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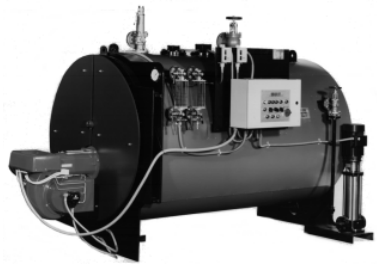

INSTRUCTION MANUAL

Document Ref: OM.001

BRADLEE BOILERS

INSTRUCTION MANUAL

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GENERAL DESCRIPTION

The BRADLEE BOILER is of the 3-pass horizontal, return flame, wet-back type and is of all-welded construction to BS2790, designed for working pressures up to 105 or 150 psig. The shell has heavy duty tubes expanded and welded into heavy steel tube plates and is well insulated and clad over-all with a sheet steel jacket. The FIRE-BOX is integral with the shell.

The SMOKE-BOX is integral with the shell and is fitted with flanged flue spigot out-let. The rear door is bolted on to the smoke-box, and gives access to the rear end of the tubes and to the rear mud-hole (for cleaning out the water space) at the bottom of the rear tube-plate. The boiler has a bolted, hinged front door for access to the fire-box and the front of the boiler.

THE BOILER FITTINGS & CONTROL EQUIPMENT COMPRISE:

- A fully automatic pressure jet oil, gas or dual fuel burner, complete with control box and flame failure device, pre-wired and interlocked with the level controls and pressure switch.

- Probe micro-electronic controls for feed pump and two low-level alarm/cut-off switches.

- Pressure stat and gauge.

- Alarm bells.

- Boiler feed water pump complete with electric motor, starter contactor and overload cut-out with re-set button.

- A control panel fitted with switches for mains, burner, pump and alarm bells, hand re-set contactor for boiler cut-off on low water level, incorporating bell contactor.

- Valves and cocks are fitted as required.

All electrical components and controls are pre-wired at the factory and the boiler requires only the following connections to be made on site -

Electric	-	Line to panel mains terminals
Steam	-	To steam out-let valve
Fuel	-	To burner oil filter, or gas governor
Water	-	To pump inlet
Chimney	-	To flue spigot
Blowdowns	-	To waste - (Mains and level gauge)

INSTALLATION

FUEL STORAGE - OIL

Advice on this will be provided by the fuel supplier or installation engineer. Generally site conditions and location of main storage tank will dictate whether to use an intermediate 'day service' tank, a main gravity feed tank, or an underground tank. This in turn will indicate whether a 1-pipe gravity feed or 2-pipe suction system for fuel feed to the burner be used. Within certain limits the burner's own fuel pump can draw fuel over reasonable distances with lifts up to 6 feet dependent on altitude and pipe-sizing. Be guided by the advice of the supplying oil company or installation engineer, or refer to us. If two or more boilers are used the fuel line should be branched off a pressurised ring main system, and a non-return valve fitted in each branch.

The provisions of BSS 2869 will normally ensure that the fuel will be of adequate performance when stored and handled without heating. However, some users will wish or may need to provide a bulk storage installation to a higher standard, in order to avoid the risks associated with the fuel being at low temperature.

It may be adequate to ensure that above-ground tankage is protected from pre-vailing winds, and to lag exposed pipework and fittings. However, these steps will do no more than reduce the rate of cooling.

To avoid wax forming under sustained cold conditions, particularly when summer grade fuel may be present in winter, heating may be provided for the storage tanks and the pipework and the associated fittings. This should be thermostatically controlled to provide a minimum temperature of 5oC (41oF).

Tanks can be fitted with electric immersion heaters or submersion heaters, the latter for use where the tank cannot be drilled or cut. Pipework and valve bodies and filters can be warmed by fitting electrical tracing cable and then lagging and weather-proofing.

OIL FEED: With gravity or suction feed connect fuel lines to burner pump with flexible pipe 14" to 16" long.
Gravity feed lines should incorporate a stop valve and strainer or filter between storage tank and burner. Insurance companies will insist that a fire-check valve be fitted.
NOTE: The boiler will usually have a flexible pipe and filter fitted at the works.

Tanks must be installed with a slight fall to a drain valve for drawing off water and sediment at the lowest point, in order to ensure that there are no problems arising from the freezing of water in the fuel. Water should be drawn off prior to the acceptance of a delivery, at least twice a year and certainly at the on-set of winter. This requirement applies equally to underground storage.

Suction-lift lines require a check-valve at the foot of the suction pipe at a minimum 4" from the bottom of the fuel tank. The return line should also have a check-valve fitted as near as possible to the burner's pump return port. Ensure that a by-pass plug is fitted inside the burner pump if a 2-pipe system is used. (This is provided with new burners).

For gravity feed supply where the distance between the oil tank and burner is over 6' and less than 40' it is recommended that the oil line be run in 0.5" to 0.75" iron - NOT galvanised pipe, or 0.5 " copper, at least up to a combination stop/fire valve adjacent to the burner. Smaller bore pipes will create fuel problems at the burner. For larger runs of feed line ask us or obtain advice from the fuel supply company.

Filter units need to have their elements regularly checked and cleaned.

We recommend the neater use of the British Standard combination fire/stop valve in preference to the old-fashioned fusible-link wire-lever valve combination.

If the oil tank is remote from the boiler a stop valve at the tank and fire/stop valve at the burner will be necessary.

Be sure that fuel lines are graded continuously either Up or Down between the burner and the tank to avoid high spots and subsequent air locks. If high spots are unavoidable provision should be made to vent air from high points.

Thoroughly flush-out fuel lines to clear dirt and remove air from inner surfaces of pipes using a gallon or two of fuel oil. With a '2-pipe' system prime the suction feed pipe with fuel and allow to stand for up to 1 hour and check for any fall in level of fuel. If fuel level falls this may be due to dirt or grit in the check valve. Clean the valve if necessary. Connect primed line to burner pump, and prime the pump with fuel before connecting the return line to the pump.

GAS FEED: Advice for this should be obtained from the local gas board. The calibre of pipes should not be less than the connection to the burner and should be sized to allow for gas pressures at the burner as indicated in the burner instruction book (lK/Cal = approx. 4 btu).

STEAM LINES: Connect steam line to main (crown) valve on top of boiler. Wherever possible steam mains should rise to highest point above the boiler and fall away thence to serve plant, with branches taken from the top of the steam pipe. Provide an approved type automatic air vent 'teed' off from this high point. As with the plant or equipment being served, the end of the steam main should be trapped with approved fittings. Where two or more boilers are used to feed into a common steam main it is essential to fit a check-valve in each boiler's branch connection to the common main to obviate steam being fed from one boiler to the other, and additional stop valves should be provided to isolate each branch from the main. The steam lines should be properly and suitably insulated.

AIR VENT: A suitable automatic air-vent should be provided in the steam line at its highest point to prevent the boiler flooding with water when it cools, and to vent air when it heats up.

CONDENSATE RETURN: In the interests of efficiency, economy and longevity of equipment all steam condensate should be returned to the boiler feed-tank. The steam heated appliances' out-lets should be fitted with a set of fittings comprising:- valve, strainer, steam trap, sight glass (to facilitate maintenance) and a non-return valve to trap steam and pass only condensate. The condensate should be drained from the traps by gravity, discharging down into a condense main at LOWER level and falling to a point adjacent to the feed tank, thence rising into the tank. Dependent upon the calibre of installation the condense return main should be not less than 1" n.b. nor less than the bore of the steam out-lets.

BLOW-DOWN PIPES & SAFETY VALVE: Connect pipes of equal size to the boiler main blow-down, and sight-level gauge blow-downs, leading to a tun-dish and thence to waste, complying with local regulations. The safety valve outlet should also be piped to atmosphere. N.B. Long, tortuous or upward pipework from the safety valve can easily prevent the correct operation of this valve, which will in any case need to be tested by the Boiler Inspector. The pipe-work away from the safety-valve must be at least 1.1 times the size of the safety-valve, and if it leads upwards, a drain must be provided at the level of the safety valve.

AUTOMATIC T.D.S. CONTROL SYSTEM: If the boiler is fitted with this system please refer to the manual supplied with the boiler covering this equipment.

WATER SUPPLY: A water-feed tank (or 'hot-well') of recommended size should be provided complete with inlet and outlet valves, ball valve and overflow, and cooling-coil if used (see below). Make-up water for the boiler is fed into this tank via the water softener from the water main through the inlet valve and ball valve. The condensate return should be fed into the tank below water level to reduce heat losses, and, if necessary, a Buffalo-type silencer or baffle may be fitted. The outlet pipe from the tank is taken from a point about 2" above the bottom, thence via a valve, strainer, and, if required, a spring-loaded check-valve to the inlet of the boiler feed-pump - (Punch out hole in flange gasket of the pump inlet).

The following table shows the approximate feed tank elevation required to maintain full feed pump capacities with feedwaters at 180o F and higher.

Feed Tank Temperature	**Minimum Height of Water Level in Feed Tank Above Pump Inlet**
Up to 180o F	5 feet
180o F - 200o F	6 feet
200o F - 205o F	8 feet
205o F - 210o F	13 feet

If the water-feed tank is sufficiently high above the boiler (perhaps 10 feet) or if the volume of the tank is high relative to the boiler size, sufficient pressure may be exerted to cause water to pass through the pump - though inoperative, and to flood the boiler. In order to avoid this, consideration should be given to fitting a check valve between water-feed tank and pump, solenoid-operated from the pump.

It may be desirable to fit a 'cooling coil' in the feed tank with water flow through it controlled by a manual or thermostatic valve to maintain the feed-water and temperature between 175oF to 180oF.

WATER TREATMENT: Treatment of boiler feed-water is very important. It may be sufficient to treat the water with suitable doses of additive placed in the feed-water tank. However, the advice of qualified and reputable local water chemical engineers should be taken. Anti-oxidant inhibitors are as important, if not more so, than 'softening' of the water. In particularly hard-water districts special advice should be sought. Blowing down should be carried out more frequently. Even if there is 100% condense return, blowing down should be carried out more than once daily. Boilers used for heavy, continuous duty should be blown down more frequently. It is essential to obtain proper advice on this matter or unwarranted damage may result.

AUTOMATIC BLOWDOWN: This is a worthwhile extra both in the interests of energy efficiency, and as an insurance. Our Automatic Blowdown System consists of an electric actuator, valves and fittings. It is controlled by a two-function timer, which may be fitted in the control panel. This timer enables the operator to set (based on the advice of local water-treatment engineers) both the duration of blow-down and the interval between blow-downs.

This intermittent operation has the effect of containing the solids in the water in the shell to an acceptable 1800 to 2000 parts per million and can act as an insurance in blowing down. A manually operated valve is also included for blowing down daily, and for draining the boiler.

Automatic blow-down units should be regularly verified for correct operation. Ensure that there is movement of water in the tell-tale on the automatic blow-down line or in the sight-glass, if so connected, and that the movement of the water is not sluggish, as this could indicate partial blockage.

FLUE CONNECTION TO CHIMNEY: This should be kept as short as possible, say 5' to 6' and graded upwards, the steeper the better. A 'draught stabilizer' should be fitted in this flue-length, preferably within 40" of the boiler spigot. Avoid horizontal runs and both 90o and undue bends. Unless clear of buildings the tops of chimneys should terminate above roof ridges well above eaves. When the burner is firing, a minimum draught (negative pressure) of .03" should be available at the flue spigot.

CHIMNEY: The advice of competent installations engineers should be taken so as to ensure correct installation. It is essential this be heeded to allow smooth, proper combustion and to avoid down-draughts and back pressures which will damage the burners and cause serious malfunctions. Sharp bends should be avoided. An 'H' type capping at the top of chimneys will abate or obviate down-draughts, especially for difficult installations.

BOILER ROOM VENTILATION: Suitable air in-let and out-let openings should be provided in doors, windows or walls of boiler rooms for correct combustion and venting of the boiler room. Permanent ventilation in the order of 5.5 sq cm per Kw (or 1 sq inch for 1,000 btu/hr or per 1 lb/hr of steam) should be provided, with a minimum of 2 sq ft. (Larger boilers may be adequately ventilated at a slightly lower ratio). Two-thirds of this should be provided at low level and one-third as high as possible. If provided with grilles, ensure that these cannot be blocked or flooded, and avoid high velocity air streams. A high level opening alone is neither sufficient nor satisfactory for the burner. No exhaust fans should draw air from the boiler room, nor should fans in adjacent rooms be capable of drawing air from the boiler room unless exceeded by an inlet fan to the boiler room.

ELECTRICITY SUPPLY AND TIME SWITCH: Must comply with local regulations. Provide adequately rated fuses. Provide an extraneous isolating switch. It is sufficient to feed phase, neutral and earth lines to the relevant mains terminals in the control panel on the boiler. All components on the boiler are pre-wired and require no further attention other than checking the terminal connections for tightness at the panel and the control units.

FLUSHING OUT: It is essential that the boiler shell be flushed out thoroughly with water prior to firing of the boiler - either with hose-fed continuous running water or by repeated draining and filling of the shell via the boiler pump. Failure to do this may block the blow-down out-let and pipe. It is also wise to do this after a short period of running, as other particles, or dirt can be dislodged in service.

BOILER SPACE: Subject to any local regulations minimum dimensions for clear space around the boilers should be allowed. (See separate leaflet).

PREPARATIONS FOR USE AND COMMISSIONING

1. Set all valves to the following positions:-

Water feed tank (inlet and outlet)	Open
Boiler water-feed inlet	Closed
Gauge glasses	Open (handles vertical)
Gauge glass blow-down	Closed (handles vertical)
Main boiler blow-down	Closed
Pressure gauge valve	Open (handle vertical)
Main steam outlet	Closed
Fuel valves at tank and adjacent to filter	Open (including fire-valve)

2. Fill water-feed tank until water is cut off by ball valve. Check level allowing suitable ullage to top of the tank and check for leaks.

3. Open Boiler feed valve. Bleed air from water pump (square nut above inlet) and prime pump.

4a Switch 'ON' (close) main switch at panel ensuring that any prior switches in line are 'ON' (closed).

4b Press re-set buttons on burner control box and water pump over-load.

4c Switch 'OFF' burner and alarm isolating switches at control panel.

4d Switch 'ON' pump and allow it to fill boiler with water to the correct level when level control will switch 'OFF' the pump automatically. Vent boiler during initial filling by opening Inspector's 3-way cock below pressure valve and slackening plug. Check water level at gauge glass. During initial filling switch 'off' pump if feed-tank is emptied and switch pump 'on' again after tank has refilled. Re-bleeding of air may be necessary at pump if tank empties.

4e Press Boiler Control Start/Reset button (usually green).

4f Turn on Alarm Bell switch on Control Panel.

5. Bleed air from oil fuel lines by using screws at top of filter. Prime the burner oil pump with fuel, and bleed off air through top return port, or pressure gauge port of oil pump. Take time doing this thoroughly and bleed off at least 2 gallons of oil.

6. Set pressure stat (switch) if RT 116 type, to approximate working pressure desired. Turn knob at top of stat clockwise to decrease and anti-clockwise to increase pressure. If small pre-set type, see instructions provided inside switch casing.

7. **BEFORE ATTEMPTING TO FIRE THE BOILER THE FOLLOWING POINTS MUST BE IMPLEMENTED BY A COMPETENT PERSON:**

LEVEL CONTROLS - check correct sequence of operation as follows:- For 'ALL PROBE' LEVEL CONTROLS: If the boiler is fitted with a self checking level control system please refer to the separate manual supplied which covers this equipment.

(1) Ensure water is at correct high level in boiler (see 4 above).
(2) Open main blow-down valve and drain out water. Observe level at sight-glass.
(3) When the water level in the sight glass falls approximately 1" to 1.25" below the high (pump 'off') mark, the pump will be switched ON by the probe relay unit. Switch 'Off' the pump immediately and note the level at the sight glass. ALLOW DRAINING TO CONTINUE.
(4) A further fall in the water level of approximately 1.75" will set the alarm bell ringing and cut-off the burner through the other probe relay units. Unless otherwise arranged by request this is done by 2 separate probe controls wired in series thus ensuring a two-fold and positive cut-off.
(5) Close main Blow Down Valve. Switch OFF bell and switch ON pump to refill the boiler, check continuously the water level in the feed tank. Close main steam (Crown) valve.

BURNERS: Check initial settings of oil or gas burners with manufacturer's instructions supplied with boiler.

8. **INITIAL START-UP** (Firing of boiler)

(1) Close the main switch and the three isolating switches at the boiler control panel for the burner, pump and alarm respectively - (switches 'ON'). Press re-set button on control panel. Dependent upon the make of control box fitted the burner will fire immediately or within 10 - 35 seconds (approximately). If not, switch 'off' the burner immediately and check that the air register on the burner is set to correct position. (See Manufacturer's Handbook). Switch burner 'on' again.

(2) Using appropriate test equipment and services of commissioning engineer, set burner to maximum efficiency to at least 70/80%. * Note: The guarantee is voided if commissioning reports are not returned to **Bradlee.**

(3) Dependent upon the pre-set firing rate the steam pressure should reach 20 - 25 psi or more within 15 - 22 minutes from cold, thereafter the pressure will climb rapidly. Adjust setting as required on the pressure stat at the control panel. (These figures are only a guide and not invariable). The exact cut-off should be set from the pressure gauge reading. The stat's differential should normally be set to 'Minimum'. Within a few minutes of the first firing of new boilers moisture condensation will drip or pour from various points around the boiler, and some joints may leak,

including mud-holes, such as that in the rear tube-plate. All may need to be tightened one or even several times. The burner should be protected by a board or plastic covering. Valve gland and cover plate nuts should be tightened. After an hour or two the water drips should cease and joints should self-seal. Thereafter no leaks should obtain.

9. **SOME OCCASIONAL COMMISSIONING PROBLEMS:**

(1) Probes - (a) Leads off or damaged.
(b) Control panels on Bradlee Package Steam Boilers are fitted with three Floatless switches which relay signals from the water-level probes in the top of the boiler to the water pump, burner, bell, etc.
Circumstances can arise in which a perfectly good Floatless switch may nonetheless not operate the control system properly.
Exceptionally soft water (e.g. the Manchester area) may lack sufficient conductivity to operate the Floatless Switch. The switch can also fail to operate for reasons to do with the technical composition of the water during the early cycles immediately after start-up of a new boiler.
All that may be necessary is to substitute another Floatless Switch whose marginally different sensitivity will successfully trigger the controls. (In that case, do not abandon the first Floatless Switch - the defective rate on the switches is less than 0.1%).

(2) Pipe-work and mud-hole leaks. Within a few minutes of the first firing of new boilers, moisture condensation will drip or pour from various points. If these are not progressively tightened one or even several times, these joints may continue to weep (unseen) and eventually cause damage to the boiler.

(3) Crown valve leaking. Weeps from the crown valve can be stopped by tightening glands and tightening fixings (flanges or screwed).

(4) Safety valves: the correct operation of the safety valve will be tested by the Boiler Inspector, and it is important that the correct size and arrangement of pipe-work be used so that back-pressure cannot build up against the valve. This can easily impair its correct operation. See section headed Safety Valve under Installation Instructions.

10. Our Commissioning Sheet is included with the Document Wallet supplied with every Bradlee Boiler. **THIS MUST BE RETURNED TO US DULY COMPLETED IF OUR GUARANTEE IS TO BE VALID.** The shell and tubes of every Bradlee Boiler are guaranteed for three years and all other components for one year subject to normal conditions (see our Terms and Conditions of Sales for full details) but these **GUARANTEES ARE VOID UNLESS THE BOILER IS PROPERLY COMMISSIONED.**

NORMAL OPERATION

START UP: This procedure should be followed each time the boiler is fired after normal shut down and where NO time control is fitted.

1. Ensure ALL valves are set correctly - (see 'Preparations for Use')
2. Check level and water supply at feed-tank.
3. Check that there is adequate fuel in tank (oil) and that fuel valves are open.
4. Check boiler water level is not too high. If level is not visible in sight-glass, blow-down at sight-glass and observe if water is too high or too low. Drain if too high, check pump operation and its effect if too low.
5. Switch 'ON' all four switches and press 'Re-set' button at boiler control panel, and at burner control box.
6. Open main steam out-let (crown) valve slowly when working pressure is obtained.
7. Check and correct any leaks.

N.B. Whenever there is insufficient water in the boiler the bell will ring. Whilst the bell rings the burner cannot fire - thus signifying a fail-safe condition. The bell is rung only by the closing of the switch by the probe controls. If this occurs it will be necessary to press the over-riding re-set button at the control panel to fire - after normal water level in the boiler has been re-established. At normal water level the bell may ring until the re-set button at the control panel is pressed.

SHUT DOWN:

a) Switch OFF Burner only, ensuring electric supply to boiler panel remains ON.
b) Leave all valves in normal operating position.

* An air vent must be provided as recommended. This is important vis-a-vis this operation. If for some reason, none has been provided, it will be necessary to close the steam outlet valve and the feed inlet valve to prevent the bell ringing or the boiler flooding.

ROUTINE MAINTENANCE

DAILY:

Blowing down (or draining-off water and/or steam): dependent upon usage and amount of condense-return blowing down should be done daily one or more times, either in the morning and/or at the end of the day at low pressure (10 to 40 p.s.i. is sufficient), to prevent sludge or scale build-up in the shell, and sight-glass. The sequence of the operation is as follows:-

1. a) Switch OFF (open) bell and pump switches to obviate ringing and pumping.
   b) Open the boiler main blow-down valve fully, for 20 to 30 seconds or more and reclose.
   c) Switch ON pump and bell switches.
2. GLASS LEVEL GAUGE
   a) Open bottom blow-down valve.
   b) Close steam valve for 5-10 seconds, re-open.
   c) Close water valve for 5-10 seconds, re-open.
   d) Close blow-down valve.

Check water-level in glass tube. Repeat above if necessary to clean glass tube. The movement of the water should be lively, not sluggish - the latter indicates partial blockage. This is very important.

MONTHLY:

Burner

Open burner isolating switch (switch 'off) at control panel before attending to the burner.

Oil Burner (Riello)

1. Remove cover.
2. Remove photocell and wipe clean..
3. Remove top cover or slide back on rails (depending on model).
4. Check for undue leaks or carbon.
5. Check condition of airways and air intake.
6. Check for signs of soot. If soot deposits are excessive, remove and clean the nozzle assembly.
7. If necessary remove burner and ensure correct settings and juxta-position of electrodes, nozzle and diffuser/flame rings (see Manufacturers Handbook) 8. Replace cover and burner.

Gas Burner (Riello)

1. Remove cover.
2. Remove top cover or slide back rails (depending on model).
3. Check for undue leaks or carbon.
4. Check condition of airways and air intake.
5. Check for signs of soot. If soot deposits are excessive, remove and clean burner.
6. If necessary, remove burner and ensure correct settings and juxta-position of electrodes, and diffuser/flame rings (see Manufacturers Handbook)
7. Replace cover and burner.

WATER LEVEL CONTROL - Switch 'OFF' pump
(CHECK DAILY)

Probes - Check cut-off action by draining water in boiler to low level and note level of water in sight-glass when bell rings. Bell should ring before water disappears from bottom of sight-glass. If not, ensure cables to top of probes have positive contact inside probe caps, and good earth connection at panel. Check contact continuity with separate 'bridging' lead if necessary. Where a boiler is being operated continuously, remove probes and check that lower ends are clean.

Valves - Open main blow-down valve on boiler and check correct function of level controls and alarms. Ease blow-off lever on safety valve. Open and close water feed valve and steam outlet valve. Valves normally left open should be turned 0.75" turn back to prevent stems becoming jammed solid.

ANNUALLY Your Insurance Company and Local Factory Inspector will normally require to inspect boiler vessels annually, or every 14 months. It is convenient at this time to have the burner and electrical controls checked and cleaned, also to have the boiler de-scaled if necessary, and all valves checked and renovated or repacked if leaking.

Arrange to have the burner and control equipment checked by an approved electrician or burner engineer. If the burner control box or photo-cell is found to be faulty in any way it should be replaced, but with normal usage this will not occur within a few years.

Bradlee offers maintenance contracts and it is wise to have your boiler serviced regularly by competent and experienced boiler engineers.

Switch 'OFF' at main isolator and all boiler switches before carrying out any work on the boiler.

BOILER CLEANING

SHELL

* Zero pressure. Drain boiler.
* Remove or lower main-hole cover on top of shell.
* Unbolt and remove or open fire-box door.
* Open mud-hole in rear tube-plate by first removing rear door.
* Remove any other access door that may be fitted to your boiler.
* Scrape scale off outer surfaces of tubes and inner surfaces of boiler shell and end-plates.
* Remove retarders/turbulators and brush out boiler tubes and clean out soot.
* Hose out water space inside shell thoroughly with blow-down valve open, clear outlet of any scale.
* Replace boiler man-hole covers and mud-hole caps ensuring seals or gaskets are in good condition, or replace. Wipe away surplus water and refill boiler as for initial filling.
* Test tightness of man-hole and mud-hole doors during warm-up period and tighten if necessary.

* N.B. Any descaling chemical compounds if used should be of reputable manufacture and be compatible with the nature of scale. The solutions must be thoroughly flushed out before closing up the boiler. (Important - or damage can be caused).

PROBE CONTROLS

It is preferable to remove the probes by unbolting the probe mounting plate completely. Examine the tube housing for undue corrosion. Remove, clean and reinsert probes. Check cables, terminals, and connection inside probe caps ensuring good contact.

Care must be taken to ensure the same wires are connected to the same probes. It is essential cross connections are not made.

BURNERS

Burners should be serviced and re-commissioned at least annually by a competent servicing organisation, as wear, dirt, local conditions and incorrect settings can cause damage.

TROUBLE SHOOTING GUIDE

If installation preparations and maintenance are done properly and carefully, faults are unlikely to occur. The Boiler and components are proven, reputable units giving years of trouble-free service.

Symptom	Cause	Correction
A. **BURNER**		
1. If after 60 seconds, the burner has not commenced its firing cycle, refer to Manufacturers Handbook.		
2. Boiler fails to start - no reaction whatever. Water level in boiler correct at glass gauge.	(1) Burner switch 'off'. No power supply.	Press Start button on control panel. Switch burner On. Check if power is on and through to control panel. Check water level.
	(2) Pressure stat contacts open. Pre-set pressure satisfied.	Set pressure switch contacts to close by increasing pressure requirement.
	(3) Water-level control contacts open.	Check water-level controls operation by manually operating controls. Check level indication at gauge glass.
3. As above, but Alarm rings and pump works. No LIGHT at burner control box.	(1) No water in boiler shell. Control blow-down valve is open - probe wires not making contact	Ensure steam valve is open and blow-down valve is closed. Check water level and that pump is filling boiler. Check wires to probes and their relay controls, including good earth contact for probe controls. Check there is water in feed tank and that valves are open. Check Pump not air-locked.
	(2) See Section B.	

Symptom	Cause	Correction
4. Burner runs for long time but no lock-out. No red light at burner, no bell ringing.	(1) Boiler pressure attained. Stat points open.	Raise pressure at stat if required.
	(2) Low-water level	Check water-feed tank, pump and control valves, and excess feed-water temperature. Check bell.
5. Burner blows back each time boiler fires, intermittent or continuous back pressure through combustion chamber.	(1) Faulty flue or chimney - insufficient height, poor cap, too restrictive.	Correct chimney. Fit 'H' type cap. Read installation instructions. Check flue draught.
	(2) See also Manufacturers Handbook.	
6. Abnormally high fuel consumption.	(1) Cold feed water	Heat tank with condensate or steam, and control feed-water temperature between 175o - 180o F.
	(2) Heat wasted from uninsulated steam lines and calorifier.	Lag all steam pipes, and calorifier if used.
	(3) Steam leaks from connections and traps in steam system.	Check and clean traps. Stop leaks. Check suitability of traps.
	(4) Burner incorrectly set.	Consult burner instructions or your burner engineer.
	(5) Too strong a draught in chimney.	Fit draught stabilizer to flue connection to chimney and adjust properly.
	(6) Unnecessarily high steam pressure.	Reduce setting on pressure stat. Check for leaks in steam lines, traps and appliances.

Symptom	Cause	Correction
B. Burner shut-off, alarm rings, pump works but water level does not rise in boiler. Intermittent ringing of alarm bell after few hours steam.	(1) Water supply fouled or blocked. Feed valve closed. Feed water too hot - cavitation at pump.	Check water supply valves and strainers. Open valves. Check water level in feed tank. Check water temperature - control to 175o/180o F Check steam traps for passing of steam, so clean traps. Pour cold water into tank and/or fit cooling coil.
	(2) Badly worn pump or loose coupling.	Check and overhaul if necessary. Tighten coupling, ensuring shaft is raised off bottom end. (See Pump Manufacturers Handbook).
	(3) Feed check-valve not seating, allowing steam and hot water to flow back to feed tank.	Re-seat or replace valve. Clean out grit or foreign matter from check valve seat. Check boiler pressure not excessive.
C. Boiler water level low, pump does not operate and burner continues firing. Boiler Overheating. N.B. DO NOT ATTEMPT TO PUMP WATER INTO BOILER UNTIL IT HAS COOLED DOWN OR SERIOUS DAMAGE MAY RESULT.	(1) Probe leads crossed to wrong probes.	Check and correct - see Wiring Diagram.
	(2) Pump probe leads dis-connected - especially within probe caps, or poor earth connection.	Check connections and caps, terminals and earth lead.
Extremely unlikely unless the wiring has been disturbed or wrong replacement components fitted and wrongly connected. All level control components FAIL SAFE.	(3) Interference with and wrong wiring connections at boiler control panel.	Completely check all wiring, especially leads to and from the floatless switches and contactors. If any components have been replaced ensure correct ones and leads have been fitted.
	(4) Burner leads wrongly connected through control panel.	See diagram and correct.
	(5) Probes fouling within probe chamber.	Remove probe assembly complete, and check chamber, and probe insulation.

Symptom	Cause	Correction
D. Burner fails to cut in/out at anticipated pressure. Safety valve may blow.	(1) Incorrect setting of working pressure stat.	Re-set correctly.
	(2) Blocked U-syphon tubes to pressure switch.	Clean out.
	(3) Incorrect differential setting	Set to '1' or 'MIMIMUM' (3 to 5 p.s.i.) on RT116.
	(4) Faulty pressure stat.	Replace stat or contact points in the pressure stats (or switches).
	(5) Relay sticking in Burner control box.	Replace relay.
	(6) Safety valve setting too low.	Remove valve cap and tighten nut, increasing spring resistance. Check pressure gauge. Re-tighten lock nut.
E. Water Feed pump fails to work. (See Manufacturers Handbook)	(1) Pump switch is 'OFF' or overload switch at panel tripped.	Switch 'on' at panel. Press re-set button at pump contactor. Check electric wires and connections through to probe caps.
	(2) Burnt-out motor.	Check and replace. Check power supply and wiring. Check free rotation of pump shaft and raise shaft slightly at coupling if necessary. Test free rotation of pump shaft with fingers.

SUMMARY OF POINTS FOR ECONOMY

* Insulate steam pipes and calorifier if used.
  Arrange for steam branch heating of feed tank manually if necessary.
  Check steam traps periodically. Control feed-water temperature.
* Conserve heat by returning hot condensate to water feed tank
  Control feed-water temperature to optimum 175o / 180o F.
* Ensure correct adjustment of burner.
  Fit draught stabilizer in flue chimney, to abate draught fluctuations. Install correct chimney and cap.
* Keep main steam valve closed until pressure has built up in boiler then crack open slowly if boiler has been off for some time, or for rapid steam raising from cold.
* Fit automatic air vent at highest point of steam line (and on secondary hot-water line).
* Return condensate at LOW level. Check for steam passing through traps.
  Fit steam traps to all steam heated appliances. Use correct fittings. Clean steam traps and filters at least annually.
* Practice regular, elementary maintenance, and to abate 'chores' fit our automatic blow-down valve assembly.

GENERAL INFORMATION

OIL or GAS BURNERS - See manufacturer's instructions, or leave to competent engineer. See also separate instructions.

WATER LEVEL CONTROLS - The position of the settings for operation by the level controls is near critical and only under rare circumstance may these be altered with the boiler manufacturer's express permission and instruction. Unauthorised interference with these settings will void all guarantees.

WATER FEED PUMP - This unit rarely goes wrong, faults attributed to it usually lie elsewhere. Check for correct rotation and tight shaft coupling. Keep strainer in feed line clean and control the feed-water temperature - thermostatically controlled solenoid valve on the cooling coil will obviate frustrations.

CONCLUSION

You have a good, sound boiler unit fitted with proven components which withstand a lot of abuse. Almost invariably where complaints or malfunctions arise these are attributable to the human element. The most common faults are burner problems due to air-locks in the fuel line and mal-setting of the electrodes - common to all types of boilers with automatic burners.

Remember also that the alarm bell cannot ring without the burner being cut-off.
A ringing bell indicates the boiler has failed safe tracing the causes and correcting the faults have been fully explained in this booklet. For the best results heed our instructions and implement our advice for the total installation.

GUIDE TO RECOMMENDED STEAM INSTALLATION FITTINGS

Steam Main and Condensate Return Lines - Allow for:-

1. Steam Main - Flow air vent at highest point (usually at top of riser above boiler out-let valve) or at any other high point where main must be 'stepped' or double rise and fall.

   Prior to each appliance's inlet - 1-stop valve.

2. Condensate Return - each dryer, calorifier, end of steam main, dry-cleaner, press etc. in the equipment's return out-let branch - in flow direction sequence:

   (a) 1-strainer, 1-steam trap, 1-sight-glass, and 1-check valve.

or

   (b) 1-combination unit comprising strainer/trap/check valve, and separate sight-glass.

or

   (c) any other sets of approved combination units each combining 2 or more functions to cover all the basic functions indicated at (a).

Condensate Return 'Cooler' - purpose made unit of suitable strength 25 gall. domestic type calorifier.

Boiler Feed Water Tank Set - comprising condensate tank, and feed water tank complete with ball-valve, and inter-connecting pipework, the whole mounted on a common stand.

Blow-down Vessel - for use with Bradlee boilers.

Boiler Feed Line - (a) Strainer prior to pump.
(b) Spring-loaded check valve - (for abnormal elevation).

Draught Stabilizer - (Steinen type) fitted on flue.