

GENERAL INSTRUCTIONS

The Weil-McLain Model CE electric boiler is a factory assembled and tested unit designed for use in any conventional low pressure hydronic heating system. The use of electricity as a fuel means that the installation will require close co-operation between the designer, the installer and the electric utility in order to obtain economical fuel usage. The structure to be heated must be insulated in the conventional manner used in your locality for electrically heated buildings. The Model CE boiler carries U.L. (Underwriters Laboratories) Listing.

CAUTION

Installation of this unit must conform with the requirements of local utilities, or any local, state, provincial, territorial, federal or insurance requirements or codes having jurisdiction and with the National Electric Code. Boilers must be installed in accordance with these instructions so as not to void our warranty. These instructions and all information shipped with this boiler are to be returned to their envelope and given to the owner or displayed adjacent to the boiler.

UNCRATING

In order to prevent shipping damage, the Weil-McLain Model CE boiler is bolted to its installation brackets which are in turn held in place in the crate with four (4) $\frac{1}{4}$ " carriage bolts. To uncrate the boiler, remove the four bolts from the installation brackets and lift the boiler from its crate. Inspect the boiler for shortages or damage and notify the transportation company if either is found.

LOCATING THE BOILER

The compact size and construction features of the Model CE boiler permit its location almost anywhere except to direct exposure to the weather. Usually no "boiler room" will be necessary; in fact, an alcove, storeroom or other small area will be an ideal boiler location. In all cases, the boiler location should be conveniently in or adjacent to the spaces it is to heat. The location and convenience of the electrical service must also be considered.

Allow 24" clearance at each side and 10" clearance at the top and bottom of the boiler for servicing and ventilation. Allow at least 20" clearance at the front of the boiler. Do not install with inadequate clearances or ventilation, or in areas where high ambient temperatures occur while boiler is operating.

MOUNTING THE BOILER

Normally the boiler will be installed against a wall or partition. Please note the 300 lbs. boiler weight and make sure the wall structure will be adequate. Two mounting brackets are attached to the back of the boiler which permit flush mounting against a wall. Before mounting the boiler, lay out and pre-drill the mounting screw holes into the wall. The boiler mounting brackets are located with 16" centers to line up with the studs in standard wall construction. Loosen the screws which hold the boiler cabinet in place and lift off the cabinet before mounting the boiler. If the mounting surface is rough, it may be necessary to mount $\frac{3}{4}$ " thick plywood on the exist-

ing wall and then mount the boiler on the plywood surface. Use $\frac{3}{8}$ " diameter lag screws when attaching the boiler to the plywood or to wall studs; use $\frac{3}{8}$ " diameter toggle bolts if wall is of concrete block construction.

PIPING THE WATER BOILER

After the boiler is secured in place, piping may be accomplished in the standard manner as illustrated in Figure 1. Do not use reverse flow through this Electric-Hydronic boiler. The boiler is designed with its own internal air-separator; the piping to the compression tank must pitch upward towards the tank. The cold water fill connection should be made to the piping between the boiler and the compression tank.

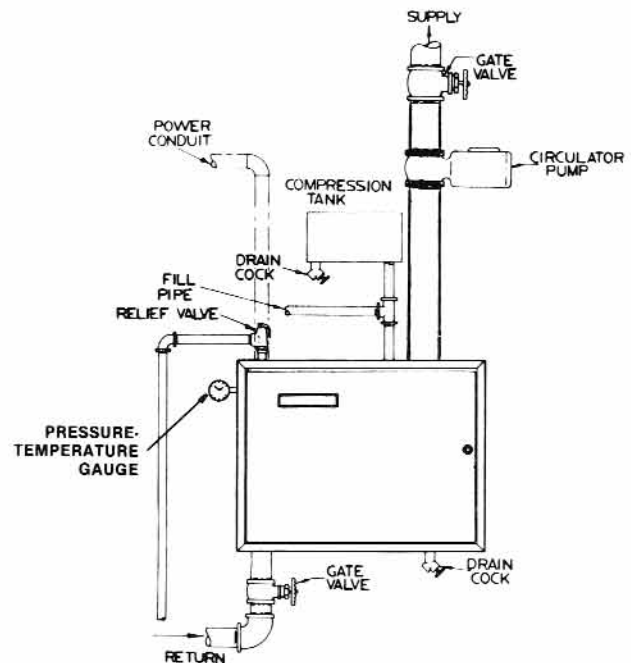


FIGURE 1

CAUTION

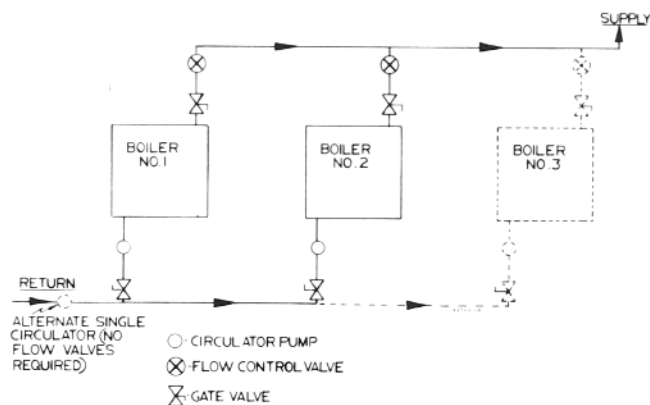
The A.S.M.E. relief valve is shipped with the boiler. Pipe the relief valve outlet to a drain or near to the floor; do not pipe relief valve discharge to any area where freezing temperatures could occur.

Install drain cock and pressure-temperature gauge as shown in Figure 1.

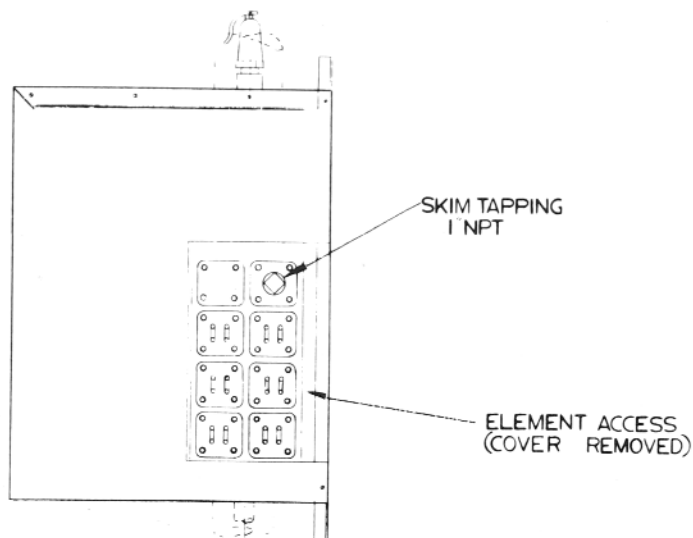
Install a correctly sized compression tank above the boiler, piping as directed above.

When the multiple zone circulators or zone valves are utilized, refer to the manufacturer's instructions for application information.

Figure 2 shows the recommended piping connections where two (2) or more boilers are headered together. Controls are not shown in Figure 2 in order to illustrate the piping connections.



**Water Boilers
FIGURE 2**



**Steam Boiler
FIGURE 3**

**WATER BOILER PIPING
RECOMMENDED MINIMUM PIPE SIZES**

WATER FLOW RATE GPM	SUPPLY PIPE SIZE A	RETURN PIPE SIZE B
To 9 GPM	1"	1"
10 - 16 GPM	1 1/4"	1 1/4"
17 - 21 GPM	1 1/2"	1 1/2"
22 - 35 GPM	2"	2"
36 - 50 GPM	2 1/2"	2 1/2"
51 - 76 GPM	3"	3"

**STEAM BOILER PIPING
RECOMMENDED MINIMUM PIPE SIZES**

Boiler Model No.	Recommended Minimum Pipe Size — Inches		
	A	B	C
CE-16-S	2"	2"	1 1/2"
CE-24-S	2"	2"	1 1/2"
CE-32-S	2"	2"	1 1/2"
CE-40-S	2"	2"	1 1/2"
CE-48-S	2"	2"	1 1/2"
CE-64-S	2 1/2"	2 1/2"	1 1/2"
CE-80-S	3"	3"	1 1/2"
CE-96-S	3"	3"	1 1/2"

TABLE A

PIPING THE STEAM BOILER

After the boiler is secured in place, piping may be accomplished in the standard manner as illustrated in Figure 4 and Table A. Normally for single boiler systems, the condensate will return by gravity to the boiler. Precautions should be taken to prevent "flooding" the boiler, especially if the system has a mechanical condensate return system. It may be necessary to adjust the float switch of the condensate pump (where used) to a small differential for proper boiler and system operation. The boiler is provided with a No. 67 L.W.C.O. installed and prewired. Notify the owner of the location of the No. 67 L.W.C.O. and instruct him in its operation and the periodic procedure of flushing the sediment bowl.

A 1" N.P.T. skim tapping is provided on the right hand side of the boiler casting; see Figure 3. Please note that no provision is made to extend the skim piping thru the boiler jacket. Skim the boiler water as directed in the Operating Card, using 1" skim piping, before putting the jacket element opening cover plate on the boiler.

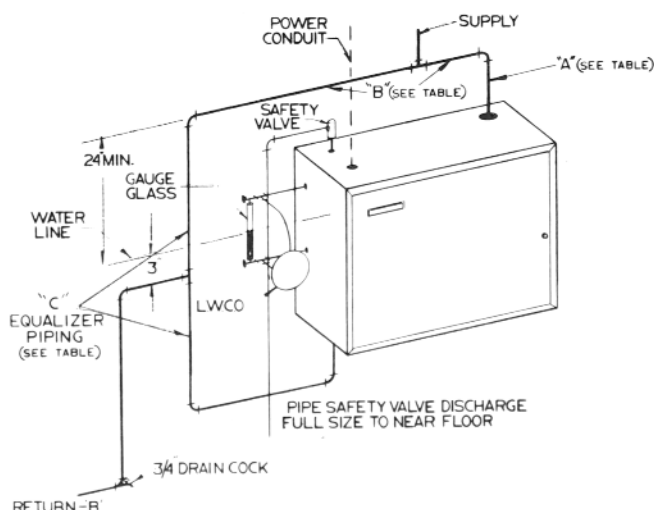


FIGURE 4

CAUTION

The A.S.M.E. safety valve is shipped on the boiler. Pipe the safety valve outlet to the drain or near to the floor; do not pipe safety valve discharge to any area where freezing temperatures could occur.

Two or more boilers may be utilized where necessary to obtain the desired capacity. Standard industry piping practices should be used for headering the steam and condensate return piping. The waterlines of all boilers should be at the same level. A boiler water-level controller and boiler feed pump system is recommended. Locate the "body mark" of the boiler water level controller $1\frac{1}{2}$ " below the centerline of the boiler's water gauge glasses.

WIRING THE BOILER

The Model CE boiler is pre-wired at the factory. Refer to the appropriate wiring diagram on Page 7 or Page 8 for internal and external wiring. The Model CE electric boiler contains internal overload protection. Provisions are made in the upper left hand corner of the boiler cabinet to accept the power input wiring.

CAUTION

Listed in the Ratings table are the minimum recommended wire sizes according to the boiler capacity. The wire size listed for each boiler size is based on using a copper conductor for runs of 50 feet or less; for runs in excess of 50 feet consult National or Local Electrical Code Manual. Bring the power input wiring from the disconnect panel through the conduit opening in the boiler cabinet and connect the wires to the fuse blocks shown in wiring diagram. Please note that the power input wiring must have at least a 90°C rating. All low voltage control wiring must be N.E.C. Class 1.

One $2\frac{1}{2}$ minute solid state time delay, up to seven (7) thermal time delays and up to eight (8) heating element contactors are prewired in the boiler cabinet. Each thermal time delay is wired in series with its respective heating element contactor to prevent a sudden inrush of electrical current. On a "call for heat", only one contactor at a time is allowed to become energized.

A low voltage (24 volt secondary) transformer is mounted in the boiler cabinet to provide a power source for the control circuit. The CE boiler is provided with both an operating control and a limit control, and the steam boiler also has a low water cutoff. Our wiring diagram also shows the use of a low voltage thermostat or controller which should be used to obtain proper control function and safety of operation. Note that high limit controls must be set at least 2 PSIG or 20°F higher than operating control settings.

**NUMBER OF BRANCH CIRCUITS REQUIRED
AND MINIMUM WIRE SIZE (90°C WIRE)**

CAUTION

For the number of branch circuits required and the wire size, please refer to the appropriate columns in the Ratings Table. Do not use aluminum conductors.

**EXTERNAL CONTROL WIRING –
WATER BOILERS**

If it is desirable to utilize outdoor thermostats to provide control of the heating elements, the outdoor bulb of such a controller must be located to sense outdoor temperatures, but the bulb should not be exposed to the sun, rain, snow or the warm air from ventilating openings.

Where only one zone is utilized, the relay, circulator, thermostat, etc., should be wired according to the controls employed (refer to manufacturer's instruction for application information). For single zone applications where only one (1) low voltage operating control is utilized, the operating control must be wired across terminals 1 and 2 of the low voltage terminal board.

On radiant panel systems, heat pumps, etc., where optimum control of the water temperature is desired, placing the operating control (bulb) in the return water piping near the boiler is desirable, as is constant water circulation through the system.

**EXTERNAL CONTROL WIRING –
STEAM BOILERS**

For single zone applications where only one (1) low voltage operating control is utilized, the operating control must be wired across terminals 1 and 2 of the low voltage terminal board.

SEQUENCE OF OPERATION

A $2\frac{1}{2}$ minute time delay is incorporated into the high limit circuit to prohibit short cycling due to electrical power interruption or high limit and low water operation.

The $2\frac{1}{2}$ minute time delay affects all heating elements with the exception of No. 1, its operation is as follows: upon initial application of power to the boiler, the $2\frac{1}{2}$ minute delay timer (EDI) is energized and the timing starts at the end of $2\frac{1}{2}$ minutes, relay RLY1 can be energized and the boiler is ready for operation.

Call for Heat –

1. The thermostat contacts close (external operating control) energizing the first contactor (1K) and the 30 second thermal time delay (TD1).
2. Approximately 30 seconds later the time delay closes, energizing the second contactor (2K) and the heater in the second thermal time delay (TD2).
3. Approximately 30 seconds later, the second thermal delay contacts close, energizing the third contactor (3K) and the heater in the third thermal time delay (TD3).
4. This sequence continues until all contactors are energized or until the call for heat ends.

End of Call for Heat –

5. The thermostat (external operating control) contacts open, de-energizing the first contactor (1K) and the heater in the first thermal time delay (TD1).

6. After a minimum of 10 seconds the contacts in the first thermal time delay open, de-energizing the second contactor (2K) and the heater in the second thermal time delay (TD2).
7. This sequence continues until all contactors are de-energized.
8. When the boiler temperature or pressure exceeds the low limit setting, the thermostat circuit is opened and the elements are de-energized in a normal off sequence. If the high limit setting is exceeded, the transformer secondary circuit is open and all element contactors are de-energized instantly.

**TROUBLE SHOOTING GUIDE
(Refer to Wiring Diagram)**

- I. Symptom—No Heat
 - A. Check all fuses, please note that fuses F1 and F5 supply power to the control circuit. Fuse TF1, located on top of the transformer, is in the 24 volt control circuit.
 - B. If fuses are good, jumper the thermostat terminals. If boiler starts, check the thermostat and associated wiring.
 - C. If thermostat and wiring are good, check the high and low limit control.
 1. Jumper terminals of high limit control together. If the boiler starts, replace the limit control.
 2. If the boiler does not start in Step 1, jumper the terminals on the low limit control. If the boiler starts, replace the limit control.
 - D. If the limit and operating controls are good, check the transformer.
 1. Measure the transformer secondary voltage from control tray to transformer side of the high limit control; it should measure 24 volts a.c. $\pm 10\%$.
 2. If the voltage is zero, check the fuse F1 located on top of the transformer. If the fuse is good and primary voltage is present, replace the transformer.

II. Symptom—Low Heat

One or more contactors do not energize. Operation of any contactor, beyond the first is dependent upon the operation of

three components:

1. Thermal time delay.
2. 2½ minute solid state time delay.
3. Relay RLY1.

Observe the sequence of operation and note the contactor where the sequence stops.

If the first element contactor energizes, but not the second, jumper terminals 2 and 4 of RLY1 and wait 60 seconds for TD1 to become energized. If 2K element contactor energizes, connect a voltmeter to terminals 1 and 3 on RLY1, it should read 24 volts. If it does not, replace ED1. If it does, replace RLY1.

If RLY1 energizes, but element contactor 2K does not, proceed as follows:

Disconnect the wire going from the contactor coil to the thermal time delay, using a jumper wire, reconnect the contactor coil terminal to terminal 1 of the thermostat terminal strip.

1. If the contactor energizes, replace the thermal time delay.
2. If the contactor fails to energize, replace it.

III. Symptom—Boiler Does Not Shut Down

One or more contactors remain on after call for heat ends.

A. Check contactors.

Lower the temperature setting on the "High Limit" control to simulate a limit of operation.

1. If all contactors instantly de-energize, the contactors are not mechanically "stuck".
2. If one or more contactors fail to de-energize, replace the contactors that failed to de-energize.

B. If all contactors de-energized check the thermal time delays.

Return the temperature setting on the high limit control to its original setting. Allow the boiler to sequence ON with a normal call for heat. When all contactors are energized, lower the setting on the low limit to satisfy the call for heat. Observe the shut down sequence and note the contactor at which it stops. Replace the thermal time delay supplying power to that contactor.

**MODEL CE ELECTRIC BOILER
REPAIR PARTS LIST**

PART NUMBER	DESCRIPTION
318-302-100	Boiler Casting
428-600-011	Control Tray
428-600-018	Door
428-600-014	Left Side Jacket Panel
428-600-013	Right Jacket Panel
428-600-016	Top Side Jacket Panel
428-600-015	Bottom Side Jacket Panel
428-600-012	Back Panel Includes Mtg. Bars
428-600-017	Element Access Panel
562-850-089	Jacket Door Latch
510-350-061	Limit and Operating Control (water boilers)
511-842-365	Transformer — 208/240 Volt
511-842-366	Transformer — 480 Volt
510-350-220	Thermal Time Delay (TD)
510-350-219	Relay (RLY1)
510-350-211	2½ Minute Solid State Time Delay Relay (ED)
512-050-018	Line Terminal and Fuse Block — 208/240 Volt — 1 & 3 Phase — For Steam Boiler
512-050-019	Line Terminal and Fuse Block — 480 Volt — 3 Phase — For Steam Boiler
512-050-021	Line Terminal and Fuse Block — 208/240 Volt — 1 & 3 Phase — For Water Boiler
512-050-023	Line Terminal and Fuse Block — 480 Volt — 3 Phase — For Water Boiler
512-150-149	Element Contactor — 3 Phase
512-150-147	Element Contactor — 1 Phase
591-550-164	16KW Heating Element — 208 Volt — 3 Phase
591-550-165	16KW Heating Element — 240 Volt — 3 Phase
591-550-166	16KW Heating Element — 480 Volt — 3 Phase
591-550-229	8KW Heating Element — 208 Volt — Single Phase
591-550-250	8KW Heating Element — 240 Volt — Single Phase
590-317-523	Element Opening Gasket
592-243-200	Element Opening Cover Plate
511-546-924	Relief Valve ¾" — Water
510-218-148	Temperature — Pressure Gauge — Water
511-548-021	Safety Valve — ¾" — Steam
510-218-035	Pressure Gauge — Steam
510-312-135	Limit and Operating Controls (steam boilers)
591-419-185	Gauge Glass
510-218-135	Gauge Cocks
511-114-490	Low Water Cut-off (steam boilers)
511-114-513	Low Water Cutoff (CE-128 water boiler only)
592-000-011	Skim Tapping Plate
512-050-013	Terminal Block — Low Voltage
591-850-176	Fuse, 250 Volt, 1 Ph.
591-850-179	Fuse, 600 Volt, 3 Ph.
591-850-181	Fuse, 250 Volt, 3 Ph.
591-850-185	Fuse, Transformer Secondary

RATINGS



DOE



Boiler Model No.	DOE Heating Capacity BTU/Hr.†	KW	Lbs. of Steam per hour @ 212° F.	No. & Size of Elements		No. of Circuits Required*		208 V.				240 V.				480 V.	
								1 Phase		3 Phase		1 Phase		3 Phase		3 Phase	
				1 Phase	3 Phase	1 Phase	3 Phase	Amps°	Wire +	Amps°	Wire +	Amps°	Wire +	Amps°	Wire +	Amps°	Wire +
WATER																	
CE-48-W	163,824	48	—	6-8KW	3-16KW	2	1	116/116	1/1	135	0	100/100	2/2	117	1	58	6
CE-56-W	191,128	56	—	7-8KW	—	2	—	154/116	00/1	—	—	134/100	0/2	—	—	—	—
CE-64-W	218,432	64	—	8-8KW	4-16KW	2	1	154/154	00/00	180	000	134/134	0/0	155	00	78	3
CE-80-W	273,040	80	—	—	5-16KW	—	2	—	—	135/90	00/2	—	—	117/78	1/3	58/40	6/8
CE-96-W	327,648*	96	—	—	6-16KW	—	2	—	—	135/135	0/0	—	—	117/117	1/1	58/58	6/6
CE-112-W	382,256*	112	—	—	7-16KW	—	2	—	—	180/135	000/0	—	—	155/117	00/1	78/58	3/6
CE-128-W	436,864*	128	—	—	8-16KW	—	2	—	—	180/180	000/000	—	—	155/155	00/00	78/78	3/3
STEAM																	
CE-16-S	54,808	16	56.3	2-8KW	1-16KW	1	1	78	3	.45	6	67	4	39	6	20	8
CE-24-S	81,912	24	84.5	3-8KW	—	1	—	117	1	—	—	102	2	—	—	—	—
CE-32-S	109,216	32	112.6	4-8KW	2-16KW	2	1	78/78	3/3	90	2	67/67	4/4	78	3	39	8
CE-40-S	136,520	40	140.8	5-8KW	—	2	—	117/78	1/3	—	—	102/67	2/4	—	—	—	—
CE-48-S	163,824	48	169.0	6-8KW	3-16KW	2	1	117/117	1/1	135	1/0	102/102	2/2	117	1	59	6
CE-64-S	218,432	64	225.3	—	4-16KW	—	2†	—	—	90/90	2/2	—	2/2	78/78	3/3	78	3
CE-80-S	273,040	80	281.6	—	5-16KW	—	2†	—	—	135/90	0/2	—	—	117/78	1/3	98	2
CE-96-S	327,648*	96	337.9	—	6-16KW	—	2†	—	—	135/135	0/0	—	—	117/117	1/1	117	1

* Gross output ratings in BTU/Hr.

° Number of circuits required to supply power to the boiler.

† Total amperes in each circuit supplying power to the boiler.

+ Minimum U.S. Gauge wire sizes based on runs of 50 feet or less using 90° C. copper only. Consult national or local electrical code manuals for temperature ratings of conductors other than 90° C., and for runs in excess of 50 feet. DO NOT USE ALUMINUM CONDUCTORS.

† 480V. boilers require only one circuit.

Fuse Sizes: 208/240V. — 60 Amps; 480V. — JKS 30 Amps.

Boiler Water Content (all sizes): Water — 10.2 gals.; Steam — 7.0 gals.

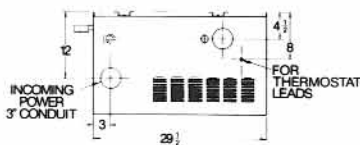
Approximate Shipping Weight (all sizes): 300 lbs.

† Based on standard test procedures prescribed by the United States Department of Energy.

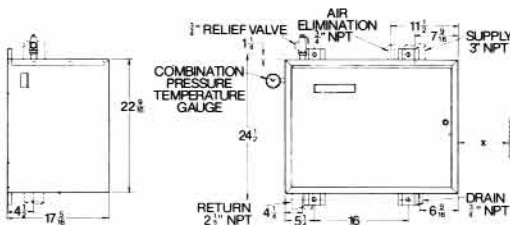
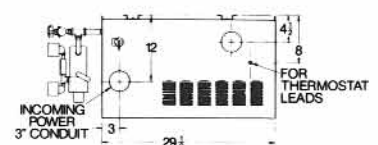
NOTE: Piping loss not confined to the heated space should be added to the building loss to determine total heating requirement.

DIMENSIONS

WATER TOP

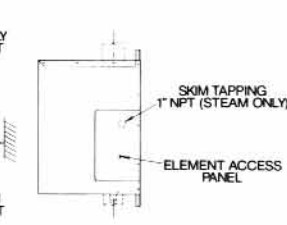


STEAM TOP

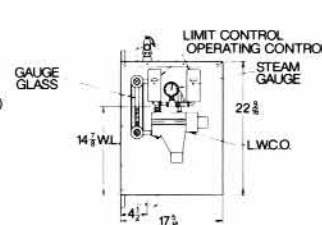


WATER LEFT SIDE

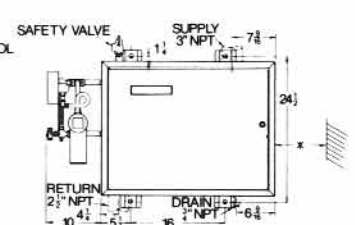
WATER FRONT



WATER/STEAM RIGHT SIDE



STEAM LEFT SIDE



STEAM FRONT

* 24" minimum wall clearance required for element removal.

STANDARD EQUIPMENT

Jacket with Wall-Mounting Brackets
One-Piece Insulated Casting
Incoloy-Sheathed, Low-Watt-Density Elements
24 Volt Control System
Fuse for Each Element Leg
Thermostat Terminal Block
Power Input Terminal and Fuse Block
Thermal Time-Delay Relays
Heavy-Duty Contactors
Electronic Time-Delay Relay

For Water Boilers

ASME Safety Relief Valve
Combination Pressure and Temperature Gauge
Combination Operating and High-Limit Control
Low Water Cutoff (CE-128 only)

For Steam Boilers

ASME Safety Valve
High-Limit Pressure Control
Operating Pressure Control
Low-Water Cutoff
Water Gauge Glass
Gauge Cocks
Steam Pressure Gauge

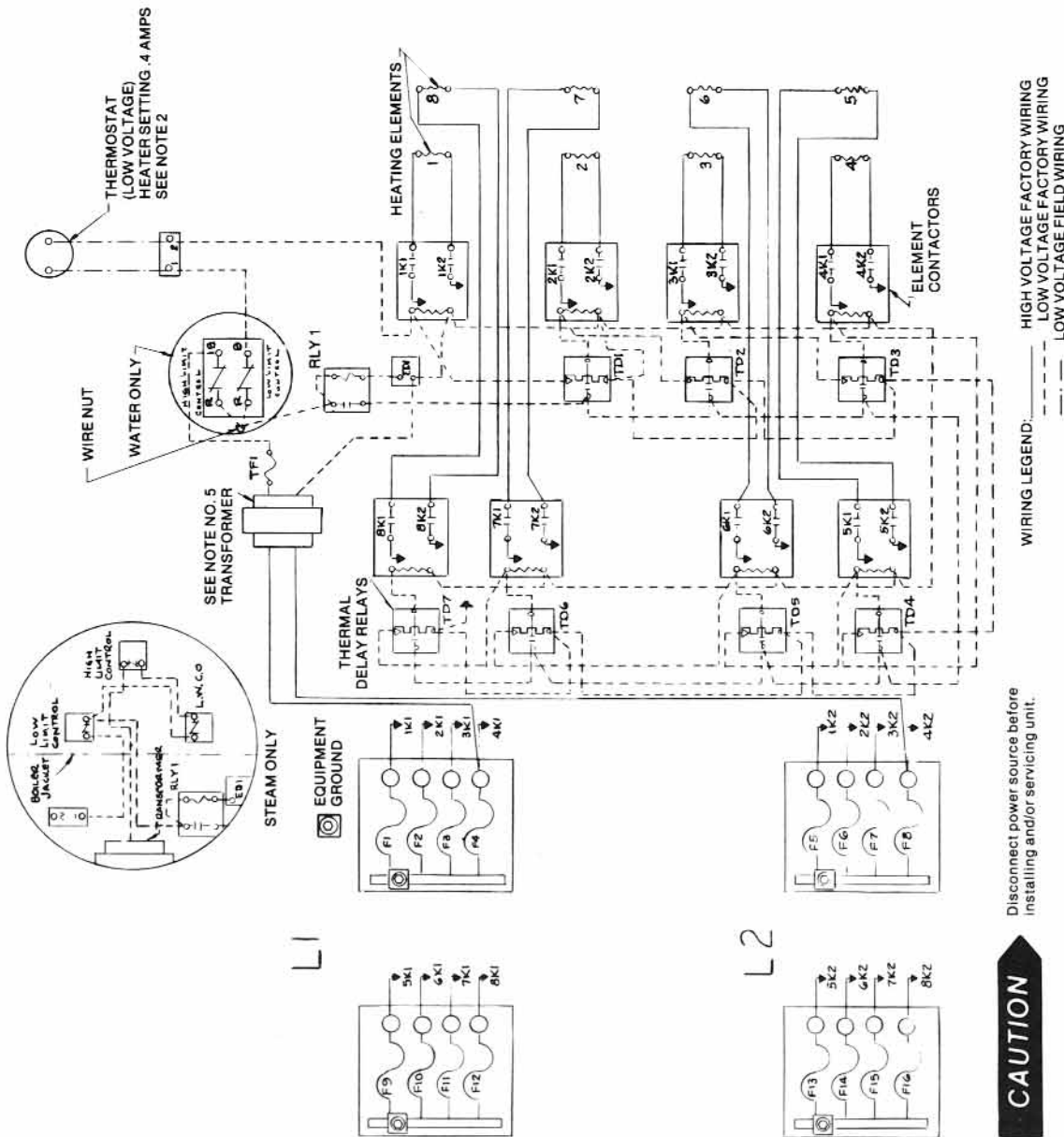
WEIL-McLAIN

Michigan City, Indiana 46360 ■ A Marley Company

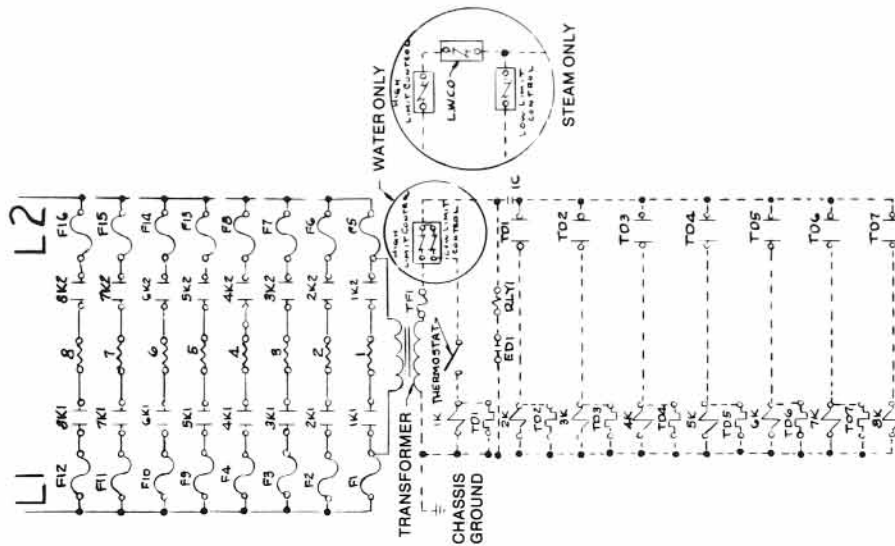


In Canada: Wylain Canada LTD., L.T.E.E., 126 East Dr., Brampton, Ontario L6T 1C2

SCHEMATIC WIRING DIAGRAM



LADDER WIRING DIAGRAM



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 and thermostat wiring must be N.E.C. Class 1.
3. Use only copper conductors for power input wiring. Do not use aluminum conductors.
4. For 208 volt power supply, wire control circuit transformer in accordance with wiring label on transformer.
5. Location of transformer leads at fuse block will vary with boiler size.
6. For steam boilers, 1K and 8K contactors, elements 1 and 8, and TD-1 and TD-7 time delay relays are not used.

CAUTION

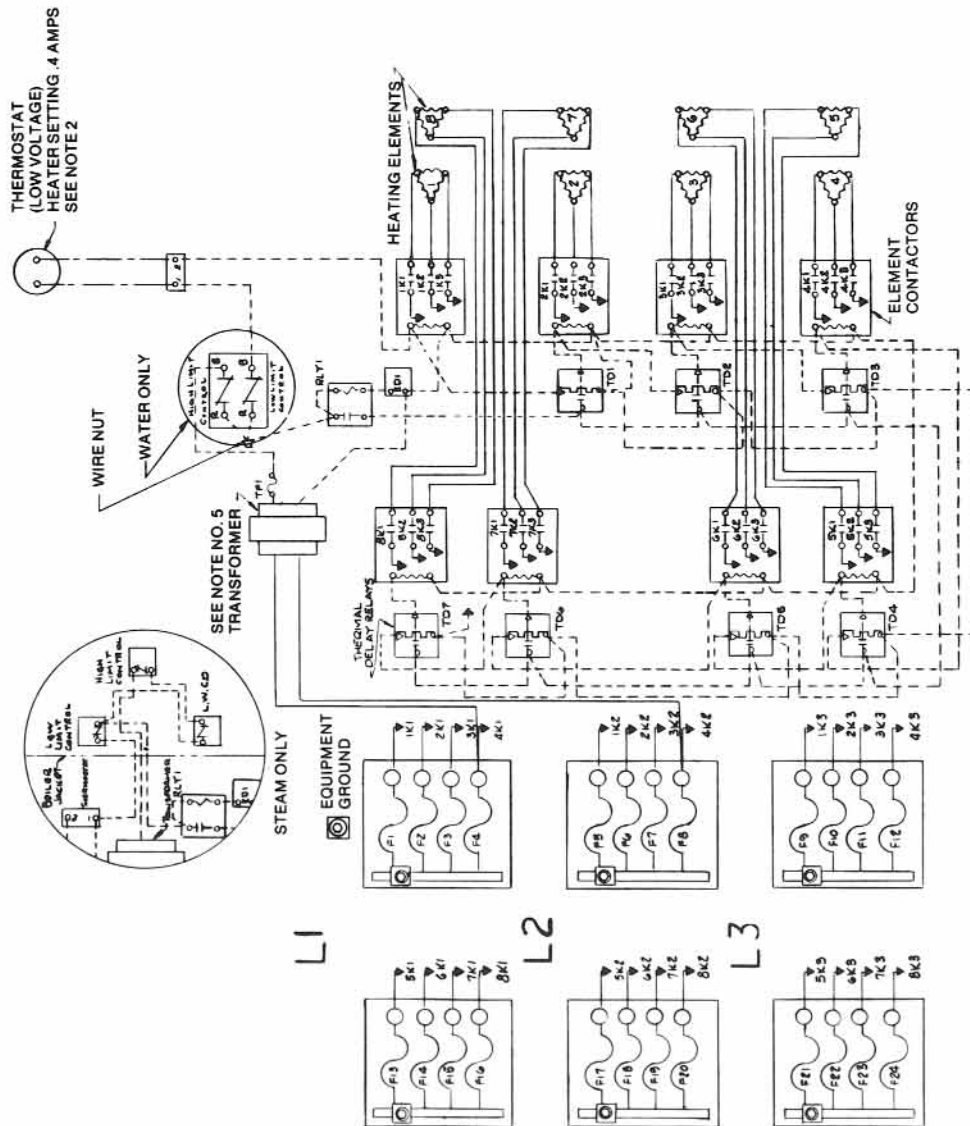
Disconnect power source before installing and/or servicing unit.

WARNING

CE, Series 2 Electric-Hydraulic Boiler Schematic and Ladder Wiring Diagrams. Single-phase power supply. Applicable to CE-48-W through CE-64-W water boilers and CE-16-S through CE-48-S steam boilers.

WEIL-McLAIN
Michigan City, Indiana 46360
A Marley Company

SCHEMATIC WIRING DIAGRAM



CAUTION
Disconnect power source before installing and/or servicing unit.

WARNING

WIRING LEGEND:
— HIGH VOLTAGE FACTORY WIRING
--- LOW VOLTAGE FACTORY WIRING
... LOW VOLTAGE FIELD WIRING

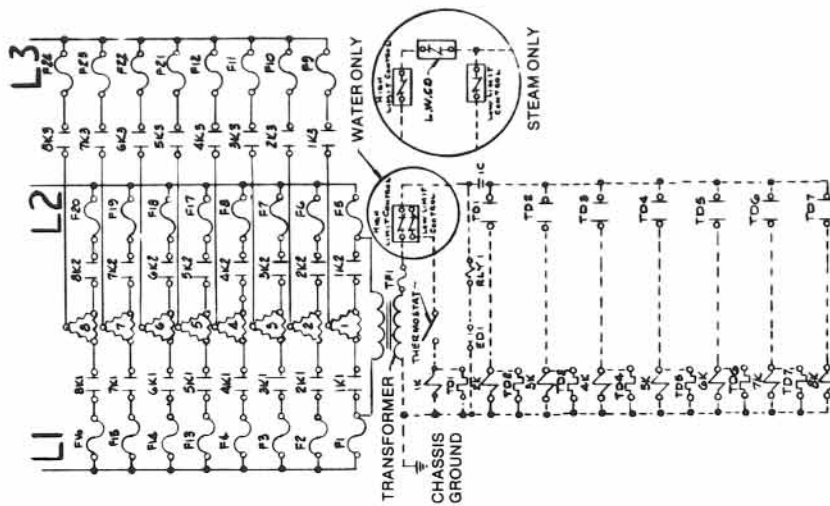
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CE, Series 2 Electric-Hydronic Boiler Schematic and Ladder Wiring Diagrams. Three-phase power supply. Applicable to all CE-W water and CE-S steam boilers.

WEIL-McLAIN
Michigan City, Indiana 46360
A Marley Company

LADDER WIRING DIAGRAM



WIRING LEGEND:
— HIGH VOLTAGE FACTORY WIRING
--- LOW VOLTAGE FACTORY WIRING
... LOW VOLTAGE FIELD WIRING

PLEASE HANG THESE INSTRUCTIONS NEAR THE BOILER

OPERATING AND MAINTENANCE INSTRUCTIONS FOR WEIL-McLAIN ELECTRIC BOILER

Mr. Boiler Owner:

Below, the procedure is outlined for starting your Weil-McLain Boiler including instructions for the care of your heating system. All mechanical equipment needs occasional attention. The boiler should be inspected, cleaned and if necessary, adjusted once a year. We recommend that a qualified serviceman be called as he has been trained for the job and will have the necessary instruments to check your boiler. This will assure you that the operation of your heating system will remain highly efficient. Your Weil-McLain boiler will give you many years of heating comfort, if you follow the few simple suggestions listed in this instruction sheet.

FILLING STEAM AND WATER BOILERS

Do not fill the boiler (except for leakage tests) until the boiler is ready to be fired. **CAUTION: Do not add large quantities of cold feed water to any hot boiler!**

Steam Systems: The boiler should be filled to the normal water line and fired for about 15 minutes at a low rate sufficient to keep the boiler at steaming temperature with the steam vented to drive off dissolved gases (also see Skimming Steam Boilers).

Water Systems: The boiler and the entire system should be filled to about 12 pounds per square inch and heated to approximately 210° F for about 15 minutes to drive off dissolved gases. Before filling the system, make sure all the system air vents are closed. Open the hand water feed valve and beginning on the lower floor, open the air vents (one at a time) until water starts to flow; then, close the vent. Repeat this throughout the building until all heat distributing units are filled with water.

Close the hand water feed valve when the correct boiler pressure is reached. After the system is in operation, keep the system filled with water by occasionally opening the air vents allowing any entrapped air to escape and adding enough make up water to maintain the correct system pressure. If your system is provided with a purge valve located in the system return piping, connect a garden hose to the drain valve and open the hand water feed valve and allow the system to purge all air. Where the system has more than one circuit, purge each circuit separately by opening each balancing valve one at a time. When the system is purged of all air, close the drain cock located above the purge valve and open the purge valve. Fill the boiler and the entire system to the correct pressure. Air in the system can interfere with circulation of water and prevent the heat distributing units from properly heating.

TO START THE BOILER

1. Be sure the main electric switch in the boiler electrical circuit is turned to the off position.
2. The boiler must be filled to the correct water level or pressure as outlined above.
3. Set the limit control at desired setting as recommended in these instructions.
4. Turn the thermostat to its lowest setting so there is no call for heat and close the main electric switch in the boiler electrical circuit.
5. Turn the thermostat above the actual room temperature and observe that the heating elements sequentially become energized.
6. Check operation of all limit controls.
7. Set the thermostat to the desired room temperature.
8. If boiler operates incorrectly (see Sequence of Operation) or fails to start, refer to Trouble Shooting Guide in these instructions.

SKIMMING STEAM BOILERS

All new boilers and steam and water piping contain oil, grease, chips, and other foreign matter. It is essential to clean new heating systems to remove these materials in order to avoid overheating of boiler metal, foaming and priming, and high maintenance costs on strainers, traps, and vents. The boiler installer should use the following procedure to clean oil, grease, and other impurities from the new boiler:

1. Close the valves in the building steam supply main(s).
2. Provide a 1" skim line, with valve, from the boiler skim tapping and run this line to a convenient floor drain.
3. Energize the boiler for a period sufficient to keep the boiler at steaming temperature allowing the steam, along with entrained water and impurities, to discharge through the skim piping to the drain.
4. Feed the water to the boiler as required to maintain proper water level in the proper water level in the gauge glass. It may be necessary to cycle the boiler to prevent a rise in steam pressure above several pounds.
5. Continue the boiling and skimming process for at least two hours or until the water leaving the skim line is clear of all grease, oil and impurities. On unusual jobs, the skimming procedure may require repeating one or more times.

CAUTION: THE USE OF CHEMICAL CLEANERS IS NOT RECOMMENDED!

6. Drain boiler and, while the boiler is warm but **NOT HOT**, remove safety valve and insert a hose nozzle into the opening. Flush all interior surfaces of the boiler with water under full pressure until all traces of dirt and impurities are removed and the drain water runs clear.
7. Replace safety valve; close drain cocks, fill with fresh water to the water-line. Start boiler and steam for 15 minutes to remove all dissolved gases; stop boiler.
8. Drain boiler sufficiently to remove skim piping; plug skim tapping; refill boiler to water-line.
9. To prevent the return of impurities to the boiler from new or old piping systems, waste all condensate for several days or until no impurities are contained in the condensate.
NOTE: IT IS IMPERATIVE THAT FEEDWATER BE SUPPLIED TO MAINTAIN THE CORRECT WATER LEVEL AND THAT A LOW WATER CUTOFF IS OPERATIVE.

BOILER SERVICE AND MAINTENANCE

Leaks in the boiler and piping system must be repaired at once. The use of makeup water in large quantities is undesirable and may damage the boiler after an extended period of time. If serious leaks occur, stop the boiler and gradually reduce boiler pressure or temperature. Do not attempt to make repairs while a steam boiler has pressure or hot water boiler temperatures are above 130° F.

Foaming or priming may occur in a steam boiler and cause large quantities of water to pass out into the steam main(s). It can be observed by violent fluctuations of water level, in the gauge glass. This trouble may be caused by dirt, oil, or precipitates in the boiler water, too high a boiler water level, a high overload on the boiler (i.e., the sudden release of boiler steam pressure into the mains by action of fast operating valves), or the addition of too much boiler water treatment. With serious foaming or priming, stop the boiler and decrease boiler load. Then alternately blowdown and slowly feed fresh water several times. If trouble persists, it may be necessary to skim the boiler one or more additional times.

Any problem in regard to large amounts of makeup water, extreme foaming or priming scale in the boiler, or internal corrosion or pitting, should be referred to a company specializing in boiler water chemistry.

Frequently check the boiler water level in the gauge glass of steam boilers, and check the boiler operating pressure of steam or water boilers. Test the low water cutoff by opening its blowdown valve to remove dirt, rust, and sediment, and observe that burner stops as the water level approaches the bottom of the water gauge glass (gauge glass on steam boilers only).

DO NOT DRAIN BOILER during periods of shutdown unless heating system is exposed to freezing temperatures. On steam boilers, open boiler blowdown valve and flush till clear while under steam pressure. On water boilers, open boiler drain cock to remove impurities that have settled to the bottom of the boiler. Refill as required to the correct water line for steam boilers or the correct pressure for water boilers. Turn off all electrical power connections to the boiler. If the water side of the boiler must be cleaned or inspected, open the blowdown valve and drain the boiler.

Remove plugs from the boiler and open the drain cock. Hose the inside of the boiler with high pressure water to remove sludge and sediment, flush again. Dry insides of boiler thoroughly, or refill with fresh water and heat to release dissolved gases (see Filling Steam and Water Boilers). Repeated drain-

ing and filling of the boiler and/or the heating system can lead to the same consequences as adding too much makeup water.

Refer to Water Boiler Controls or Steam Boiler Controls for specific service requirements.

Periodically check and if necessary, tighten any gasket bolts.

CHANGING HEATING ELEMENTS

1. If the boiler will not get hot enough to properly heat the building, it is possible that one or more heating elements are burned out.
2. Open the main electric switch in the boiler electrical circuit.
3. Your serviceman can determine whether any of the heating elements are burned out by disconnecting the wires to each element and checking the resistance and continuity with an Ohmmeter.
4. Close the system valves located at each side of the boiler.
5. Open the boiler drain cock and completely drain the boiler.
6. Remove the four (4) cap screws which secure the burned out heating element to the boiler casting and remove the burned out element.
7. Use a new heating element gasket and insert a new heating element of the same type (voltage, dimensions and KW or watts rating) into the opening in the boiler casting. Secure the element to the casting using the four (4) cap screws.
8. Fill the boiler with water to the correct level or pressure.
9. Open the system valves located at each side of the boiler.
10. Close the main electric switch in the boiler electrical circuit.

WATER BOILER CONTROLS

BOILER PRESSURE: The initial fill pressure of a hot water system is generally to 12 pounds per square inch. When the system is heated to the limit control setting, the pressure may range up to 30 pounds per square inch. Normal system pressure will fluctuate between the fill pressure; when the system is cold; and up to 20 to 28 pounds per square inch when the system is hot.

BOILER WATER TEMPERATURE: Modern hot water heating systems with "closed" type expansion tanks may operate at water temperatures up to 250° F. Set the high limit control at 220° F; during severe weather you may find this temperature setting needs to be raised or lowered, depending upon the characteristics of your heating system.

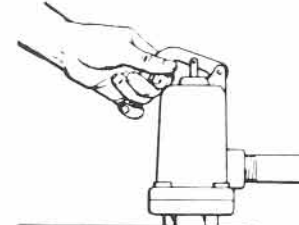
PRESSURE-TEMPERATURE-ALTITUDE GAUGE: This gauge indicates the boiler pressure in pounds-per-square-inch, the boiler water temperature in degrees fahrenheit.

WATER RELIEF VALVE: Check the relief valve at least once a year by pulling the handle and allowing a small quantity of water to flow. Be sure the relief valve reseats properly and is entirely free from seepage. If the relief valve sticks or appears to be clogged, it should be repaired or replaced immediately.

COMPRESSION TANK: Compression tank(s) are employed with hot water heating systems to accept the increased water volume which results from heating the system water. The compression tank on a closed hot water heating system should provide adequate pressurization under all system operating conditions. **Closed Type Expansion Tank:** When the system is initially filled with water, a cushion of air is trapped within the tank and this air cushion is compressed to provide the initial fill pressure. When the system is heated, the expansion of the system water further compresses the air cushion and provides the additional space required for the additional water volume. A rapid increase in boiler pressure with frequent opening of the pressure relief valve during warm-up of the boiler and heating system usually indicates a "water-logged" compression tank. Your serviceman should be called to correct this condition by partially draining the compression tank to again establish an air cushion. **Closed Diaphragm Type Compression Tank:** Closed diaphragm type compression tanks are welded gas-tight and a rubber diaphragm is employed to separate the air cushion from the system water. Use a tire pressure gauge at the air charging valve (under the red cap); if tank pressure is same as boiler pressure and at least 12 PSIG this is normal. If water flows from charging valve, the tank must be replaced at once. If no pressure is observed, the air charge should be replaced to 12 PSIG; periodic air loss probably indicates a leaking charging valve.



Combination Pressure-Temperature Gauge



Manually opening Pressure Relief Valve.



Pressure Gauge

STEAM BOILER CONTROLS

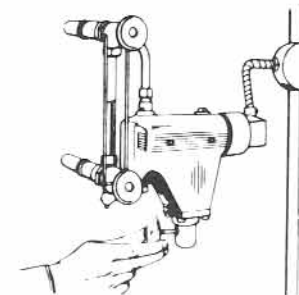
BOILER PRESSURE. Steam boiler pressures may range up to 15 psig maximum, but in normal service usually will not exceed 5 psig and may even operate under vacuum conditions at certain times.

The compound gauge used for steam boilers indicates steam pressure in pounds per square inch (psig) and boiler vacuum in inches of mercury (hg).

CLEANING LOW WATER CUT-OFF: Accumulated sediment in the low water cut-off should be flushed out through a blow-off valve provided for this purpose at least once each month of heating system operation.

CLEANING THE GAUGE GLASS: This may be done by closing the lower gauge glass cock and carefully opening the petcock below the glass to blow water and sediment out of the gauge glass by steam pressure. Then slowly open the lower gauge glass cock, allowing a small amount of water to flush out through the open petcock. Close petcock and fully open the lower gauge glass cock. The water level should immediately rise to its proper level. If gauge glass breaks, close off both gauge cocks and loosen glass retaining nuts to remove gauge glass. Replace broken gauge glass with new gauge glass made of heavy walled pyrex. DO NOT USE THIN GLASS TUBING!

CHECKING THE SAFETY VALVE: The safety valve should open at 15 psig to prevent excessive boiler pressure. Manually open the safety valve once each year by pulling the valve lever or handle and allowing a small amount of steam to escape. This will help to assure proper operation of the safety valve if boiler pressures reach 15 psig. Be sure that the valve reseats properly and does not leak steam. If the safety valve sticks or appears to be clogged it should be repaired or replaced immediately by your serviceman.



Flushing Low Water Cut-off.

