

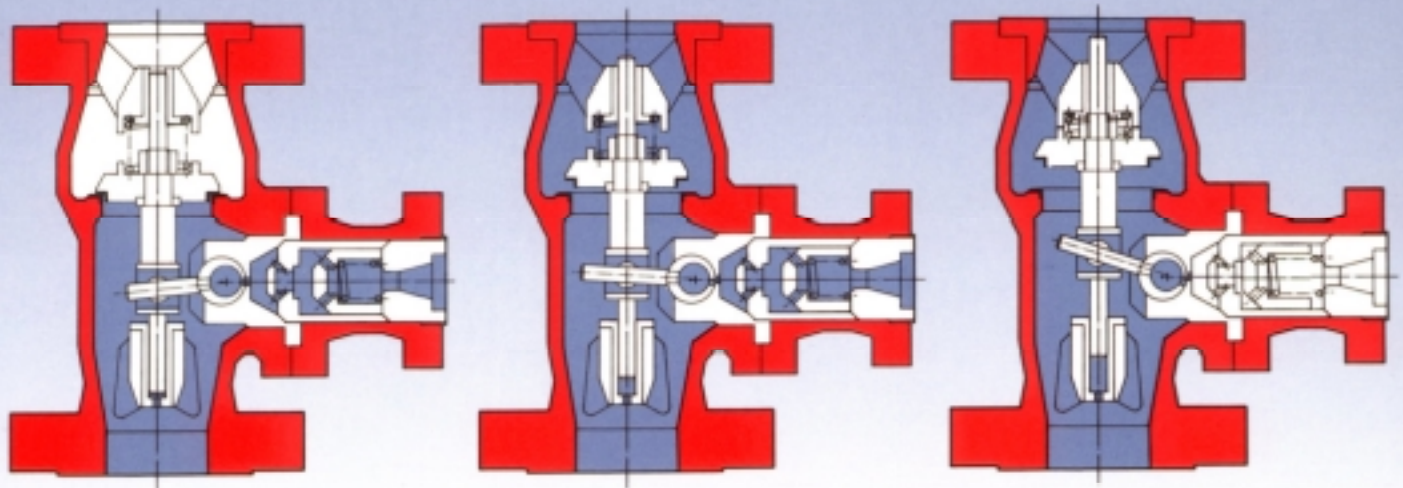
**BLACKHALL**  
**engineering**



**AUTOMATIC RECIRCULATION VALVE**

**BY-PASS NON-RETURN VALVE**

**SERIES**  
**6000**



**SAVES POWER COSTS**

**SAVES SYSTEM ENGINEERING TIME**

**SAVES INSTALLATION AND MAINTENANCE COSTS**

**REDUCES DOWNTIME**

**FIVE FUNCTIONS IN ONE**

**NO EXTERNAL POWER SOURCE**

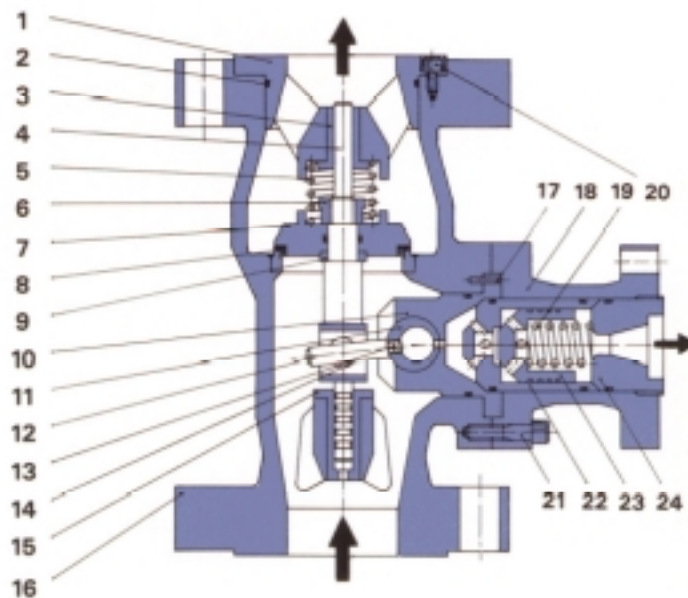
**CAVITATION ELIMINATED**

# INTRODUCTION

The demands of modern industrial processes has led to the need for higher and higher pressure. This in turn has created a need for centrifugal pumps with high heads and low specific speeds. Tolerances within such pumps have become smaller and this has led to the pumps being more sensitive to temperature increases. It is therefore essential that the flow through such pumps should not fall below minimum cooling quantities. The design of the flow control system for centrifugal pumps therefore demands certain essential functions:

- 1 Protection against pump over heating due to minimum cooling flow not being maintained.
- 2 The ability to rapidly build pressure to achieve hydraulic balance on start up.
- 3 Protection against flow reversal from the feed line on pump shut down.

The conventional flow control systems used to be complex and troublesome, relying on multiple interlinked valves and pressure switches. The **Blackhall** Automatic Recirculation Valve was designed specifically to simplify the flow control system. Since 1965 Blackhall Valves have proven themselves to be not only reliable but also extremely flexible, being utilised in areas ranging from the Power Generation to Petro Chemical installations.

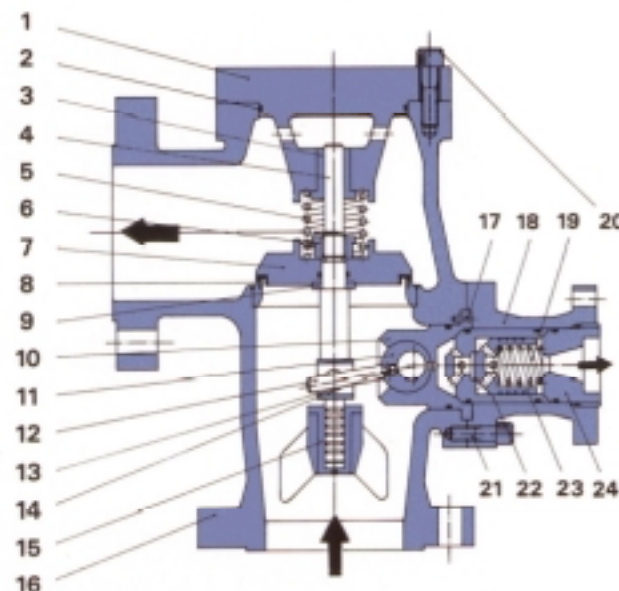


**STRAIGHT WAY**

REF	COMPONENT	MATERIAL	BRITISH STANDARD
1	Cover	Carbon Steel	BS970-070 M20
2	'O'-Ring Seal	Viton 'A'	-
3	Top Bush	HT Brass	BS 2874-CZ114
4	Spindle	Stainless Steel	BS 970-431S29
5	Stopper Spring	Stainless Steel	BS 2056-316S42
6	Stopper Nut	Stainless Steel	BS 970-304S15
7	Stopper	Carbon Steel Stellite 6 Faced	BS 970-070M20
8	Seat	Carbon Steel Stellite 6 Faced	BS 970-070M20
9	Adjusting Washer	Stainless Steel	BS 970-304S15
10	1st Stage Nozzle	Stainless Steel	BS 970-420S29
11	By-Pass Valve	Aluminium Bronze	BS 2874-CA104
12	Lever	Stainless Steel	BS 970-431S29
13	Grubscrew	Stainless Steel	BS 4168 GrA2
14	Lever Bush	Aluminium Bronze	BS 2874-CA104
15	Bottom Bush	H.T. Brass	BS 2874-CZ114
16	Body	Cast Steel	BS 1504-161-480
17	Dowel Pin	Stainless Steel	BS 970-304S15
18	By-Pass Housing	Cast Steel	BS 1504-161-480
19	NRV Spring	Stainless Steel	BS 2056-316S42
20	Capscrews	High Tensile Steel	BS 2470 Gr12.9
21	Capscrews	High Tensile Steel	BS 2470 Gr12.9
22	2nd Stage Nozzle	Stainless Steel	BS 970-420S29
23	Non-Return Valve	Aluminium Bronze	BS 2874-CA104
24	Final Stage Nozzle	Stainless Steel	BS 970-420S29

## VALVE MATERIAL SPECIFICATION

Materials of construction are carefully selected to suit individual service conditions, and vary widely from Carbon Steel (see table) for Boiler Feed water duty to Duplex stainless steels for Off-Shore applications.



**ANGLE PATTERN**

# VALVE

## DESIGN

The **Blackhall** range of Automatic Recirculation Valves have been designed to give absolute reliability with maintenance requirements minimised. Each **Blackhall** valve is designed specifically to suit the individual customers' requirements. The range includes both ON/OFF and Modulating options with options available in Angle or Straightway pattern design. The Angle pattern valve has the additional feature of not requiring removal from the pipeline during maintenance 'Shut Downs'.

### By-Pass Configuration ON/OFF

The **Blackhall** ON/OFF Automotive Recirculation valve is really a system which incorporates five functions in one:

#### 1 NON RETURN VALVE:

preventing reverse flow through the centrifugal pump via the main line.

#### 2 BY-PASS CONTROL VALVE:

protecting the pump from overheating by regulating a passage of fluid through the pump during START UP, SHUT DOWN and when the pump is run against a closed outlet.

#### 3 FLOW SENSING CAPABILITY:

which actuates the by-pass control valve.

#### 4 PRESSURE REDUCTION NOZZLES:

which dissipate the pressure energy, and allows the line fluid to be delivered to the by-pass system quietly and safely.

#### 5 NON-RETURN VALVE:

preventing reverse flow through the centrifugal pump via the by pass line.

# O P E R A T I O N

When the pump is started the stopper (7) initially remains closed, with the by-pass valve (11) fully open. The by-pass is individually sized to pass a fixed minimum quantity and at the same time reduce the pump outlet pressure to a lower figure as determined by the by-pass system configuration. The pressure reduction within the by-pass is achieved by passing the flow through a series of opposed orifices. As the pump delivery pressure increases the spring (5) pre-load and any back pressure on the main valve outlet are overcome and the stopper (7) starts to open.

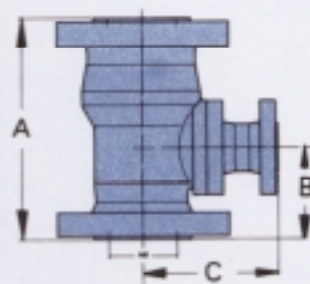
The stopper (7) is fitted with a parallel skirt which is designed to ensure a positive opening action; within the same action the by-pass valve (11) closes. The positive closure ensures the by-pass valve (11) is either fully open or fully closed and never in a partially open position.

As the main flow continues to rise, so too does the stopper (7), until eventually normal running delivery is achieved. When the pump is shut down the reverse action takes place. To prevent "slamming", the bottom spindle bush has been fitted with a damping device which comprises of an orifice through which the line fluid has to be ejected.

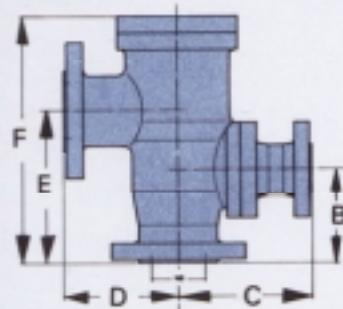
If at any point the pump is run against a closed outlet, the by-pass valve (11) remains fully open, thus ensuring minimum flow is always maintained.

# D I M E N S I O N S

## STRAIGHT WAY



## ANGLE PATTERN



VALVE SIZE	A	B	C	D	E	F
DN65 (2 1/2")	360	143	211	208	264	400
DN80 (3")	360	143	211	208	264	400
DN100 (4")	440	184	286	229	264	440
DN150 (6")	500	187	302	229	370	560
DN200 (8")	552	222	378	254	435	625
DN250 (10")	1000	350	575			
DN300 (12")	1050	350	600			
DN350 (14")	1200	394	688		ON APPLICATION	
DN400 (16")	1250	394	699			
DN450 (18")	1300	394	699			

Larger sizes available on request.

Due to diversity of flow conditions, the above dimensions are subject to conformation on receipt of order.

END CONNECTION AVAILABLE : FLANGED, BUTTWELD  
 PRESSURE RATING : CL150 TO CL2500  
 : PN16 TO PN420

NOTE: BY-PASS FLANGE SIZE AND RATING TO BE ADVISED UPON RECEIPT OF DESIGN DATA BY CLIENT.



**PURCHASE**

**REQUIREMENT DATA**

**SERVICE:**

Boiler Feed  
Condensate  
Process  
Fire pump  
Other

**MAIN FLOW (m<sup>3</sup>/h):**

Normal Flow  
Maximum Flow  
Minimum Process Flow

**MINIMUM PUMP FLOW/  
BY-PASS FLOW (m<sup>3</sup>/h):**

**FLUID:**

**TEMPERATURE (°C:Min/Max):**

**SPECIFIC GRAVITY:**

**VAPOUR PRESSURE (bar a):**

**VISCOSITY (Centipoise):**

**PUMP DISCHARGE  
PRESSURE (bar g):**

@ Normal Flow  
@ By-Pass Flow  
@ Shut-Off

**BY-PASS LINE PRESSURE  
(bar g):**

**MODE OF OPERATION:**

On/Off  
Modulating

**END CONNECTIONS:**

Flanged  
Butt Weld  
Rating

**INSTALLATION:**

Horizontal  
Vertical

**VALVE TYPE:**

Straight Way  
Angle Pattern

**OTHER VALVES  
IN THE  
BLACKHALL RANGE**

Series 5000 & 7000 Automatic Recirculation Valves

Pressure Reducers

4-Way Cardio Switch Valves

Cryogenic gate, globe & check valves

Titanium gate, globe & check valves

High temperature gate & plate valves

'Blakeborough' Larner-Johnson flow control valve

Bespoke valve - any temperature/any pressure/any fluid

Complete valve maintenance and service department



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