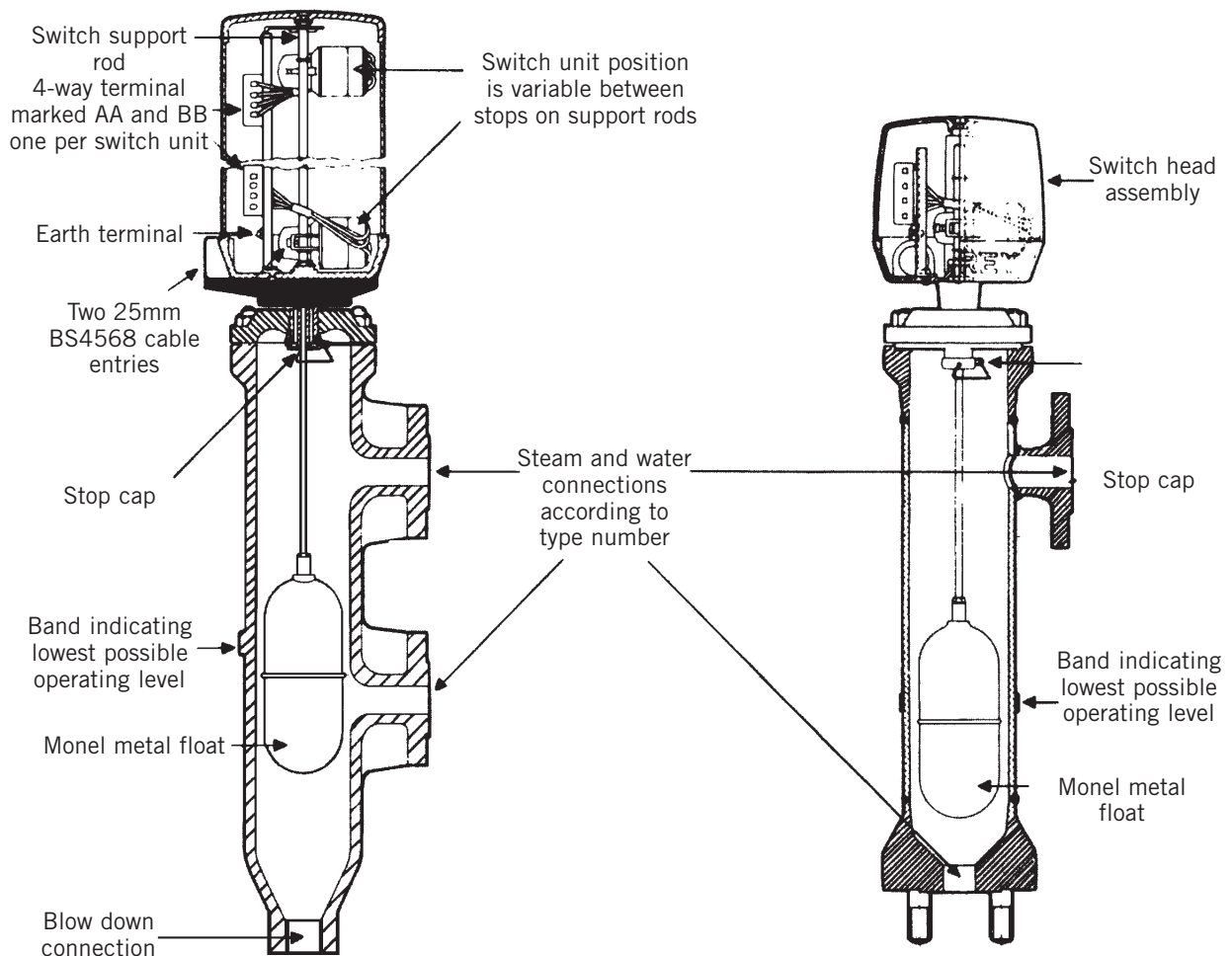


# Mobrey

## Vertical level controls for industrial steam boilers

**Multi-switch box and float assembly**

**Single-switch box and float assembly**



**Introduction**

It is normal practice to use two independent machines on each boiler, one incorporating the pump switch or switches and first low water cut-out alarm switch, the other with either one switch to provide second low water cut-out and alarm, or two switches to provide second low water cut-out and high level alarm.

**Operation**

A primary permanent magnet attached to the float rod slides vertically inside a non-magnetic stainless steel centre tube and transmits the movement of the float to a secondary magnet in each switch unit. Self-holding switch units, located on vertical support rods in proximity to the centre tube and positioned by clamp screws, have two pairs of contacts which are operated with a snap action and held by repulsion between the secondary and tertiary magnets of the switch unit assembly.

**Installation - external mounting**

1. Remove all tapes sealing the steam and water connection holes, and the tapes and packing around the float assembly, taking care to cut the securing string.
- Note:** It will be necessary to withdraw the mechanism from the float chamber in order to remove the packing, see "Periodical check" page 7. Care should be taken not to bend the float rod.
2. Mount the machine on the boiler and check that the raised band on the float chamber is positioned correctly. See Figures 1, 2 & 14.
- It is important that the MOBREY Vertical Level Control operates within the visual limits of the gauge glass at all times.
3. A horizontal raised band on the chamber indicates the lowest level at which the control will operate, see figure 1.
4. The range of the control is measured upwards from the raised band.
5. Figure 2 shows the recommended levels at which the raised band should be positioned in relation to the required mean operating level.
6. For marine applications, or where vibration is present from sources other than the boiler, the weight of the control must be supported by a bracket independent of the connection pipework.
7. Ensure that connection pipes, pads and flanges are clean and free from any obstruction.
8. Connection pipes must be as short as possible and in no case should the water leg be more than 1m long.

**Installation - Direct Mounting**

Satisfactory operation of direct mounted controls is governed by :

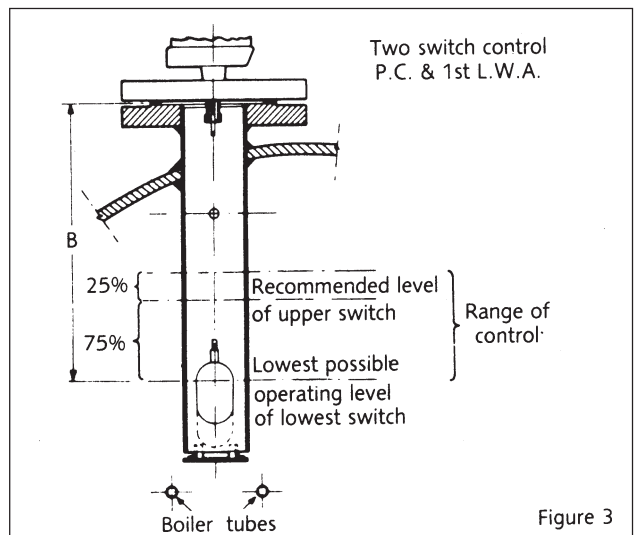
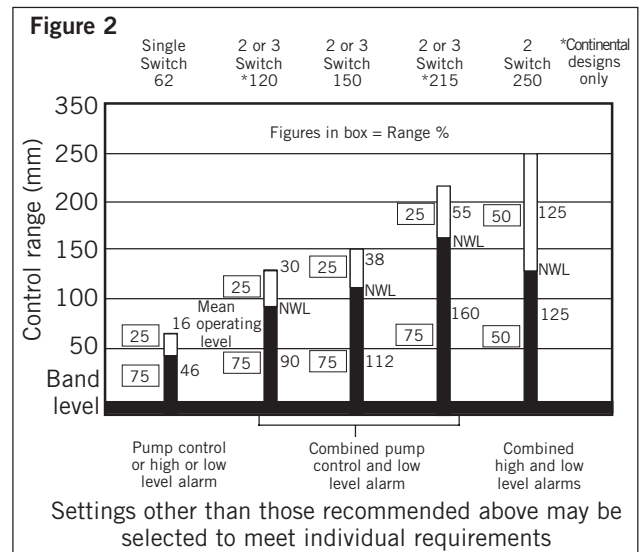
- (i) Steam pressure - by reason of the pressure/temperature relationship and its effect on the density of the water in the boiler, also the relative volume of the steam.
- (ii) Rate of steam release - its effect on the ebullition also the effect of entrained steam bubbles in further reducing the effective density of the water immediately

surrounding the float.

(iii) Positioning of the controls relative to heating surfaces, feed water inlets and sparge pipes, steam take-off points. Close proximity to any of these is to be avoided.

Advice is available to whatever extent possible but no responsibility can be accepted for final installations. Guide tubes are not included with the supply of the MOBREY Air Break Vertical Control.

Where necessary the control may be offset from the vertical centre line of the boiler in order to avoid the furnace or smoke tubes. Where difficulty is met in positioning the guide tube due to the proximity of the furnace or smoke tubes the complete mechanism can be lifted provided sacrifice of some of the range adjustment is acceptable.



**Float Size Selection Guide**

Float units are supplied with 762mm long float rod unless ordered otherwise.

For working pressure up to 21 kg/cm<sup>2</sup> use 152 x 64 float.

If required length of float rod exceeds maximum length 'L' as taken from Graph 2 overleaf, use 152 x 89 float.

For working pressures up between 21kg / cm<sup>2</sup> and 32kg/cm<sup>2</sup> use 152 x 89 float. Maximum permissible float rod length 1016mm.

### Method of determining float rod length

Standard Float Rod length for all machines 762mm.

1. Find lowest operating position of the control below the required operating level by using recommended percentage of nominal range - see page 2.
2. Check that this lowest operating position does not uncover any heating surface.
3. From the dimensions of the boiler fill in dimension 'B'.
4. From GRAPH 1 page 3 find constant 'K' for the float size to be used.
5. Add 'B' and 'K' to find total rod length 'L'.
6. If using 152 x 64 float check from GRAPH No. 2 that the maximum rod length 'L' has not been exceeded for the boiler working pressure.

**NOTE :** Maximum rod length for 152 x 89 float = 1016mm for all cases.

7. If maximum rod length for 152 x 64 float is exceeded recalculate using 152 x 89 float.

8. Calculate guide tube dimensions :

$$\text{Length} = B + 180$$

$$\text{Minimum inside Diameter} = \text{float diameter} + 13$$

9. Check clearance between guide tube and heating surface (recommended minimum 25).

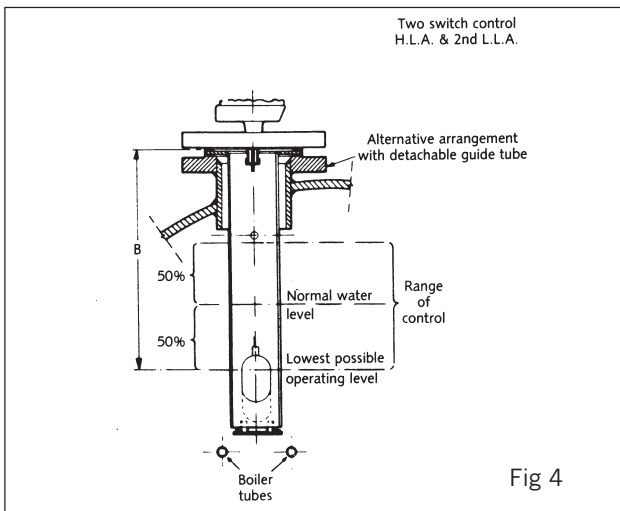


Fig 4

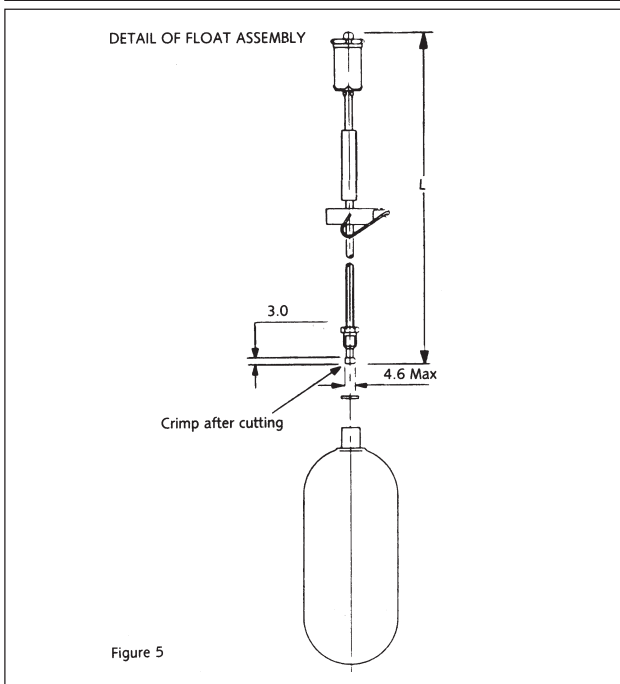
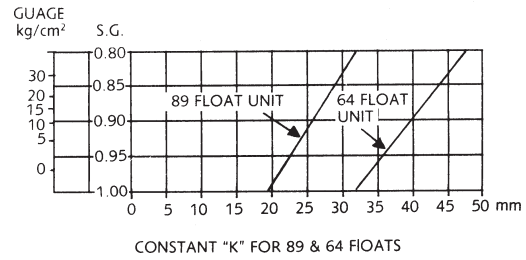
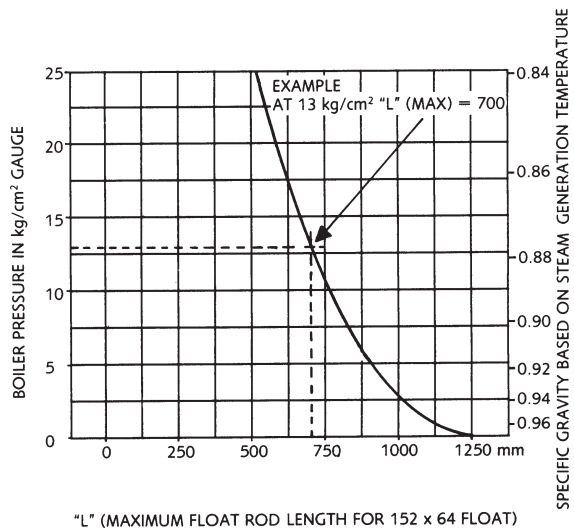


Figure 5

### GRAPH 1



### GRAPH 2



### Hydraulic Test Device

Controls should be connected to the boiler feed water supply between the pump and the boiler check valve by 9mm bore pipe. The pipe should incorporate isolating, check and stop valves. The isolating valve should be close to the flange and the check valve should be adjacent to the isolating valve (see installation arrangement below). A minimum pressure differential of 0.35 kg/cm<sup>2</sup> is recommended between the boiler and the feed water delivery to the test cup. This will result in the cup filling in approximately 24 seconds. In most cases this differential will exist due to pipe and boiler check valve resistances in the main feed water line.

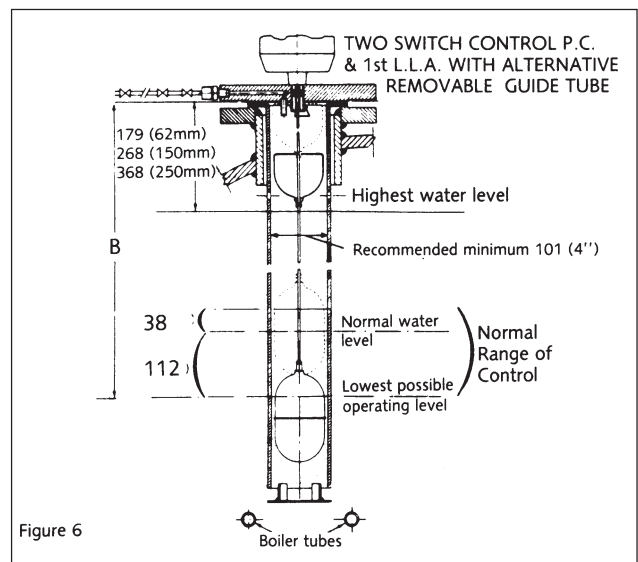


Figure 6

### Operation of Hydraulic Test Device

The pump control must be overridden in order to start the feed water pump. A hand start push button for the feed pump contactor starter is recommended so that the operative must hold it "on" during the test. Opening the test device stop valve will allow water to flow into the control where it is directed into the cup fixed to the float rod, causing it to sink. The stop valve should be closed when the alarm sounds. The water in the cup will drain away and the float will return to its original position.

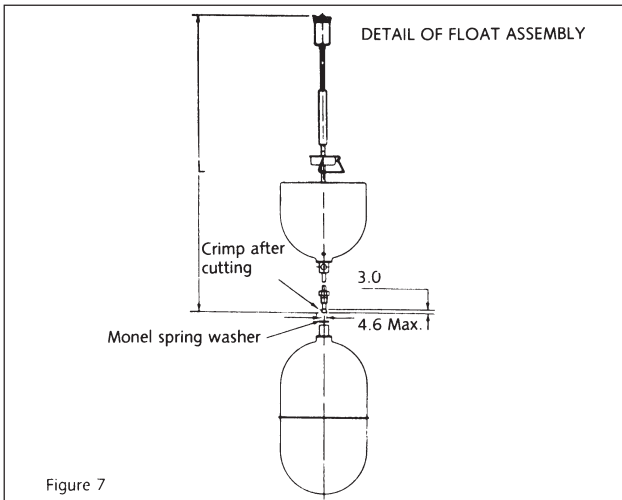
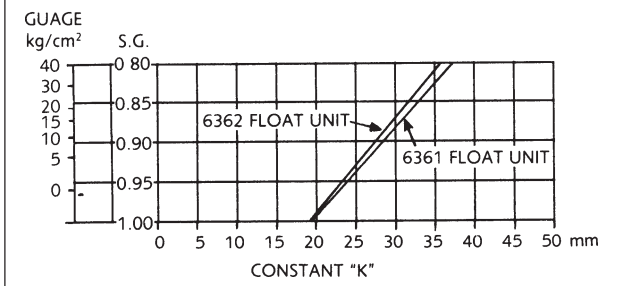
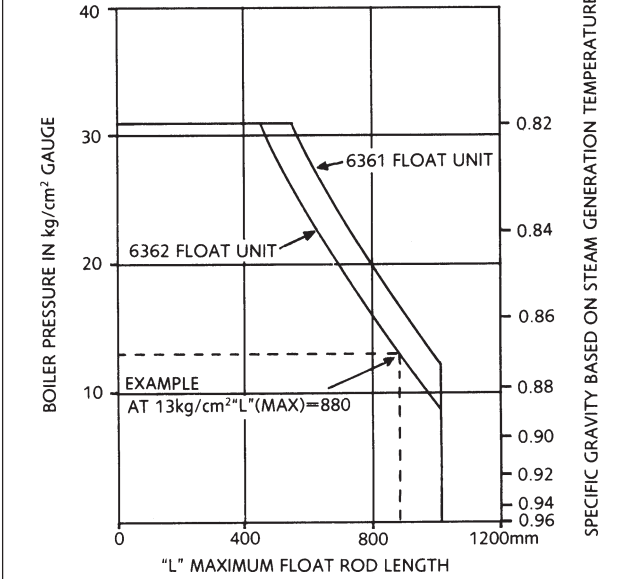


Figure 7

### GRAPH 3



### GRAPH 4



### Method of determining float rod length with hydraulic test device

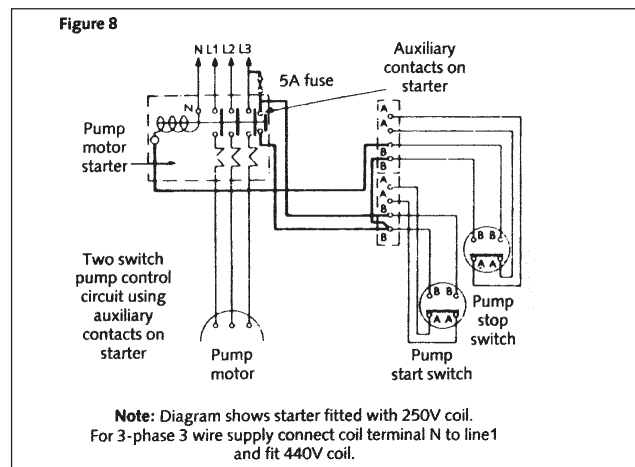
Standard float rod length for all machines 1016mm

1. Find lowest operating position by using recommended percentage of nominal range.
  2. Check that this lowest operating position does not uncover any heating surface.
  3. From the dimensions of the boiler determine dimension 'B'.
  4. From GRAPH 3 find Constant 'K' for the float type to be used.
  5. Add 'B' and 'K' to find total length 'L'.
  6. Check from GRAPH No. 4 that the maximum rod length 'L' has not been exceeded for the boiler working pressure.
- NOTE : Maximum rod length 1016 for all cases.
7. Check that the distance between underside of flange and highest water level is not less than minimum shown.
  8. Calculate guide tube dimensions :  
 Length = 8 + 180  
 Minimum Inside Dia. = Float diameter + 13
  9. Check clearance between guide tube and heating surface (recommended minimum 25).

### Electrical Characteristics

#### Important:

The temperature of the switch head may at times approach the temperature of the boiler and suitable heat-resisting cables should therefore be used.



Two 25mm BS 4568 cable entries are provided for the electrical connections (PG adaptors are available). A sufficient length of flexible cable must be fitted to permit easy removal of the switch head and float assembly for routine maintenance.

#### Switches

Single-pole double-throw operation for :-

#### AC

Maximum voltage	440V
Maximum current	5A
Minimum power factor	0.4
Maximum power	2000VA

#### DC

Resistive	
Maximum power	50W
Maximum voltage	250V
Maximum current	5A

**Inductive**

Maximum voltage	250V
*Maximum current	0.5A
Maximum time	
Constant	40ms
Maximum power	50W
*Maximum up to 2A dependent upon time constant of circuit, consult with Delta Mobrey .	

Switches must not be used for the direct starting of motors. Contacts should be wired in series with the operating coils of relays, contactor starters or solenoid valves, and fused separately. The A-A circuit makes on a rising level and the B-B circuit makes on a falling level.

**Electromagnetic Test Facility**

Coil Voltage	220VAC± 10% 50Hz
Coil Current	5 amp max.
Coil Working Cycle	No longer than 1 second every 2 minutes

It is recommended that a thermal trip such as Rilton Electronics Ltd, Part No. GDU IT73C is connected in series with the coil to prevent overheating.

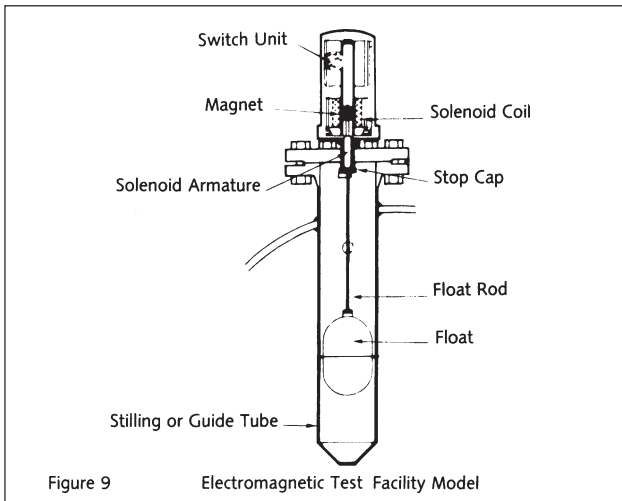


Figure 9 Electromagnetic Test Facility Model

**Electrical connections**

<b>Single - Switch Control</b>	
As High Level Alarm	A ●   ALARM ON A ●   B ● B ●
As Low Level Alarm	A ●   FIRING OFF A ●   B ●   ALARM ON B ●
As Pump Control	A ● A ● B ●   PUMP ON B ●
<b>Two-Switch Control</b>	
<b>Combined Pump Control and Low Level Alarm</b>	
Pump Control Switch	A ● A ● B ●   PUMP ON B ●
L.L.A. Switch	A ●   FIRING OFF A ●   B ●   ALARM ON B ●

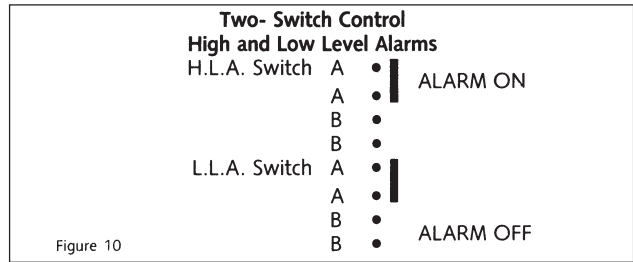


Figure 10

For wide pump differential using an additional switch see wiring diagram figure 8.

**Operating levels**

**Differentials**

Each switch has a nominal water level differential of 25mm between circuits A-A and B-B. To obtain a differential greater than 25mm, two switch units must be used and a holding circuit arranged for the starter control circuit see figure 8.

The minimum water level differential for two switch units is 33mm, with switch centres positioned 8mm apart.

The maximum adjustable differential for two switch machines will vary with the operating range of each model, i.e. the distance between rising and falling level which is required to operate the switches when they are positioned at the extreme ends of their adjustments, see figure 11.

**Switch adjustment**

Figures 11 and 12

Each switch is secured to the pillar by locking screws - the locking screws can be loosened with a screwdriver allowing the switch units to be adjusted up or down. Re-tighten the locking screw after positioning the switch.

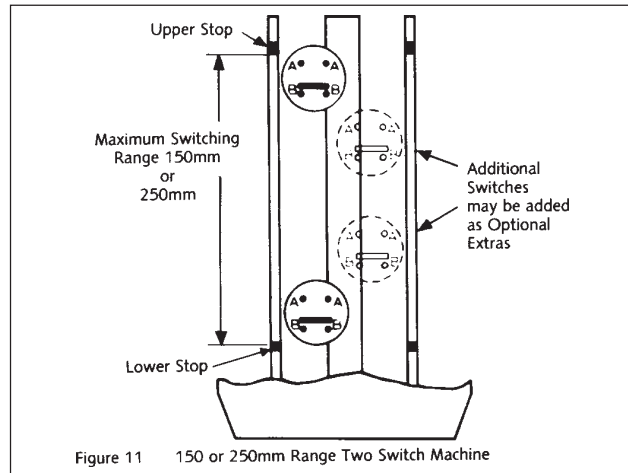


Figure 11 150 or 250mm Range Two Switch Machine

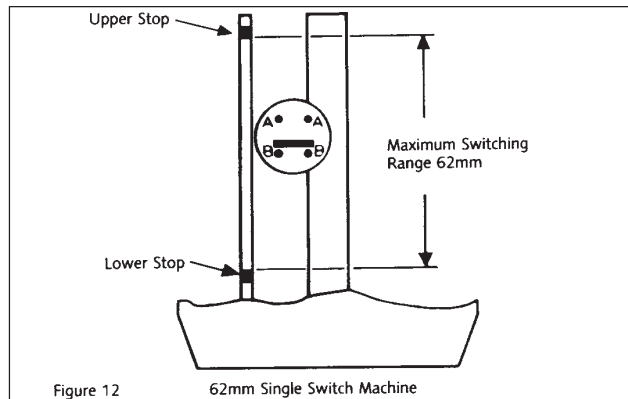


Figure 12 62mm Single Switch Machine

<b>62mm</b>	37mm adjustment + 25mm fixed differential = 62mm
<b>150mm</b>	125mm adjustment + 25mm fixed differential = 150mm
<b>250mm</b>	225mm adjustment + 25mm fixed differential = 250mm

## Boiler Steaming

1. Switch on the electric supply

### When fitted with Mobrey sequencing valve:

2. a). Slowly open steam isolating valve.  
b). Operate sequencing valve fully anti-clockwise to open.

or

### When fitted with separate isolating and blow-down valves:

- a). Check that the blow-down valve is open.
  - b). Slowly open steam isolating valve
  - c). After a period of at least 15 seconds, slowly open water isolating valve.
  - d). Slowly close blow-down valve.
- 3\*. a). Raise the water level in the boiler to a point where the highest switch unit should operate for a rising water level condition.
  - b). Check that the switch and its associated circuit operate correctly.
  - c). Drop the water level in the boiler to a point where the lowest switch unit should operate for a falling water level condition.

As the level falls, check that all switch units and associated circuits operate correctly and at the desired levels.

### If it is necessary to adjust the levels :

1. Loosen the centre screw and remove the switch head cover.
2. Position switch units to provide operation at water levels desired within a range of the control when it has been mounted on the boiler. Loosen the clamp screw(s) of the switch unit(s) and adjust the switch unit(s) to the required level(s) on the vertical support rods to provide pump control and/or alarm(s).

**Note :** Switch unit clamp screw(s) must be securely tightened after the adjustments to the switch unit(s) are made.

3. Replace cover and tighten screws.

The above procedure will ensure that the switch units are operating correctly.

The control is now ready for use.

### After replacing a fuse in a level control or alarm circuit following a failure, carry out the operation in Paragraph 3\*.

### To put the control out of operation

1. Switch off the electric supply.
- When fitted with MOBREY Sequencing valves :
2. a). Operate sequencing valve fully clockwise to close.  
b). Slowly close steam isolating valve.

or

### When fitted with separate isolating and blow-down valves :

- a). Slowly open blow-down valve;
- b). Slowly close water isolating valve;
- c). Slowly close steam isolating valve;

## Operational tests

### Daily routine

It is important that the control should be blown down at least once per day while the boiler is under pressure. An operating Instruction Card BP/109 suitable for permanent display in the boilerhouse is available on request.

## Weekly routine

### To test low water alarm and cut-out switch

Shut off the feed water to the boiler, either by closing down the feed pump or in certain cases closing the feed valve.

**With a competent attendant standing by**, allow the water level to fall by evaporation until the low alarm level is reached. At this point the machine should operate the low alarm and the firing apparatus should cease to operate. With the feed pump under hand control, restore the feed water to the boiler. Upon a short rise in water level the low alarm should be re-set and the firing apparatus should commence to operate. Restore normal feed water control to the boiler.

Any change in operating level from the set positions may be indicative of blocked connections to the float chamber, a waterlogged float or a loose switch unit and should be investigated immediately.

### To test pump control switch

Under normal operating conditions:

- a). Allow the water level to rise until the 'Pump Cut-out' level is reached. At this point the pump should stop.
- b). Allow the water level to fall until the 'Pump Cut-in' level is reached. At this point the pump should start.

### To test high water alarm

- a). With the feed pump under hand control, allow the water level to rise until the high alarm level is reached. At this point the alarm should operate.
- b). Shut off the feed water. After a short fall in water level, the high alarm should re-set.
- c). Restore normal control of feed water to boiler.

Warning :

**Any unauthorised interference or modifications to the mechanisms of these machines can be detrimental to their correct operation.**

### "Periodical check"

At such times as the boiler plant is inspected MOBREY Vertical Level Controls should be dealt with in the following manner :

1. Isolate the float chamber from the boiler. (See "Commissioning and operating instructions" to put the control out of operation).
2. Remove nuts holding chamber cover to chamber and lift away the complete switch 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.

### Important

The magnet must not touch any magnetic material such as the float chamber, tools, steel benchtops, etc., and the assembly must only be put down in a clean place where there is no danger of the magnet collecting magnetic particles.

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. Offer float rod assembly magnet into centre tube and check that it moves freely up and down. Withdraw float assembly and put to one side.

5. After ensuring that the unit is isolated electrically, withdraw screw on top of switch head and remove cover.  
 6. Examine the ceramic body for damage or cracks. Ensuring that wiring is in good order and that all screws are tight. Dismantling of switch units is not recommended and replacement of the complete switch unit will be found to offer the quickest and most economical solution in the event of faulty operation.

7. a) Examine valves and pipe connections between float chamber and boiler to make sure they are clean. Reseat and repack stop valves if necessary.  
 b) Check that the chamber is clean and position a new joint in its recess in the chamber.  
 c) Check that the inside of the centre tube is clean and that no swarf is attached to the float magnet. Before refitting the switch head and chamber cover assembly to the chamber it is essential that the switch head is checked for correct operation.  
 d) Fit the float rod assembly with its magnet into the centre tube and secure the stop cap with the clip provided.  
 e) Move the float assembly slowly to the top of its travel.  
 f) Lower the float assembly slowly, checking that the switch units are operated by the float rod magnet as it passes them.  
 g) Replace switch head cover and tighten securing screw.  
 h) Position the switch head complete with float on to the chamber, securing the cover with the nuts.

8. Recommission the control as stated in **“Commissioning and operating instructions”** (see page 6).

**Switch units**

If a switch unit is adjusted or replaced (at any time) it must be checked according to the operating instructions or the instructions covering periodical checks.

**Methods of Mounting**

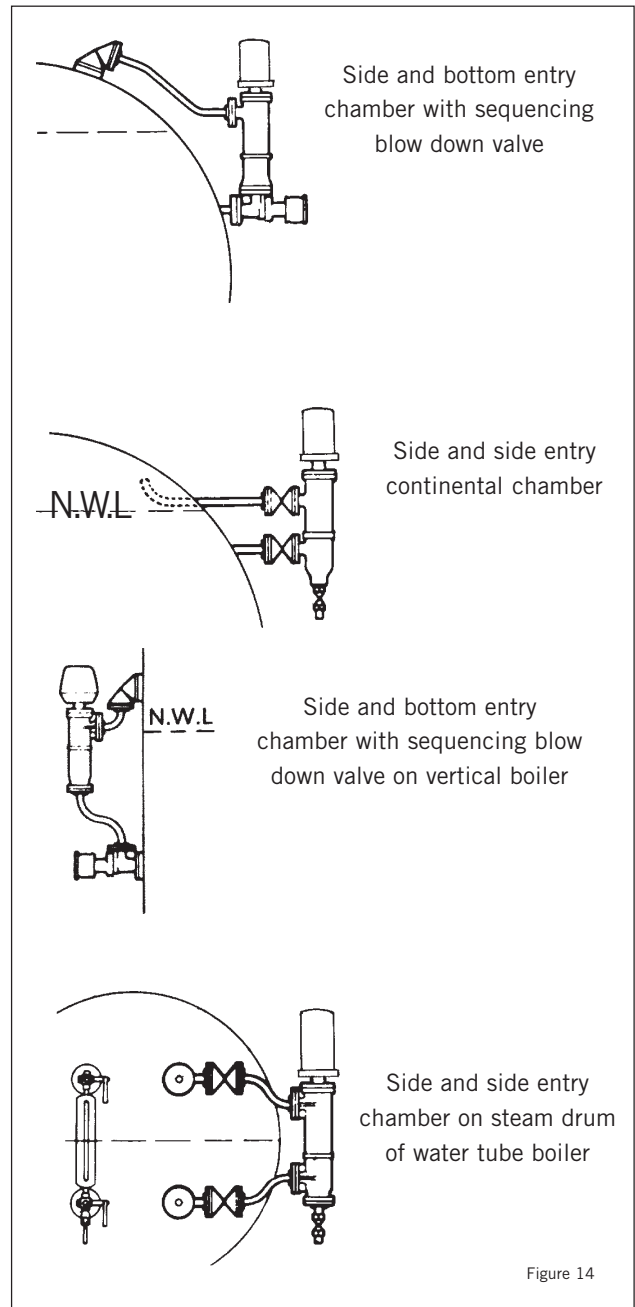


Figure 14

**Section through switch assembly**

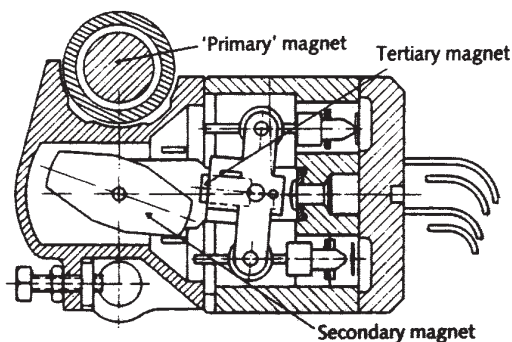


Figure 13

# Vertical level controls



**MOBREY**  
www.mobrey.com

**IMPORTANT:-**  
**FOR USE WITH HIGH TENSILE STEEL BOLTS ONLY**  
 MOBREY use high tensile bolts/studs as standard for pressure vessel flange applications which allows the use to full switch rating.  
 The following recommended torques assume the use of high tensile bolts.

*Minimum torques in Nm (lbf.ft) max torque = min+10%*

CONTROL					TORQUE	
BD01/1	BD43/1	BDM06/1	BDTM03/1	BX25/1	316 (232)	
BD02/1	BD44/1	BDT01/1	BDTM05/1	BXM12/1		
BD03/1	BDM01/1	BDT02/1	BX12/1	BXM13/1		
BD04/1	BDM02/1	BDT03/1	BX13/1	BXM14/1		
BD05/1	BDM03/1	BDT05/1	BX14/1	BXM23/1		
BD06/1	BDM04/1	BDTM01/1	BX23/1	BXM24/1		
BD21/1	BDM05/1	BDTM02/1	BX24/1	BXM25/1		
BD22/1						
BD07/1	BD41/1	BX16/1	BXM03/1	BXM19/1		106 (78)
BD08/1	BD42/1	BX17/1	BXM05/1	BXM20/1		
BD09/1	BDM08/1	BX18/1	BXM07/1	BXM21/1		
BD10/1	BDM11/2	BX19/1	BXM08/1	BXM22/1		
BD11/1	BDM14/2	BX20/1	BXM09/1	BXM45/1		
BD12/1	BDM16/2	BX21/1	BXM10/1	C62/1		
BD13/1	BDT06/1	BX22/1	BXM11/1	81006		
BD14/1	BX07/1	BX45/1	BXM15/1	81007		
BD15/1	BX10/1	BX87/1	BXM16/1	81008		
BD16/1	BX11/1	BX88/1	BXM17/1	81660		
BD40/1	BX15/1	BXM02/1	BXM18/1	81661		
C150/2			C250/2		103 (76)	
F62/1		F150/2		F250/2	94 (69)	
BDT04/1		BDT07/1		BDTM04/1	154 (113)	

*Bolts should be lubricated with suitable grease.  
Correct bolt tightening sequence:-*

Information given on this sheet is to the best of our knowledge correct. Since conditions of use are beyond our control users must satisfy themselves that bolt / torques are suitable for the Flange / Process / Condition of the application.

ISSUE	2	TITLE			
DATE	16/2/2000	RECOMMENDED BOLT TORQUES FOR JOINTS USING NON-ASBESTOS GASKETS TO BS7531 GR.X			
CHANGE	T16665	DRAWN	JSH	12/92	DOC. NO.
NAME	S.L.C	CHECKED	NW	12/92	L1890
CHECKED	BTK	Sheet 1 of 1			

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