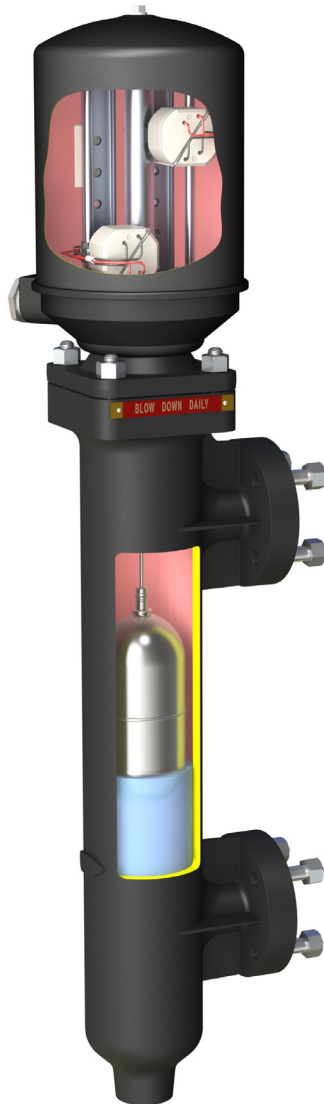


# Mobrey Boiler Water Level Controls



# Overview of Mobrey Boiler Water Level Controls

## Introduction

Mobrey originally entered the industrial boiler control market in 1923 with a range of steam operated equipment. Since that time, the range has expanded to cover most aspects of control associated with the boiler house.

The products include a range of electromechanical float controls and associated valves. These reliable products are described in greater detail on the following pages and each carries the quality and service guarantee synonymous with the Mobrey name.

## Alarm and Pump Control

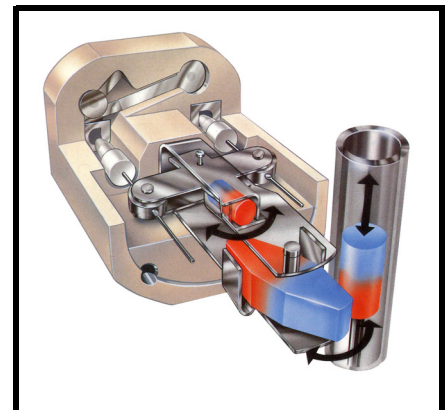
Mobrey Vertical Air Break Controls are a comprehensive range of magnetically operated water level controls. They are designed to meet all the requirements for automatic on/off control of boiler feed pump, burner cut-out, high and/or low level alarm or any combination of these.

## Modulating water level controllers

The Mobrey Controller is a single-element electro-hydraulic control with an electronic feedback. The system consists of a control unit float chamber, a feed-line modulating valve and a control box. It is used for the throttle control with the modulating valve in the boiler feed line.

## Sequencing blow-down valves

The Mobrey Sequencing Valve is designed to function as a manually operated combined water isolating valve and sequencing valve. It provides positive purging of the water connection, float chamber and steam connection of a boiler control.



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# Vertical air break alarm and pump controls

## Description

The Mobrey Vertical Air Break Controls (VABC) are a comprehensive range of magnetically operated water level controls for steam boilers. They are designed to meet all requirements for automatic on/off control of boiler feed pump, burner cut out, high and/or low level alarm or any combination of these.

Models available with Industrial (NEMA4) or Marine Heads. TÜV approved models are available in chambers and for direct mounting.

## Operation

The Mobrey VABC is a gland-less construction. A primary permanent magnet is attached to the float rod and slides vertically inside a non-magnetic stainless steel centre tube. Movements of the float are transmitted to a secondary magnet in each switch unit. There are two pairs of contacts which are operated with a snap-action and held by repulsion between the secondary magnet and the tertiary magnet of the switch unit assembly.

## Operating Levels

### Differentials

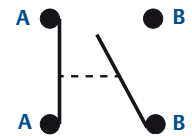
Each level switch has a nominal fixed water level differential of 25 mm between circuits A-A and B-B. To obtain a differential greater than 25 mm, two switch units must be used. The minimum water level differential for two switch units is 33 mm, with switch centres positioned 8 mm apart.

The maximum adjustable differential for two switch mechanisms varies with the operating range of each model, i.e. the distance between a rising and falling level which is required to operate the switches positioned at the extreme ends of their adjustments (Figure 1).

Switches have adjustments as follows:

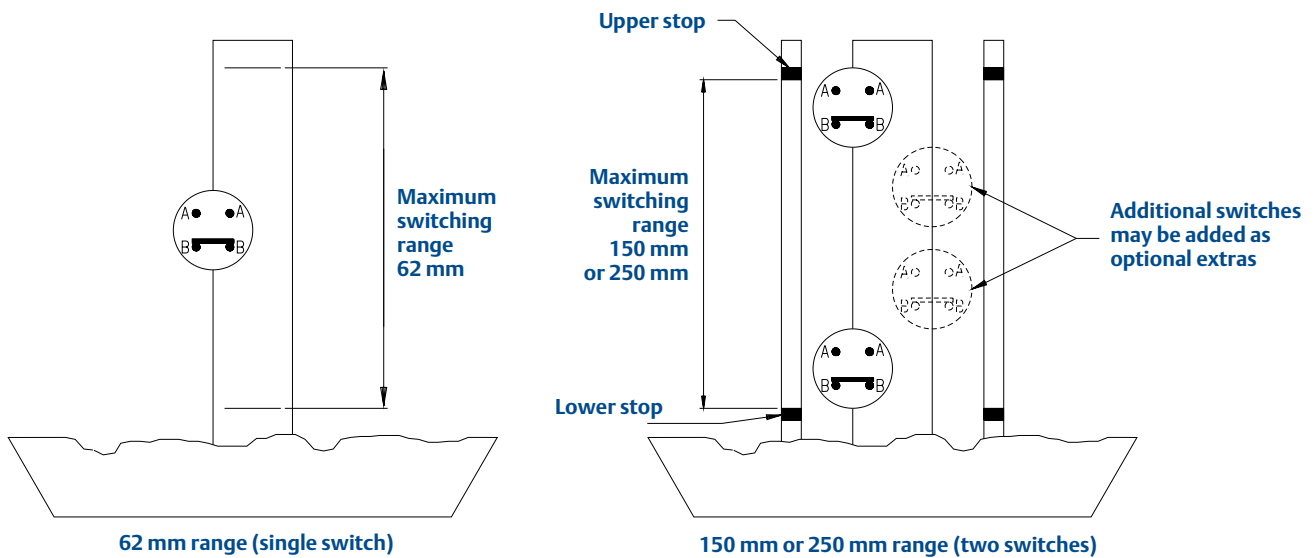
- 62 mm range: 37 mm adjustment + 25 mm fixed differential = 62 mm
- 150 mm range: 125 mm adjustment + 25 mm fixed differential = 150 mm
- 250mm range: 225 mm adjustment + 25 mm fixed differential = 250mm

2 x SPST  
AA make on rise  
BB make on fall



[Link for SPDT/SPCO](#)

Figure 1. Cut-away illustration showing switch adjustments



**Table 1. Electrical ratings for Single-Pole Double-Throw (SPDT) operation**

AC maximum values			DC maximum values				
VA	Volts	Amps	Watts	Volts	Resistive amps	Inductive amps	Inductive time constant
2000 <sup>(1)</sup>	440	5	100	250	5	0.5 <sup>(2)</sup>	40 ms

(1) Maximum power factor is 0.4.

(2) Maximum up to 2 A dependent upon time constant of circuit. Consult factory.

**Note**

- Switches must not be used for the direct starting of motors.
- Contacts should be wired in series with the operating coils of relays, contact starters or solenoid valves, and fused separately.
- Two 25 mm BS4568 cable entries are provided for the electrical connections. A sufficient length of flexible cable must be fitted to permit easy removal of the switch head and float assembly for routine maintenance.

**Dimensional drawings for chamber mounted models**

**Table 2. Side-and-bottom chamber dimensional and operating data**

Chamber and switch head	Type number	Operate range (mm)	No. of switches		EN1092 flanged and screwed connections	Dimensions							
			Std.	Max.		C	G	H	H1	L	W	F	
	<b>Cast iron chamber (working pressure: 13 kg/cm<sup>2</sup>)</b>												
	BX02/1	62	1	-	DN25 PN16	-	102	193	303	366	182	160	
	BX05/2	150	2	4	DN25 PN16	-	102	293	497	468	277	160	
	BX07/2	250	2	6	DN25 PN16	-	102	393	602	557	370	160	
	<b>Fabricated steel chamber (working pressure: 21 kg/cm<sup>2</sup>)</b>												
	BX09/1	62	1	-	DN25 PN40	-	87	193	303	366	182	160	
	BX10/2	150	2	4	DN25 PN40	-	87	293	497	468	277	160	
	BX11/2	250	2	6	DN25 PN40	-	87	393	602	557	370	160	
	<b>Fabricated steel chamber (working pressure: 32 kg/cm<sup>2</sup>)</b>												
	BX12/1	62	1	-	DN25 PN40	-	102	193	303	366	182	160	
	BX13/2	150	2	4	DN25 PN40	-	102	293	497	468	277	160	
	BX14/2	250	2	6	DN25 PN40	-	102	393	602	557	370	160	

**Explanation of type numbers**

- The type numbers are arbitrary except that BX denotes chamber mounting and BD denotes direct mounting.
- The stroke number (e.g. \*\*\*/n) indicates the number of switch units fitted as standard. When extra switches are required, this stroke number will indicate the total number of switches to be provided.
- When Marine models are required the letter 'M' is inserted after the letters BX and before the number, e.g., the Industrial and NEMA 4 model BX05/2 becomes BXM05/2 when in Marine construction.

**Marine type approvals:**

- American Bureau of Shipping
- Bureau Veritas
- Det Norske Veritas, Germanischer Lloyd
- Russian Maritime Register of Shipping
- TUV approved models (side and side connections only) are available on request. Before ordering, please contact us. If the models shown here do not meet your specific requirements, please contact us for assistance.

**Table 3. Side-and-side chamber dimensional and operating data**

Chamber and switch head	Type number	Operate range (mm)	No. of switches		EN1092 flanged connections	Dimensions							
			Std.	Max.		C	G	H	H1	L	W	F	
	<b>Cast iron chamber with 1-in. BSP drain connection (working pressure: 13 kg/cm<sup>2</sup>)</b>												
	BX03/1	62	1	-	DN 25 PN16	216	102	193	303	448	277	160	
	BX15/1	62	1	-	DN20 PN16	180	100	193	303	480	240	160	
	BX87/1	62	1	-	DN20 PN16	180	135	193	303	480	240	160	
	BX16/2	120	2	4	DN20 PN16	180	100	293	497	480	240	160	
	BX88/2	120	2	4	DN20 PN16	180	135	293	497	480	240	160	
	BX06/2	150	2	4	DN 25 PN16	216	102	293	497	448	277	160	
	BX08/2	250	2	6	DN 25 PN16	317	102	393	597	557	370	160	
	<b>Fabricated steel chamber with ½-in. BSP drain connection (working pressure: 21 kg/cm<sup>2</sup>)</b>												
	BX17/1	62	1	-	DN20 PN40	270	100	193	303	570	335	160	
	BX45/1	62	1	-	DN25 PN40	270	100	193	303	570	335	160	
	BX18/2	120	2	4	DN20 PN40	270	100	293	497	570	335	160	
	BX19/2	150	2	4	DN25 PN40	270	100	293	497	570	335	160	
	BX20/2	150	2	4	DN20 PN40	270	100	393	497	570	335	160	
	BX21/2	215	2	6	DN25 PN40	270	100	393	602	570	335	160	
	BX22/2	215	2	6	DN25 PN40	270	100	393	602	570	335	160	
	<b>Fabricated steel chamber with ½-in. BSP drain connection (working pressure: 32 kg/cm<sup>2</sup>)</b>												
	BX23/1	62	1	-	DN 25 PN40	350	112	193	303	595	372	160	
	BX24/2	150	2	4	DN 25 PN40	350	112	293	497	595	372	160	
	BX25/2	250	2	6	DN 25 PN40	350	112	393	597	595	372	160	

**Chamber Mounted Controls**

Float chambers are manufactured in these approved materials:

- Cast iron equal to BS1452 Grade 17  
– for up to 13 kg/cm<sup>2</sup> rating.
- Fabricated steel BS3602 - HFS 27  
– for both 21 kg/cm<sup>2</sup> and 32 kg/cm<sup>2</sup> ratings.

For chamber dimensions and process connections arrangement see [Table 2 on page 4](#) and [Table 3 on page 5](#).

**Switch heads** contain one or more switching mechanism units mounted in a housing comprising die-cast base with a zinc coated mild steel casing.

Two 25mm BS.4568 cable entries are provided.

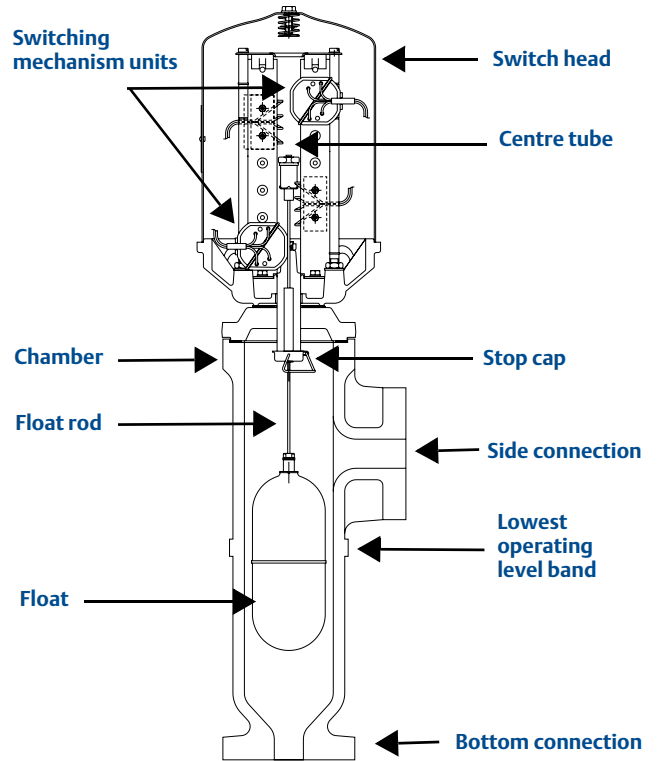
**Switching mechanism units** have single pole double throw contacts, are latching and are positioned and held in place by clamp screws.

The **centre tube** is made of non-magnetic stainless steel and expanded into the top cover flange. It is fitted with a stop cap which also acts as a guide for the float rod carrying the primary magnet.

**Floats** are manufactured in Monel metal.

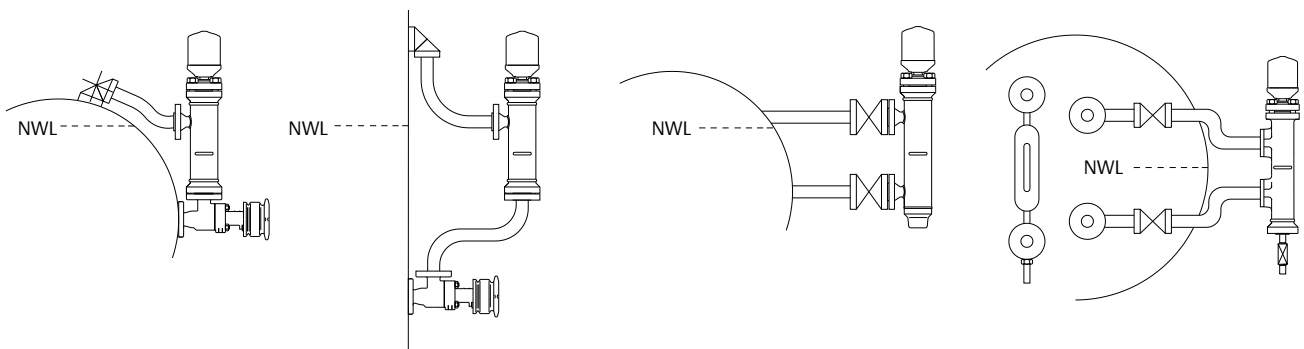
**Float rods** are manufactured in stainless steel.

Figure 2. Chamber mounted controls



The Chamber band mark indicates the lowest adjustment position of the low level alarm. We recommend that the positioning of the boiler control chamber is relative to the water level gauge glass and that, even at the lowest operating band level, the N.W.L. is such that there is always water visible in a gauge glass. Arrangements of Mobrey Vertical Air Break Controls on various types of boiler are shown in [Figure 3](#).

Figure 3. Typical mounting arrangements



Side and bottom entry chamber with sequencing valve on horizontal boiler

Side and bottom entry chamber with sequencing valve on vertical boiler

Side and side entry chamber on horizontal boiler

Side and side entry chamber on steam drum of water tube boiler

## Direct mounted water level controllers

### Direct mounted models (standard models)

Direct Mounted Vertical Air Break Controls have the same principles of operation and piece parts as the chamber-mounted equivalents, except that the chamber is exchanged for (1) a large round flange and (2) the tube assembly for mounting the control directly on to the boiler shell connection.

A fixed or removable stilling or guide tube should be provided to ensure that the float rod is not damaged and the correct vertical movement is achieved.

### Direct mounted controls incorporating test facilities

These controls have the provision for testing the operation of the mechanism without lowering the level of water in the boiler. Testing can be initiated manually or by a timer. U.K. Patent 1279504 or 1473939 and international equivalents.

#### Hydraulic cup test facility

The test is achieved by lowering the float to the low water alarm level, by the following means:

The float rod includes a **cup**, above the float, which is fed with water from the boiler feed pump via small bore pipework and valves through the control mounting flange (Figure 4) for approximately 24 seconds. The additional weight overcomes the buoyancy of the float, causing it to sink, stop the burner firing and operate the alarm system. After closing the test valve in the supply from the feed pump to the control, a small hole in the bottom of the cup drains off the water, permitting the float to rise to the normal operating position. Control of the water supply to the cup can alternatively be by means of a solenoid valve, which can be initiated by a timer or a manually operated push button. In this design the alarm switch remains fully adjustable.

#### Electromagnetic test facility

The switch head includes an inductive coil below the single switch subassembly (Figure 5). This surrounds an armature located inside the stainless steel centre tube and fixed to the float rod.

To initiate the test cycle, the coil can be energised by a timer or a manually operated push button and the float will be thrust downwards to stop the burner firing and operate the alarm system. When the coil is de-energised the float rises to its normal level. In this design the alarm switch unit is not adjustable.

Figure 4. Hydraulic cup test facility

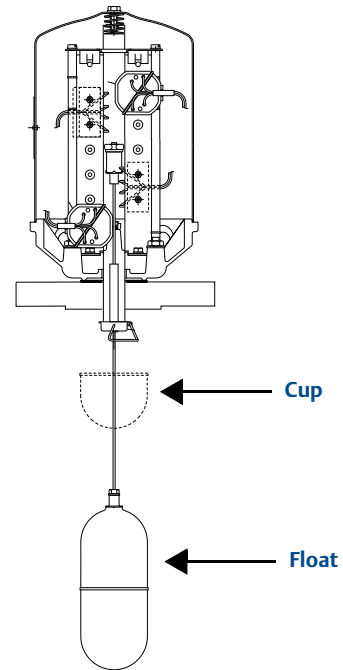
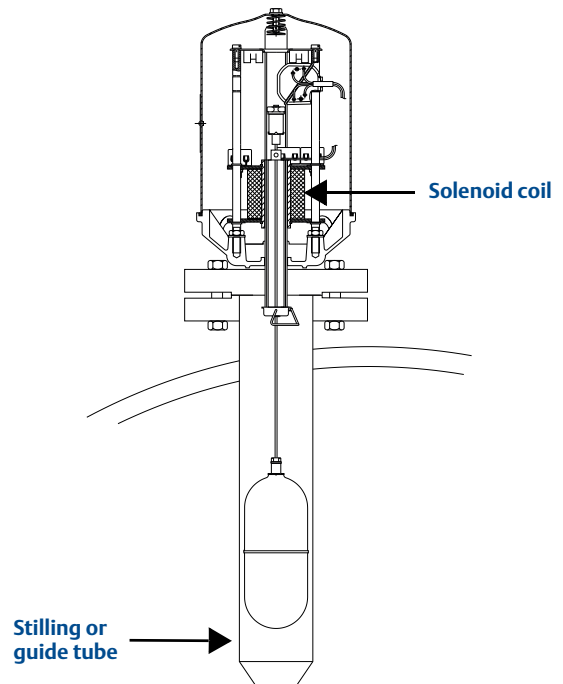


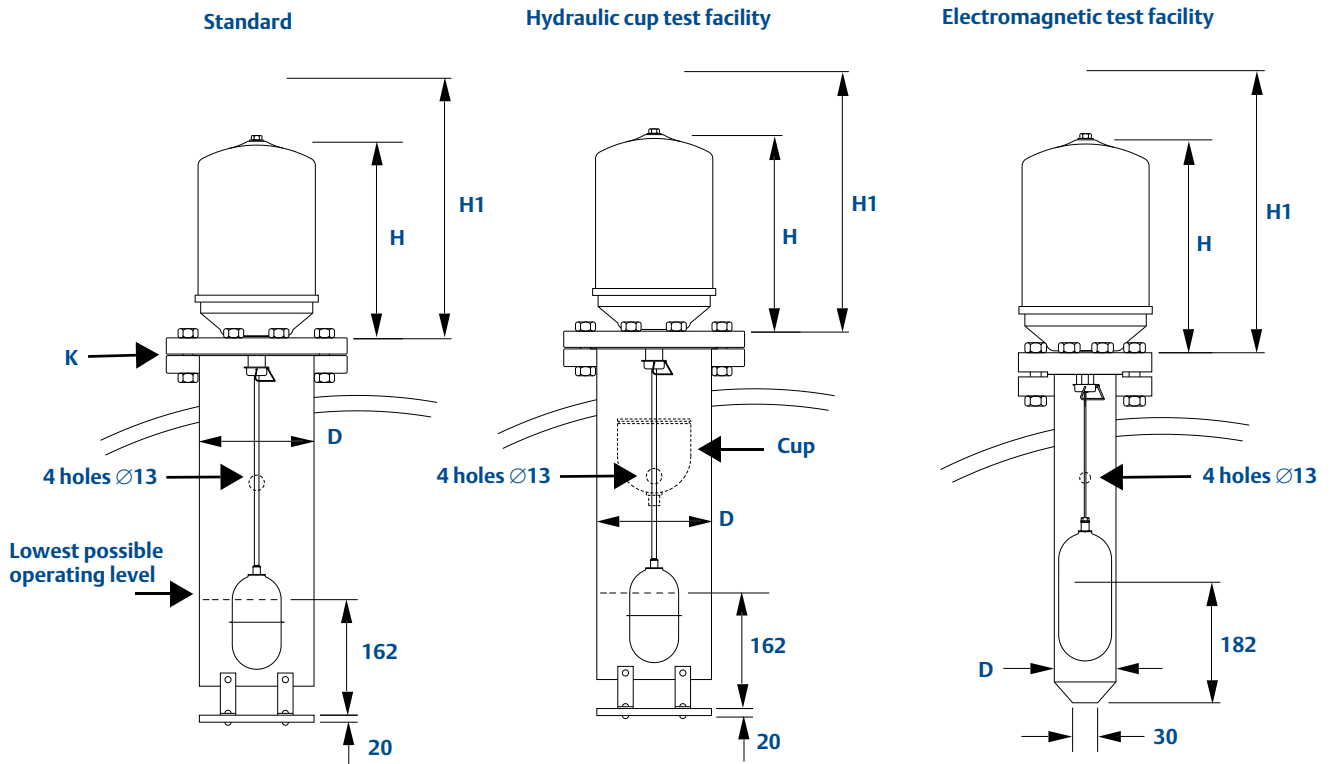
Figure 5. Electromagnetic test facility model



**Table 4. Dimensions and Ordering Information: Direct Mounted Models**

Type number	Working pressure at saturated steam kg/cm <sup>2</sup>	Operate range in mm	No of switches		Forged steel flanged connections	Float length x diameter	Dimensions			Max. float rod length
			Std.	Max.			D min.	H	H1	
<b>Standard</b>										
BD01/1	21.0	62	1	1	EN1092 DN100 PN40	152 x 67	77	193	303	765
BD02/2		150	2	4				293	497	
BD03/2		250	2	6				393	597	
BD04/1	32.0	62	1	1	EN1092 DN100 PN40	155 x 90	100	193	303	1016
BD05/2		150	2	4				293	497	
BD06/2		250	2	6				393	597	
BD07/2	21.0	120	2	4	BM115mm Sq	152 x 67	77	293	497	260
BD08/1		62	1	1				193	303	765
BD09/1		62	1	1				193	303	356
BD10/1	13.0	62	1	1	BM115mm Sq	155 x 90	77	193	303	260
BD11/2	21.0	150	2	4	BM115mm Sq	152 x 67	77	293	497	765
BD12/2		150	2	4				293	497	356
BD13/2		150	2	4				293	497	298.5
BD14/2		215	2	6				293	602	356
BD15/2		250	2	6				293	602	756
BD16/2		250	2	6				293	602	394
BD21/2	32.0	150	2	4	EN1092 DN100 PN40	155 x 90	100	293	497	385
BD22/2		250	2	6			100	393	602	385
BD41/2	21.0	62	1	1	EN1092 DN100 PN40	152 x 67	77	193	303	298.5
BD42/2		62	1	1			77	193	303	394
BD43/1	32.0	62	1	1	EN1092 DN100 PN40	155 x 90	100	193	303	1016
BD44/2		150	2	4			100	293	497	1016
<b>Hydraulic cup test facility</b>										
BDT01/1	32.0	62	1	1	EN1092 DN100 PN40	155 x 90	100	193	303	1016
BDT02/2		150	2	4				293	497	
BDT03/2		250	2	6				393	597	
<b>Electromagnetic test facility</b>										
BDT04/1	21.0	-	1	-	BM128mm sq	155 x 90	100	293	497	1016
BDT05/1	32.0	-	1	-	DN100 PN40					





## Modulating water level controllers

### Description

The Mobrey Modulating Controller is a single element electro-hydraulic control with an electronic feedback system comprising:

- i) A control unit float chamber, mounted on the boiler shell, fitted with an Inductance Coil 'A' head assembly which can be made suitable for either Industrial or Marine Applications.
- ii) A flanged modulating valve, fitted with an Inductance Coil 'B' and twin solenoid valve assembly, which is mounted in the boiler feed water line.
- iii) An electronic control box.

### Operation

A positive change of water level in the boiler alters the inductance value of Coil "A" causing an imbalance in the system. This signal is transmitted through the electronic control box to the appropriate solenoid valve on the modulating valve thus producing a change of hydraulic pressure on the piston assembly, the movement of which modulates the flow of water to the boiler.

Simultaneously this same vertical travel creates a change in the inductance value of Coil "B" until the balance is restored, thus closing the solenoid valve and hydraulically locking the modulating valve spindle.

This sequence is repeated in very small steps until the feed water input equals the required evaporation rate of the boiler. To prevent the modulating valve responding to random water movement against the general direction of level change, a 13 mm reversal or (dead) band is incorporated in the electronic circuitry.

Low water alarm and burner cut out contacts are also provided within the control box to operate when the water level falls to a predetermined position.

### General note

Models shown are for 21 kg/cm<sup>2</sup> maximum working pressure. Details of modules for 32 kg/cm<sup>2</sup> will be provided on request.

**Installation note**

- For the further safety of boilers, it is recommended that the Mobrey Control Unit is mounted on a Mobrey Sequencing Valve.
- The water connection from the boiler to the float chamber should be as short as possible and the control head float chamber should be mounted close to the gauge glasses.
- The chamber band mark indicates the lowest adjustment position of the 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. If required our technical staff will advise on individual installations.

**Features**

- Inherently stable
- Easily adjusted for individual operating requirements
- Instant reversion to hand control in emergency.

**Application notes**

**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 closes progressively to reduce the rate of feed into the boiler. The size of valve lid is determined by the actual capacity of the boiler plus an allowance. See [page 13](#).

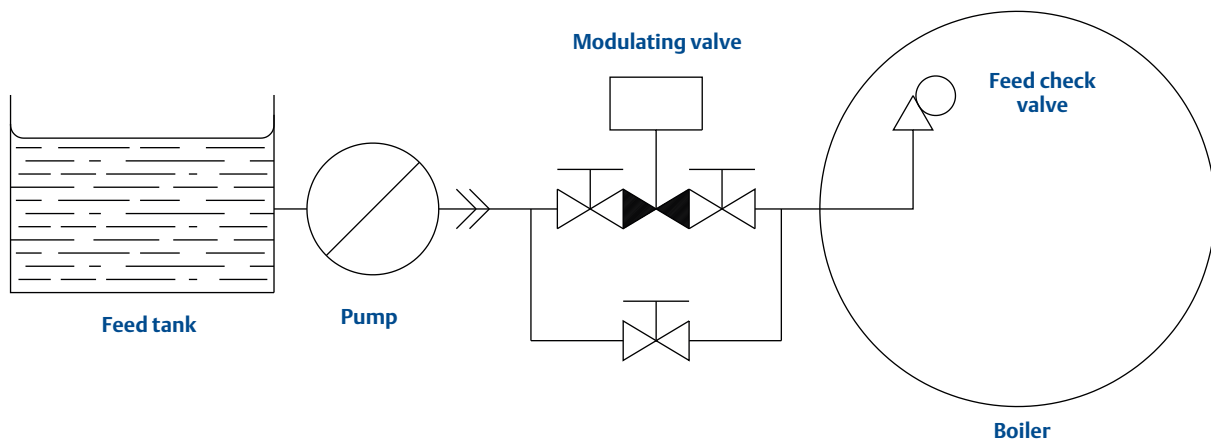
**Power failure and high water shutdown – with a third solenoid valve**

Where one pump is feeding more than one boiler it is imperative that a boiler cannot be overfilled. Therefore a third solenoid valve can be installed on the modulating valve which is operated by either a loss of power on the boiler control circuit or the high water alarm. In either case the valve will be closed and prevent further water entering the boiler. The third solenoid valve can be retrofitted to existing valves.

**Common feed pump arrangement**

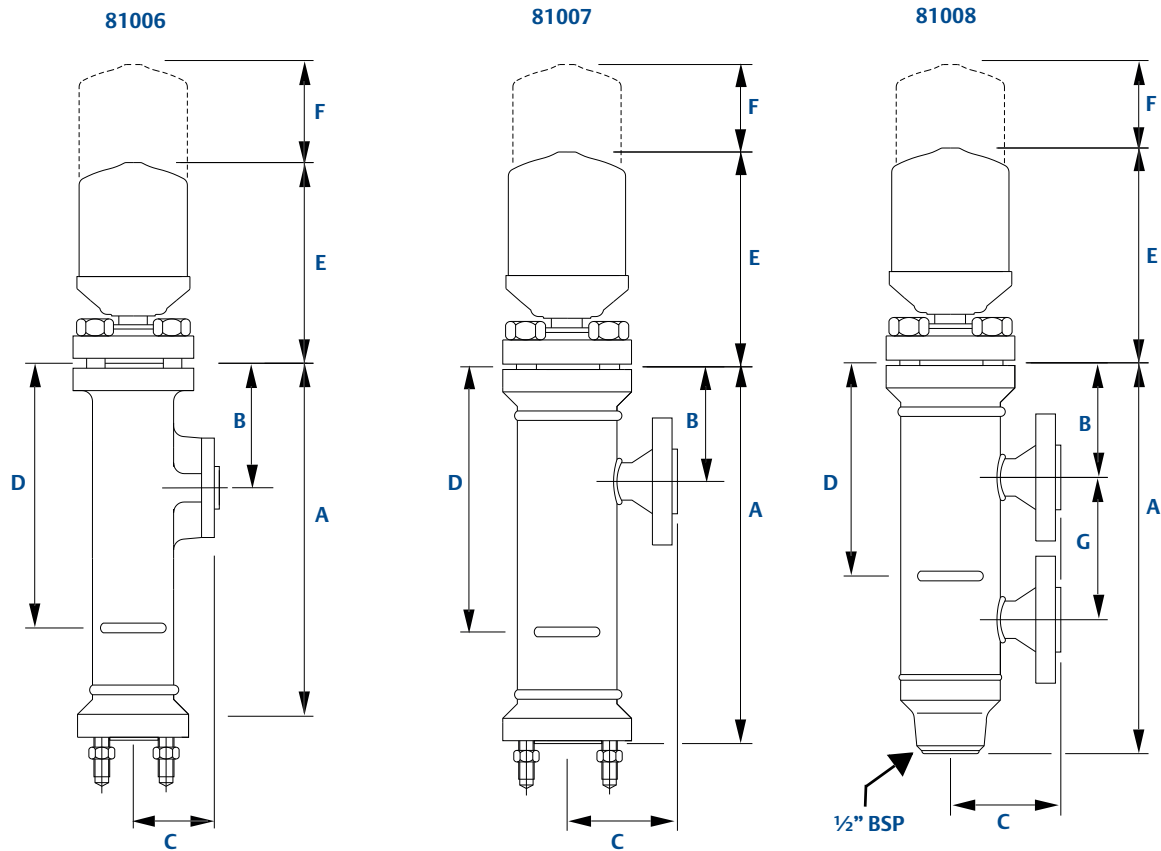
Multi-boiler installations operating on a common feed system require special sizing consideration and full details should be provided so that a suitable valve can be recommended.

**Figure 6. Installation with a modulating valve**



## Control units

Table 5. Standard control heads and chambers



Models are available for up to 32kg/cm<sup>2</sup> steam working. Details on request.

Table 6. Standard control heads and chambers

Type number	81006	81007	81008	81951
Material	Cast iron	Fabricated steel	Fabricated steel	Forged steel flange
Max. pressure kg/cm <sup>2</sup>	13	21	21	32
Connections	Side and bottom EN1092 DN25 PN16	Side and bottom EN1092 DN25 PN40	Side and side EN1092 DN25 PN25	Direct mounted EN1092 DN100 PN40
A	468	468	570	-
B	100	100	100	-
C	102	87	100	-
D	277	277	335	-
E	390	390	390	390
F	430	430	430	430
G	-	-	270	-

## Control box

Figure 7. Control box

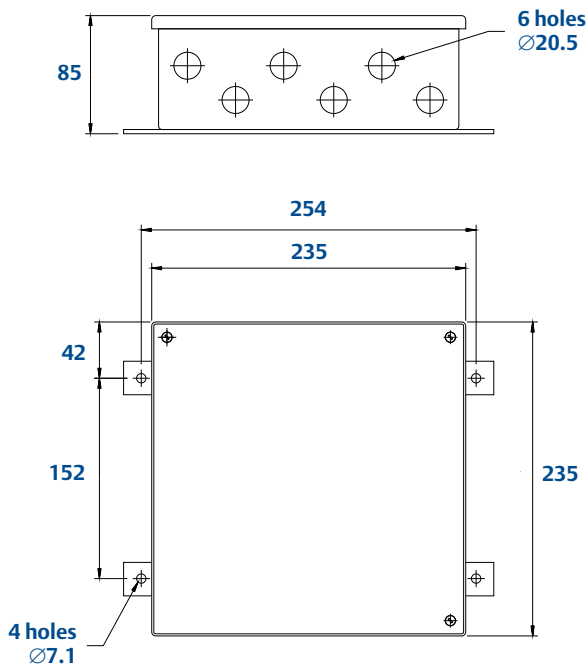


Table 7. Control box options

Type number	80436	80660
Input supply	240 Vac 50/60 Hz ±10%	110 Vac 50/60 Hz ±10%

### Electrical characteristics

Input circuit protected by 1 amp HRC fuse.

Alarm and control relays protected by 2 amp HRC fuses.

Relay contacts voltage free rating:-

- Maximum voltage: 250 Vac
- Maximum current: 2 amp

Facility available to special order for separate supply to solenoid valves with 2 Amp HRC maximum protection.

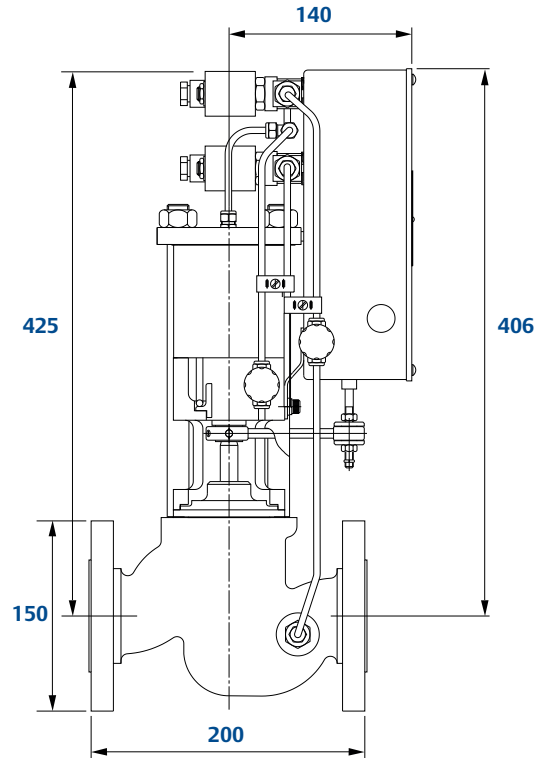
Output option: 0 to 10 V available on request.

### Important notice

Electronic control box must not be subjected to either vibration or excessive temperature. It is therefore recommended that they are NOT mounted directly on to the boiler shell.

## Modulating valves

Figure 8. Modulating valves



Valve body: Cast steel

Feed line pressure: Maximum 40 kg/cm<sup>2</sup>; Minimum 5.3 kg/cm<sup>2</sup>

Feed line temperature: Maximum 120 °C

Flanged EN1092 DN40 PN40 and 1½" BS10 table H

Table 8. Modulating valve options

Type number	Flanged	No. of solenoid valves	Electrical supply
80310/*	1½" table H	2	230 Vac 50 Hz
80311/*	DN40 PN40	2	230 Vac 50 Hz
80653/*	DN40 PN40	2	110 Vac 50 Hz
80486/*	DN40 PN40	2	230 Vac 50 Hz
80310/80435/*	1½" table H	3	230 Vac 50 Hz
80311/80435/*	DN40 PN40	3	230 Vac 50 Hz
80653/80435/*	DN40 PN40	3	110 Vac 50 Hz

### Note

The internal trim on the modulating valve can be changed without the need to replace the valve should operating conditions change.

**Sizing of valve lids**

A range of valve lids and associated seats are available, and provide linear flow characteristics. A table of Cv values for water (S.G.=1) is given below for valve lids in the fully open position.

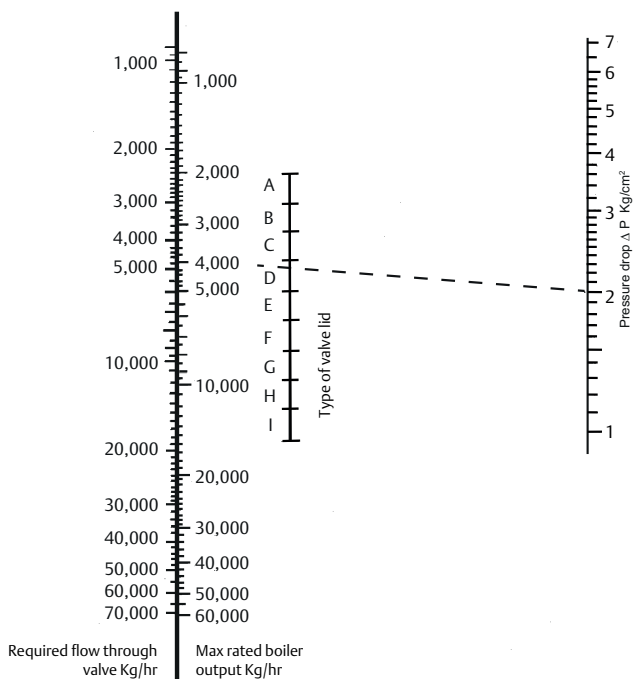
**Table 9. Sizing of valve lids**

Type of lid	Cv = kg/hr for 1 kg/cm <sup>2</sup>
A	1690
B	2260
C	3030
D	4100
E	5480
F	7480
G	9840
H	13520
I	18480

**Note**

The J-type Lid is available on request for larger boilers.

**Table 10. Modulating Level Controller valve size chart**



The formula for determining the Cv value and correct size of valve lid are given below. The pressure drop across the valve should be 1.4 kg/cm<sup>2</sup> or greater – normally, the higher the pressure drop the better the degree of control. The lid size is that with the nearest Cv value above the calculated value.

$$Cv = \frac{Q}{\sqrt{P}}$$

Where:

Q = Actual Evaporation of Boiler plus 15 per cent margin kg/hr.

P = Pump discharge pressure in kg/cm<sup>2</sup> when passing Q quantity of water minus (boiler max working pressure + 0.4 kg/cm<sup>2</sup>).

In the following example, an allowance of 0.4 kg/cm<sup>2</sup> has been made for all feed line losses. In practice, the allowance should be that of the installation under consideration and may well be in excess of 0.4 kg/cm<sup>2</sup>, particularly where the feed pump is remote from the boiler and/or where an anti-siphon valve adjacent to the boiler feed check valve has been fitted.

**Example**

Boiler evaporation (actual) = 4000 kg/hr.

Boiler working pressure = 6.6 kg/cm<sup>2</sup>

Pump discharge pressure at Q quantity = 6.6 kg/cm<sup>2</sup>

$$Cv = \frac{4000 \times 1.15}{\sqrt{11 - (6.6 + 0.4)}} = 2300$$

Lid required: Type C

# Sequencing blowdown valves



## Description

A purpose built flanged isolating angle and sequencing valve with ½” BSP screwed drain connection and back seating features, all valve trims are in stainless steel.

## Function

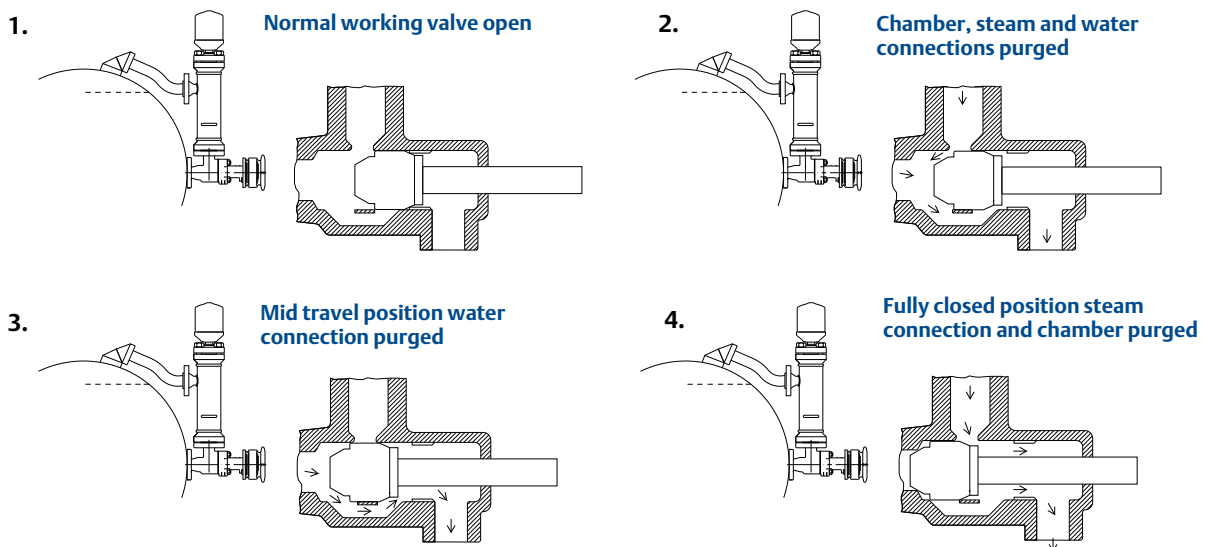
The Mobrey sequencing valve is designed to function as a combined water isolating valve and a sequencing valve to provide positive purging of the water connection, float chamber and steam connection of a boiler control.

Blowdown of float chamber and connections is effected separately and in a predetermined sequence by the operation of the single specially designed hand-wheel.

## Features

- One valve to provide separate blowdown of:
  - Control Chamber
  - Steam Connection
  - Water Connection
- Blowdown by predetermined sequence
- Stainless steel trim
- Back seating ensures packings are not subjected to continuous pressure
- Available with Imperial or Metric flanges
- Available for pressures up to 32 kg/cm<sup>2</sup>

**Figure 9. Sequence of operation**



## Dimensions and Ordering Information

Figure 10. Dimensions

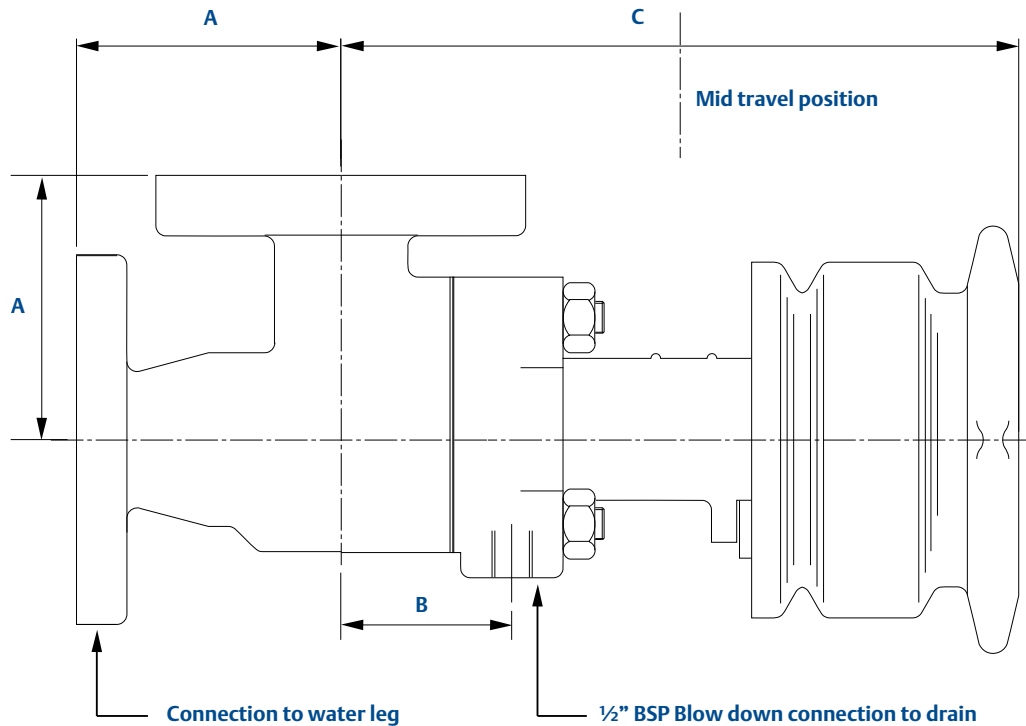


Table 11. Ordering information

Type number	Flange connections EN1092	Material body and stuffing box	Maximum working pressure (bar)	Dimensions		
				A	B	C
80938	DN25 PN16	Cast iron	13 <sup>(1)</sup>	83	54	219
80947	DN25 PN25	Gunmetal	21	83	54	219
80951	DN25 PN40	Cast steel	32	83	54	219
81390	BS10 Table H	Gunmetal	21	83	54	210

(1) The maximum working pressure is 10.5 bar for Lloyds applications.

### Important

The blowdown connection should be piped directly to an independent covered drain, or tun dish with removable lid, capable of accepting the full discharge without danger of blow-back. The bore of blowdown pipe should not be less than 12 mm and the length should be kept as short as possible. Sight glasses must not be fitted in the blowdown line.


### Blowdown procedure card


Delta Mobrey produce a useful blowdown procedure card, part number BP109, which is available on request.


## Head Office

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