

Installation Maintenance Instructions

BP106, Rev. AB

May 16

Installation/Maintenance Instructions

for modulating water level controllers

The Mobrey modulating level control is designed to control the flow of feed water to the boiler in proportion to steam demand and uses the change in boiler level as the load detector.

The control consists of three main components: -

1 Modulating controller

Mounted on the boiler at the require operating level, comprises a chamber containing a float and float rod attached to a ferrous actuator. This actuator is free to move up and down inside a stainless steel steam tube around which is mounted inductive coil 'A'. The inductance of this coil is varied by movement of the actuator with changes in water level.

2 Modulating control valve

Installed in the boiler feed water line, is also fitted with an actuator and inductive coil 'B'. The inductance of this coil is varied by movement of the valve spindle. The flow of feed water to the boiler is controlled by the piston operated modulating valve lid which is actuated by two solenoid valves mounted on the modulating valve.

The inlet solenoid valve admits water at feedline pressure to the cylinder and piston to decrease the modulating valve opening. The exhaust solenoid valve releases water from the cylinder and piston (which is spring assisted) to increase the modulating valve opening. The modulating valve is hydraulically locked when both solenoid valves are closed.

An optional feature giving modulating valve shutdown on high water or power failure is provided when specially ordered. See fig 4.

3 Control box

The control box contains a printed circuit board with a 15-way terminal block for connecting mains input, solenoid valves, sensing coils and the first low level alarm/burner cut out functions. The control box detects any difference in inductance balance between the modulating controller inductive coil 'A' and the modulating valve inductive coil 'B' and signals the appropriate solenoid valve to open.

Daily Routine

Modulating controller

It is important that the modulating controller float chamber should be blown down at least once per day, or in the case of shift working, at the start of each shift while the boiler is under pressure. The following procedure is recommended:-

(a) When fitted with a MOBREY sequencing valve:

Turn handwheel clockwise until valve is in mid-travel position (approximately $2\frac{1}{2}$ turns). Remain in this position for 5-10 seconds to ensure full blow-down of chamber.

Turn handwheel anti-clockwise to full extent of travel. The valve is now in normal working position.

(b) When fitted with separate isolating and blow-down valves

Fully close water isolating valve. Slowly open blow-down valve to fully open position. Allow the chamber to blow through for a period of 5-10 seconds. Very slowly open the water isolating valve and allow blow-down to continue for a further 5-10 seconds. Fully close blow-down valve.

Closing the isolating valve in the steam leg during the blow-down procedure is not recommended as damage can occur to the mechanism of the control due to water hammer.

Either of these procedures will cause the equipment to operate as for falling water level condition.

The mobrey modulating level control is designed to control the flow of feed water to the boiler in proportion to steam demand and used the change in the water level as the load detector.



Warning

If this equipment is used in a manner not specified by the manufacturer, the protection provided may be impaired.

Installation

Electrical Connections

Suitably rated cable glands must be fitted to maintain the enclosure rating of IP44. The control box should be connected to a supply fused at no more than 5A.

Protection for permanently installed equipment

The Modulating control box is a piece of permanently installed equipment and as such it is required that a switch or circuit breaker be included in the installation. The device should be in close proximity to the equipment and be marked as it's connecting device.

Protective earthing

A protective earth should be used for all applications.

Explanation of symbols

The IEC symbols used on the modulator are as follows:

Protective earth symbol

Specification

Power consumption:	70VA max.
Enclosure rating:	IP44
Operating temperature:	0 to 60°C
Maximum Altitude:	2000m (for altitudes consult factory)
Maximum Humidity:	95% r.H
Installation Category:	III - IEC60664
Pollution Degree:	2 - IEC60664

Forms of application

Operation throttle control (Modulating valve in feed line)

Suitable for automatic cold start conditions

Used for all pumps capable of operating against a closed discharge. With a rising water level in the boiler, the modulating valve lid is determined by actual capacity of boiler plus an allowance.

Rising water level i.e. a reduction in rate of boiler evaporation. When the float rises the actuator changes the inductance at coil 'A'. The control box will sense this change and open the inlet solenoid valve (the exhaust solenoid valve remains closed). The inlet solenoid valve then admits feed pump pressure onto the piston to move the modulating valve lid downwards to reduce the flow of water into the boiler. The downward movement of the modulating valve continues until the inductance at coil 'B' is in balance with coil 'A'. The control box then closes the inlet solenoid valve to lock the modulating valve in its new flow position.

With each rise in level this sequence occurs in small steps and the modulating valve moves in proportion to boiler evaporation.

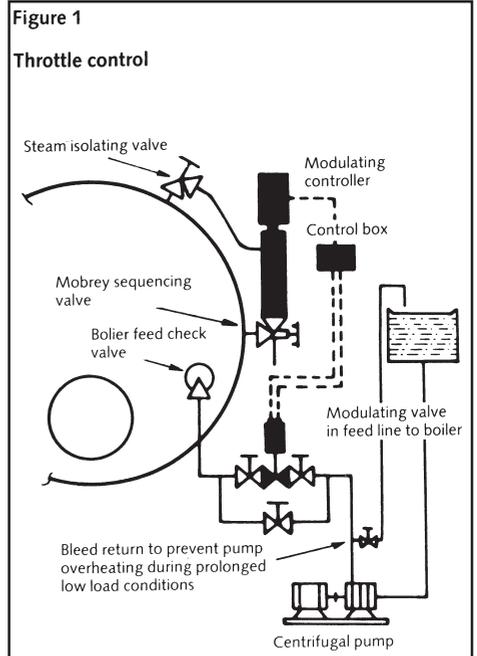
Falling water level i.e. increased rate of boiler evaporation. The above sequence is reversed and the outlet solenoid valve releases hydraulic pressure from the piston causing the modulating valve to open and increase the flow of water to the boiler.

Preparing the modulating control for installation

Machines are normally despatched ex-works completely assembled with the lid and seat sized to suit customers requirements and with levels set in the lowest positions.

First check that the model numbers and voltage are as ordered

- Remove adhesive tapes covering the connection openings of the control chamber and modulating valve.
- Untie and withdraw the string holding the float mechanism.
- Remove nuts holding chamber cover and withdraw the steam tube assembly and mechanism, taking care not to bend the float rod.
- Check that the float rod is straight and manually operate the float mechanism to ensure that it moves freely.
- Reassemble the mechanism into the chamber taking particular care not to bend the float rod, and then tighten the nuts to specified torque.



Installation

Mounting the modulating controller

The boiler connecting pads or nozzles should be installed close to the gauge glass to minimise level differences between the chamber and gauge glass.

The chamber band mark indicates the lowest adjustment position of low level alarm and it is our recommendation that the positioning of the boiler control chambers relative to the water level gauge glasses and the N.W.L. is such that there is always water visible in the gauge glass even at the lowest operating band level. Refer fig 6 page 5.

The steam and water connections to the control float chamber should be independent of other boiler mountings and pipework must be as short as possible without sharp bends or pockets. **In no case should the water leg be more than 1m long.** A Mobrey sequencing valve for blow-down should always be fitted and a lockable steam isolating valve installed so that the chamber can be isolated from the boiler for maintenance and inspection - refer to Figure 1 on page 2

For side and side entry installations it is necessary to fit steam and water isolating valves and a blow down valve at the bottom of the chamber.

The control chamber must be mounted vertically.

Note: For marine duty the control will operate up to a tilt angle of 22.5°.

Mounting the modulating control valve

The control valve should be mounted as close as possible to the upstream side of the feed check valve. The spindle must be vertical. The cast arrow on the valve body must point in the direction of flow. The pipes from the outlet solenoid valve and the exhaust needle valve should be connected to a suitable open drain.

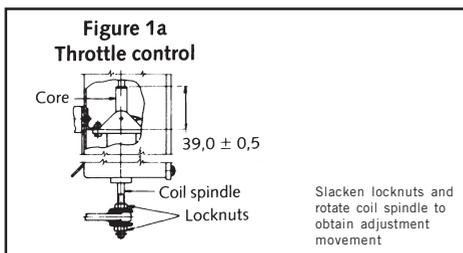
Mounting the control box

The control box can be mounted in a convenient place by the fixing straps provided.

Mounting on the boiler shell or supporting members is not recommended.

Care should be taken to ensure that cable lengths do not exceed 30 metres between inductance coils and Control Box.

Ambient temperature at the box must not exceed 60°C.



Electrical Connections

All wiring should be in accordance with figure 3 or 4 for Throttle Control and tagged with terminal numbers to facilitate reconnection after servicing. Heat resistant cable should be used and conductors must have a cross sectional area of at least 0.5mm².

1 Wiring from inductive coils 'A' and 'B' to control box

Cable length must not exceed 30 metres and screened cable of the 2-core metal sheathed type (e.g. MICC) is recommended. The screen must be connected to terminal 12 from coil 'A' and terminal 14 from coil 'B'. Wiring at the Modulating Controller must be long enough and sufficiently flexible to permit easy removal of float mechanism at the control head or the valve at the feed line for maintenance. Unscreened heat resistant flexible cable may be used for this purpose provided it is in metallic flexible conduit which is correctly earthed and which **does not** carry any other supply conductors.

2 Wiring from solenoid valves to control box

Connection polarity is not important and unscreened 2-core cable is satisfactory. When a third High Water/Power Failure Solenoid Valve has been supplied, wiring to the coils of the Inlet and Outlet Solenoid Valves can be facilitated by slacking the banjo bolt and compression coupling nut, then swinging the third solenoid valve clear.

Refit in normal position and re-tighten connections before wiring this valve.

3 1st Low water alarm and burner cut-out connections to control box

Unscreened 4-core or 2-core cables can be used.

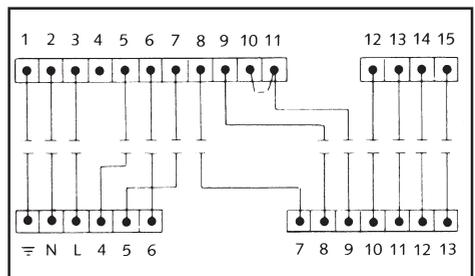
4 Main supply to control box

Unscreened 3-core cable is satisfactory.

Equipment to be wired to the mains via a double pole switch/circuit breaker which should be clearly marked to which device it is protecting

Replacement printed circuit board assembly

Earlier models (before serial no.7702) have 13 way terminal strips - when replacing with a current model having a 15 way terminal strip - reconnect as indicated below.



Safety messages

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. PPE equipment should be used at all times.

Failure to follow these installation guidelines could result in death or serious injury.

- The Mobrey Modulator controls the water feed for boilers. It must be installed, connected, commissioned, operated, and maintained by suitably qualified personnel only, observing any national and local requirements that may apply.
- Ensure the wiring is suitable for the electrical current and the insulation is suitable for the voltage, temperature, and environment.
- Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.
- Any substitution of non-recognized parts may jeopardize safety and is under no circumstances allowed.
- The weight of the modulator control valve assembly may exceed 43 lb. (19.5 kg). The control box may exceed 7 lb. (3.2 kg). The Modulator controller may exceed 33 lb. (15.0 kg). A risk assessment is required to be done before carrying, lifting, and installing the Modulator system.

External surface may be hot.

- Care must be taken to avoid possible burns.

Process leaks could result in death or serious injury.

- Install and tighten process connectors before applying pressure.
- Do not attempt to loosen or remove process connectors while the Modulator is in service.

Electrical shock could cause death or serious injury.

- If the Modulator is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on leads and terminals.
- Use extreme caution when making contact with the leads and terminals.
- Make sure that power to the Modulator is off while making connections.

Electrical characteristics of the control box

Input supply 110V AC or 230V AC + 10% 50/60 Hz.

Fuses See figure 5

Fuse 1 1 amp H.R.C. input to control circuit & solenoid valves

Fuse 2 2 amps H.R.C. low water alarm supply relay.

Fuse 3 2 amps H.R.C. burner control supply relay

Relay contacts voltage free rating:

Maximum voltage 250V Ac.

Maximum current 2 amps.

Fuse 4 2 amps. H.R.C. max.

Terminals 4 and 5 give a separate supply to the solenoid valves when specially ordered. See figure 8 for circuit diagram.

Solenoid valves - Standard: 230V AC 50 Hz or 60 Hz
110V AC 50 Hz or 60 Hz

Adjustments

(see figures 5 & 6)

Modulating control band length (inc. reversal band)

This factory is preset at 76mm.

Modulating band position - (VR1)

The position of the Modulating Control Band is adjustable: -

To raise make fractional turn of the potentiometer VR1 anti-clockwise for throttle control or clockwise for by-pass control.

To lower make a fractional turn of VR1 clockwise for throttle control or anti-clockwise for by-pass control.

1st Low Water Alarm - (VR3)

Differential - Less than 3mm.

Factory pre-set to operate at chamber band level.

To raise turn VR3 clockwise.

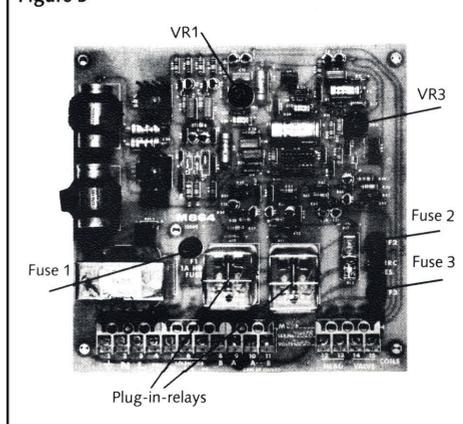
To lower turn VR3 anti-clockwise

When raising to operate over 25mm (max 50mm) above chamber band level - raise modulating band position also by adjusting VR1.

Level Adjustment range

Inductance coil 'A' is factory set to operate at the lowest level. The total operating range from low water alarm setting to valve closed position may be raised or lowered as a group adjustment by altering the height of inductance coil 'A' in the control head.

Figure 5



Manual control or emergency operation

There are two needle valves fitted to the Modulating Valve which enables it to operate independently of the solenoid valves. This would be necessary if it required to put the boiler in hand feed or to fully open the control valve in an emergency.

To do this proceed as follows; -

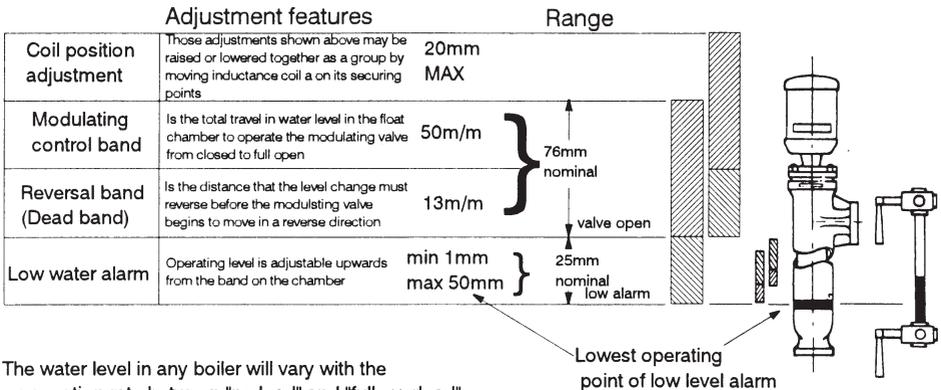
- 1 Close isolating inlet needle valve to inlet solenoid valve.
- 2 Open isolating exhaust needle valve to release hydraulic pressure from the piston.

3 The modulating valve will fully open and the boiler water level can then be controlled by normal manual operation of the feed line check valve, and/or feed pump.

Accidental damage to or blockage of either the inlet or outlet Solenoid Valves of the modulating valve may blow fuse 1. The control would fail safe shutting down the firing and sounding the First Low Water Alarm.

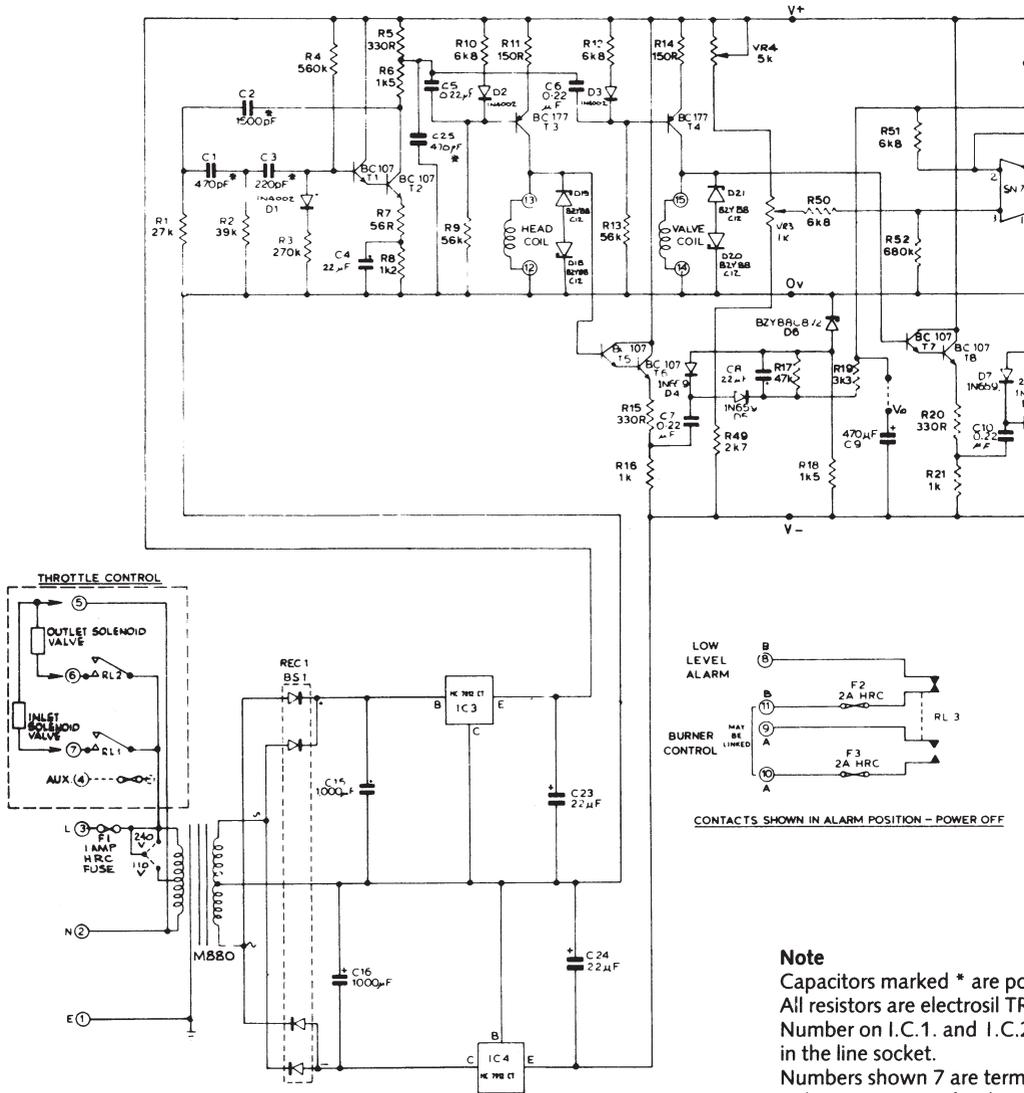
To restart under manual control isolate from electrical supply, then disconnect solenoid connections (5), (6) and (7) - earlier models (4), (5) and (6) and replace fuse 1. Reconnect electrical supply, then follow emergency operation instructions paras. 1,2 and 3, opposite.

Figure 6



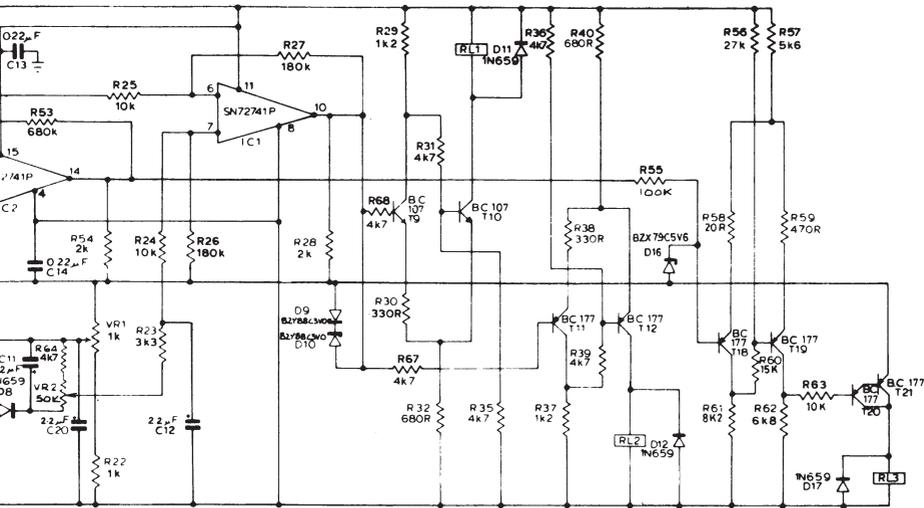
The water level in any boiler will vary with the evaporation rate, between "no load" and "full overload" conditions. The total variation in water level is the sum of the modulating control band and the reversal band, i.e. 76mm nominal.

Figure 8

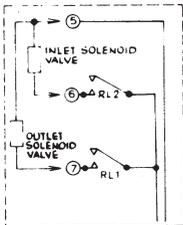


CONTACTS SHOWN IN ALARM POSITION - POWER OFF

Note
 Capacitors marked * are polystyrene
 All resistors are electrosil TR
 Number on I.C.1. and I.C.2. are
 in the line socket.
 Numbers shown 7 are term
 Valve connections for thro
 Points V+, Vo, V-, 0v are f



BY PASS CONTROL



Modulating controller circuit diagram

Circuit board Nos. M865 or M866
Control boxes 80436 or 80660

Warning:

It is recommended that damaged or faulty circuit boards are replaced complete. Faulty or damaged printed circuit boards should be returned to Slough, England or your local agent for repair.

Any unauthorised replacement of parts or repair will invalidate the guarantee.

Figure 3

Throttle control

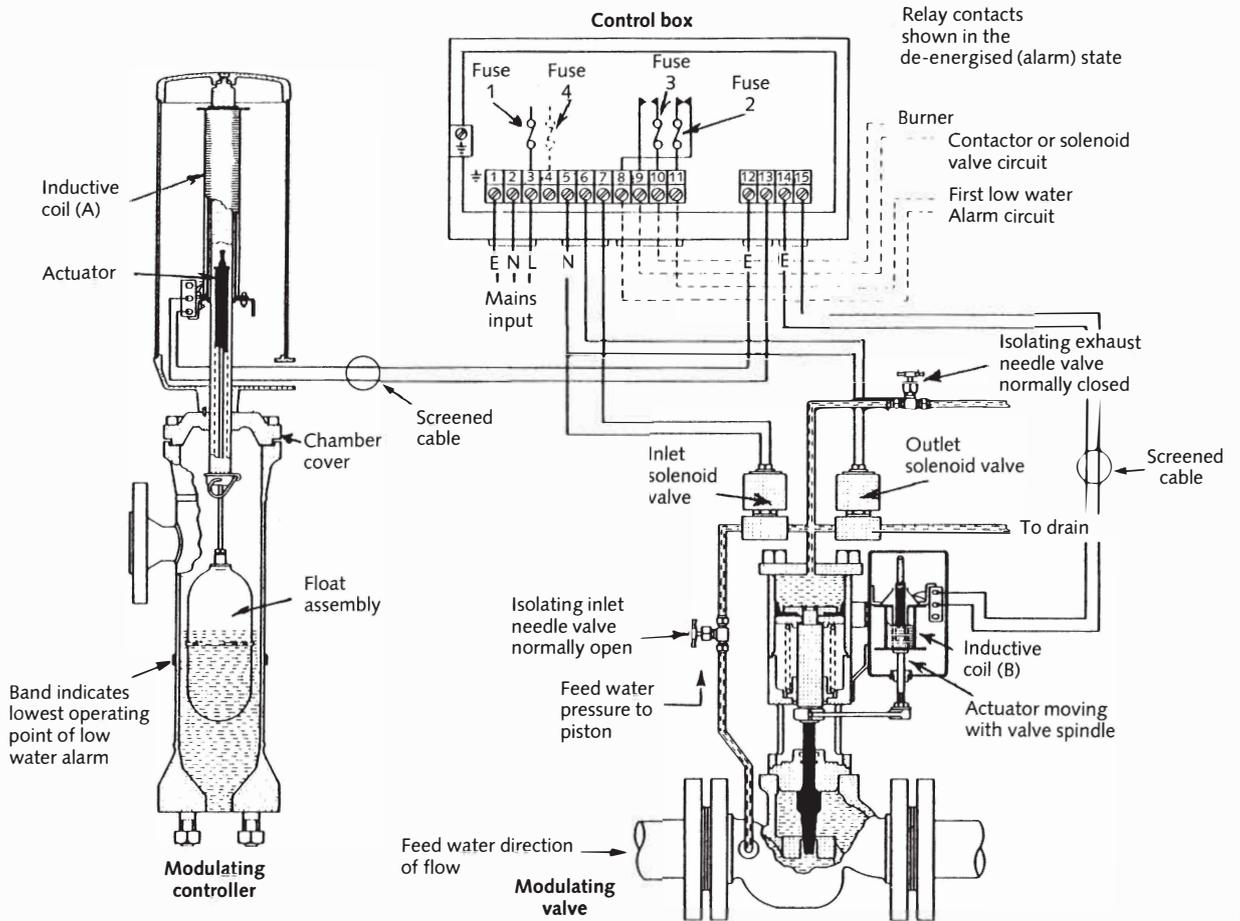
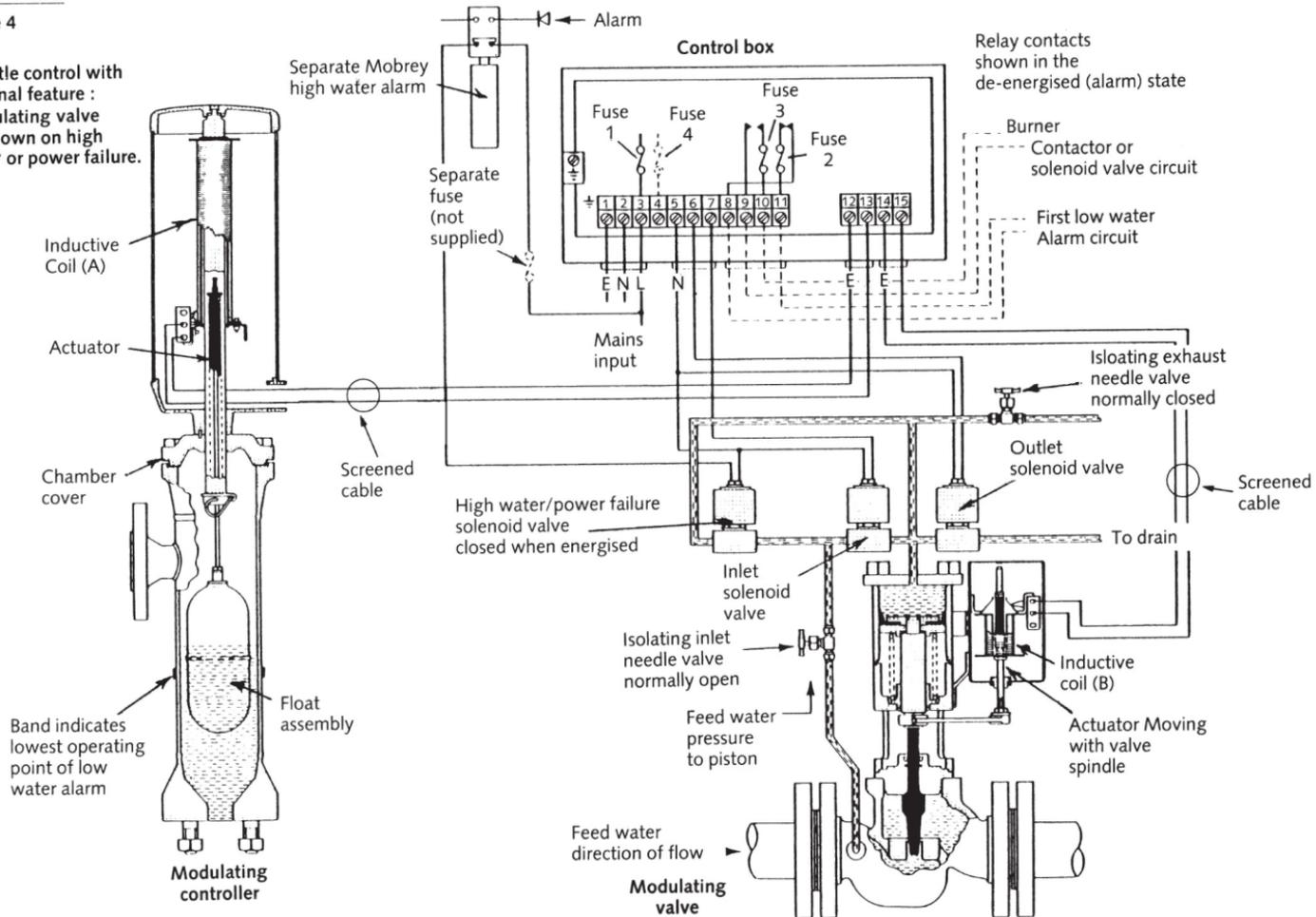


Figure 4

Throttle control with optional feature : Modulating valve shutdown on high water or power failure.



Commissioning

Commissioning must be carried out with a competent person in attendance.

Throttle Control

1 With the control box switched off, fill the boiler with water to maximum controlled water level; as required as indicated on the gauge glass.

2 Close the feed check valve to maintain the water at this level.

3 Switch on Control Box. Allow fifteen minutes for the control circuit to warm up.

4 Ensure that feed line pump pressure is available to operate the valve. Open the isolating needle valve between the feed line and the inlet solenoid valve.

5 When fitted with a Mobrey Sequencing valve
(a) slowly open steam isolating valve
(b) operate Mobrey sequencing valve fully anti-clockwise.

or

When fitted with separate isolated and blow-down valves

(a) check that the blow-down valve is open
(b) slowly open steam isolating valve
(c) after a period of fifteen seconds slowly open water isolating valve
(d) slowly close blow-down valve

6 Adjust potentiometer VR1 until the modulating control valve closes.

7 Close isolating inlet needle valve and then open the isolating exhaust needle valve and wait until the control valve opens fully; this will expel any air trapped in the cylinder. Close the isolating exhaust needle valve and open isolating inlet needle valve and the modulating valve will return to the closed position.

8 Lower the water level in the boiler to the level at which the 1st. low level alarm is required to operate, ensuring that the modulating valve opens as the water level drops.

9 Adjust potentiometer VR3 until the alarm just operates.

10 Open the Feed Check Valve. The modulating control is now ready for use.

Maintenance

At such times as the boiler is inspected, Mobrey Controls should also be inspected as follows:

Modulating controller - See figure 3

1 Isolate the float chamber from the boiler by closing the steam isolating valve and operating the Mobrey Sequencing valve fully clockwise OR, fully close water isolating valve and slowly open blow-down valve - this must remain fully open.

2 Remove nuts holding chamber cover to chamber and lift away the complete head, chamber cover and float assembly, locating it temporarily by means of one stud over the edge of the float chamber.

3 Remove clip securing stop cap and withdraw float assembly.

4 Check that the float is not waterlogged. Examine float rod for alignment and wear. check that the float locking nut is tight and ensure that the whole assembly is clean and free from deposit.

5 Offer rod assembly into centre tube and check that it moves freely up and down.

6 Fit float rod assembly into the centre tube and secure the stop cap with the clip provided.

7 Withdraw screw on top of head and remove cover.

8 Examine inductive coil and external wire connections for mechanical damage.

9 Replace head cover and tighten securing screw.

10 Fit new cover joint and position the head complete with float on to the chamber, and tighten down cover nuts.

Modulating control valve

1 Switch off all electrical power supplies

2 Ensure that the modulating valve is isolated from any pressure from he feed pumps or back pressure from any boiler. This should be checked by breaking a joint in the copper pipe between the inlet solenoid valve and the isolating inlet needle valve and opening this valve.

3 Disconnect electrical connections from solenoid valves.

4 Disconnect solenoid valve piping from cylinder cover, valve boiler and retaining clips.

5 Remove Coil Box Cover.

6 Lift off Coil Box and Solenoid Valve Assembly by removing 4 Disconnect solenoid valve piping from cylinder cover, valve boiler and retaining clips.

5 Remove Coil Box Cover

6 Lift off Coil Box and Solenoid Valve assembly by removing retaining screws and split pin and lower retaining nut on actuator spindle, taking care not to bend the actuator spindle.

7 Fit compression tool No. M730. Screw down key sufficiently to allow removal of 3/16" dia. valve spindle shear pin and remove pin. Unscrew key and remove compression tool.

8 Remove cylinder cover nuts and remove cover.

9 Remove cylinder and lift off stool and piston rod assembly.

10 Apply 3 or 4 drops of silicone oil (DC 200/350-Dow Corning) to felt ring located at top of stuffing box.

11 Lift off stuffing box.

12 Examine two small 'O' rings, replace if necessary, lubricate with Molykote III Silicone Grease.

13 Carefully remove valve spindle and examine for signs of wear.

14 Examine Valve Seat for signs of wear.

15 If either 13 or 14 are found to be damaged, replace both valve spindle and seat as a matched pair.

16 To fit new seat; remove old one, clean new seat with Inhibisol, apply Hylomar SO.32/M to threads of seat and body, and allow 10 minutes to set. Assemble seat to body.

17 Examine 'O' rings and replace if necessary.

18 Examine piston cup and replace if necessary. Lubricate with Molykote (Dow Corning) grease.

19 Examine cylinder bore for signs of wear. Remove any sludge or sediment. Lubricate with MS4 Silicone grease.

20 Carefully slide valve spindle through stuffing box. Align cross pin hole in valve spindle with stool location spigot on stuffing box and replace stuffing box, ensuring that the large 'O' ring is correctly positioned.

21 Replace stool and cylinder, ensuring correct location of all items.

22 Replace cylinder cover, ensuring 'O' ring is correctly positioned.

23 Replace cover nuts and fully tighten.

24 Install compression tool M730 and screw down to permit re-assembly of 3/16" dia. shear pin.

25 Pull up spindle to locate in piston rod socket and replace shear pin through arm, piston and spindle. Replace split pins. When new arm is fitted, tighten the 2BA grub screws on to the piston rod.

26 Remove compression tool M730.

27 Dismantle solenoid valves and ensure that the plunger seating is in good condition or replace. Examine restrictors on outlets of solenoid valves and ensure that the orifice holes are clear.

28 Re-assemble solenoid valves, ensuring internal cleanliness.

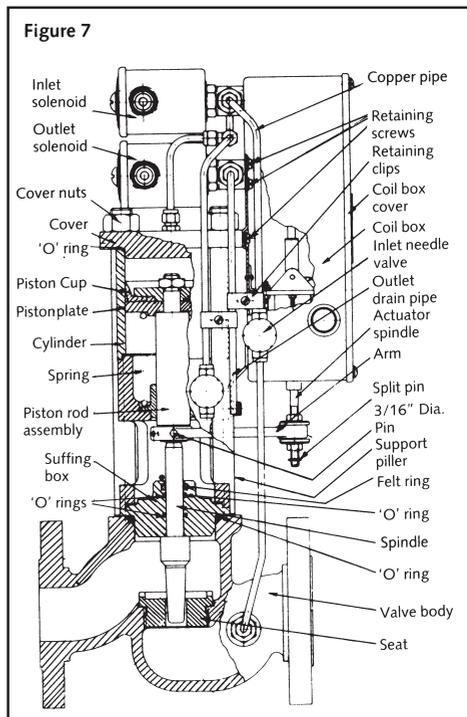
29 Re-assemble solenoid valve assembly, pipework and coil box to main valve and replace coil box cover.

30 With Actuator spindle lock nuts slackened, set core and coil spindle to dimensions in Figure 1A.

31 Reconnect solenoid valve pipework.

32 Reconnect electrical supply to solenoid valves.

33 The system may now be returned to normal operating conditions.



For spare parts see spare list under type no. prefixed SPL.

Valve will not modulate

Check

- 1 Check valve sizing
- 2 Check blowdown procedure of control chamber
- 3 Check setting of Potentiometer VR1
- 4 Check external wiring, to control head and valve induction coil. Wires must be screened
- 5 Check mechanical setting of inductive actuator on valve induction coil

No alarm operation

- 1 Blowdown procedure of control chamber
- 2 Mains supply to alarm circuit
- 3 Fuse No.2 rating 2 amp
- 4 Manual operating of float
- 5 Setting of potentiometer

Possible fault

False levels, overloading, priming blocked connections
VR1 : Position of modulating band
Wires unscreened or run in common conduit or in junction boxes with AC supply can cause false signals to control box

False levels, overloading, priming, blocked connections
Terminals 11 and 8 or 11 and 9
Overloading of firing and alarm optional circuit via control box alarm relay
Mechanical damage to float mechanism
Required level of alarm operation

Fault check list

Fault - Valve will not open

Action

1. Open relief valve
2. Blowdown of chamber
3. Mains supply to control box
4. Manual operation of float
5. Fuse No. 1(2 Amp)
6. Potentiometer settings
7. Supply for solenoid valves at control box
8. Continuity of external wiring and solenoid coils
9. Continuity of external wiring and control head coil
10. Continuity of external wiring of control valve

Check

Checks for mechanical jamming
Checks for false levels

Terminals 2 and 3 (240V AC)
Check for mechanical jamming of float mechanism
This supplies power to control box
Check for incorrect settings due to maladjustment

Float up position. Terminals 5 and 7 (240V AC) float down position. Terminals 5 and 6 (240V AC)
With **Mains Off** disconnect terminals 5 and 7 (between 500-900 OHMS) 5 AND 6 (between 500-900 OHMS) With **Mains Off** disconnect terminals 12 and 13 (140 OHMS)
With **Mains Off** disconnect terminals 14 and 15 (76 OHMS)

Possible Cause

Swarf in feed line
Boiler priming, foaming overloading, blocked connections

Bent float rod. Steam tube cap loose

Fuse blown
VR1 : Position of Modulating Band
VR3 : Alarm setting position

If no supply at this point check as Section 9 and 10

If these readings are obtained and valve not open, mechanical fault in solenoid valves
If these readings are obtained on continuity. Check mechanical setting of inductive actuator. If at this point no sign as in check 7
Printed circuit board as fault.

Fault - Valve will not shut

1. Check for mechanical jamming
2. Blowdown of chamber
3. Mains supply to control box
4. Manual operation of float
5. Fuse No. 1 (2 amp)
6. Potentiometer settings
7. Supply for solenoid valves at central box
8. Continuity of external wiring and solenoid coils
9. Continuity of external wiring and control head coil
10. Continuity of external wiring and control valve

Check for false levels

Terminals 2 and 3 (240V AC)
Check for mechanical jamming of float mechanism
This supplies power to control box
Check for incorrect settings due to maladjustment
Float up position. Terminals 5 and 7 (240V AC) float down position terminals 5 and 6 (240V AC)
With **Mains Off** disconnect terminals 5 and 7 (between 500-900 OHMS) 5 and 6 (between 500-900 OHMS)
With **Mains Off** disconnect terminals 12 and 13 (140 OHMS)
With **Mains Off** disconnect terminals 14 and 15 (76 OHMS)

Foreign bodies trapped under valve lid
Boiler priming, foaming, overloading, blocked connections
Bent float rod. Steam turn cap loose.
Water logged float
Fuse blown
VR1 : Position of modulating band
VR3 : Alarm setting position

If no supply at this point check as section 9 and 10

If reading obtained and valve does not shut, mech. fault in solenoid valves

If these readings are obtained on continuity. Check mechanical setting of inductive actuator. If at this point no signals as in check 7
Printed circuit board as fault

Do's and Don'ts

DO Pay attention to the type of wiring and how it is run between control box and induction coils.
DO Establish and rectify the cause of a fuse blowing before restarting with a new fuse.
DO Ensure that the solenoid valves and their restrictors are free from obstruction.
DO NOT Change printed circuit board until fault check lists have been understood and carried out.
DO NOT Dismantle solenoid valves or remove coils, with control box switched on
DO NOT Leave solenoid valve coils hanging by their connecting wires.

DO NOT Check supply to solenoid valves at the control box terminals with a test lamp having a current rating of over 100 M/A
DO NOT Alter the position of the Potentiometers VR1 and VR3 in desperation to solve a fault.
DO NOT Remove the integrated circuit chips
DO NOT Increase fuse ratings in control box
DO NOT Connect mains voltage to the coil connections on printed circuit board numbers 12, 13, 14 and 15
DO NOT Run mains wiring in the same conduit or M.I.C.C. as control wiring from inductive coils A & B to control box.

Delta Mobrey Limited

Hudson House, Albany
Park Camberley Surrey,
GU16 7PL, UK.

T +44 1252 729 140

F +44 1252 729 168

www.delta-mobrey.com