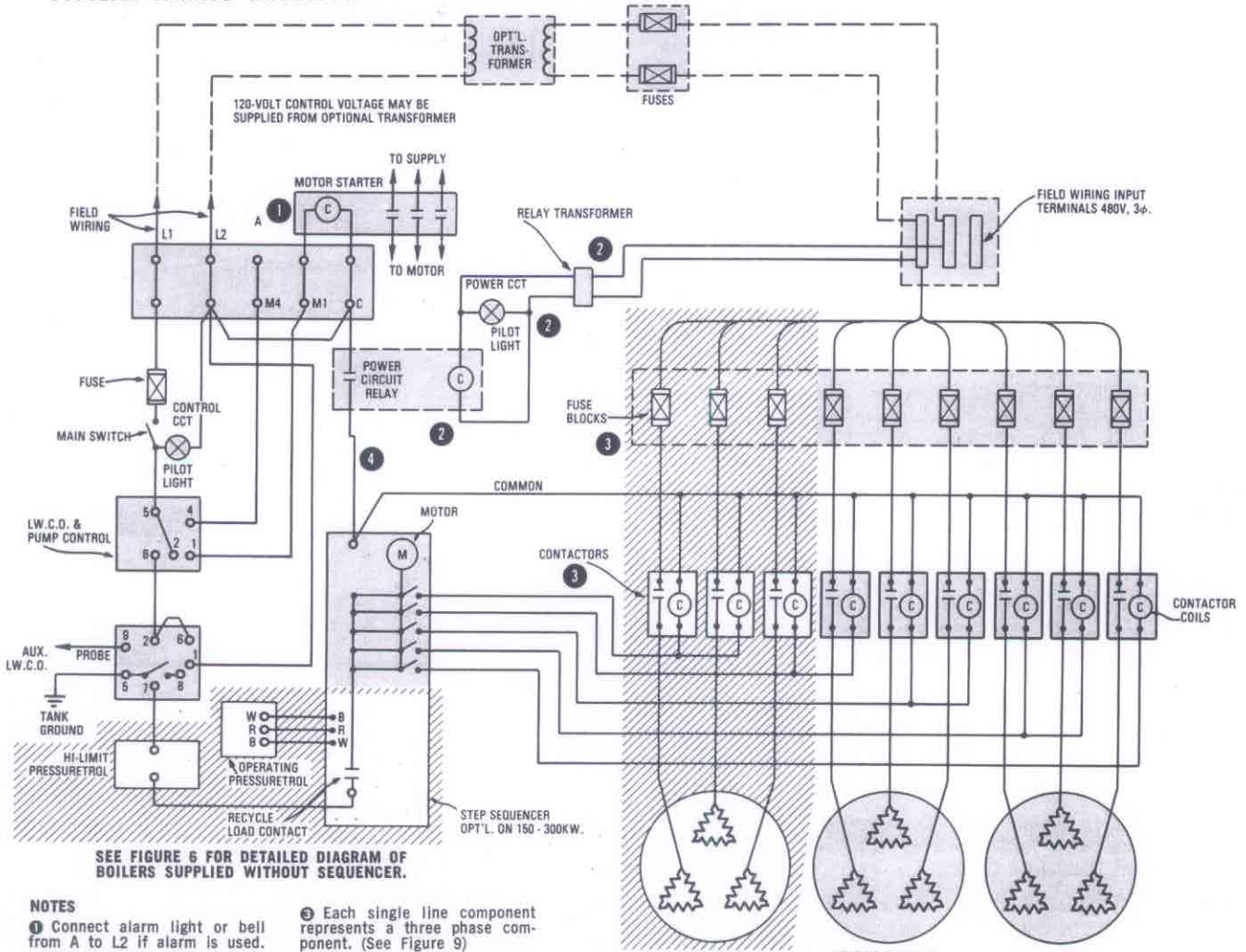
Serious thought should be given to the advisability of using a shunt trip safety switch of the circuit breaker type as an additional safety precaution. It is possible to utilize

the spare contacts in the low water cutoff to energize the shunt mechanism on the safety switch. This is an additional safety feature that prevents a dangerous situation should a contactor or relay stick. Activation of the shunt trip device will completely disconnect the boiler from the power supply. (See Figure 7).

3. Since Boiler heating elements are susceptible to lightning damage, plants not having lightning arresters that have above-ground electrical cable supply sources should install lightning arresters in the proper size to meet the boiler kw load.



TYPICAL WIRING DIAGRAM

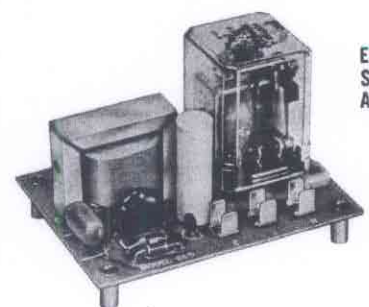
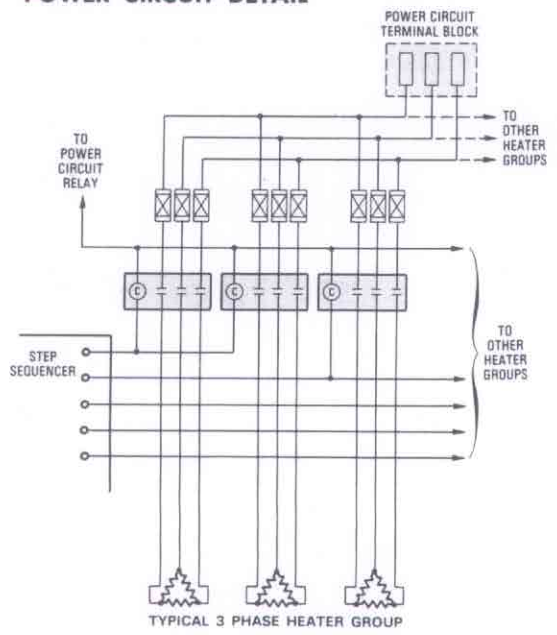


SEE FIGURE 6 FOR DETAILED DIAGRAM OF BOILERS SUPPLIED WITHOUT SEQUENCER.

- NOTES**
- ① Connect alarm light or bell from A to L2 if alarm is used.
  - ② Not included if control circuit fed from optional transformer or if pressuretrol control system is used. (See Figure 6)
  - ③ Each single line component represents a three phase component. (See Figure 9)
  - ④ When pressuretrols are used contactor common goes to L2 on the terminal block. (See Figure 6)

Figure 8

Figure 9  
POWER CIRCUIT DETAIL



ELECTRONIC RESISTANCE SENSING AMPLIFIER FOR AUXILIARY LOW WATER CUTOFF.

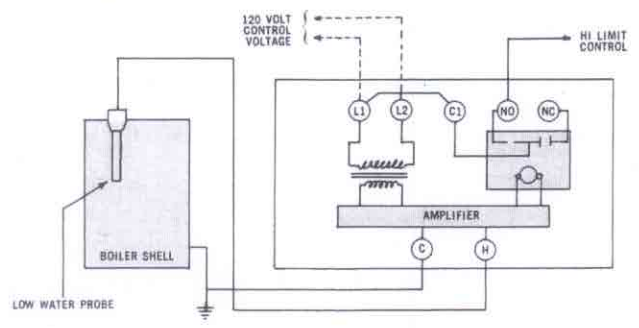


Figure 10 — Auxiliary Low Water Cutoff

## PRE-OPERATION CHECK

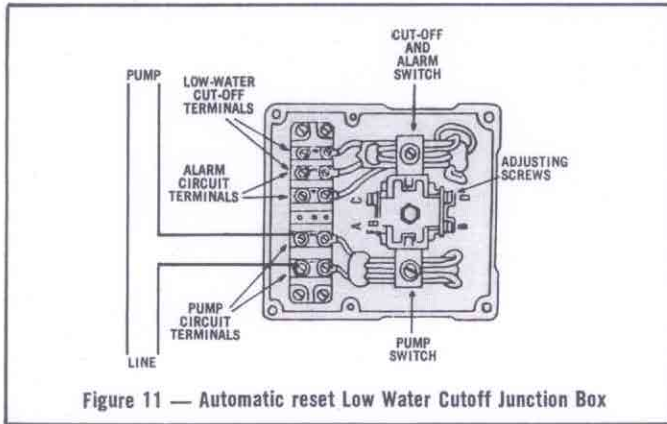


Figure 11 — Automatic reset Low Water Cutoff Junction Box

### NOTES

1. Motor, Solenoid Valve and Dotted Control Wiring are included if Motor and Pump package is supplied. Solenoid Valve only is supplied with 99117 Water Feed.
2. ½ HP Motor is controlled directly without use of Motor Starter.

After proper wiring and piping of boiler system is complete, testing of controls can start. **Before testing controls, it is recommended that all contactor fusing be removed.** This is to prevent possible element failure under test conditions.

**CAUTION:** Be sure all electrical connections are tight before energizing boiler. Reset all manual reset controls by pushing reset buttons on: (1) high limit control located on top of boiler and (2) McDonnell-Miller located on side of boiler.

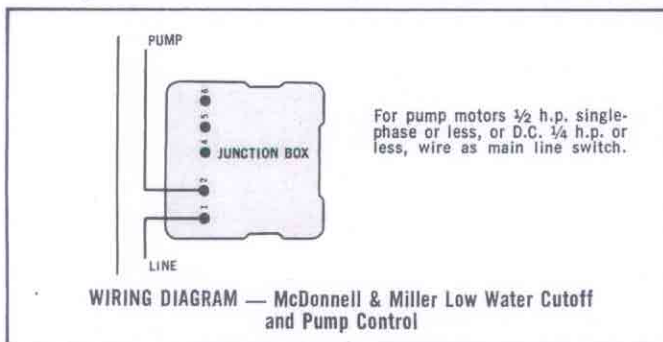
### A. McDONNELL & MILLER LOW WATER CUTOFF CONTROL OPERATION AND TESTING

1. Be sure all valves from incoming water supply are fully open. Turn boiler switch to "ON" position, pump or solenoid valve will energize, allowing boiler to fill with water. Proper water level is automatically reached with level control supplied. Pump or solenoid feed will shut off at proper water level. Contactor(s) will energize, supplying power voltage to elements.

2. **Checking operation of pump switch.** (Figure 11) With water level visible in sight glass, partially open drain valve at bottom of boiler. If automatic blowdown supplied, push manual blowdown switch until valve open light is on, hold for few seconds. Water level will fall, allowing float to trip pump switch to "ON" position. Close drain valve or release manual blowdown switch.

Pump motor or solenoid valve will energize and water level will resume to normal level in sight glass.

3. **Checking low water cutout switch operation,** open drain valve completely. If automatic blowdown supplied, push in and hold manual blowdown switch until water level falls enough to trip cutout switch. Close drain valve or release manual blowdown switch. If low water cutout is automatic reset, pump or solenoid will return water level to normal. If low water cutout is manual reset, then manual reset button on McDonnell & Miller low water cutoff control must be pushed to complete circuit. **Turn off boiler. Reinstall contactor fuses.**



WIRING DIAGRAM — McDonnell & Miller Low Water Cutoff and Pump Control

### B. ADJUSTING OPERATING PRESSURE CONTROLS

1. Chromalox boilers are supplied with operating and high limit pressure controls. One is used for controlling the operating pressure of the boiler while the other is used as a high limit control. To determine the difference in the controls, the high limit has a manual reset lever on top of the case. Also, there is no differential scale present.

2. On all controls, the pressure adjusting screw on the top of the case sets the desired pressure. Turning the screw counterclockwise reduces the pressure setting (see Figure 12). High limit control should be set at 10 psig above the operating pressure of the boiler.

3. The differential adjusting screw on the operating control is set in the same manner as the pressure adjusting screw. This scale setting, plus the main scale setting, equals cutout pressure of the operating control. (Scale A thru F equals 3 psi per letter. L91B only) L404A Differential is indicated on Scale Plate.

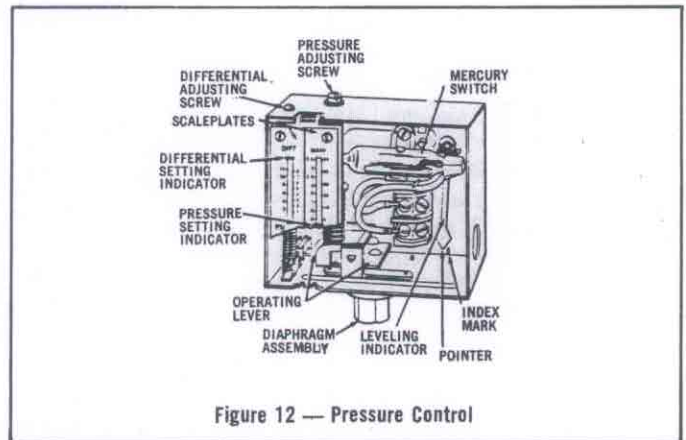


Figure 12 — Pressure Control

To check operation of the controls, close steam outlet valve and adjust operating pressure control to a **low pressure setting**. Also, set high limit control at 10 psig above operating pressure control.

**Turn on boiler** and allow pressure to build up. When pressure gauge reading approaches set point of pressure control, the switch will trip and shut off boiler. **Turn boiler main switch to "OFF"**.

To reset pressure control, bleed off enough pressure in the boiler by opening steam outlet drain, or blowdown valve to allow the operating control to reset.

### 4. HIGH LIMIT PRESSURE CONTROL OPERATION

The high limit is tested in the same manner but with the operating control set above the pressure setting of the high limit. (Figure 13)

### CAUTION: THIS IS FOR TEST PURPOSES ONLY!

When the high limit trips turn off boiler and reset high limit to proper setting, the manual reset level must be pushed to resume operation upon startup.

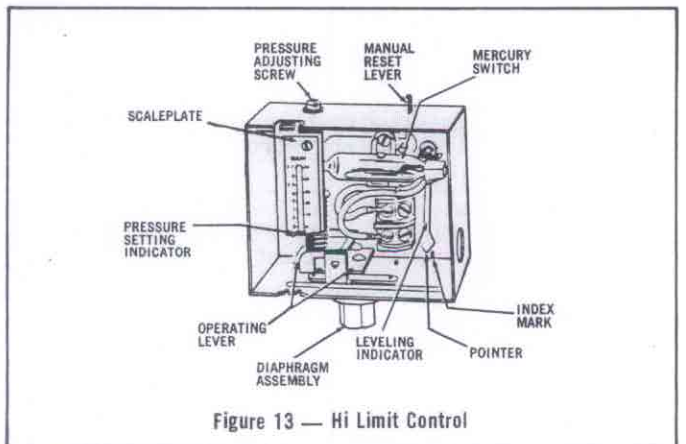


Figure 13 — Hi Limit Control

## OPERATION

### RECOMMENDED START-UP PROCEDURES

1. Close globe valve on outlet side of boiler. (Customer Supplied)
2. Turn on boiler and allow pressure to build up to operating pressure.
3. Only open globe valve by quarter turns at first, introducing smaller amounts of steam into process. *Avoid opening globe valve all at once.* This will eliminate the possibility of evacuating the boiler of water caused by the suddenly increased boiling of the water in the vessel as the pressure is reduced. On boilers where constant pressure is not maintained, globe valve should be kept partially closed. This will maintain a constant head on the boiler and stabilize any fluctuation in boiler water level.  
(NOTE): For best boiler performance, a steam valve 1/4" smaller than size of safety valve should be plumbed as close as practicable to steam outlet.

### MANUAL BLOWDOWN INSTRUCTIONS

*Blowdown is an essential part of boiler operation. It is the best preventive maintenance you can give your boiler and will add years of life to the unit. Make sure a blowdown schedule is established and followed regularly.*

In extremely hard water areas blowdown is necessary once a day. In soft water areas, once each week. If there is a particular problem which applies to your own local water condition other than mineral content, take this into consideration in determining which schedule is to be followed.

1. At the end of the working day, while boiler is still operating, turn switch to the OFF position and close water supply valve. De-energize wall mounted safety switch.
2. If blowing-down into a receptacle, allow pressure to decrease to 15-20 psi before opening blowdown valve.
3. It is preferable to connect the blowdown valve directly into a drainage system. If this is done, the boiler can be discharged at operating pressure.
4. When discharge is complete and boiler is drained — (a) close the blowdown valve; (b) open water supply valve; (c) put boiler switch to the "ON" position; and, (d) close wall mounted safety switch.
5. When refilling is complete turn off the boiler switch unless further operation is desirable.
6. If you have been supplied with a Manual Reset Low Water control as required in some states, the reset button on the control must be pushed before boiler will begin developing pressure. (Do not push reset until boiler has filled with water.)

The use of chemical boiler cleaning compounds in these boilers voids all warranties unless approved by manufacturer. Some compounds will damage copper-sheathed heating elements, thereby shortening their life.

### AUTOMATIC BLOWDOWN INSTRUCTIONS (IF FURNISHED) (See Figures 14 and 15)

The Automatic Blowdown is a device which automatically starts up your boiler in the morning; shuts it down at night and blows down (partially drains) the main boiler drain and the low water cut-off column for a predetermined time interval each working day.

The heart of the unit is an electrically operated straight through type ball valve. It is specially designed to handle dirty, corrosive fluids and particles without requiring cleaning or the use of a strainer.

Both the valve and the boiler are controlled by an electric control unit which indicates with pilot lights when the drain valve is ON or OFF. In addition to the automatic control function, the unit has a push button which momentarily de-energizes the boiler and opens the drain valve regardless of the time of day.

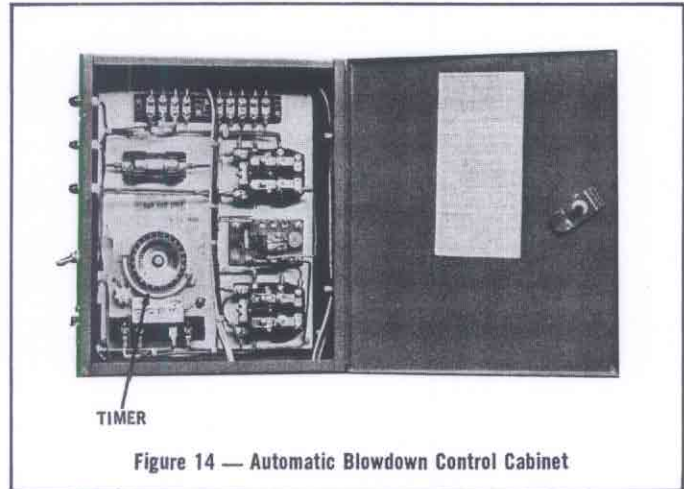


Figure 14 — Automatic Blowdown Control Cabinet

The unit may also be used to blow down boilers which run continuously, day and night.

**INITIAL TESTING** — Set the switch marked "Boiler Normal/24-hour duty" located on the panel box to the "Boiler Normal" position.

On the large timer set the "ON" tab to 8 AM and the "OFF" tab to 8 PM. Set the small, time delay relay to "0".

Turn the larger timer by hand until the "ON" tab passes the "TIME NOW" indicator so that the "TIME NOW" arrow indicates 10 AM.

Energize the main feed to the "line terminals" of the unit. The "boiler normal" pilot light as well as the "drain valve closed" light should glow.

Hold down the "drain" button for about six seconds. The "Boiler normal" light should go out immediately as well as the "drain valve closed" light. It takes about 4 seconds for the drain valve to open fully at which time the "drain valve open" light should light. As soon as the "drain" button is released, the valve begins to close. When it reaches the closed position, the "drain valve closed" light and the "boiler normal" light should light up again.

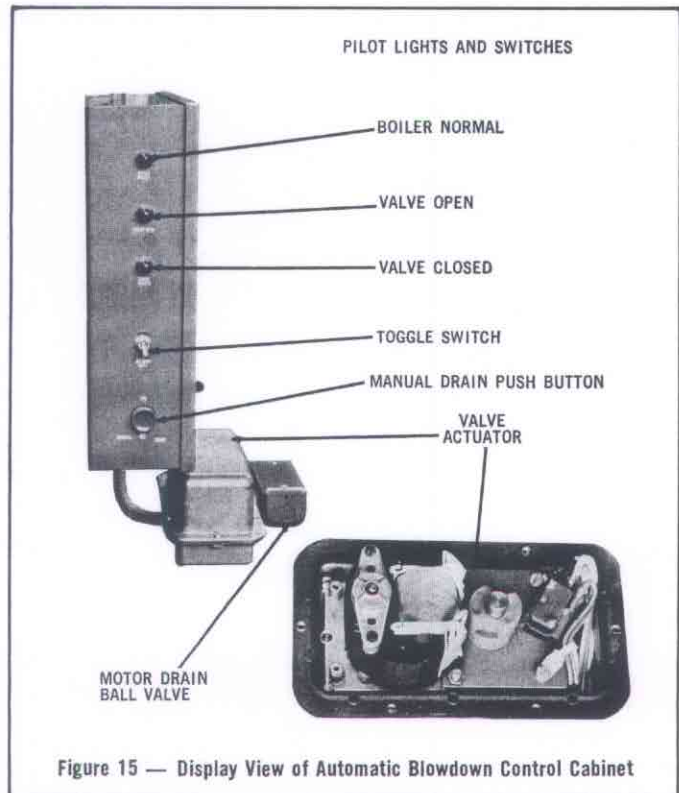


Figure 15 — Display View of Automatic Blowdown Control Cabinet

## OPERATION (Continued)

Now turn the wheel on the large timer until the "off" tab passes the "time now" arrow. The "boiler normal" light should go out and the valve should begin to open. Once the "valve open" light goes on, the valve should remain open for a few seconds and then automatically close. The "drain valve closed" light should light and the "boiler normal" light should remain off.

**NORMAL OPERATION** — Set the "Boiler Normal/24-hour duty" switch located on the inside of the control panel to "boiler normal" if the boiler is to be shut down each night. Set it to "24-hour duty" if the boiler is to remain on continuously 24 hours per day (except during blowdown).

Set the tabs on the large timer for the ON and OFF times desired for the boiler, screw in the small black day-skip tabs if the boiler is to remain off for the weekend, etc.

If the boiler is on 24-hour duty set the OFF tab for the time that is desired for blowdown. The ON tab can be ignored, but must remain on timer.

The small time delay relay controls the time that the drain valve remains open. Counterclockwise decreases, clockwise increases blowdown time. Time must be adjusted by trial.

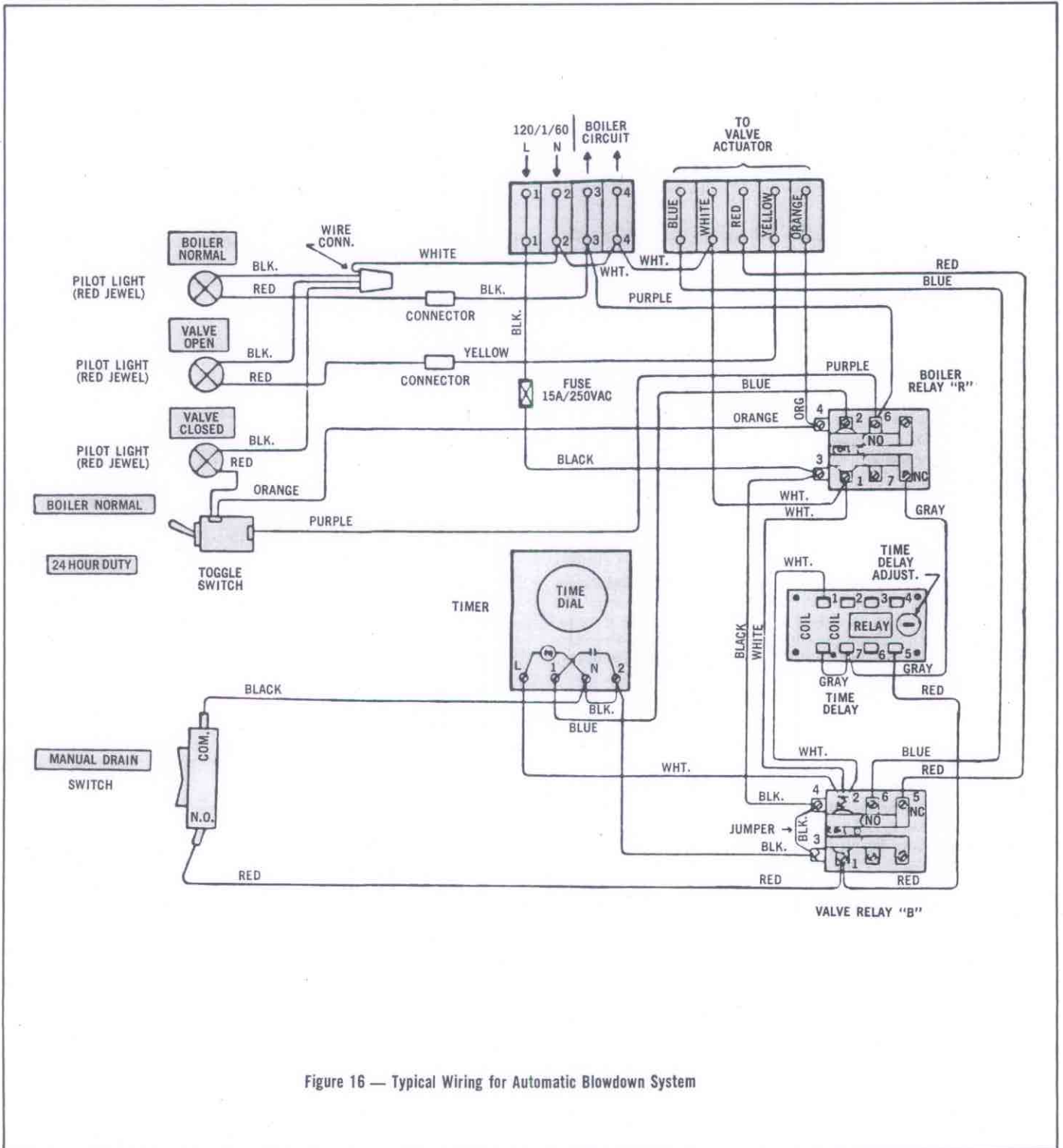


Figure 16 — Typical Wiring for Automatic Blowdown System

## OPTIONAL EQUIPMENT FOR CHROMALOX STEAM BOILERS

### AUXILIARY LOW WATER CUT-OFF

(See page 4 for Wiring Diagram)

#### Operation

Operation of this control is accomplished by sensing a minute AC current flowing between submerged contact probe in the boiler shell.

When this minute AC current is conducted through an external circuit resistance up to 100,000 ohms or less, a signal of sufficient magnitude is present to trigger the SCR and, in turn, energize the control relay.

As the water level in the boiler drops below the level of the probe, the AC circuit is broken and the control relay is de-energized. The control will not energize until sufficient water is present in the boiler.

#### Specifications

Input supply — 120 vac/50-60 hz

Detectable Range — 100,000 ohms

Probe Voltage — 24 vac

Probe Current — 10 milliamps

Control Relay — Single pole double throw

**CAUTION** — Control will not work with de-ionized or demineralized water.

### PROPORTIONING PRESSURE CONTROL (See Figure 17)

#### Typical Operation

Pressure variations cause the bellows to expand or contract. Linkage between the bellows and the potentiometer wiper causes the wiper to move across the windings on the potentiometer. This varies the resistance between R and B, and between R and W, causing an imbalance in the circuit connected to the controller.

A proportioning pressure control is used to regulate a motor driven or solid state sequencer. The controller potentiometer, the feedback potentiometer in the motor and a balancing relay in the motor form an electric bridge circuit. As long as the pressure of the controlled medium remains at the set point of the controller, the circuit is balanced; i.e., equal currents flow through both sides of the balancing relay and the relay contacts are open. When the circuit is balanced, the motor does not run.

If the pressure of the controlled medium rises, the wiper in the controller moves toward W. This unbalances the circuit, so a larger current flows through one side of the balancing relay. The "close" contacts in the relay make, causing the motor to drive toward its closed position. As the motor runs, the wiper on the feedback potentiometer moves in a direction to balance the circuit. When the circuit is again in balance, the balancing relay contacts open and the motor stops.

Similarly, if the pressure of the controlled medium falls, the wiper on the controller potentiometer moves toward B, and the "open" contacts in the balancing relay make. The motor drives toward its open position until circuit balance is achieved.

The slightest change in the pressure of the controlled medium will cause a change in the number of elements energized to compensate for it, thus keeping the pressure constant. This process is called modulation.

### PROPORTIONAL PRESSURE CONTROL ONLY SUPPLIED WITH SEQUENCER

**Main Setting** — Turn the adjustment screw until the indicator is opposite the low point of the desired throttling range. That is, if the pressure is to be held to a minimum of 50 psi, set the indicator at 50 psi. The pressure will then be maintained between 50 psi and a higher pressure equal to the 50 psi plus the throttling range.

#### THROTTLING RANGE SETTING L91B

After setting the indicator for the minimum pressure, turn the throttling range adjustment screw until the throttling range indicator points to the desired throttling range on the

scale. This scale is graduated from "min" to "F". The value of each division varies with the scale range of the instrument.

PRESSURE SCALE RATING	VALUE EACH DIVISION ON SCALE
0-15 psi	2.2 psi
5-150 psi	3.6 psi

Pressure scale rating will vary depending on pressure control supplied.

#### CHECKOUT

After the controller has been installed, wired, and set, it should be tested with the system in operation. First allow the system to stabilize. Then observe the operation of the controller while raising and lowering its set point. Pressure should increase when the set point is raised and decrease when the set point is lowered. Use accurate pressure testing equipment when checking out the controller. Do not rely on inexpensive gauges. The controllers are carefully calibrated at the factory.

If the motor or actuator runs in the proper direction when the set point is adjusted, it can be assumed that the controller is operating properly. If it runs in the wrong direction, reverse the B and W wires. Observe the action of the motor to see if it stabilizes. If the motor is moving constantly, widen the proportioning range a little at a time, until the system is stable.

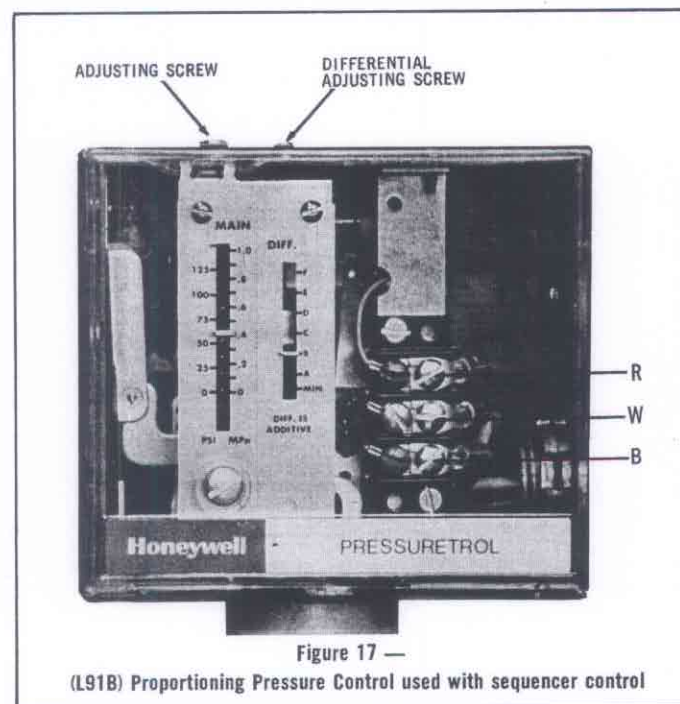


Figure 17 —

(L91B) Proportioning Pressure Control used with sequencer control

### IF A CONTROLLER SEEMS TO OPERATE IMPROPERLY (See Figure 18)

If the controller is suspected of operating improperly, it may be further checked as follows.

1. Leave the controller installed where it is, but disconnect all power to the controlled motor.
2. Loosen the cover screw below the main scaleplate and remove the cover.
3. Disconnect the wires from the controller.
4. Connect an ohmmeter between controller terminals B and W to measure the resistance of the potentiometer in the controller. The ohmmeter should read about 135 ohms on an L91B.



## OPTIONAL EQUIPMENT FOR CHROMALOX STEAM BOILERS (Continued)

5. Connect the ohmmeter between controller terminals W and R and raise the set point of the controller above the actual pressure being measured. The ohmmeter should read the full value of the potentiometer measured in step 4 (135 ohms for an L91B).
6. Slowly lower the set point of the controller while observing the ohmmeter reading. The resistance should drop to zero at some set point below the actual pressure.
7. An approximation of the proportioning range can be made by observing the change in set point required for a resistance change from zero to full value.
8. When the controller is operating properly, reconnect the wires, replace the cover, tighten the cover screw, and reset the controller to the desired value.
9. Reconnect power to the controlled motor.

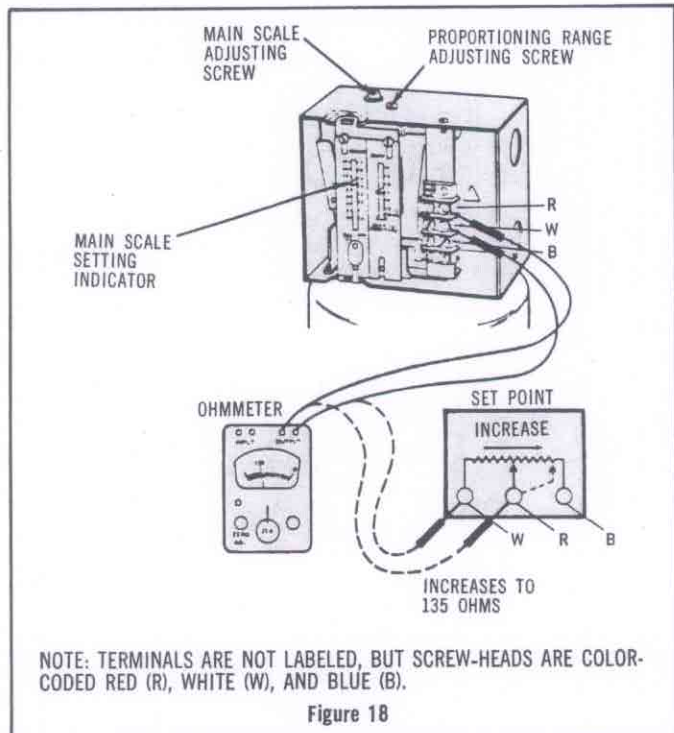


Figure 18

### BOILER SEQUENCER (5 STEP)

#### RECYCLE FEATURE (See Figure 19)

The step control is designed to drop out all contactors when control circuit is interrupted. On resumption of power, the camshaft rotates to the counter-clockwise (ccw) limit, opening all the load switches. The recycle relay then energizes, pulling in the load contact, and finally the camshaft rotates clockwise (cw) to the position called for by the pressure controller energizing, in sequence, the required load stages.

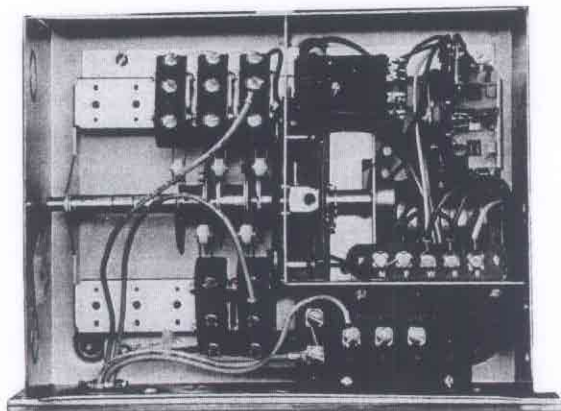


Figure 19 — Five Step Sequencer

### TESTING OPERATION OF SEQUENCER (See Figure 20)

1. With boiler off, remove wiring from pressure control on sequencer low voltage terminal board.
2. Turn on boiler to supply the voltage to sequencer. Short terminal R and B for counter-clockwise rotation and terminal R and W for clockwise rotation.
3. If sequencer operates under this test procedure, but when rewired to pressure controller, does not function, check pressure control. Note that wiring is W-B and B-W-R-R between sequencer and pressure control.

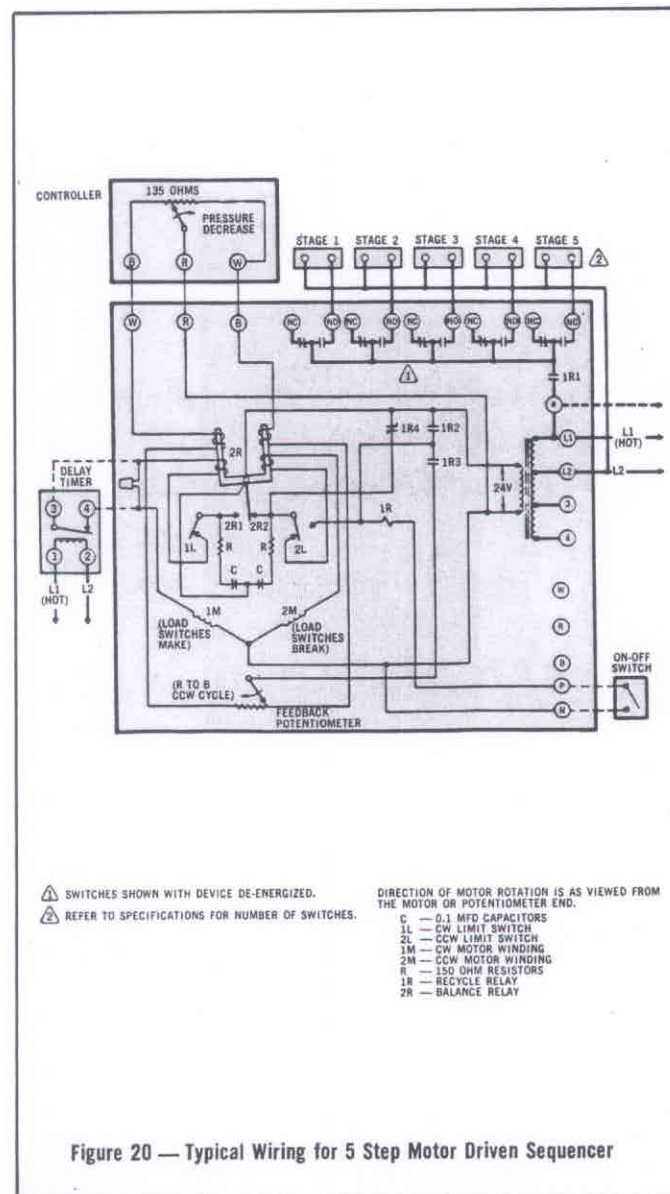


Figure 20 — Typical Wiring for 5 Step Motor Driven Sequencer

### SEQUENCE REVERSER (See Figure 21)

#### GENERAL:

Sequence Reverser is an automatic switching device which is interposed on an electric boiler between the proportional sequence controller and the heating element contactors. The device is periodically actuated to alter the operating sequence of each of the heating elements, thereby increasing the overall reliability of the boiler.

#### DETAILS:

The Sequence Reverser consists of an eight-day timer set up for four days on and four days off which energizes and de-energizes double throw relays which are wired to reverse the "firing" order of the heating element contactors with each operation of the timer.

## OPTIONAL EQUIPMENT FOR CHROMALOX STEAM BOILERS (Continued)

The Sequence Reverser accomplishes its tasks and shows the relative use of each of ten heat stages during the first four days of the cycle. This is how the work load would be distributed on a boiler without Sequence Reverser. It can be seen the early stages are ON most of the time and the later stages are OFF most of the time, since they are used only during heat load peaks. (This analysis assumes hours of use directly affecting component life. Frequency of on/off operations has been ignored because of the limited in-rush associated with heating elements and because of the relative independence of contactor life on number of operations in the resistive load situations.)

It is clear, without sequence reversing, the early stages would tend to fail long before the later stages. The sequence reverser essentially equalizes the relative usages of heating stages. It can be seen, without the sequence reverser the first heat stage is used approximately twice as much as it is with the sequence reverser. This means the boiler will be likely to have its first element failure in half the time without sequence

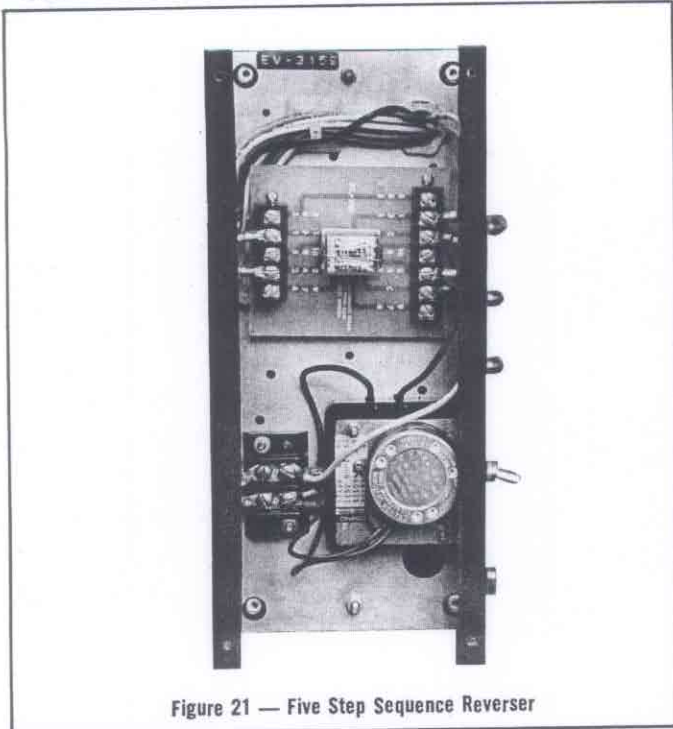


Figure 21 — Five Step Sequence Reverser

reverser as compared to the boiler with sequence reverser. In addition, boilers without sequence reverser will have many failures spread over a long time while boilers with sequence reversing will require element changes at roughly the same time. (See wiring diagram on Page 4).

**CAUTION: Hazard of electric shock. Disconnect all power before working on boiler.**

Chromalox Electric Steam Boilers are designed for years of trouble-free performance. To establish a good preventative maintenance program, we suggest the building maintenance man or engineer familiarize himself with these simple rules:

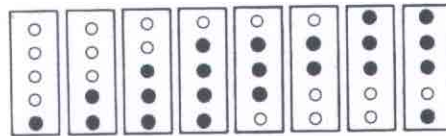
1. The use of specific boiler cleaning compounds cannot be recommended. We do recommend that a reputable firm of water treatment engineers be consulted regarding conditioning boiler water. Proper selection must be made of a compound to prevent damage to copper sheath heating elements.
2. The sight glass should be checked daily to ensure the boiler has adequate water.
3. A monthly inspection should be made of the internal wiring. All electrical connections should be checked for tightness.

### Solid State Progressive Sequencer (See Figure 22)

The solid state progressive sequencer provides accurate electronic control of multi-stage loads of the type used in Chromalox steam boilers. It features progressive sequencing (first on-first off) which equalizes the operating time of each load. This control gives visual indication of each energized stage by means of integral solid state light emitting diodes. In the event of power interruption all heating elements are immediately de-energized for safety. When power resumes, the control will re-stage the loads one at a time. Refer to the diagram for visual description of progressive sequencing.

### PROGRESSIVE SEQUENCING

+1 +1 +1 +1 -1 -1 +1 +1



The solid state sequencer operates on 120 V AC/60 Hz and each output is relay switched with a load rating of 125 VA at 120 V AC.

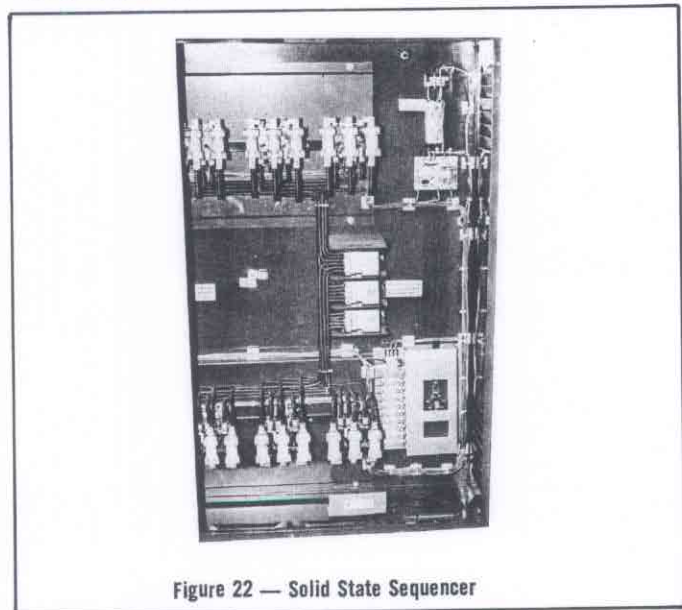


Figure 22 — Solid State Sequencer

## MAINTENANCE

4. A check for water or steam leaks should also be made and any loose fittings immediately tightened.

5. If boiler is equipped with a Solid State Auxiliary Low Water Cutoff, every four months the probe should be checked for deposits and cleaned, if necessary. This is accomplished by removing the inspection plate, removing the probe (with a standard sparkplug wrench) cleaning and replacing.

**Note:** The system will not operate if the boiler is using distilled, demineralized or deionized water.

At the same time, one of the bottom heating elements should be removed. If scale has begun to form, all elements should be cleaned and boiler drained and flushed.

6. **IMPORTANT:** The Manufacturers' Data Report enclosed within the instruction sheet is very important and must be put in a safe place. You may be called upon to produce it by a state agency.

## MAINTENANCE

### INSTRUCTIONS FOR ELEMENT REPLACEMENT

**CAUTION:** Before installing your new elements be sure the McDonnell-Miller low-water cut-off is operating perfectly and the float chamber and lower equalizer column are completely clear of sludge or other foreign matter. (See Figure 23)

Failure to do this may cause the immediate burnout of the new elements.

All elements are thoroughly checked before shipment. The manufacturer cannot be responsible for burnouts caused by a faulty low-water cut-off.

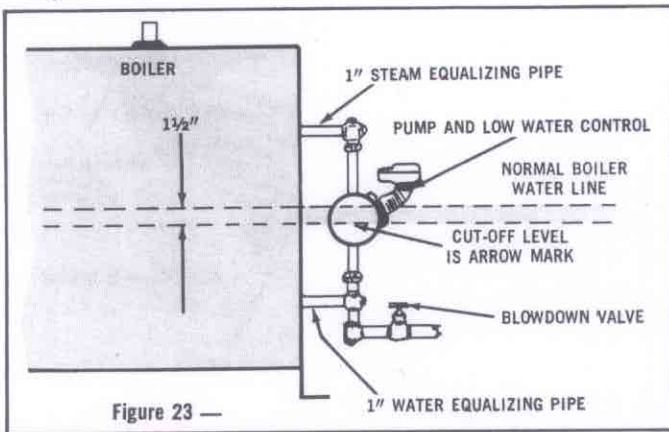


Figure 23 —

The lower equalizer column can best be examined by breaking the unions on either side and then visually and manually examining the piping with your fingers or probes to see if it is clear and clean.

### READ COMPLETELY BEFORE STARTING WORK

1. Disconnect boiler from electric power supply at **main safety switch or fuse panel**. Then turn boiler switch to "off" position.

2. On automatic feed units, close valve on incoming water line. Drain boiler completely of water.  
3. Open boiler door to expose heating element.  
4. Disconnect wire (electric) leads connecting element to main power system of boiler. Again note wire connections to facilitate re-assembly. Proceed to remove (6)  $\frac{5}{16}$ -18 bolts from flange.

5. Thoroughly clean boiler flange of all foreign material. Be certain no part of old gasket remains on boiler flange.

6. Apply "Slic-Tite" Gasket Compound (or equal) to both surfaces of new gasket supplied with replacement element. Proceed to install element flange assembly with gasket between boiler flange and element flange. In doing this, be careful to align flange holes so wire connection terminals on element assembly are in line with previously disconnected wire leads to facilitate easy connections.

7. When all (6) flange bolts are tight, connect all wires to terminals. Make certain wires are clean and bright to assure good electrical contact and nuts on screws are firmly secured.

**CAUTION:** Bolts should be tightened to a torque of 22 ft lbs.

8. Open water valve so water supply can reach boiler feed mechanism.

9. Put Main safety switch to "on" position.

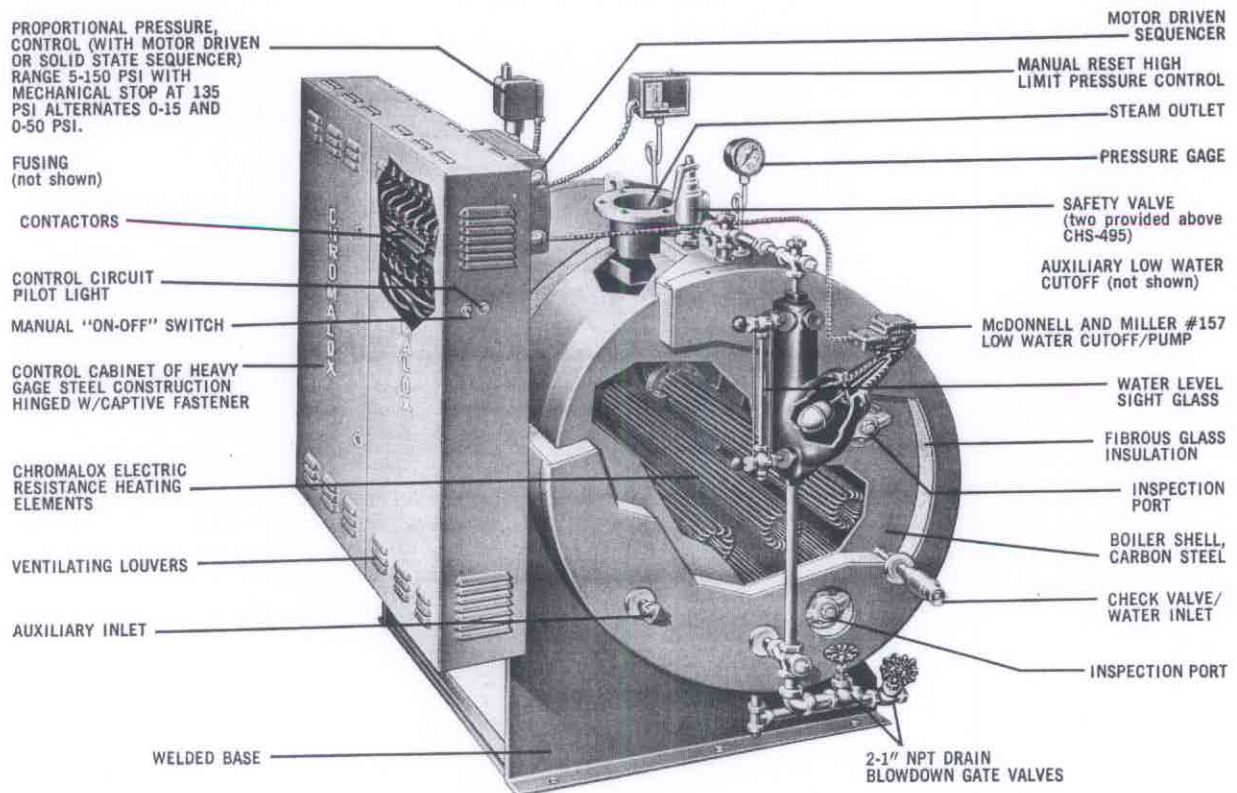
10. Turn boiler switch to "on" position.

11. As boiler automatically refills, observe the new flange assembly for possible leaks. If water is noticed, the bolts must be retightened. Before doing this, turn the boiler off at the main fuse safety switch.

12. As boiler is heated to working pressure, check flange assembly again for leaks.

**Caution — Avoid use of chemical cleaning compounds. Follow maintenance instructions**

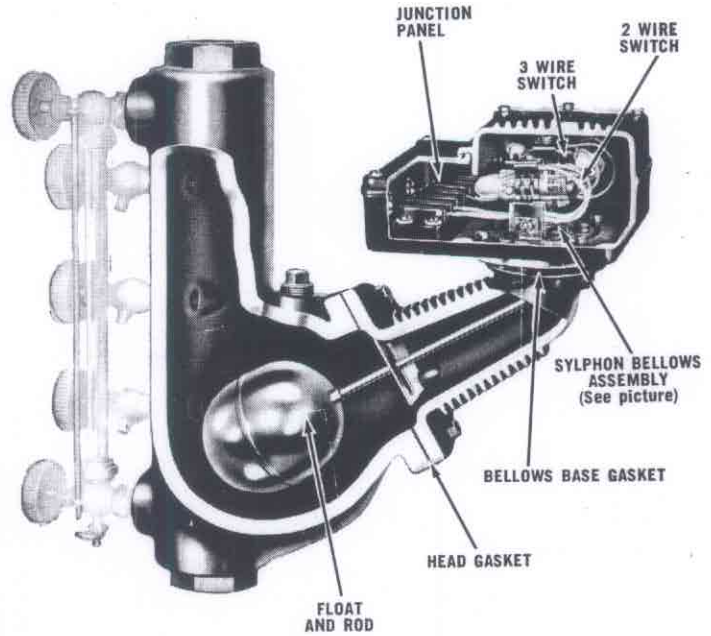
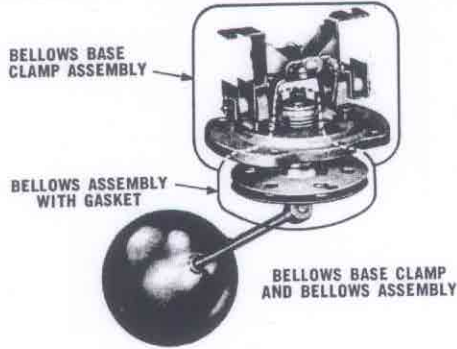
## RENEWAL PARTS IDENTIFICATION



Chromalox Model CHS-360 Steam Boiler with Factory Installed Standard Features.

# RENEWAL PARTS IDENTIFICATION (Continued)

## AUTOMATIC FEED PUMP CONTROLLER



Part Description	Part Number
<b>LOW WATER CUTOFF and WATER FEED CONTROLS</b>	
Complete Assembly .....	300-118538-013
Complete Assembly (Manual Reset) .....	300-118538-026
Complete Head Mechanism .....	300-118538-027
Complete Head Mechanism (Manual Reset) .....	300-118538-028
Float and Rod .....	300-118538-029
Head Gasket .....	300-118538-030
3 wire Cut-Off and Alarm Switch .....	292-118665-003
3 Wire Cut-Off and Alarm Switch (Manual Reset) .....	292-118665-004
2 Wire Pump Switch .....	292-118665-002
Junction Panel .....	300-118538-031
Bellows Base Clamp & Bellows Assembly .....	300-118538-032
Bellows Base Clamp & Bellows Assembly (Manual Reset) .....	300-118538-033
Bellows Base Gasket .....	300-118538-034
Bellows Base Clamp Assembly .....	300-118538-035
Bellows Base Clamp Assembly (Manual Reset) .....	300-118538-036
Bellows Assembly w/gasket .....	300-118538-037
B-W Auxiliary Low Water Cut-Off .....	300-118538-038

Part Description	Part Number
<b>HEATING ELEMENTS and GASKETS</b>	
30KW, 3 ph, 240V. ....	155-118524-040
30KW, 3 ph, 480V. ....	155-118524-021
45KW, 3 ph, 480V. ....	155-118524-041
45KW, 3 ph, 240V. ....	155-118524-042
60KW, 3 ph, 240V. ....	155-118524-026
60KW, 3 ph, 480V. ....	155-118524-022
90KW, 3 ph, 480V. ....	155-118524-023
135KW, 3 ph, 480V. ....	155-118524-043
Element Gasket .....	132-146012-002
Hand Hole Gasket .....	132-118533-004

Part Description	Part Number
<b>CONTACTORS and CONTACTOR PARTS</b>	
Contactors (50 amp, 115V., 60 cy.) .....	072-118525-001
Contactors (50 amp, 240V., 60 cy.) .....	072-118525-002
Contactors (60 amp, 115V.) .....	072-118525-003
Contactors (75 amp, 115V., 60 cy.) .....	072-118525-005
Contactors (75 amp, 208/240V., 60 cy.) .....	072-118525-006
Relay PR 7AY, 115V. ....	072-118525-008
Relay PR 7AY, 230V. ....	072-118525-009

Part Description	Part Number
<b>TERMINAL BLOCKS and FUSES</b>	
Control Circuit Fuse and Block .....	129-118527-001
Fuse Block, Class "J", 100 amp. ....	129-118527-003
Power Circuit Fuse, Class "J", 60 amp. ....	128-118530-003
Power Circuit Fuse, Class "J", 100 amp. ....	128-118530-004

Part Description	Part Number
<b>VALVES and GAUGES</b>	
Pressure Gauge 3/4" 160# .....	344-118529-024
Gauge Glass Assembly .....	374-118537-002
Sight Glass .....	374-118537-009
Safety Valve — 30#, 1" .....	344-118529-006
Safety Valve — 125#, 1" .....	344-118529-020
Safety Valve — 150#, 1 1/2" .....	344-118529-025
Check Valve, 1" Spring Type .....	276-118536-003
Safety Valve — 15#, 1" .....	344-118529-008

Part Description	Part Number
<b>CONDENSATE RETURN SYSTEMS</b>	
Condensate Return System (Comp.) 1/2 H.P. 115V or 230V, 60cy. (CHS-150) .....	226-118656-002
Condensate Return System (Comp.) 3/4 H.P. 115V or 230V, 60cy. (CHS-180 to CHS-300) .....	226-118656-009
(For Boilers CHS-360 through CHS-1350 check Factory)	

Part Description	Part Number
<b>PRESSURE CONTROLS and SEQUENCERS</b>	
Pressure Control Complete .....	344-118529-010
Pressure Control Complete (Manual Reset) .....	344-118529-011
Mercury Tube (Two Wire) .....	292-118665-001
Pressure Control Type L91B, 0-150 .....	334-118529-015
5 Step Proportional Sequencer .....	300-118538-005
10 Step Proportional Sequencer .....	300-118538-008
Pressure Control Type L91B, 0-15 .....	334-118529-016

Part Description	Part Number
<b>PARTS FOR CONDENSATE SYSTEMS — HOT WATER MOTORS and PUMPS</b>	
Impeller for pump (1/2 or 3/4 H.P.) .....	226-118671-001

Part Description	Part Number
<b>PARTS FOR CONDENSATE RETURN SYSTEMS</b>	
Pump and Motor, 1/2 H.P., 115 Volts or 230 Volts, 1 ph. (CHS-150) .....	226-118656-005
Pump and Motor 3/4 H.P., 115 Volts or 230 Volts, 1 ph. (CHS-180 — 300) .....	226-118656-006
Float Valve — 33 Gallon Tank (CHS-150 — 300) .....	344-118662-002
Seal for Pump (CHS-150 — 300) .....	251-118657-002
(For Boilers CHS-360 through CHS-1350 check Factory)	
Vacuum Breaker .....	300-118538-039

The warranty below has been drafted to comply with the Federal Law applicable to products manufactured after December 31, 1976. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. The warranty in no manner reduces the coverage provided to you under the warranty it replaces.

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**Warranty Period:** This warranty extends for twelve months from date of shipment from factory or authorized distributor. **Limitations:** Products must be installed and maintained in accordance with Chromalox Instructions. Users are respon-

sible for the suitability of the products to their application. There is no warranty against damage resulting from corrosion, misapplication, improper specification or other operating conditions beyond our control. Claims against carriers for damage in transit must be filed by the buyer.

**Remedy:** Return the defective part or product, freight prepaid, to the location designated by Chromalox Product Service. All such items must be accompanied by a Material Return Authorization. This form, which includes a tear-out mailing and identification label, should be obtained from your local Chromalox Sales Office.

Defective items will be repaired or replaced, at our option, at no charge. SUCH REPAIR OR REPLACEMENT IS THE EXCLUSIVE REMEDY AVAILABLE FROM EDWIN L. WIEGAND DIVISION, EMERSON ELECTRIC CO. WIEGAND IS NOT LIABLE FOR LABOR COSTS INCURRED IN REMOVAL, REINSTALLATION, OR UNAUTHORIZED REPAIR OF THE PRODUCT OR FOR DAMAGE OF ANY TYPE WHATSOEVER, INCLUDING INCIDENTAL OR CONSEQUENTIAL DAMAGE. Some states do not allow the exclusion or limitations of incidental or consequential damages, so the preceding limitation or exclusion may not apply to you.

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