

Slant/Fin[®]

★ LIBERTY II[®]

OIL-FIRED WATER AND STEAM KNOCKED DOWN BOILERS AND BOILER/BURNER UNITS/NO. 2 OIL

See publication LD-41K for assembly and parts and publication LD-42KB for approved oil burners.

INSTALLATION AND OPERATING INSTRUCTIONS

SAFETY WARNING:

KEEP BOILER AREA CLEAR AND FREE FROM COMBUSTIBLE MATERIALS, GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS. FAILURE TO ADHERE TO ABOVE SAFETY WARNING, MAY RESULT IN PERSONAL INJURY OR DEATH AND PROPERTY DAMAGE.

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IMPORTANT: The installation of this equipment must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the installation of Oil Burning Equipment, ANSI/NFPA 31, latest edition, and to the National Electrical Code ANSI-NFPA 70, latest edition. The installation must also conform to the additional requirements in this Slant/Fin Instruction Manual. Where there is any difference, the more stringent requirement shall govern.

IMPORTANT: This boiler must be installed by a trained, experienced, service technician, licensed for the installation and servicing of oil burning equipment or otherwise qualified by the authorities having jurisdiction over the installation.

In addition, where required by the authority having jurisdiction, the installation must conform to American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, No. CSD-1, latest edition.

THIS MANUAL MUST BE LEFT WITH OWNER AND SHOULD BE HUNG ON OR ADJACENT TO THE BOILER FOR REFERENCE.

TAPPINGS AND OPENINGS

3 2 TOP VIEW

FRONT VIEW WATER

FRONT VIEW STEAM

Flue Collector

6 5A 5B 11A 11B 12 1A* 9

Front Section

4

FRONT 13

FRONT 13

REAR 14

REAR 14

Figure 1

* Rear section LD-50, LD-60, LD-70 steam boilers only.

Tapping Loc.	Steam Boiler
1	3" supply
1A*	2" supply onn rear section *
3	3/4" steam safety valve
4	1/4" siphon, pressure gauge & pressure cut-out
8	3/4" alternate electronic low water cut-off
9	1-1/2" skimmer tapping
10	1/2" low limit for tankless
11A	1/2" tankless inlet
11B	1/2" tankless outlet
12	1/2" steam gauge glass & 67 LWCO
13	1-1/2" bushed to 3/4" for drain cock
14	1-1/2" condensate return

Tapping Loc.	Water Boiler
1	1-1/2" supply
2	3/4" air vent or expansion tank
3	3/4" water relief valve
5A	1/2" tankless inlet
5B	1/2" tankless outlet
6	1/4" pressure temp. gauge
7	1/2" high limit, hi/lo or combination control
13	1-1/2" return & 3/4" drain cock
14	1-1/2" alternate return

DIMENSIONS

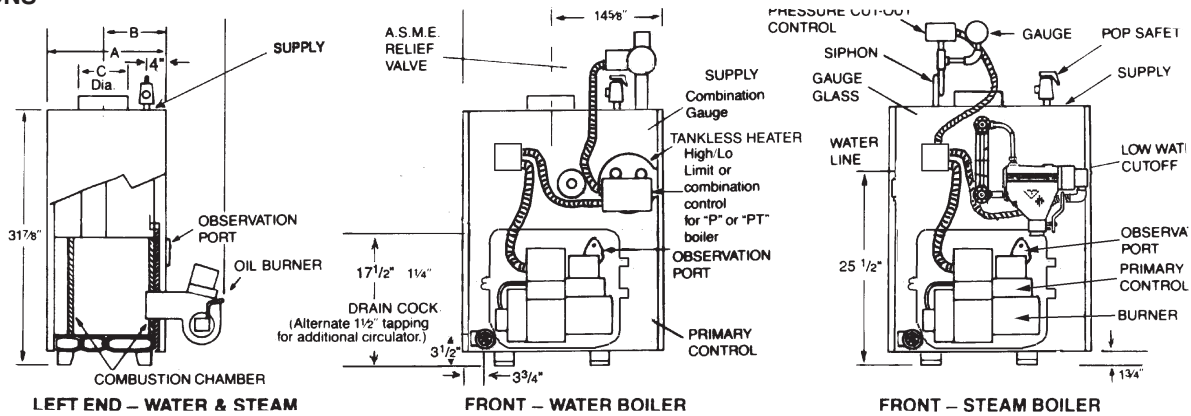


Figure 2

RATINGS

Boiler Model No.*	I=B=R Burner Capacity Oil Input		D.O.E. Heating Capacity MBH		I=B=R Net Ratings			I=B=R Chimney Size		A.F.U.E. %		Dimensions (inches)					Tankless Heater GPM **		
												Boiler Length "A"	Front to Flue "B"	Flue Dia. "C"	Return Circulator Flange "D"	Overall Length "E"			Boiler Sect.
	Water MBH †	Steam MBH †	Steam Sq. Ft. ‡	Nom. Rect. x Height § (in x in x ft)	I.D. Round x Height (in x ft)	Water	Steam												
LD-20	0.75	105,000	90	—	79	—	—	8 x 8 x 15	5 x 15	83.50	—	11 1/2	8 3/2	6	1 1/4	24 1/4	2	2.20	—
LD-20 BK	0.95	133,000	110	—	96	—	—	8 x 8 x 15	5 x 15	81.76	—	11 1/2	8 3/2	6	1 1/4	24 1/4	2	2.40	—
LD-30H	1.00	140,000	121	—	105	—	—	8 x 8 x 15	6 x 15	86.00	—	14 1/4	10 1/2	6	1 1/4	27 1/4	3	3.10	—
LD-30	1.10	154,000	134	134	117	101	421	8 x 8 x 15	6 x 15	84.85	84.15	14 1/4	10 1/2	6	1 1/4	27 1/4	3	3.20	3.00
	1.25	175,000	151	—	131	—	—	8 x 8 x 15	6 x 15	83.50	—	14 1/4	10 1/2	6	1 1/4	27 1/4	3	3.40	—
LD-40H	1.50	210,000	182	179	158	134	558	8 x 8 x 15	7 x 15	86.00	84.00	18 1/4	11 3/2	7	1 1/4	31	4	3.80	3.40
LD-40	1.60	224,000	195	195	170	146	608	8 x 8 x 15	7 x 15	84.45	83.80	18 1/4	11 3/2	7	1 1/4	31	4	3.90	3.50
	1.80	252,000	218	—	190	—	—	8 x 8 x 15	7 x 15	83.33	—	18 1/4	11 3/2	7	1 1/4	31	4	4.15	—
LD-50H	2.00	280,000	243	239	211	179	746	8 x 8 x 15	8 x 15	86.00	84.00	21 1/4	13 3/2	8	1 1/2	34 1/4	5	4.30	3.90
LD-50	2.10	294,000	256	255	223	191	796	8 x 8 x 15	8 x 15	84.06	83.45	21 1/4	13 3/2	8	1 1/2	34 1/4	5	4.40	4.00
	2.35	329,000	272	—	237	—	—	8 x 12 x 15	8 x 15	—	—	21 1/4	13 3/2	8	1 1/2	34 1/4	5	4.70	—
LD-60	2.60	364,000	298	298	259	224	933	8 x 12 x 15	10 x 15	—	—	25	15 3/2	8	1 1/2	37 1/4	6	4.90	4.50
	2.85	399,000	327	—	284	—	—	8 x 12 x 15	10 x 15	—	—	25	15 3/2	8	1 1/2	37 1/4	6	5.20	—
LD-70	3.10	434,000	352	354	306	266	1108	8 x 12 x 15	10 x 15	—	—	28 1/4	16 3/2	9	—	41 1/4	7	5.45	5.00
	3.35	469,000	381	—	331	—	—	8 x 12 x 15	10 x 15	—	—	28 1/4	16 3/2	9	—	41 1/4	7	5.70	—

Standard working pressure 30 PSI water, 15 PSI steam. All boilers hydrostatically tested - A.S.M.E.

* For forced hot water heating systems where the boiler and all piping are located within the area to be heated, the boiler may be selected on the basis of gross D.O.E. capacity output. The net I=B=R output ratings shown are based on an allowance for piping and pickup of 1.15 (water) or 1.33 (steam). D.O.E. capacity gross output is divided by the allowance to obtain net rating. The manufacturer should be consulted before selecting a boiler for unusual piping and pickup requirements such as intermittent system operation extensive piping, etc.

† Ratings are based on light oil at 140,000 Btu per gallon, and apply only when burner models listed in publication no. LD-42KB are used, and are properly adjusted to produce 13% CO₂.

‡ Nominal clay tile liner dimensions. Tankless heater rating based on intermittent draw.

§ I.B.R. gross output.

□ Collar is oblong, will fit 6" diameter nominal connector.

NOTE: All boilers under 300,000 Btu input are tested and rated for capacity under the U.S. Department of Energy (D.O.E.) Test Procedures for Boilers

BOILER LOCATION

Provide a level, solid foundation for the boiler. Location should be near the chimney so that the Flue Pipe Connector or Breeching to the chimney is short and direct.

- A. The foundation must be capable of supporting the weight of the boiler when filled with water:

Boiler Size	Approximate Total Weight of Boiler Assembly, filled with water
LD-20	440
LD-30	550
LD-40	660
LD-50	785
LD-60	895
LD-70	1000

- B. The Liberty Boiler has full wet base sections which surround fire-box for maximum heat absorption of burning fuel, and low floor temperature.
- C. If boiler is to be located over buried conduit containing electric wires or telephone cables, consult local codes or the National Board of Fire Underwriters for specific requirements.

MINIMUM CLEARANCE

Provide accessibility clearance of 24" from surfaces requiring servicing (top and front) and 18" on any side requiring passage. The boiler shall be installed with the following MINIMUM clearances from combustible materials:

- A. CHIMNEY CONNECTOR - 18"
- B. BACK AND SIDES - 6" EXCEPT as limited by 18" clearance from chimney connector.

NOTE: Except in closets and alcoves, clearances above in (A) and (B) may be reduced by providing forms of protection as specified in NFPA31, latest edition.

CHIMNEY REQUIREMENTS

- A. The chimney must be constructed in accordance with all local applicable codes and the National Board of Fire Underwriters. See boiler models and rating table shown on page 2 for chimney sizes.
- B. Check chimney condition. Existing chimneys and stacks may have deteriorated; without re-

- pairs their use would be hazardous. Before connecting to an old chimney or stack.
 1. Clean it.
 2. Inspect it thoroughly.
 3. Remove obstructions.
 4. Replace worn sections of metal stacks.
 5. Seal bad masonry joints.
 6. Repair damaged linings.

- C. Where more than one appliance vents into a common chimney, the area of the common breeching should at least equal the area of the largest appliance flue plus 50% of the additional flue areas.
- D. Breeching area must not be reduced at connection into chimney. Breeching must be inserted into, but not beyond, inside of chimney liner.
- E. Chimney height shall extend at least 3 feet above where it passes through the roof of the building, and at least 2 feet above any ridge within 10 feet of the chimney.
- F. The use of a vent cap, where permitted by code, gives additional protection against adverse wind conditions and precipitation.
- G. Flue Connection: Connect flue pipe between top of boiler and chimney. Horizontal sections of flue pipe must be pitched upward to the chimney at least 1/4" per foot. Flue must be inserted into, but not extend beyond, the inside wall of the chimney flue. Install draft regulator in flue pipe, as shown in figure 3.

AIR SUPPLY AND VENTING

Sufficient air for combustion and ventilation in the boiler room must be provided. Failure to do this will result in poor combustion, heavy soot and health hazards. Any oil-fired boiler must have a steady draft* and an ample supply of combustion air at all times during firing. If air supply or chimney draft* is unreliable, CO₂ and overfire draft* will change unpredictably.

DO NOT vent this boiler to the same chimney flue used by a fireplace or coal or wood burning furnace or boiler. The draft* produced by solid fueled devices varies tremendously between high fire and low fire:

In modern, weatherstripped, energy-saving buildings, natural infiltration may not supply enough air for combustion, particularly if other fuel-burning appliances, exhaust fans or draft inducers are competing for the same air supply. Fireplaces and other solid fuel burning appliances consume great quantities of air while at high

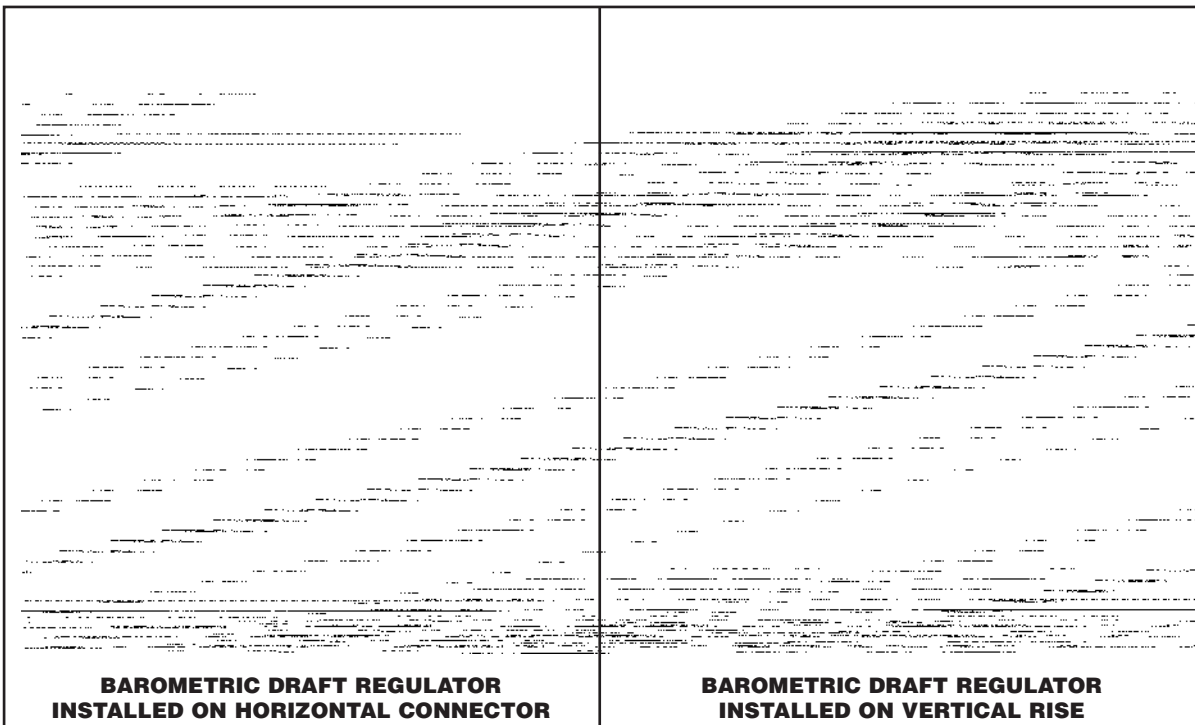


Figure 3. Barometric Draft Regulator

a normal movement. Add make up fresh water to the boiler as described in (D) above, during the blow-off operation, to maintain the proper skimming water level in the vessel. Empty bucket frequently in order to see the difference in water cleanliness.

- F. When surging has stopped and water is clean, and no film can be seen floating in the bucket, shut off boiler, drain down to level of skimmer tapping, remove valve, plug skimmer tapping and refill the boiler to 24-1/2" water level.

After 15 minute operation, readjust level to normal operating level of 25-1/2" from bottom of boiler (see figure 6). Check the pop safety valve for proper operation.

Check for low water cut-off operation. See section on page 7 for check-out.

- G. The entire process may have to be repeated over a period of a few days on extremely fouled system.

CLEANING PIPING SYSTEM

- A. To clean piping system, open all valves at the heating elements. After getting up a good head of steam, shut the boiler down and allow the condensate to return to the boiler. The condensate will carry the oil film with it. Again blow-off the boiler. On extremely fouled systems, it may require several visits over a few days to clean the system.

- B. When steam only (no water) is released through the hand valve, the boiler will not surge or flood.

PIPING FOR WATER UNITSS

NOTE: On knock down boiler only, jacket may be installed after supply and return piping connection, but must be installed prior to adding trim.

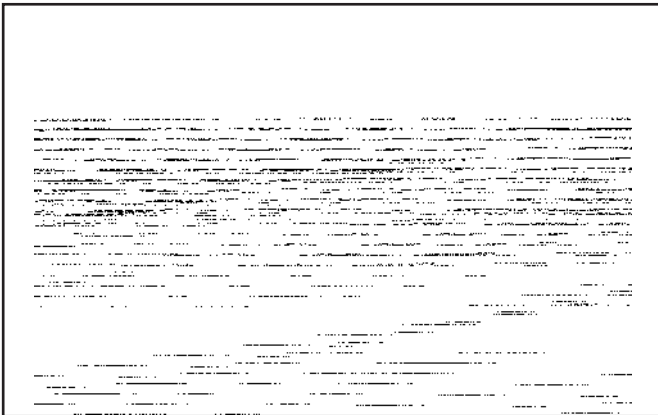


Figure 6.

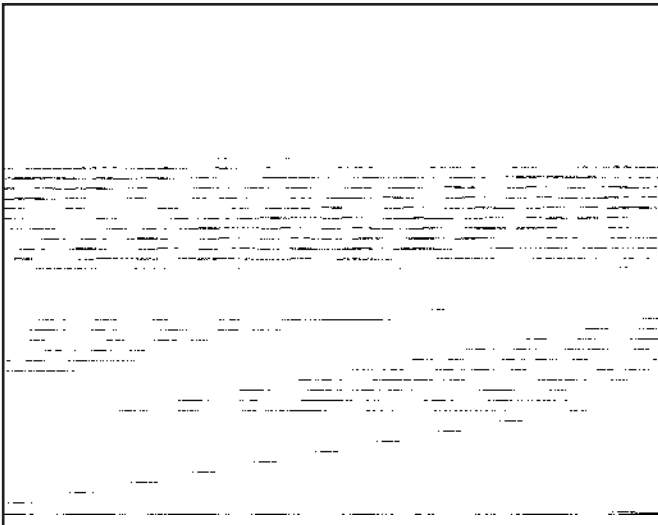


Figure 7. Air Eliminating System

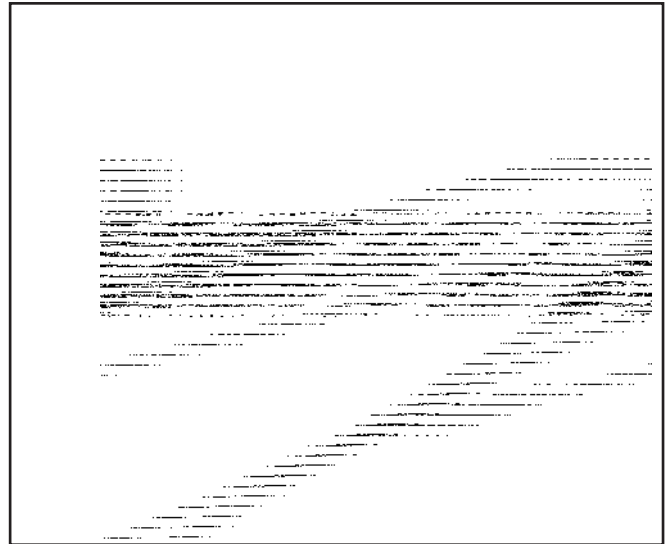


Figure 8. Air Collecting System



Figure 9. Recommended Piping to Tankless Heater

I. CIRCULATING SYSTEM

- A. FORCED CIRCULATION hot water heating system: top tapping as supply tapping, and use the front or rear bottom tappings for the return.
- B. A FLOW CONTROL VALVE (See figure 7) will prevent gravity circulation and usually is required when tankless heater is installed.

II. AIR CONTROL SYSTEMSS

- A. DIAPHRAGM - TYPE COMPRESSION TANKS are used to control system pressure in an AIR ELIMINATING SYSTEM: an automatic air vent is used to REMOVE air from the system water. See figure 7.
- B. CONVENTIONAL COMPRESSION TANKSS (non-diaphragm type) are used to control system pressure in an AIR COLLECTING SYSTEM. Within the system, after initial start-up and venting, air is collected in the tank and acts in contact with the water to control pressure. Air is not vented from this system.
- If system pressure needs further control, add another tank in parallel with the original tank or install a large capacity tank. Locate the tank at the inlet end of the pump near the boiler. (See figure 8.)

- C. HOT WATER RADIATION VENTING - Manual air vents should be installed at the top of all "drops" (where piping goes downward). Air must be vented or purged from all zone lines to permit proper system heating.
- D. PUMP LOCATION - Locating low-head pump(s) on return to boiler is acceptable for smaller boiler sizes in residences of one or two stories. (See figure 7). The pump location shown in figure 8 is required in large, multi-story building installations, especially when high-head pumps are used.
- E. A conventional compression tank may be connected to the 3/4" tapping as shown in figure 8.

PIPING TANKLESS HEATER (if used)

- I. Heater capacities are listed on Page 2.
- II. Pipe the built-in tankless heater using the inlet and outlet tapings indicated on the heater (figure 9)
 - A. Tempering valve (illustrated, but not furnished) is suggested to provide more volume of temperate water to kitchen and bath.
 - B. High temperature water, for dishwasher and laundry, may be piped direct.

INSTALLING THE BURNER

See Liberty Knocked Down Assembly and Parts Instructions, pub. no. LD-41K, number 8 for the installation of burner mounting studs. Mount burner to boiler, placing flange over mounting studs. Use gasket between flange and boiler. Distance between flange and nose of burner must be as shown in Liberty KD Approved Oil Burners pub. no. LD-42KB. Check to see that nozzle and settings are as given in burner data tables, pub. no. LD-42KB.

OIL SUPPLY PIPING

Install the oil tank or tanks and piping from tank to burner. Follow local codes and practices, NFPA No. 31, INSTALLATION OF OIL BURNING EQUIPMENT and the instruction sheet attached to the oil burner pump. A one-pipe system should be used for gravity fed fuel systems and for lift systems, where the total lift is less than 8 feet. where the total lift is greater than 8 feet, a two-pipe system must be used. In some instances, local codes may require a two-pipe system for below grade fuel oil tanks. Be sure to set-up the fuel oil pump for the piping system used; follow the instructions attached to the pump. Be sure to include a good quality, low pressure drop fuel oil filter in the supply line from the tank. This is necessary, especially at low fuel oil flow rates (small nozzle sizes), to prevent nozzle plugging. See Slant/Fin publication on one-pipe and two-pipe fuel oil systems.

WIRING THE BOILER

- A. The wiring diagrams for the burner and boiler may be found on pages 8-10.
- B. 24 volt control wiring should be approved Safety Circuit wire, protected as needed.
- C. Power supply wiring to the burner must be 14 gauge or heavier, as required, and should have a properly fused disconnect switch. 120 volt wiring to pumps and safety controls must also be 14 gauge or heavier. Wire must be enclosed in approved conduit.
- D. All wiring must be installed in compliance with the National Electric Code, or any local or insurance codes having jurisdiction.

VENT PIPING AND DRAFT REGULATOR

- A. Vent pipes must be installed having the same diameter as the boiler outlet. (See page 2).
- B. Vent pipes and breeching must be pitched upward a minimum of 1/4" per foot.
- C. Connect vent pipe to the chimney using as few elbows as possible.
- D. Horizontal vent connector into the chimney should not be inserted beyond the inside wall of the chimney.
- E. Install barometric draft regulator on horizontal breeching, near chimney, with hinge horizontal and face vertical. See manufacturer's instructions packed in carton with barometric draft regulator.

- F. If two or more appliances are used on the same chimney, see CHIMNEY, page 3.
- G. Make up all joints with minimum air leaks, secure with sheet metal screws.

PRECAUTIONS BEFORE STARTING OIL BURNER

Make a positive check of A through F before starting burner:

- A. Boiler and system are full of water. All air is vented from system. See below.
- B. All wiring is completed. See pages 8-10.
- C. Oil supply is connected to the burner; nozzle is installed correctly, oil valve is open at tank.
- D. Smokepipe is connected to chimney.
- E. All combustible materials are cleared away.
- F. Combustion air supply is provided. See page 3.

WARNING: NEVER OPERATE any natural draft* boiler (Liberty boiler is a natural draft boiler) with zero draft or overfire pressure: early failure of the burner, nozzle and chamber is inevitable if you do. Use a draft gauge, and make sure that overfire draft* is .02", minimum, during all operating conditions.

* Draft is negative or suction pressure.

STARTUP (COMBUSTION TEST INSTRUMENTS MUST BE USED)

- A. Make sure the boiler is installed and wired properly and is full of water.
- B. Open the observation door (on the front, above the burner).
- C. Start the oil burner (see burner instructions for bleeding air from oil, etc.) IMMEDIATELY, set burner air bands to obtain a bright fire without smoke or oil stain. Set the DRAFT REGULATOR to obtain .02" overfire draft*. Take draft reading through slot in observation door.
- D. Close the observation door. Allow the burner to fire for at least one hour total firing time, to bake out the volatile binders in the combustion chamber before taking final combustion readings.
- E. By alternate adjustment of the barometric draft regulator, the burner air regulation and head regulation devices (whichever apply) an additional 1/8". This should result in zero smoke with NO raw oil on the smoke paper and a smooth light-off. DO NOT ATTEMPT TO SET FIRE BY EYE. Flame retention burners may appear efficient and smoke free from an inefficient 7% up to an overly high 14% CO₂. However, a very low CO₂ can also result in poor ignition and raw (unburned) oil entering the fire box. At very high CO₂, any slight decrease in air flow for any reason will cause incomplete combustion, with high smoke and dry soot formation in the fire box.
- F. If smoke reading is satisfactory, but CO₂ can not be increased to a satisfactory level (12% or better) or overfire draft of 0.02" W.C. can not be obtained, check for proper sealing between sections, between burner mounting plate and front section, seal is not satisfactory, reseal with furnace putty or silicone with a temperature rating of at least 400° F. (All safety precautions indicated on material package must be followed.)
- G. Once burner and draft have been set-up, then smoke, CO₂ and stack temperature should be checked and recorded. If smoke is greater than trace, review the burner instructions; replace the nozzle if necessary. Normal smoke to be expected at approximately 13% CO₂ is zero to a trace.

CLEANING AND FILLING A NEW WATER BOILER

- I. BEFORE FILLING WATER BOILER.
 - A. Check burner to be certain it is ready for firing. DO NOT FIRE into an empty boiler.
 - B. Be prepared to heat raw water to at least 180°F, as soon as it is introduced into the boiler. This procedure will remove dissolved, corrosive gases.
 - C. Provide drain line, with valve, from boiler. Use a bottom tapping. Line and drain must be suitable for handling caustic solution.

lution.

II. CLEANING WATER BOILER SYSTEM

- A. Prepare a boil-out solution of *sodium hydroxide* (caustic soda) or *tri-sodium phosphate*.

NOTE: Use caution in handling chemicals. Caustic soda is harmful to skin, eyes and clothing.

1. Proportions: 1lb. of either chemical per 50 gallons of system water.
2. Stir chemical in whater until dissolved and pour into the boiler through a top tapping. Replace plug.

- B. Fill the entire system with water.
- C. Start the burner, using the start-up procedure.
- D. Circulate the water through the entire system.
- E. Vent the system, including the radiation.
- F. Allow boiler water to reach operating temperature, if possible.
- G. Continue to circulate the water for a few hours.
- H. Shut off the burner.
- I. With CAUTION, drain the boiler solution to a safe location. DO NOT LEAVE SOLUTIONN SITTING IN SYSTEM OVER 2 HOURS.
- J. Wash the water side of the boiler thoroughly using a high pressure water stream. Fill and drain the boiler several times.

III. TREATING WATER FOR CORROSION CONTROL

(This is not Scale Control)

- A. Prepare a solution of *sodium chromate*.
Proportions: 6 oz. per 50 gallons of system water.
- B. Stir chemical into water until dissolved and pour into the boiler through a top tapping. Replace plug.

IV. FILLING AND VENTING THE WATER BOILER.

- A. Refill the system with fresh water.
- B. Bring water temperature to at least 180° F promptly.
- C. Circulate water through entire system.
- D. Vent the system, including the radiation.
- E. The boiler is now ready to be put into service or on standby.
- F. If brand-name air-control devices are used, venting instructions furnished with the devices should be followed.

V. SAFETY CHECK FOR CONTROL SYSTEM

High limit control test: Set thermostat high enough for boiler water temperature to reach high limit control setting. When this temperature is reached, the high limit switch should open, and the burner should shut off automatically. If the high limit does not operate to shut off the burner, the high limit or the wiring is faulty. Repair or replace immediately.

CLEANING AND FILLING A NEW STEAM BOILER

I. BEFORE USING STEAM BOILER.

WATER CONTENT OF BOILER (GALLONS)						
	LD-20	LD-30	LD-40	LD-50	LD-60	LD-70
Water Boiler	8.3	10.7	13.1	15.5	17.8	22.6
Steam Boiler	—	6.9	8.8	10.7	12.6	14.5

VOLUME OF WATER IN STANDARD PIPE OR TUBE

Nominal Pipe Size Inches	Standard Steel Pipe			Type L Copper Tube	
	Schedule No.	Inside Diameter Inches	Gallons per Lin. Ft.	Inside Dia. Inches	Gallons per Lin. Ft.
3/8				0.430	0.0075
1/2	40	0.622	0.0157	0.545	0.0121
5/8				0.666	0.0181
3/4	40	0.824	0.0277	0.785	0.0251
1	40	1.049	0.0449	1.025	0.0429
1 1/4	40	1.380	0.0779	1.265	0.0653
1 1/2	40	1.610	0.106	1.505	0.0924
2	40	2.067	0.174	1.985	0.161
2 1/2	40	2.469	0.249	2.465	0.248
3	40	3.068	0.384	2.945	0.354

- A. Check burner to be certain it is ready for firing. DO NOT FIRE into an empty boiler.
- B. Be prepared to heat raw water to at least 180° F as soon as it is introduced into the boiler. This procedure will remove dissolved, corrosive gases.
- C. Provide drain line, with valve, from boiler. Use a bottom tapping. Line and drain must be suitable for handling caustic solution.
- D. Check for low water cut-off operation, see section below for check out.

II. CLEAN STEAM BOILER SYSTEM.

- A. Fill the boiler to water line indicated on the boiler.
- B. Follow start-up procedure for burner and operate the boiler with steam in the entire system for 2 or 3 days to bring oil and dirt from the system to the boiler. While system is in operation, maintain the proper water level in the boiler by slowly adding wate to the boiler
- C. Shut down burner, cool down boiler and drain system.
- D. Procedure to dissolve oil and grease in boiler:
 1. Fill boiler to proper water line.
 2. Prepare a boil-out solution of sodium hydroxide (caustic soda) a and tri-sodium phosphate: NOTE: Use caution in handling chemicals. Caustic soda is harmful to skin, eyes and clothing.

STEAM CONTROL ASSEMBLY

Installed McDonnell & Miller 67 low water cut-off and water level gauge.

SPECIAL FLUSHING INSTRUCTIONS

Installation of new boiler may break loose a heavy accumulation of sediment and scale from old piping and radiators. It is extremely important to blow down your McDonnell Cut-off more frequently the first week.

First week - 3 times

Thereafter - at least once a week

See "CARE & MAINTENANCE" section for instructions.

- (a) Proportions: 1lb. of each chemical per 50 gallons of system water.
 - (b) Stir chemicals into water until dissolved and pour into the boiler through a top tapping. Replace plug.
 - 3. Start the burner; boil the water for at least 5 hours; shut off the burner.
 - E. With CAUTION, drain the boiler solution to a safe location. DO NOT LEAVE SOLUTION SITTING IN SYSTEM OVER 2 HOURS.
 - F. Wash the water side of the boiler thoroughly using a high pressure water stream. Fill and drain the boiler several times.
- III. TREATING WATER FOR CORROSION CONTROL
(This is not scale control).
- A. Prepare a solution of *sodium chromate*. Proportions: 1lb. per 50 gallons of boiler water.
 - B. Stir chemical in water until dissolved and pour into boiler through a top tapping. Replace plug.
- IV. FILLING AND VENTING THE STEAM BOILER.
- A. Refill the boiler to the indicated water line.
 - B. Bring water to boiling temperature, promptly.
 - C. The boiler is now ready to be put into service or on standby.

LOW WATER CUT-OFF CHECK OUT

- I. Electronic probe type low water cut-off. If this boiler is factory equipped with an electronic probe type low water cut-off, operation of cut-off should be checked at least twice a year as follows:
 - A. While boiler is running, drain down boiler water slowly through Boiler Drain Cock shown on page 5, just until light goes on. Boiler should shut down 10 seconds after light goes on.
 - B. Be sure that it is the low water cut-off and not the room thermostat, pressure cut-out, or other control that has shut-off the burner.
 - C. Refill the boiler and repeat test.
 - D. Refill the boiler and reset controls for normal operation.
- II. Float type low water cut-off
If this boiler is factory equipped with a McDonnell & Miller float type low water cut-off, the low water cut-off must be blown down (flushed), at least once a week.
CAUTION: When flushing float type low water cut-off control, hot water and steam will flow out the blow down valve. Blow down valve is illustrated below.
 - A. SPECIAL FLUSHING INSTRUCTIONS
For new boiler installed in old system.
Installation of new boiler may break loose a heavy accumulation of sediment and scale from old piping and radiators. It is extremely important to blow down your McDonnell cut-off more frequently the first week.

First week - 3 times

Thereafter - at least once a week.

- B. As boiler water circulates through the float chamber, dirt or other sediment may be deposited. This chamber is extra deep. But the only sure way to keep any accumulation from interfering with float action is to "blow down", or flush out, the control once a week.
Do it while boiler is in operation. First not water level in gauge glass. Open blow-off valve at bottom of control; water will pour out, flushing away sediment. Drain until water is clear - about a pail - then close valve. If level in gauge glass has dropped, add water to boiler to restore level.
- C. NOTE: Opening blow-off valve checks cut-off operation too. as float drops with falling water level, burner will stop. After burner is off and normal operating conditions restored, burner will resume firing.
- D. Be sure that it is the low water cut-off and not the room thermostat, pressure cut-out, or other control that has shut off the burner.

PRESSURE CONTROL CHECK-OUT

- A. Check burner to be certain it is ready for firing. DO NOT FIRE into an empty boiler.
- B. Set thermostat high enough for boiler to make steam. Set the pressure control down to its lowest setting. As the boiler starts to produce steam, the steam pressure will start to build. The burner will shut-off when the steam pressure exceeds the pressure setting (plus differential if control has this feature).
- C. Adjust the pressure control to a higher setting. The higher setting should be above the steam pressure in the boiler. This should turn the burner back on.
- D. Reset the pressure control as needed for the system. The pressure control should be checked at least twice a year.

REPLACEMENT OF STEAM BOILERS

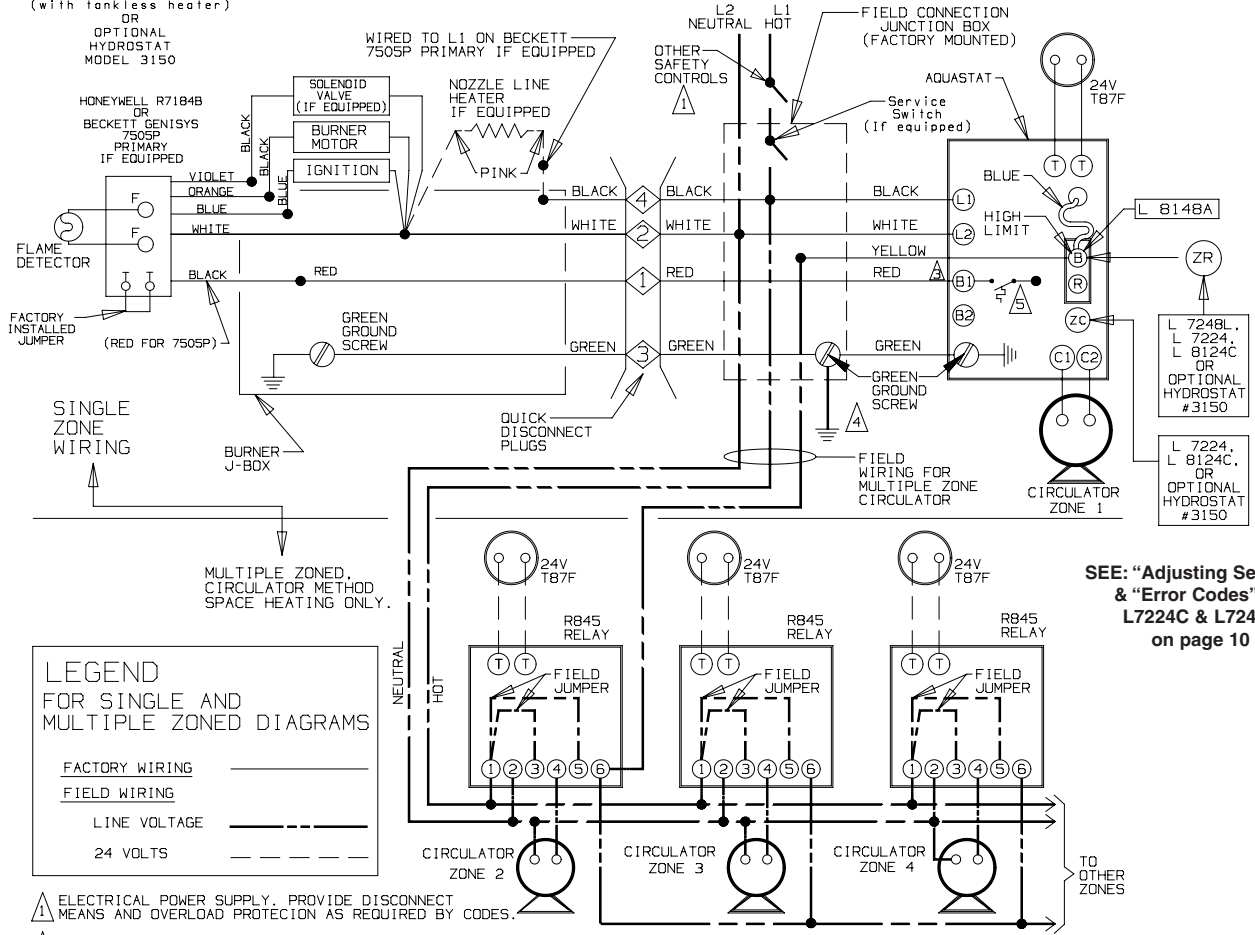
Anytime an older steam boiler is removed from the heating system and replaced with a new boiler, there are certain conditions that have to be examined on the heating system.

- A. Steam systems have a tendency to develop scale inside the wet return lines and the boiler. The older the system the greater the accumulation of scale that can exist inside the piping. Therefore, it is necessary when replacing a steam boiler to check the piping for blockage or restrictions. Clean or replace the piping as required. (See special flushing instructions above.)
- B. Replace all buried wet return lines.
- C. All equipment (air vents, radiation equipment, etc.) in the steam heating system should be checked for proper operation. All piping should be checked for proper pitch.
- D. It is good engineering practice to repack or tighten the packing.

BASIC WIRING DIAGRAMS
 L8148A OR L7248L
 (without tankless heater)
 OR
 L8124 OR L7224
 (with tankless heater)

See page 10 for other primaries.

15 AMP. MAXIMUM
 OVERCURRENT
 PROTECTION DEVICE



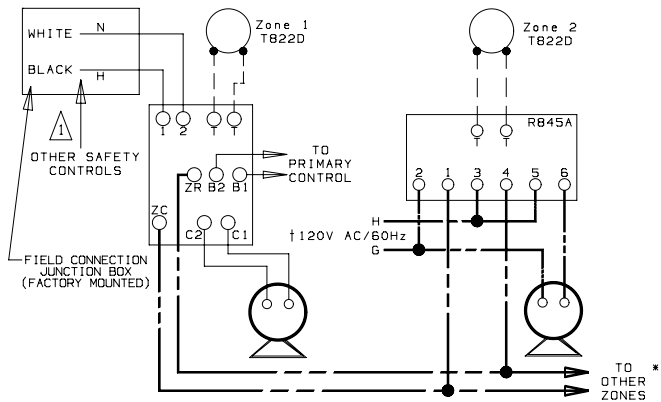
LEGEND
 FOR SINGLE AND
 MULTIPLE ZONED DIAGRAMS

FACTORY WIRING ————
 FIELD WIRING - - - - -
 LINE VOLTAGE - - - - -
 24 VOLTS - - - - -

- ⚠ ELECTRICAL POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED BY CODES.
- ⚠ CONTROL CASE MUST BE CONNECTED TO EARTH GROUND. USE GROUNDING SCREW PROVIDED.
- ⚠ B1 IS 1/4 IN. TAB TERMINAL.
- ⚠ GROUNDING CONDUCTOR: TWO GREEN GROUND WIRES ARE FACTORY CONNECTED TO THE GREEN GROUND SCREW IN THIS BOX. FIELD WIRE A GROUNDING CONDUCTOR TO THIS SCREW TOGETHER WITH THE TWO GREEN FACTORY CONNECTED GREEN GROUND WIRES.
- ⚠ OPTIONAL HYDROSTAT MODEL 3150 IS EQUIPPED WITH AN INTERNAL LOW WATER CUT-OFF.

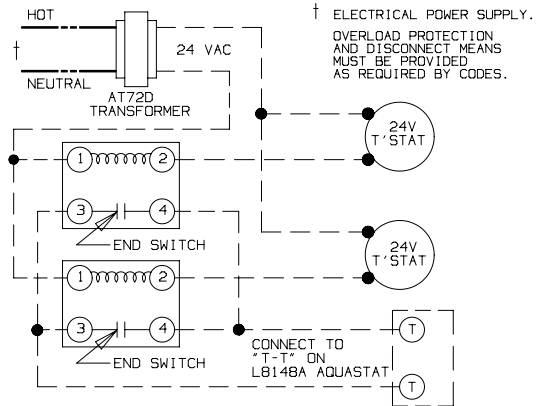
SEE: "Adjusting Settings"
 & "Error Codes" for
 L7224C & L7248L
 on page 10

ZONE WIRING DIAGRAM
 CIRCULATOR METHOD FOR
 L8124, L7224 OR OPTIONAL
 HYDROSTAT #3150 CONTROLS.
 (FOR TANKLESS HEATER APPLICATIONS)



*Note: Total load not to exceed 8 amp full load, for circuits shown.

MULTIPLE ZONED, ZONE VALVE METHOD
 USING HONEYWELL V8043F OR ERIE 765



43-0864

FOR L7224C OR L7248L

ADJUSTING SETTINGS

To discourage unauthorized changing of Aquastat settings, a procedure to enter the ADJUSTMENT mode is required. To enter the ADJUSTMENT mode, press the UP, DOWN, and I buttons simultaneously for three seconds. Press the I button until the feature requiring adjustment is displayed:

- . HL_ . High Limit.
- . LL_ . Low Limit. (L7224 only)
- . Ldf . Low Limit Differential. (L7224 only)
- . °F . °C.
- . ELL_ External Low Limit (L7248L only)

Then press the UP and/or DOWN buttons to move the set point to the desired value, to change between °F and C°, or to enable (On) or disable (Off) the External Low Limit. After 60 seconds without any button inputs, the control will automatically return to the RUN mode.

DISPLAY

In the RUN mode, the Aquastat will flash .bt. (boiler temp) followed by the temperature (i.e., 220), followed by °F or °C.

To read boiler settings, press the I key to read the parameter of interest. For example, press I High Limit (HL) is displayed, followed by a three-digit number, i.e., 220, fol-

lowed by °F or °C. Pressing the I button again (on L7224 models) will display the Low Limit (LL) followed by a three-digit number and the corresponding degree designator.

After approximately 60 seconds without any key presses, the display will enter a dim display mode. To return to the bright display mode, simply press any key.

DESCRIPTION

- Boiler Temperature –
- High Limit –
- Low Limit –
- Low Limit Differential –
- Local Thermostat Status –
- EnviraCom Thermostat Status –
- Error Code –
- Degrees Fahrenheit –
- Degrees Celsius –



Aquastat Error Code	Cause/Action	EnviraCOM Alarm
Err1	Aquastat sensor fault; check water sensor.	18
Err2	ECOM fault; check EnviraCOM™ wiring.	18
Err3	Excessive electrical noise or frequency out of range. Hardware fault; replace controller.	18, 58
Err4	B1 fault; check B1 wiring/voltage.	64
Err5	Low Line; check L1-L2, 110 Vac.	59
Err6 ^a	Warning: Fuse; check ECOM wires, replace fuse.	92
Err7	Warning: EEPROM, HL, LL, Hdf, Ldf; reset to default values.	N/A
Err8 ^b	Repeated B1 fault (voltage present at B1 when output is turned off); check B1 wiring/voltage.	25
Err9 ^a	Warning: Outdoor Reset System failure; communication to Outdoor Reset Module lost, Outdoor Reset Module failure, multiple outdoor temperature sensors detected on the bus, or outdoor temperature sensor failure. Check EnviraCOM wiring (1, 2, 3), check sensor wiring.	50, 53, 149
Err10 ^a	Warning: Boost Failure; Boost Mode active at least once per cycle for the last 60 consecutive cycles. Check Outdoor Reset curve settings.	150
Err11 ^a	DHW Module/Sensor failure; communication to DHW Module lost, DHW Module failure, or temperature sensor failure. Check EnviraCOM wiring (1, 2, 3), check sensor wiring.	146, 147, 148

^a Warnings are generated to enunciate the system is not operating optimally, but the Aquastat is still operating and maintaining boiler temperature. In the instance where an Outdoor Reset Module is used, the warnings may indicate a reset curve setting error one or more features is not running optimally, and the Aquastat is reverting to default settings or has stopped running the Outdoor Reset algorithms. The warnings are cleared when the issue(s) is resolved.

^b To clear Err 8 condition, depress and hold all three user keys simultaneously for 60 seconds. Err 8 condition clears and display returns to normal. Err 8 condition is designed to catch welded relays on the Aquastat and will normally only occur near end of life for the control. If Err 8 condition has occurred early in the controls life, be sure to check for voltage feedback to B1 when B1 should be off and check current draw on b terminal to be sure oil burner is not drawing excessive current. Err 8 condition will keep repeating if B1 fault is not cleared.

BASIC WIRING DIAGRAMS

- L8124C or A** (with tankless heater)
- L8148A** (without tankless heater)

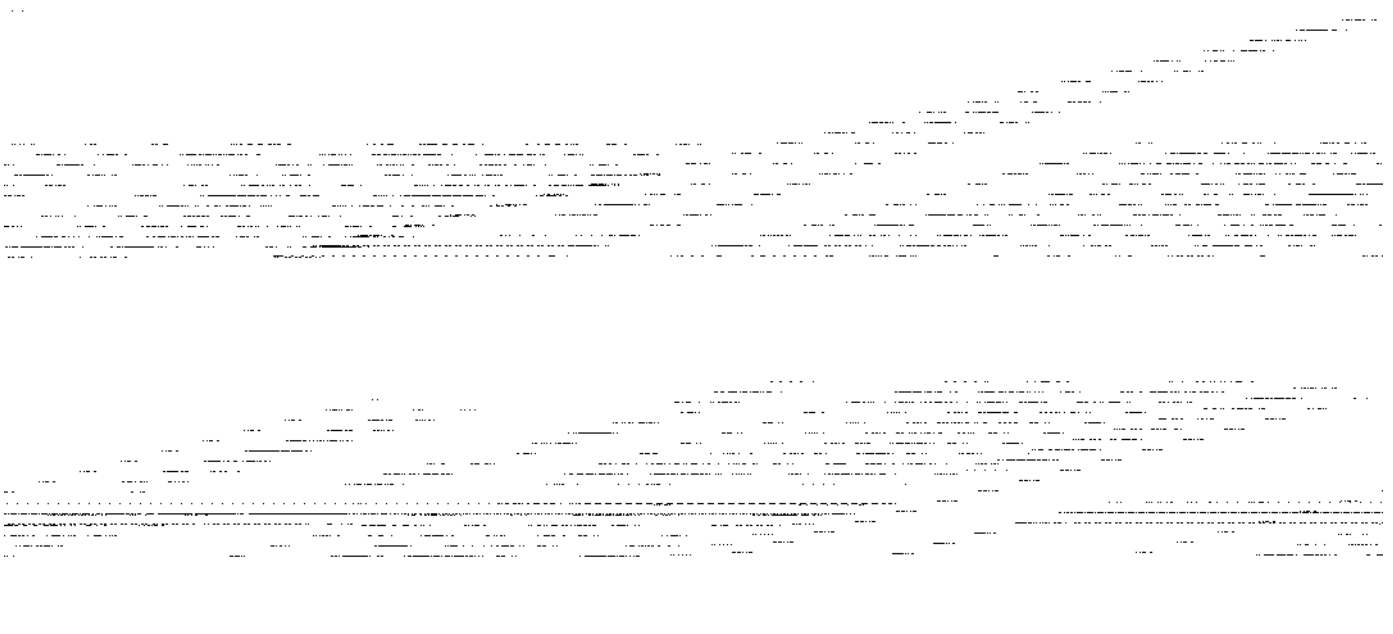
NOTES

1. Recommended high limit setting is 200°F. Low limit must be set at least 20°F below high limit setting.
2. Pump zone terminals ZR, ZC furnished on L8124 controls only. See pump zoning diagram below.

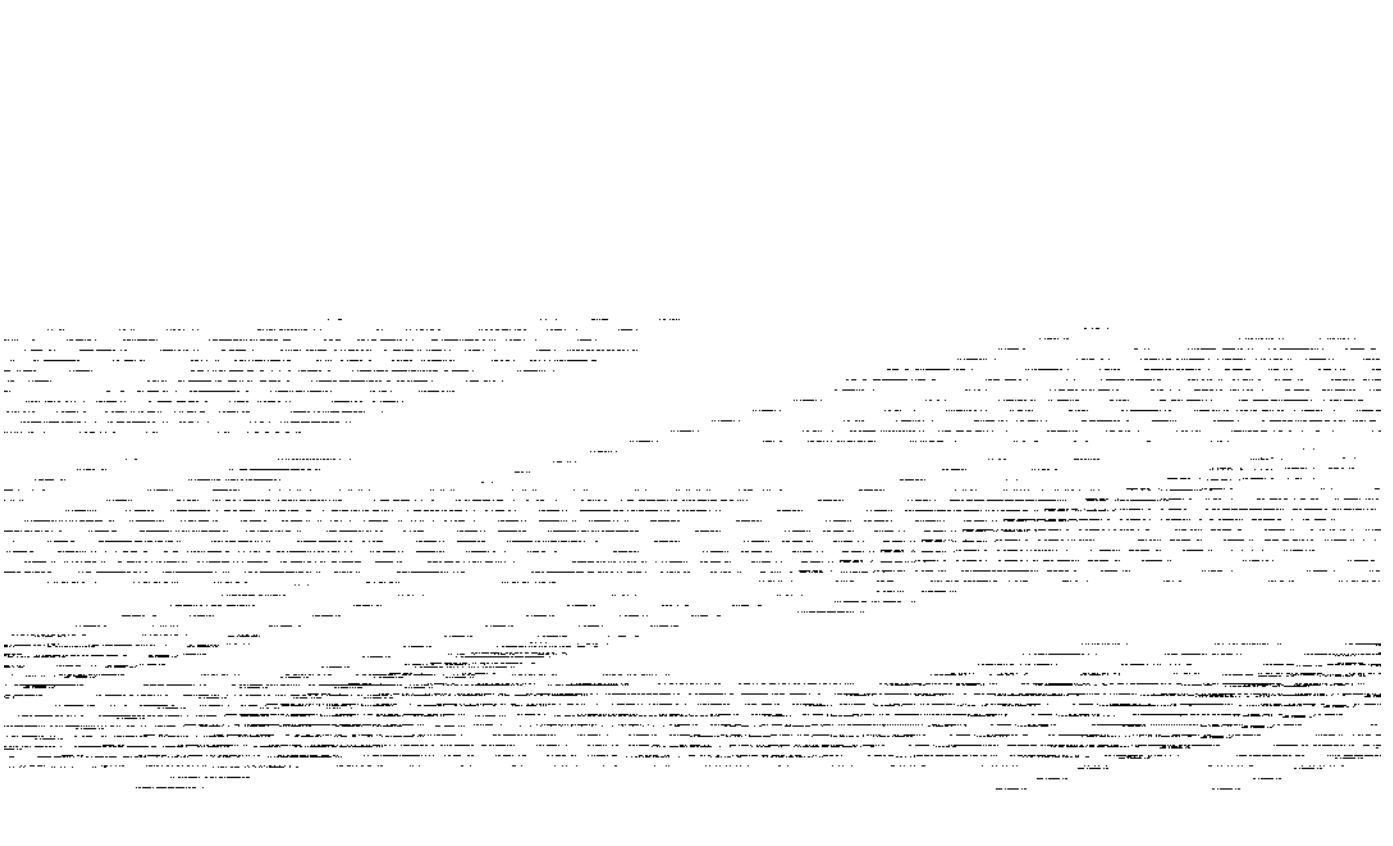
† **Overload protection and disconnect switch must be provided as required by local codes.**

**FIELD WIRING FOR STEAM
KNOCKED DOWN BOILER & BOILER/
BURNER UNIT EQUIPPED WITH
McDONNELL NO. 67. L.W.C.O.**

Low limit (tankless model only)
Recommended setting - 160°F

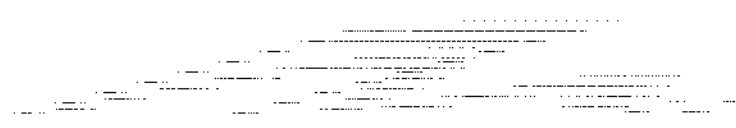


WIRING FOR PACKAGED STEAM BOILER
For alternate option PS - 801 - 120 L. W. C. O

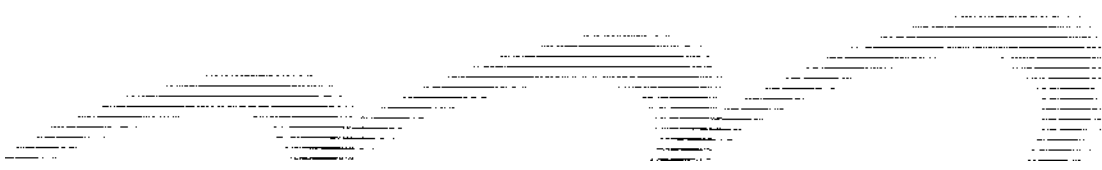


**ZONE WIRING DIAGRAM,
CIRCULATOR METHOD
(L8124. only)**

**MULTIPLE ZONE WIRING DIAGRAM,
ZONE VALVE METHOD**



WIRING FOR L8148A PUMP ZONE DIAGRAM



CARE AND MAINTENANCE**I. EXTENDED SHUTDDOWN, OR REMOVAL OF BOILER FROM SERVICE.**

- A. Flush sludge from bottom of boiler. While the boiler is still hot (180° to 200°F), drain water from the bottom of the boiler until it runs clear.
- B. Provide corrosion protection to water (this is not scale control):
1. For steam boilers, maintain a *sodium chromate* solution strength of 16 oz. per 50 gallons of water; and refill to the top of the gauge glass.
 2. For water boilers, maintain a *sodium chromate solution* strength of 6 oz. per 50 gallons of water, and refill to normal fill-pressure with system vented.
 3. Raise water temperature to at least 180°F for one hour to release dissolved gases.
 4. Shut down burner by disconnecting the main switch.
- C. Clean boiler heating surfaces thoroughly, down to clean metal.
1. Remove flue and clean thoroughly.
 2. Remove top flue collector to facilitate cleaning soot and scale from the heating surfaces.
To remove the flue collector, the top rear jacket panel must first be removed. The flue collector is held in place by a single carriage bolt and wing nut at the rear of the boiler. Remove the wing nut and pull up firmly on the rear of the flue collector tipping it forward to break the seal between it and the boiler. Then, pull it out from under the lip in the front boiler section.
 3. To gain access to the combustion chamber for cleaning, the burner must be removed. The flexible electrical conduits from the burner to the limit controls are long enough to allow removing the burner without disconnecting them. The cast iron burner mounting plate should be removed along with the burner to completely expose the combustion chamber for thorough cleaning and for inspection of the target wall.
 4. Use the flue brush to clean the pined flueways between the sections. A wire brush may be used to remove any carbon accumulation that may have developed in the combustion chamber. Vacuum the loose soot and debris from the boiler.
 5. Inspect the refractory target wall in the rear of the combustion chamber. If badly deteriorated, it should be replaced. Inspect the burner combustion head. Clean if necessary a and make sure all the adjustments are correct. (See burner data pages for the burner installed.) Replace oil nozzle with a new one. To insure proper burner operation. **ONLY THE NOZZLES SPECIFIED IN THIS MANUAL OR ON THE BURNER LABEL SHOULD BE USED FOR REPLACEMENT.**
 6. Protect all of the fireside surfaces by swabbing with neutral mineral oil.
 7. Replace burner and flue collector.
In most cases, the flue collector sealant can be reused. Smooth the sealant in the groove around the top of the boiler sections and under the lip in the front section. Be sure that there are no gaps.
The head of the carriage bolt fits into the slot on the top of the rear section. Insert the front edge of the flue collector under the lip on the front section. Push forward and down on the flue collector, guiding the bolt into the bracket on the flue collector. Add the washer and wing nut and tighten until a proper seal is obtained.
- D. If boiler room is damp, provide ventilation.

II. PROVIDING PROTECTION FOR FREEZING

Anti-freeze is sometimes used in hydronic heating systems to protect against freeze-up in the event of power failure, or safety control shutdown when the building is unoccupied. It should be recognized that unless the building is kept above freezing temperature by some means, the plumbing system is not protected.

Two types of anti-freeze may be used: ETHYLENE GLYCOL, used in automobiles, has desirable properties, but is toxic. Its use may be prohibited when system water/glycol solution is in contact with a potable water vessel (as with a tankless heater). PROPYLENE GLYCOL is used in the quick-freeze food industry; it is practically non-toxic. Its use may be permitted when tankless heaters are used. When anti-freeze must be used, inhibited propylene glycol is recommended. Useful information on the characteristics, mixing proportions, etc. of glycol in heating systems is given in Technical Topics No 2A, available from the Hydronics Institute, 35 Russo Place, Berkeley Heights, N.J. 07922. Consult glycol manufacturers for sources of propylene glycol.

III. OIL BURNER

Inspect and clean annually and following any period of improper operation. Redcheck and adjust settings as specified for burner model and nozzle size.
Set burner air and draft regulator, using test instruments to obtain recommended CO₂ and draft without smoke. Refer to page 6.

IV. GENERAL MAINTENANCE

These operations are recommended to be performed at regular intervals:

- A. **BOILER HEATING SURFACES:** clean off all coatings found. Reseal covers.
- B. **BOILER CONTROLS:** check contacts, settings, correct functioning.
- C. **PIPING:** check piping and accessories for leaks.
- D. **CHIMNEY or STUB VENT and BREECHING:** check for obstructions and leaks.
- E. **COMBUSTION AIR TO BURNER:** check for continued POSITIVE supply of air as required. Air needs are greatest in coldest weather. Refer to AIR SUPPLY, page 3.
- F. **WATER SYSTEM:** check
1. System to be full of water and pressure to remain stable (between 12 psi and 25 psi).
 2. Air-control system: noise and air binding in radiation should not occur.
 3. Water lines: slightest leaks should be corrected.
 4. Low water cutoff, for operation (see instructions furnished with unit). See page 8
- G. **STEAM SYSTEM:** check
1. Low water cutoff, for operation (see instructions furnished with unit). See page 8.
 2. Check pressure cut-off for operation. See page 8.
 3. Any unusual water conditions. Obtain water analysis and treat water.
- H. **BOILER ROOM AIR SUPPLY:** air vents should be open and free of obstruction. See page 3.

† A flue brush (2-1/4" dia.) is supplied with boiler.
Replacements are available from dealer or hardware stores.



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