

# 08V

07/04

## Cast Steel Temperature Control Valve

R Valve



### Typical applications

- Refrigeration compressors
- Industrial compressors
- Turbines
- Engines
- Gear boxes
- High pressure applications

### Key benefits

- No leak design
  - No external moving parts
  - No external dynamic seals
- Easily removable elements
- Environmentally friendly, reliable performance
- Easy installation - operates in any mounting position

# Positive acting temperature control

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AMOT thermostatic valves provide reliable control of fluid temperatures in cooling systems, heat recovery and many other temperature control applications.

They are also suitable for process control and industrial applications where fluids must be mixed or diverted depending upon temperature.

All AMOT internally sensed valves have positive 3-way action. This ensures that on process start up all of the flow is through the bypass line giving the fastest possible warm up time.

Operation and flow control is established by the temperature element, which constantly monitors and regulates the medium to the exact specified temperature setting.

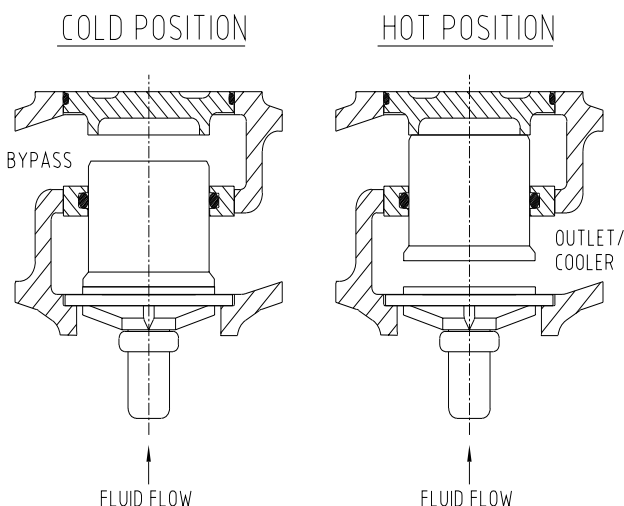
When required the valve will positively shut off the bypass line to give full cooling.

A 3-way valve ensures constant volume flow in the system and gives no restriction during the warm up cycle, ensuring maximum performance. Where shut off is not required, bypass holes are available.

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## Operation

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The temperature control power is created by the expansion of a wax/copper mixture which is highly sensitive to temperature changes.

Large forces are created by the warming/expansion of the mixture which in turn acts upon the sliding valve, thus regulating the flow.

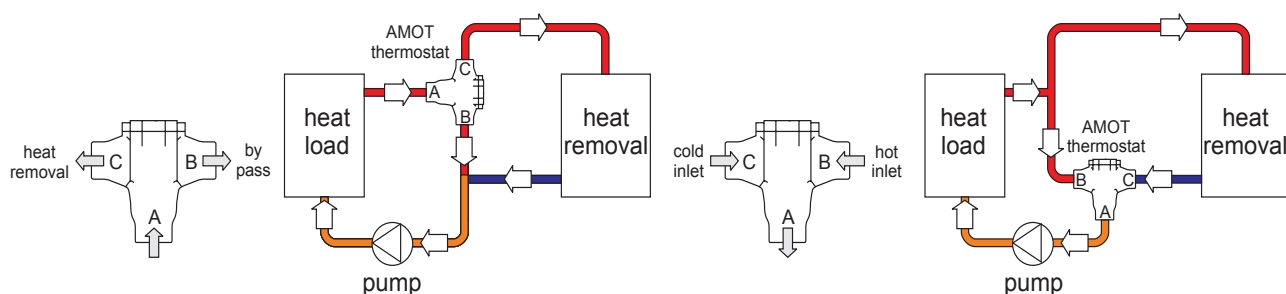
The diagram opposite shows the valve actuation in diverting mode at start and cooling positions.

During operation the sliding valve constantly modulates for accurate temperature control.

The reliable rugged construction provides a unit sensitive to temperature variations, not easily disturbed by pressure changes and sudden surges, which maintains stable temperatures over a wide range of operating conditions.

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# Typical installation diagrams



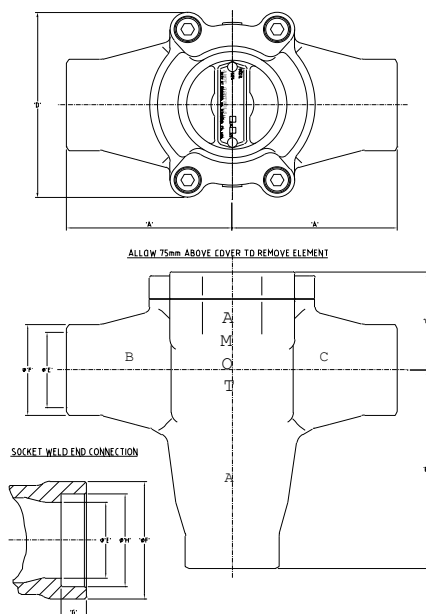
## Specification

<b>Body material</b>	Cast steel BS 3146 CLA 1A-ASTM A216 Grade 1.0169 (GSC 25N)	WCB-DIN 17245
<b>Element material</b>	Standard elements are of electroless nickel plated brass and bronze	Elements without plating available (refer to specification check list on page ix)
<b>Seal materials</b>	Neoprene/VITON	
<b>Port connections</b>	Flanged or welded.	Refer to part number specification check list on page ix for detail
<b>Valve sizes (nominal bore)</b>	20 - 80mm	( <sup>3</sup> / <sub>4</sub> " - 3")
<b>Control temperatures</b>	35°C to 82°C	(95°F to 180°F)
<b>Flow rate</b>	4 to 70m <sup>3</sup> /hour (18 to 308 US gpm)	Based on water
<b>Pressure rating</b>	10 - 45 bar	(145 - 650 psi)
<b>Recommended pressure drop</b>	0.14 to 0.48 bar	(2 to 7 psi)

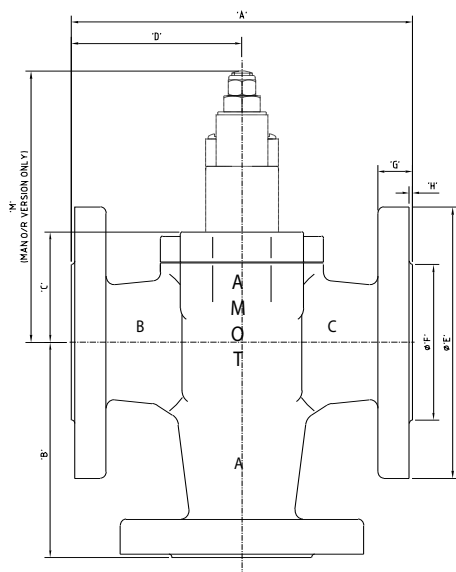
## Model/size availability

Connection versus size availability									
Size mm (")	B	C	J	H	X	Y	Z	T	U
20 ( <sup>3</sup> / <sub>4</sub> )					✓	✓	✓	✓	✓
25 (1)	✓	✓	✓	✓	✓	✓	✓	✓	✓
40 (1 1/2)	✓	✓	✓	✓	✓	✓	✓	✓	✓
50 (2)	✓	✓	✓	✓	✓	✓	✓	✓	✓
65 (2 1/2)	✓	✓	✓	✓	✓	✓	✓		
80 (3)	✓	✓	✓	✓	✓	✓	✓		

# Dimensions



Allow 75mm above cover or manual override to remove element



General				
Nominal bore	20, 25 & 40mm		50, 65 & 80mm	
Connection	Butt	Socket	Butt	Socket
A	85	95	100	110
B	105	115	132	142
C	52	52	64	64
D	102	102	123	123

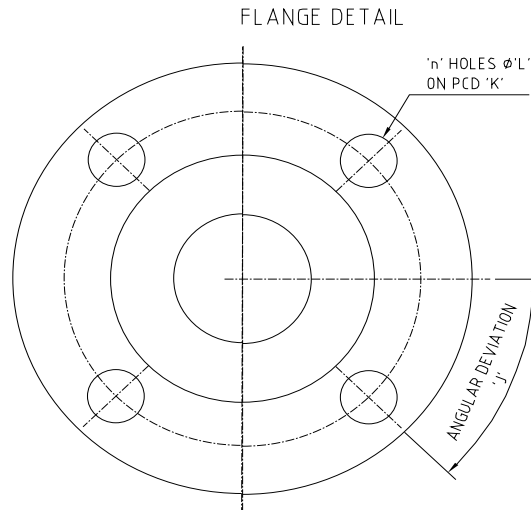
Butt weld DIN 2448 PN40						
Nominal bore	20 (3/4")	25 (1")	40 (1 1/2")	50 (2")	65 (2 1/2")	80 (3")
Dia E	22.3	28.5	43.1	54.5	70.3	78
Dia F	27	34	48	60	76	89
Weight Kg (lbs)	3.2 (7)	3.2 (7)	3.5 (8)	7 (15)	7 (15)	17.5 (39)

Butt weld schedule 40						
Nominal bore	20 (3/4")	25 (1")	40 (1 1/2")	50 (2")	65 (2 1/2")	80 (3")
Dia E	20.9	26.6	40.9	52.5	N/A	N/A
Dia F	27	34	48	60	N/A	N/A
Weight Kg (lbs)	3.2 (7)	3.2 (7)	3.5 (8)	7 (15)	N/A	N/A

Socket weld ANSI 16.11						
Nominal bore	20 (3/4")	25 (1")	40 (1 1/2")	50 (2")	65 (2 1/2")	80 (3")
Dia E	20	25	40	50	65	N/A
Dia F	38	46	62	74	92	N/A
G	13	13	13	16	16	N/A
Dia H	27.2	33.9	48.8	61.2	74	N/A
Weight Kg (lbs)	3.5 (8)	3.5 (8)	4 (9)	7.5 (16)	7.5 (16)	N/A

General - dimensions in mm (inches)								Weight Kg (lbs)		
Type	Size	A	B	C	D	M	N	Metric	ANSI 150lb	ANSI 300lb
RF3	25 (1")	178 (7")	101 (4")	52 (2")	89 (3.5")	127 (5")	90 (3.54")	6 (13)	5.5 (12)	7 (15)
RF5	40 (1 1/2")	178 (7")	101 (4")	52 (2")	89 (3.5")	127 (5")	90 (3.54")	9 (19)	7.5 (17)	10 (22)
RF6	50 (2")	225(8.86")	149 (5.87")	63 (2.48")	113 (4.45")	TBA	125 (4.92")	15 (33)	13.5 (30)	15 (33)
RF7	65 (2 1/2")	254 (10")	165 (6.5")	63 (2.48")	127 (5")	TBA	125 (4.92")	16 (36)	17 (37)	19.5 (43)
RF8	80 (3")	267 (10.5")	171 (6.73")	72 (2.83")	134 (5.28")	114 (4.49")	140 (5.51")	29 (64)	30 (66)	31 (68)

# Dimensions continued



Flange details - ND10/ND16								
Type	Dia E	Dia F	G	H	Dia K	Dia L	N	J
RF3	115 (4.53")	68 (2.68")	16 (0.63")	2 (0.08")	85 (3.35")	14 (0.55")	4	45°
RF5	150 (5.91")	88 (3.46")	18 (0.71")	3 (0.12")	110 (4.33")	18 (0.71")	4	45°
RF6	165 (6.5")	102 (4.02")	20 (0.79")	3 (0.12")	125 (4.92")	18 (0.71")	4	45°
RF7	185 (7.28")	122 (4.80")	20 (0.79")	3 (0.12")	145 (5.71")	18 (0.71")	4	45°
RF8	200 (7.87")	138 (5.43")	22 (0.87")	3 (0.12")	160 (6.3")	18 (0.71")	8	22.5°

Flange details - ANSI 150lb								
Type	Dia E	Dia F	G	H	Dia K	Dia L	N	J
RF3	108 (4.25")	66.5 (2.62")	14.2 (0.56")	1.52 (0.06")	79.2 (3.12")	15.7 (0.62")	4	45°
RF5	127 (5")	73.2 (2.88")	17.5 (0.69")	1.52 (0.06")	98.6 (3.88")	15.7 (0.62")	4	45°
RF6	152.4 (6")	92 (3.62")	19.5 (0.77")	1.52 (0.06")	120.7 (4.75")	19.5 (0.77")	4	45°
RF7	177.8 (7")	104.6 (4.12")	22.4 (0.88")	1.52 (0.06")	139.7 (5.5")	19.5 (0.77")	4	45°
RF8	190.5 (7.5")	127 (5")	25.5 (1")	1.52 (0.06")	152.4 (6")	19.05 (0.75")	4	45°

Flange details - ANSI 300lb								
Type	Dia E	Dia F	G	H	Dia K	Dia L	N	J
RF3	124 (4.88")	66.5 (2.62")	17.5 (0.69")	1.52 (0.06")	88.9 (3.5")	19.05 (0.75")	4	45°
RF5	155.4 (6.12")	73.2 (2.88")	20.6 (0.81")	1.52 (0.06")	114.3 (4.5")	22.4 (0.88")	8	22.5°
RF6	165.1 (4.5")	92 (23.62")	22.5 (0.89")	1.52 (0.06")	127 (5")	22.4 (0.88")	8	22.5°
RF7	190.5 (7.5")	104.6 (4.12")	25.4 (1")	1.52 (0.06")	149.4 (5.88")	22.4 (0.88")	8	22.5°
RF8	209.6 (8.25")	127 (5")	28.4 (1.12")	1.52 (0.06")	168.1 (6.62")	22.4 (0.88")	8	22.5°

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# Temperature settings

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A wide selection of temperatures are available. Follow the equipment manufacturers' guidelines for oil systems and for specific operating temperatures of cooling/heating systems.

In general the temperature quoted is the nominal operating temperature in diverting mode on water systems.

For long life AMOT valves should not be operated continuously at temperatures in excess of their maximum continuous rating. If this condition is anticipated then consult AMOT for suitable alternatives.

For mixing and oil circuits the temperature may be 1 to 2°C higher due to flow, viscosity and other system parameters.

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# Leakholes

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Leakholes can be drilled to allow fluid between ports B and C:

1. To allow small flows to cooler during start up which slows down warm up cycle.
2. To allow small flows to maintain some flow through cooler in order to prevent condensation or, in extreme cases, freezing. In applications where additives are not or cannot be used.

In applications where a valve is used as 2-way, with port 'B' blocked and when the circuit is cold and the valve closed, a leakhole is necessary to ensure small flow in order to detect a temperature change in the system.

# Manual override option

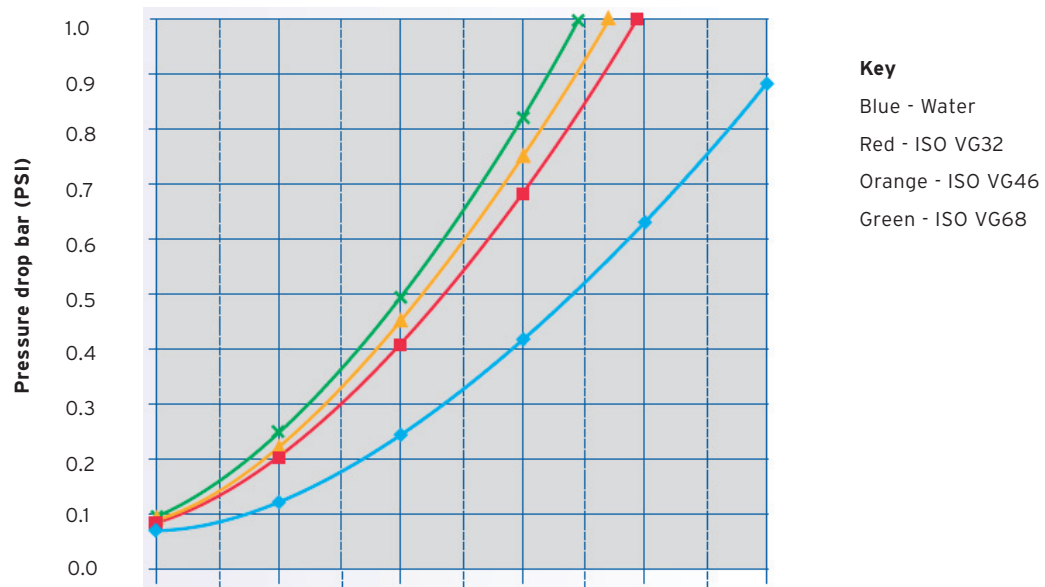
R type valves are fitted with a variable manual override which allows a progressive opening of port A to C.

Manual override is often a requirement for marine applications.

In automatic mode the valve will control the temperature automatically, but turning the adjusting nut on top of the operator clockwise will cause the element to move toward its hot (extended) position, regardless of temperature. There is a position indicator on each manual override which shows the element position during manual operation. Each element assembly has its own Manual Override.

Manual Override should only be used in case of an emergency or element failure.

# Valve characteristics



Size	Kv	♦	♦	♦	♦	♦	♦
20mm (3/4")	14	3 (13)	5 (22)	7 (31)	9 (40)	11 (48)	13 (57)
25mm (1")	16	4 (18)	6 (26)	8 (35)	10 (44)	12 (53)	14 (61)
40mm (1 1/2")	22	5 (22)	8 (35)	11 (48)	14 (62)	17 (75)	20 (88)
50mm (2")	44	10 (44)	16 (70)	22 (97)	28 (123)	34 (150)	40 (176)
65mm (2 1/2")	79	20 (88)	27 (119)	40 (176)	50 (220)	62 (273)	74 (326)
80mm (3")	87	22 (97)	30 (132)	51 (224)	60 (264)	70 (308)	82 (360)

Flowrate m<sup>3</sup>/hr - water

## Flow coefficient

AMOT valve flow coefficient (calculated)		
Size	Kv	Cv
20mm (3/4")	14	16
25mm (1")	16	18
40mm (1 1/2")	22	25
50mm (2")	44	51
65mm (2 1/2")	79	91
80mm (3")	87	101

The basic formula to find a valve's Cv is shown opposite (1). Kv is the metric equivalent to Cv.

There are two ways the formula can be written to find the flow in metres cubed per hour and find the pressure drop in bar. These are shown opposite (2).

(3) shows the calculation adjusted for US measurements, with formulae to find the flow coefficient, flow in US gallons and pressure drop in Psi.

A Cv is the valve's flow coefficient (Kv is the metric coefficient). It is defined as the number of US gallons per minute of room temperature water which will flow through the valve with a pressure drop of 1 PSI across the valve (see table).

$$1. \quad K_v = Q \sqrt{\frac{SG}{DP}}$$

Q = Flow in m<sup>3</sup> per hour  
 Dp = Pressure drop in Bar  
 SG = Specific gravity of fluid (water = 1.0)  
 Kv = Valve flow coefficient

$$2. \quad Q = K_v \sqrt{\frac{DP}{SG}} \quad DP = \left(\frac{Q}{K_v}\right)^2 SG$$

$$3. \quad C_v = Q \sqrt{\frac{SG}{DP}}$$

Q = Flow in US gallons  
 Dp = Pressure drop (Psi)  
 SG = Specific gravity of fluid (water = 1.0)  
 Cv = Valve flow coefficient

$$Q = C_v \sqrt{\frac{DP}{SG}} \quad DP = \left(\frac{Q}{C_v}\right)^2 SG$$

## Element characteristics

All temperatures in °C (°F)

Control temperature	Temp. range		Max. continuous		Code
	20 - 40mm (")	50 - 80mm (")	20 - 40mm (")	50 - 80mm (")	
35 (95)	30-40 (86-104)	29-41 (85-105)	15 (122)	49 (120)	095
38 (100)	33-42 (91-108)	34-42 (91-108)	75 (167)	50 (122)	100
43 (110)	38-47 (100-117)	38-47 (100-117)	82 (180)	56 (133)	110
49 (120)	43-55 (110-131)	43-54 (110-130)	88 (191)	66 (150)	120
54 (130)	49-60 (120-140)	51-60 (124-140)	95 (203)	68 (158)	130
60 (140)	54-65 (130-150)	57-66 (135-151)	99 (210)	74 (165)	140
66 (150)	60-71 (140-160)	63-72 (145-161)	100 (212)	82 (180)	150
71 (160)	65-76 (150-170)	68-78 (155-173)	100 (212)	88 (190)	160
77 (170)	72-82 (163-180)	74-83 (165-181)	100 (212)	93 (200)	170
79 (175)	76-85 (170-185)	77-85 (170-185)	105 (221)	102 (215)	175
82 (180)	79-88 (175-190)	79-88 (175-191)	110 (231)	104 (220)	180

# Viscosity correction

For the selection of valves for use with more viscous fluids than water, the following must be calculated in addition to using the previously mentioned formulae:

- Viscosity

Find the viscosity of the fluid to be used in the valve. This will generally be in centistokes.

ISO grade oil is easy to calculate as the grade no. is the viscosity.

i.e. ISO VG 46 = 46 centistokes at 40°C (110°F)

- Viscosity Correction

Once the viscosity value has been found, the Flow Coefficient correction factor can be established using the viscosity correction graph below.

The correction value that is produced by the graph should then be multiplied by the original Flow Coefficient. This gives the corrected Flow Coefficient, which can then be used in the standard formulae.

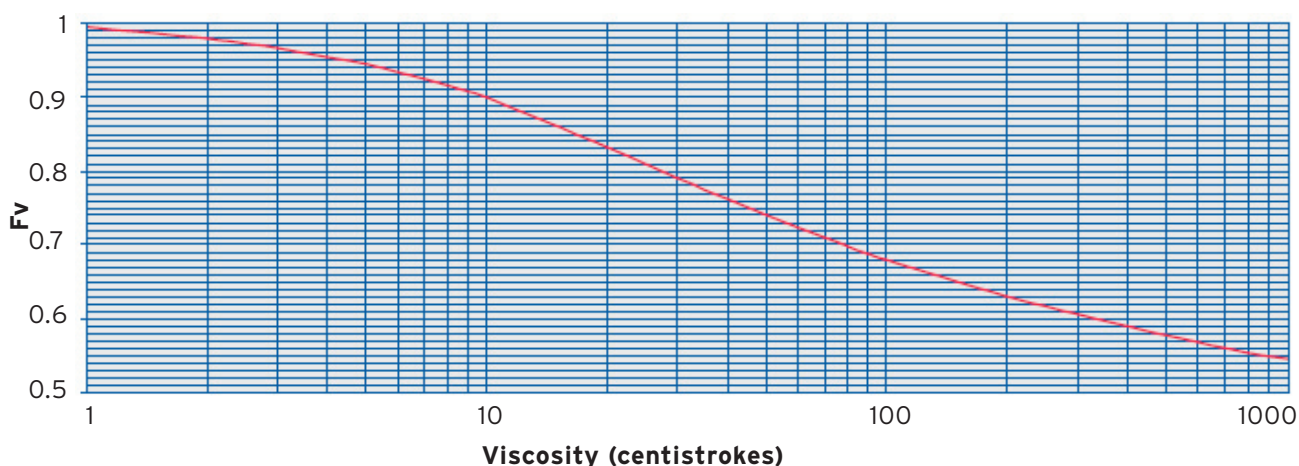
e.g:

100 CST = correction factor of 0.68

0.68 x Flow Co. = corrected Flow Co. (Kv or Cv)

## Viscosity correction graph

Viscosity correction curve (Fv)



## SAE oils viscosities

Engine Oils	
Oil	CST
SAE 5W	6.8
SAE 10W	32
SAE 20	46
SAE 20W	68
SAE 30	100
SAE 40	150
SAE 50	220
6 B	394
8 B	571

Gear Oils	
Oil	CST
SAE 75W	22
SAE 80W	46
SAE 85W	100
SAE 90	150
SAE 140	460

Approximate viscosities of SAE oils at 40°C (110°F) (CST).

Based on leading oil manufacturers' published data.

# Specification check list

Use the tables below to select the unique specification of your R Valve.

Please select one characteristic from each section. Each characteristic is associated with a code that you will need to state when ordering.

Type	Code	✓
Standard construction	RO	
Manual override fitted	RM	

Valve size		Code	✓
Nominal bore	No. of elements		
20mm (3/4")	1	20	
25mm (1")	1	25	
40mm (1 1/2")	1	40	
50mm (2")	1	50	
65mm (2 1/2")	2	65	
80mm (3")	2	80	

Material	Code	✓
Steel BS:3146 CLA a! - ASTM A216 WCB - DIN 17245 GSC25N	S	

Connection	Max. working pressure	Code	✓
Flanged ND10	10 bar	B	
Flanged ND16	16 bar	C	
Flanged ANSI 150lb	16 bar	J	
Flanged ANSI 300lb	45 bar	H	
Butt weld DIN 2448 PN40	35 bar	X	
Socket weld ANSI B16.11	35 bar	Y	
Butt weld ANSI B36.10 SCH.40	35 bar	Z	
Screwed NPT B2.1	35 bar	T	
Screwed BSP.PL	35 bar	U	

Nominal temperature °C (°F)	Code
See element characteristics table on page vii Code located in last column	

Element code			Code	✓
Seal material	Plating	Type		
Nitrile	None	Standard	01	
Viton			02	
Neoprene			03	
Nitrile	Electroless Nickel		04	
Viton			05	
Neoprene			06	
Nitrile	None	Manual override	07	
Viton			08	
Neoprene			09	
Nitrile	Electroless Nickel		10	
Viton			11	
Neoprene			12	

Leakhole diameter between ports B & C mm (inches)	Code	✓
None	0	
2 (.079)	2	
3 (.118)	3	
4 (.157)	4	
5 (.197)	5	
6 (.236)	6	
8 (.315)	8	

Leakhole quantity (no. of elements with leak hole, maximum 1 per element)	Code
Refer to valve size table for number of elements	

Special requirements	Code	✓
Standard	AA	
Please contact us for any special requirements		
Notes		

Once you have made your selection, or if you need advice, please call us on:

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