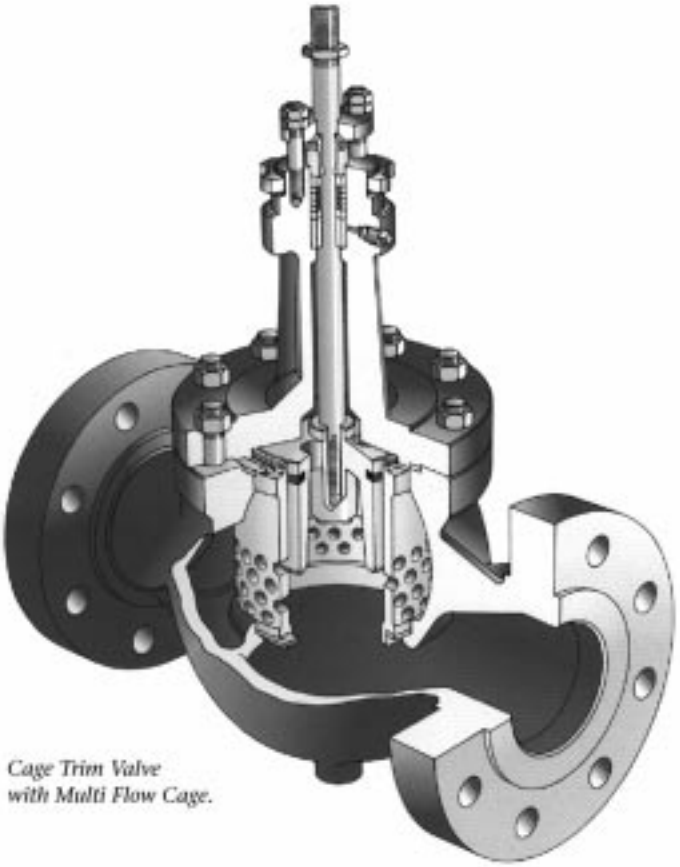
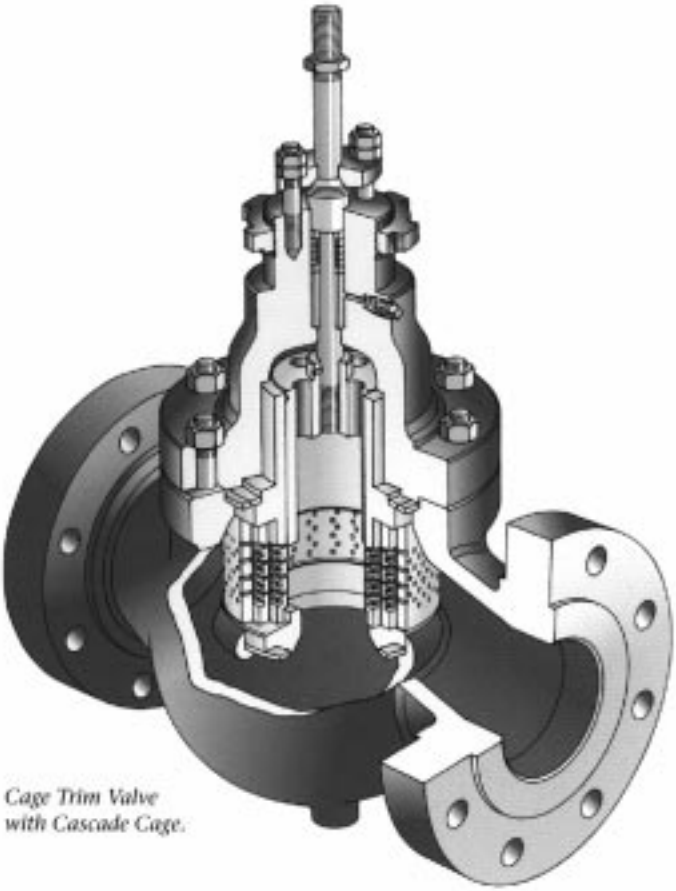
HOPKINSONS
BLAKEBOROUGH
CONTROL VALVES

CAGE TRIM VALVES
BV500/1 & BV990/2



Cage Trim Valve with Multi Flow Cage.



Cage Trim Valve with Cascade Cage.

DESCRIPTION

The Blakeborough cage trim series of control valves, BV500 and BV990, is designed to meet the requirements of most process control applications.

These ranges of control valves have been developed by Blakeborough to meet the ever increasing demands of modern day processing plant.

The valves incorporate high integrity features of previous designs together with a highly flexible philosophy of trim design options.

There is a wide range of standard and high duty trims available which can be fitted within the same valve body. The options include 'Multi-flow', 'Cascade' (2 to 5 stages of letdown) and various designs which can be manufactured to suit the specific application.

At the enquiry stage Blakeborough will consider the most suitable combination of valve components for each application. Pressure drop, noise, potential for cavitation are all considered to give the most cost effective solution for the particular application.

DESIGN FEATURES

- Cage guided
- Wide range of trim options
- High stability
- Easy maintenance

PRESSURE RATING

- Class 150LB to 4500LB
  PN10 to PN640

SIZES

- 40mm to 750mm
  1 1/2" to 30"

TRAVELS

- 28.5mm to 300mm
  1 1/8" to 12"

END CONNECTIONS

- Flanged (all current standards)
- Butt weld
- Socket weld
- Screwed
- Clamped ends

HOPKINSONS
BLAKEBOROUGH
CONTROL VALVES

VERSATILITY

Blakeborough Cage Trim Valves offer a wide choice of options to meet most system requirements, eliminating or greatly reducing the multiplicity of valve designs that would otherwise be required.

This flexible range of valves offers an extensive selection of trim designs, materials and sizes, and is therefore able to meet the ever increasing demands of modern day plant. All parts are interchangeable between globe and angle style valves in a given size and pressure rating.

Parts substitution, internal inspection and maintenance are effected with minimum trouble, the essential working components being removable while the body remains undisturbed in the pipeline.

- Simple, low cost, in line maintenance
- Comprehensive interchangable parts systems
- High-stability plug guiding
- High flow capacity

MAIN DESIGN STANDARDS

- ASME B16.34 - Valves-Flanged, Threaded & Welding End
- ANSI FCI 70-2 - Control Valve Seat Leakage
- ASME B16.25 - Butt Welding Ends
- ASME B16.5 - Pipe Flanges & Flange Fittings
- NACE MR-01-75 Valve Materials (option)
- BS1560 - Circular Flanges for Pipes, Valves & Fittings
- BS4504 - Circular Flanges for Pipes, Valves & Fittings

FEATURES

Pressure ratings

- ANSI Class 150lb to 600lb (BV500 Series)
- ANSI Class 900lb to 4500lb (BV990 Series)
- Equivalent metric pressure ratings

Body

- A choice of globe or angle patterns available
- BV500 & BV990 Globe body
- BV501 & BV992 Angle body

Body Materials

The Cage Trim series valves can be produced in most forms of castable alloys. Standard body materials are:-

- Carbon steel; Grade WCB
- Stainless steel; Grade 316/304/347
- 1.1/4% chrome moly. steel; Grade WC6
- 2.1/4% chrome moly. steel; Grade WC9
- Monel
- Aluminium Bronze
- Hastelloy B/C
- Duplex/Super duplex
- Most other materials can be cast in the on site foundry

Trim Options

- Multi-Flow (MF) – standard
- Cascade (CS) – severe service duties
- Soft faced – for tight shut off
- Variable Stage Cascade (VS)
- Single stage Multi-Flow (SS)
- Flash cone
- Pilot balanced

CAGE TRIM VALVES
BV500/1 & BV990/2

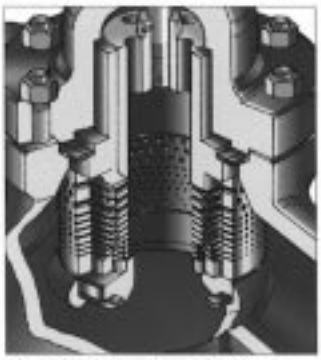
CAGE DESIGNS

Multi-Flow (MF) – Single stage of pressure drop

This form of trim design is fitted as standard and is suitable for most flow control applications (refer to front cover detail). In this design the flow is broken up into multiple jets by a number of radial holes in the cage. The flow is conventionally from outside to inside the trim so that jet impingement/high turbulence levels are controlled within the confines of the valve cage. Impingement of the jets within the valve cage produces a more stable downstream flow, reduces the effect of large scale separation and produces a smaller scale turbulence structure in the valve outlet. This in turn leads to a reduction in acoustic efficiency and changes the power spectrum of the generated noise, both of which contribute to a noise level reduction of between 15 and 20 dBA compared to a contoured or ported trim valve. Further noise reduction in this style of trim can be achieved by reducing the size of the jets in the cage by drilling smaller holes, this design is referred to as the Single Stage Multi-Flow (SS), and can lead to a further 5 dBA reduction in noise level.

Cascade (CS)

(Refer to front cover for details) The Cascade valve trim is a further advancement over the standard Multi-flow valve cage. It is used in control applications where high noise levels or cavitation would be predicted, with a standard trim design. Noise, flow erosion and/or vibration can result in a high pressure drop/ratio application if attention to controlling the pressure drop is not considered. The cascade trim has been specifically designed to eliminate these problems at source by controlling the pressure drop through a number of discrete stages of let-down. The Cascade cage is manufactured to close tolerances and consists of a series of sleeves. The number of sleeves (stages of let-down) required depends upon the amount of treatment necessary for the particular application. Each successive sleeve, has a number of radial holes, and a carefully calculated increase in flow area to ensure correct apportionment of the pressure drop. Thus, the small radial jets pass through a tortuous flow path resulting in high frictional and impingement losses. At the same time the impingement of the jets onto the outer radially drilled sleeves control the shock wave formation which has a major influence on overall noise reduction in gas/vapour applications.



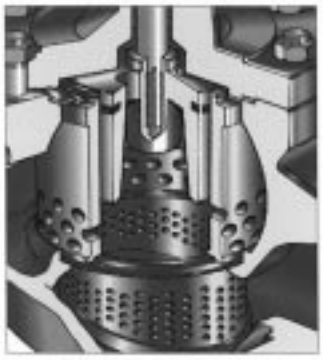
Variable Stage Cascade

Variable Stage Cascade (VS)

Is available when multiple stages of pressure letdown are required at low valve openings. This design particularly suits applications where there is a high-pressure drop at low flows, and a reduced pressure drop at normal to maximum flow-rates. The design philosphy of the Cascade and Multi-Flow Trims designs is combined within this trim.

Body Protection Unit

This design option is utilised on flashing liquid, multi-phase fluids, and on contaminated gas/vapour flows. The unit is designed to prevent erosive outlet flow, from the valve seat, directly impinging onto the pressure containing body walls. It is manufactured from hardened or hard-faced material to reduce erosion rates. The design breaks the erosive fluid flow into small jets and directs the bulk of the flow towards the valve outlet.

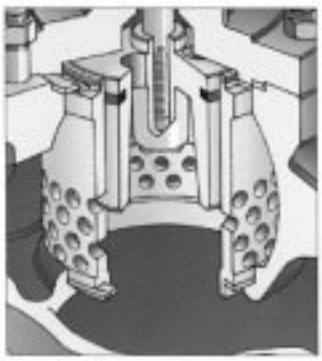


Body Protection Unit

PLUG DESIGNS

Balanced

The balanced plug design is utilised to greatly reduce fluid forces acting on the valve plug allowing economical actuation and stable control. The cylindrical plug head is drilled with balancing ports to admit pressure above the plug head. The annular leakage flow between the valve plug and cage is minimised by a sealing ring retained within a plug groove. The standard sealing rings are carbon graphite which give Class III leakage. Alternatively a 'U' seal can be fitted to give either Class IV or Class V leakage dependant on seating load applied by the actuator.

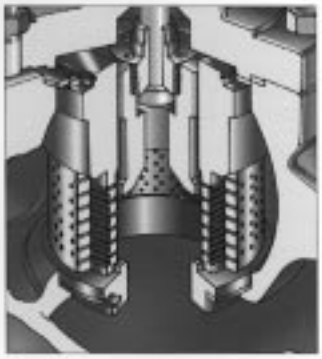


Solid (Unbalanced)

The design is used on relatively low-pressure drop and/or on-off applications. It generally requires the use of much larger actuators than would be required on the balanced plug design and in all but small valve sizes is not suited to control applications.

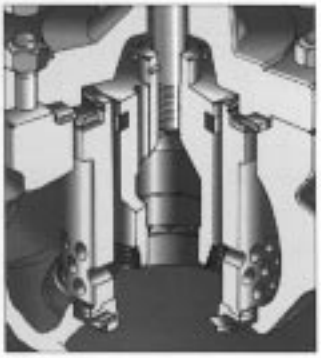
PLUG DESIGN

Pilot Balanced Trim



The pilot balanced plug design incorporates two plugs, the main larger diameter plug used for control and the smaller pilot situated inside the main plug significantly reduces fluid forces acting on the main plug. This design produces a high integrity metal to metal seal enabling Class V (or MSS-SP-61) shut-off, which can be used at high temperature where a resilient seal would be unsuitable. Opening of the valve is by the pilot plug, which lifts from its seat prior to the main plug head. This produces a flow passage to equalise the pressure above and below the valve plug, thereby significantly reducing the fluid forces acting on the valve plug. In the closed position the inlet pressure is admitted above the plug to produce a high downward seat load and the only leakage path is across metal to metal seating.

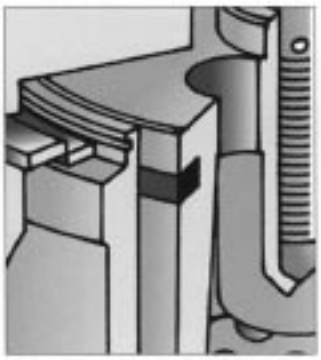
Flash-cone



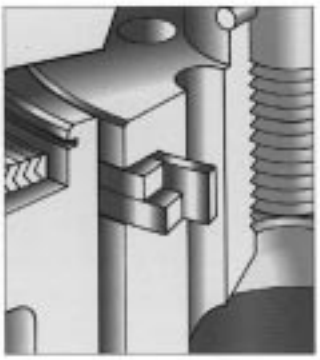
This plug design is specified on applicatons requiring a very high rangeability. At low openings the conical plug nose fits inside a matching conical seat. The plug nose has a number of circumferantial grooves, which produce a staging of the pressure drop as the flow passes between the small annular passage between the plug and the valve seat. In addition to the increased rangeability this trim also allows the valve to handle higher-pressure drops at low valve openings than can be adequately handled by a standard plug designs.

Soft seat

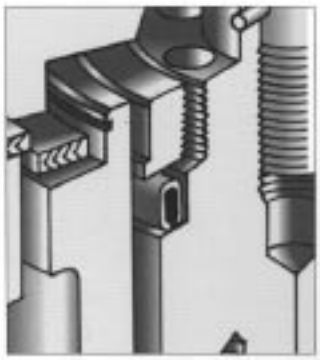
Is specified on applications where it is desirable to have a maximum closure on the control valve. The soft seat design consists of a resilient seal ring clamped into the plug by a face ring. When the soft seal contacts the valve seat, a lip on the seat bites into the face of the seal and effectively prevents leakage through the seat. The soft seat design can be specified in both balanced and un-balanced designs.



Carbon Ring



Triple Seal Ring



'U' Seal

Seal Rings

On balanced design valves the valve plug is designed to incorporate a seal ring which prevents leakage around the periphery of the valve plug. Depending upon the desired leakage and temperature through the valve a variety of seal rings are specified.

Standard

Normalising

Bellows Seal

Cryogenic

BONNET FORMS

Standard

For applications where the temperature of the controlled fluid is between -18 ˚C and (O ˚F) and 232 ˚C (450 ˚F). May be used with graphite packing up to 315 ˚C (600 ˚F). Although modern packings are suitable for much higher temperatures it is recommended that the normalising bonnet be fitted in cases where the temperatures exceed the above values to accommodate lagging of the control valve body.

Normalising

For protection of the gland packing at temperatures above 232 ˚C (450 ˚F) and below -18 ˚C (O ˚F) down to -100 ˚C (-150 ˚F). The bonnet is designed with fins which dissipate the heat from process fluid and help protect the packings and actuator assembly from high temperatures. In addition the normalising bonnet is longer than the standard plain bonnet so that the valve can easily be lagged without interference with the actuator.

Bellows Seal

A positive leakproof stem seal for cases where gland leakage cannot be permitted. The standard bellows material is 321 stainless steel, although many other materials are available on request. The design consists of a welded flexible steel bellows which is clamped in an extended bonnet/bonnet hood. This effectively cuts out any possible leakage path around the plug stem and therefore prevents emissions from the valve packings. Packings are fitted in these valves but only act as a backup to the bellows.

Cryogenic

Used for temperatures below -100 ˚C (-150 ˚F). The bonnet is designed with a long necked section which distances the packing away from the process fluid. The necked section is designed with a minimum wall section to minimise heat transfer. Cold box extension/cryogenic bonnets are also available.

PACKING

Packings are selected based on fluid temperature and fluid type. The most common packing system materials are PTFE for low temperature and graphite to high temperature. For hydrocarbons service and where emission levels need to be controlled there are two further types of packings available. These incorporate specially selected materials and live loading to both minimise emissions and extend packing life allowing for cyclic operation. These packings are referred to as LTEP and HTEP.

Packings have been tested to prove emission levels of less than 500 parts per million over 50,000 cycles and under thermal cycling conditions.

PTFE Chevron packing is used for applications where the temperature is between cryogenic to 232 ˚C (450 ˚F)

Grafoil packing is used on high temperature applications where the temperature exceeds 232 ˚C (450 ˚F)

LTEP low emission packing, temperatures below 260 ˚C (500˚F)

HTEP low emission packing, temperatures above 260 ˚C (500 ˚F)

Other packing types can be accommodated as required.

PTFE Chevron

Grafoil

LTEP – Carbon filled PTFE Chevron

HTEP – Graphite wedge rings

CHARACTERISTICS

Linear

This form of characteristic provides a flow rate which is directly proportional to the valve lift. This proportional relationship produces a characteristic with a constant slope, so that with constant pressure drop the valve gain will be the same at all flow rates. Valve gain is the ratio of an incremental change in flow rate to an incremental change in valve plug position. The linear valve plug is commonly specified for liquid level control and for certain flow control applications requiring constant gain.

Equal Percentage

Equal increments of valve lift produce equal percentage changes in the fluid flow. The change in flow rate is always proportional to the flow rate just before the change in plug position is made. The equal percentage characteristic is generally used on pressure control applications, and on other applications where a large percentage of pressure drop is normally absorbed by the system itself, with only a relatively small percentage available at the control valve. Valves with this characteristic should also be considered where highly varying pressure drop conditions occur or high rangeability is required.

Quick Opening

This provides for maximum change in flow rate at low valve lifts with a fairly linear relationship. Additional increases in valve lift give sharply reduced changes in flow rate, when the valve plug nears the wide open position, the change in flow rate approaches zero.

Intermediate

Other intermediate or special characteristics are available on request to meet specific control requirements.

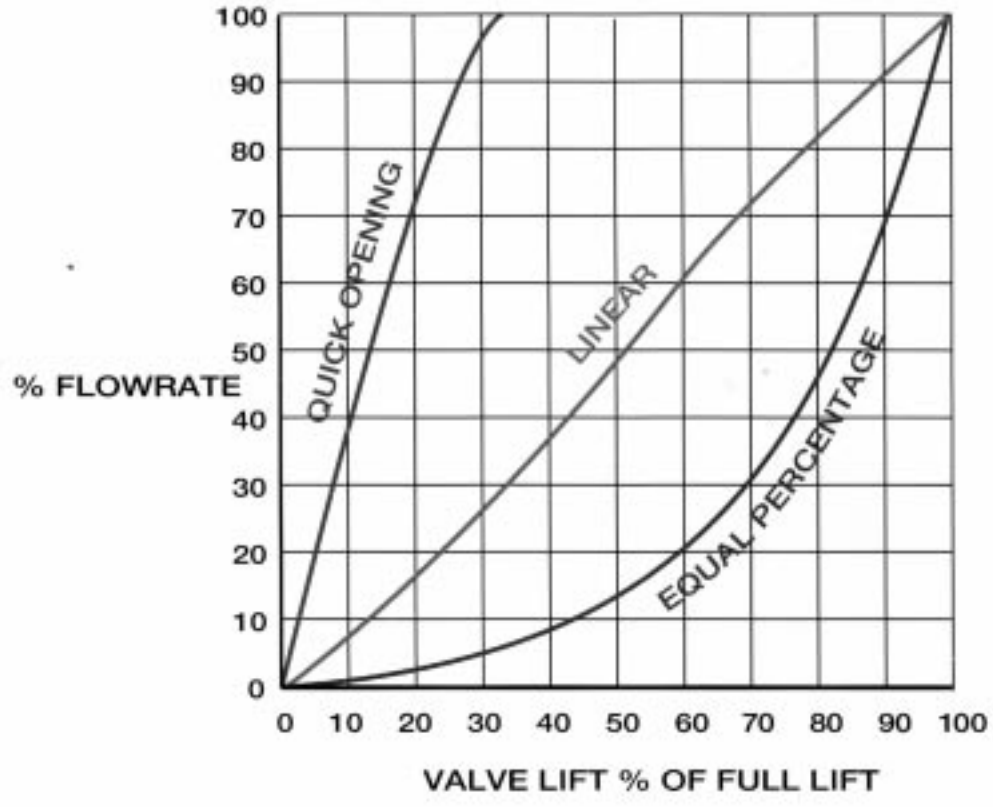


TABLE 1 – MATERIALS OF CONSTRUCTION

CAGE	PLUG	PLUG STEM	SEAT	SERVICE
420 ST.ST. Hardened	17-4PH ST.ST. Hardened	316 ST.ST./	Integral with Cage/	-35°C to 399°C
		17.4 PH	316 ST.ST./	-30°F to 750°F
420 ST.ST. Hardened	316 ST.ST. with		316 + STELLITE	400°C to 565°C
	Stellite Face & Guide			750°F to 1050°F
316 ST.ST./	316 ST.ST. with Chrome Plated			NACE MR-01-75
17-4PH ST.ST.	Guide Diameter			-35°C to 232°C
				-30°F to 450°F
420 ST.ST. Hardened	17-4PH ST.ST.		316 ST.ST.	-35°C to 232°C
	Hardened with PTFE Face			-30°F to 450°F
Monel K500	Monel 400	Monel 400/	Integral with Cage/	-35°C to 500°C
		Monel K500	Monel K500	-30°F to 932°F
Hastelloy C	Hastelloy C	Hastelloy C	Integral with Cage/Hastelloy C	
Duplex	Duplex	Duplex	Integral with Cage/Duplex	
Ceramic/420 ST.ST.	316 ST.ST. + Ceramic	316 ST.ST.	316 ST.ST. + Ceramic	

*options for Stellite face or full Stellite available for most materials.

TABLE 2 – LEAKAGE GLASS

LEAKAGE CLASS	SEAL RING MATERIAL	TEMPERATURE
Class III	Carbon Graphite	-35°C (-30°F) to 565°C (1050°F)
Class IV & V	Carbon PTFE 'U' Seal	-35°C (-30°F) to 260°C (500°F)
Class IV & V	High Temp 'U' Seal	260°C (500°F) to 350°C (660°F)
Class IV & V	Virgin PTFE 'U' Seal	Cryogenic to -35°C (-30°F)
Class IV	Carbon Triple Seal	350°C (660°F) to 565°C (1050°F)
Class V & MSS-SP-61	Pilot Balanced	-35°C (-30°F) to 565°C (1050°F)
Class VI	Soft Face Seat	-35°C (-30°F) to 232°C (450°F)
Class III, IV & V	None (un-balanced)	Cryogenic to 565°C (1050°F)

Silencers/Dynamic Attenuator

This equipment is used on gas/vapour services to control fluid velocity and to produce dynamic attenuation. Each silencer is designed for its specific application and is considered in conjunction with the selection of the upstream control valve/trim. In selecting the silencer design all operating conditions are considered to ensure acceptable performance.

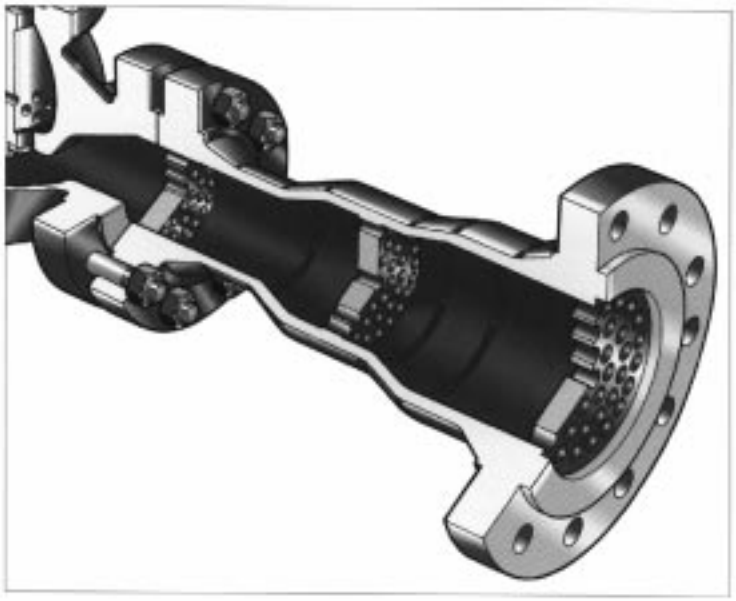


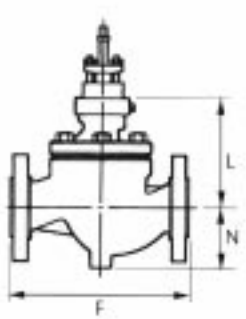
TABLE 3 – RECOMMENDED LIMITING INLET VELOCITIES

METRIC UNITS			US UNITS		
BODY SIZE (MM)	LIQUID (M/S)	STEAM OR GAS (M/S)	BODY SIZE (IN)	LIQUID (FT/S)	STEAM OR GAS (FT/S)
40, 50	13.5	150	1 1/2, 2	44	490
80, 100	13.5	150	3, 4	44	490
150, 200, 250, 300	13.5	150	6, 8, 10, 12	44	490
350, 400, 450, 500	12	130	14, 16, 18, 20	39	425
≥ 600	8.5	120	≥ 24	28	390

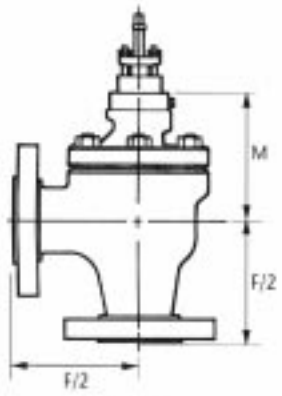
NOTE: MAXIMUM OUTLET VELOCITY (STEAM OR GAS) = 0.65 X SONIC

TABLE 4 – RANGEABILITY

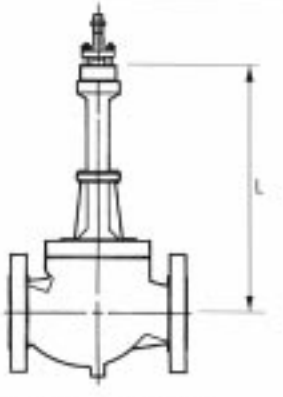
BODY SIZE		MF1 & MF2	MF3 & MF4	MF5 & MF6	MF7 & MF8
MM	IN	SS1 & SS2	SS3 & SS4	SS5 & SS6	SS7 & SS8
40 to 80	1 1/2 to 3	50:1	45:1	30:1	20:1
100 to 200	4 to 8	65:1	55:1	45:1	35:1
250 to 400	10 to 16	70:1	65:1	55:1	45:1
450 to 750	18 to 30	80:1	70:1	60:1	50:1



BV500



BV501



BV500 Extension Bonnet

TABLE 5 – BV500 SERIES VALVES DIMENSIONS

VALVE SIZE		1 1/2" 40mm	2" 50mm	3" 80mm	4" 100mm	6" 150mm	8" 200mm	10" 250mm	12" 300mm	14" 350mm	16" 400mm	18" 450mm	20" 500mm	24" 600mm	30" 750mm
Up to ANSI	F	9 1/4	10 1/2	12 1/2	14 1/2	18 5/8	22 3/8	28 1/4	30 1/2	41 5/8	41 5/8	47	54	60	66
300 Class RF and BS4504		235	267	317	368	473	568	718	775	1057	1057	1194	1372	1524	1676
Up to ANSI		9 3/4	11 1/8	13 1/8	15 1/8	19 1/4	23	28 7/8	31 1/8	42 1/4	42 1/4	47 5/8	54 5/8	60 5/8	66 5/8
300 Class RTJ		248	283	333	384	489	584	733	791	1073	1073	1210	1388	1540	1692
Class 300 Butt Weld		9 7/8	11 1/4	13 1/4	15 1/2	20	24	30	30 1/2	41 5/8	41 5/8	47	54	60	66
		251	286	337	394	508	610	762	775	1057	1057	1194	1372	1524	1676
BS,PN64,PN100,ANSI 600		9 7/8	11 1/4	13 1/4	15 1/2	20	24	30	32 1/4	43 5/8	43 5/8	49 1/4	60	63	70
Class RF Flanged & Butt Weld		251	286	337	394	508	610	762	820	1108	1108	1251	1524	1600	1778
ANSI 600 Class RTJ		9 7/8	11 3/8	13 3/8	15 5/8	20 1/8	24 1/8	30 1/8	32 3/8	43 3/4	43 3/4	49 3/8	60 1/8	63 1/8	70 1/8
		251	289	340	397	511	613	765	823	1111	1111	1254	1527	1603	1781
Plain Bonnet (L)		5 13/16	5 13/16	7 9/16	7 5/8	9 15/16	13 3/16	18 11/16	20 3/16	23 3/8	23 3/8	37 7/8	37 7/8	43 7/8	CF
		148	148	185	193	252	335	475	513	721	721	963	963	1114	
Plain Bonnet (M)		4 7/8	4 7/8	5 1/2	6 5/16	7 7/16	9 5/16	CF	CF	CF	CF	CF	CF	CF	CF
		124	124	140	160	189	237								
Norm Bonnet (L)		10 11/16	10 11/16	11 3/4	12 1/16	14 7/16	18	25 3/4	28 1/2	41 5/8	41 5/8	52	52	59	CF
		272	272	298	306	368	457	655	724	1057	1057	1321	1321	1499	
Norm Bonnet (M)		9 3/4	9 3/4	9 15/16	10 3/4	12	14 1/8	CF	CF	CF	CF	CF	CF	CF	CF
		248	248	253	273	305	359								
Bellows Bonnet (L)		13 9/16	13 9/16	16 15/16	16 15/16	22 9/16	30 1/16	32	33 9/16	CF	CF	CF	CF	CF	CF
		344	344	430	430	572	763	815	853						
Bellows Bonnet (M)		12 5/8	12 5/8	15 5/8	15 5/8	20 1/16	26 3/16	CF	CF	CF	CF	CF	CF	CF	CF
		320	320	397	397	509	665								
Extension Bonnet (L)		17 1/4	17 1/4	17 13/16	17 13/16	21 5/8	25 3/8	35 7/8	CF	CF	CF	CF	CF	CF	CF
		438	438	455	455	550	645	910							
Extension Bonnet (M)		16 5/16	16 5/16	16 9/16	16 9/16	20 1/8	21 1/2	CF	CF	CF	CF	CF	CF	CF	CF
		414	414	421	421	511	546								
N		3 1/2	3 5/8	4 11/16	5 5/16	6 3/4	8 1/2	10 5/8	12 1/8	16	16	18 5/8	18 5/8	21 3/8	CF
		89	92	119	135	172	216	270	308	406	406	473	473	543	
Standard Travel		1 1/8	1 1/8	1 1/2	1 1/2	2 1/4	3 1/2	3 1/2min	3 1/2min	7	7	10	10	12	CF
(Also refer to Table 8)		28.5	28.5	38	38	57	89	89	89	178	178	254	254	305	
Bonnet Mount Dia		2 1/8	2 1/8	2 13/16	2 13/16	3 9/16	3 9/16	5	5	5	5	5	5	5	CF
		54	54	71	71	90	90	127	127	127	127	127	127	127	
EXTENDED TRAVELS FOR CASCADE TRIM VALVES															
Extended Travel		1 1/2	1 1/2	2 1/4	2 1/4	3 1/2	6	6	7	CF	CF	CF	CF	CF	CF
(Refer Table 9)		38	38	57	57	89	152	152	178						
Bonnet Mount Dia		2 13/16	2 13/16	3 9/16	3 9/16	3 9/16	5	5	5	CF	CF	CF	CF	CF	CF
		71	71	90	90	90	127	127	127						
Plain L		8 1/8	8 1/8	10 9/16	9 7/8	13 5/16	18 5/8	22	26	CF	CF	CF	CF	CF	CF
		207	207	268	251	338	473	555	650						
Norm L		12 3/4	12 3/4	16	15 13/16	18 13/16	24	30	34 1/2	CF	CF	CF	CF	CF	CF
		324	324	400	386	478	600	765	877						

RF = RAISED FACE. RTJ = RING TYPE JOINT. FACE-TO-FACE AND FACE TO CENTRE LINE DIMENSIONS ARE GENERALLY IN ACCORDANCE WITH ISA 5.75.03.

CF = CONSULT FACTORY.

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TABLE 6 – BV990 SERIES VALVES DIMENSIONS

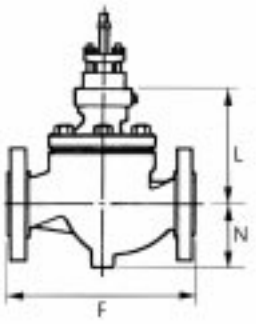
VALVE SIZE		1 1/2" 40mm	2" 50mm	3" 80mm	4" 100mm	6" 150mm	8" 200mm	10" 250mm	12" 300mm	14" 350mm	16" 400mm	18" 450mm	20" 500mm	24" 600mm	30" 750mm
RATINGS UP TO AND INCLUDING ANSI CLASS 1500lb															
ANSI 900	F	12	13 1/4	15 1/2	18 1/2	21 7/8	36 3/4	36	44 1/2	56	56	68	68 1/2	CF	CF
RF & PN160		305	337	394	470	556	934	914	1130	1422	1422	1727	1740		
ANSI 900 RTJ		12	13 3/8	15 5/8	18 5/8	22	36 7/8	36 1/8	44 1/2	56	56	68	68 1/2	CF	CF
		305	340	397	473	559	937	918	1130	1422	1422	1727	1740		
ANSI 1500		12	13 1/4	16 1/4	19 1/4	24	39	45	45 1/8	56	56	68	68 1/2	CF	CF
RF & PN250		305	337	413	489	610	990	1142	1146	1422	1422	1727	1740		
ANSI 1500		12	13 3/8	16 3/8	19 3/8	24 1/4	39 3/8	45 3/8	45 1/8	56	56	68	68 1/2	CF	CF
RTJ		305	340	416	492	616	1001	1153	1146	1422	1422	1727	1740		
ANSI 900 & 1500 PN160		12	13 1/4	16 1/4	19 1/4	24	39 3/8	45	45 1/8	56	56	68	68 1/2	CF	CF
& PN250 Butt Weld		305	337	413	489	610	1001	1142	1146	1422	1422	1727	1740		
Plain Bonnet	L	7 7/8	8 1/2	9 3/8	11 3/4	11 7/8	19 5/8	23 3/4	26 3/4	28 3/4	28 3/4	37	41 1/2	CF	CF
		200	215	238	298	302	498	602	680	730	730	940	1054		
Norm Bonnet		12 5/16	12 7/8	14	16	16 5/16	27 3/8	29 1/2	31 1/2	35 1/2	35 1/2	43 1/2	49 1/4	46 3/8	CF
		313	327	355	406	415	695	750	800	902	902	1105	1250	1178	
N		3 3/8	3 3/4	5	5 7/8	7 3/8	11 1/4	12 3/8	13	13 1/2	13 1/2	17 3/4	19 5/8	22 7/8	CF
		86	95	126	149	188	286	315	330	342	342	451	500	582	
Standard Travels		1 1/8	1 1/8	1 1/2	2 1/4	2 1/4	3 1/2	3 1/2	REFER TO TRIM SELECTION						
		28.6	28.6	38	57	57	89	89							
Bonnet Mount Dia		2 1/8	2 1/8	2 13/16	3 9/16	3 9/16	3 9/16	5	5	5	5	5	5	5	5
		54	54	71	90	90	90	127	127	127	127	127	127	127	127
ANSI CLASS 2000lb															
ANSI 2000	F	12	14 1/4	20	24	32	39	44 15/16	52	CF	CF	CF	68	CF	CF
Butt Weld		305	368	508	610	813	990	1142	1321				1727		
Plain	L	7 7/8	8 9/16	9 7/8	12 1/8	13 3/4	19 5/8	22 3/4	26 1/4	CF	CF	CF	33 7/8	CF	CF
Bonnet		200	217	251	309	350	499	603	667				859		
Norm		12 5/16	13 9/16	15 1/8	16 5/8	20	27 3/8	31 1/2	34 1/8	CF	CF	CF	CF	CF	CF
Bonnet		313	344	385	422	507	696	800	867						
N		3 3/8	4 1/16	5	6 1/16	9 1/4	11 1/4	13 3/8	15 5/8	CF	CF	CF	CF	CF	CF
		86	103	128	154	235	286	339	397						
Travel		1 1/8	1 1/8	1 1/2	2 1/4	2 1/4	3 1/2	3 1/2	REFER TO TRIM SELECTION						
		28.6	28.6	38	57	57	89	89							
Bonnet Mount Dia		2 1/8	2 1/8	2 13/16	3 9/16	3 9/16	3 9/16	5	5	5	5	5	5	5	5
		54	54	71	90	90	90	127	127	127	127	127	127	127	127
ANSI CLASS 2500lb															
ANSI 2500	F	14 1/8	16 1/4	21 1/2	25 5/8	35 7/16	45 1/4	55 1/8	63	71	CF	CF	CF	CF	CF
Butt Weld		359	413	546	650	900	1150	1400	1600	1803					
Plain Bonnet	L	8 7/8	10 1/4	11 5/8	15	20 1/4	25 1/2	CF	CF	CF	CF	CF	CF	CF	CF
		225	260	296	381	514	649								
Norm Bonnet		14	14 7/8	16 5/8	19 7/8	26 3/8	45 1/4	CF	CF	CF	CF	CF	CF	CF	CF
		355	377	422	504	669	846								
N		4	4 3/8	5	7	9 3/8	12 3/8	CF	CF	CF	CF	CF	CF	CF	CF
		100	110	128	177	238	315								
Travel		1 1/8	1 1/8	1 1/2	2 1/4	2 1/4	3 1/2	3 1/2	REFER TO TRIM SELECTION						
		28.6	28.6	38	57	57	89	89							
Bonnet Mount Dia		2 13/16	2 13/16	3 9/16	3 9/16	3 9/16	5	5	5	5	5	5	5	5	5
		71	71	90	90	90	127	127	127	127	127	127	127	127	127

CF = CONSULT FACTORY CONSULT FACTORY FOR ANSI CLASS 4500lb RATED VALVES

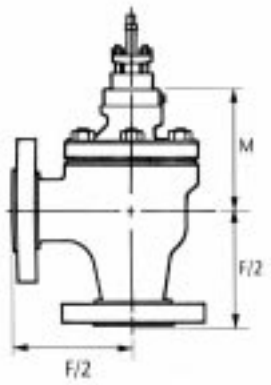
TABLE 7 – BV992 SERIES VALVES DIMENSIONS

VALVE SIZE		1 1/2" 40mm	2" 50mm	3" 80mm	4" 100mm	6" 150mm	8" 200mm	10" 250mm	12" 300mm	14" 350mm	16" 400mm	18" 450mm	20" 500mm	24" 600mm	30" 750mm
RATINGS UP TO AND INCLUDING ANSI CLASS 1500lb															
ANSI 900	F/2	6	7	8 1/8	9 1/4	12 13/16	CF	CF	CF	CF	CF	CF	CF	CF	CF
RF & PN160		152	178	206	235	310									
ANSI 900 RTJ		6	7 1/16	8 3/16	9 5/16	12 1/4	CF	CF	CF	CF	CF	CF	CF	CF	CF
		152	179	208	237	311									
ANSI 1500		6	7	8 1/2	9 5/8	13 1/4	CF	CF	CF	CF	CF	CF	CF	CF	CF
RF & PN250		152	178	216	244	337									
ANSI 1500		6	7 1/16	8 9/16	9 11/16	13 5/16	CF	CF	CF	CF	CF	CF	CF	CF	CF
RTJ		152	179	218	246	338									
ANSI 900 & 1500 PN160		6	6 5/8	8 1/2	9 5/8	13 1/4	CF	CF	CF	CF	CF	CF	CF	CF	CF
& PN250 Butt Weld		152	168	216	244	337									
Plain Bonnet	M	6 7/8	7	7 7/16	9 1/16	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF
		175	178	188	230										
Norm Bonnet		11 3/8	11 7/16	12	13 3/8	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF
		288	290	304	339										
Standard Travels		1 1/8	1 1/8	1 1/2	2 1/4	2 1/4	3 1/2	3 1/2	REFER TO TRIM SELECTION						
		28.6	28.6	38	57	57	89	89							
Bonnet Mount Dia		2 1/8	2 1/8	2 13/16	3 9/16	3 9/16	3 9/16	5	5	5	5	5	5	5	5
		54	54	71	90	90	90	127	127	127	127	127	127	127	127
ANSI CLASS 2000lb															
ANSI 2000	F/2	6	7 1/4	10	12	16	19 1/4	22 1/4	24 3/4	CF	CF	CF	CF	CF	CF
Butt Weld		152	184	254	305	407	495	565	629						
Plain	M	6 7/8	7	7 13/16	9 7/16	12 3/16	16 1/4	CF	CF	CF	CF	CF	CF	CF	CF
Bonnet		175	178	199	239	310	413								
Norm		11 3/8	12	13 1/8	13 7/8	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF
Bonnet		288	306	333	352										
Travel		1 1/8	1 1/8	1 1/2	2 1/4	2 1/4	3 1/2	3 1/2	REFER TO TRIM SELECTION						
		28.6	28.6	38	57	57	89	89							
Bonnet Mount Dia		2 1/8	2 1/8	2 13/16	3 9/16	3 9/16	3 9/16	5	5	5	5	5	5	5	5
		54	54	71	90	90	90	127	127	127	127	127	127	127	127
ANSI CLASS 2500lb															
ANSI 2500	F/2	6 7/8	8 1/8	10 3/4	12 13/16	17 3/4	22 5/8	27 9/16	31 1/2	CF	CF	CF	CF	CF	CF
Butt Weld		175	207	273	325	450	575	700	800						
Plain Bonnet	M	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF
Norm Bonnet		CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF
Travel		1 1/8	1 1/8	1 1/2	2 1/4	2 1/4	3 1/2	3 1/2	REFER TO TRIM SELECTION						
		28.6	28.6	38	57	57	89	89							
Bonnet Mount Dia		2 13/16	2 13/16	3 9/16	3 9/16	3 9/16	5	5	5	5	5	5	5	5	5
		71	71	90	90	90	127	127	127	127	127	127	127	127	127

CONSULT FACTORY FOR ANSI CLASS 4500lb RATED VALVES



BV990



BV992

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TABLE 8 – BV500 & BV501 SERIES VALVES – MULTI-FLOW TRIM DESIGN CV

SIZE	TRAVEL	MF1		MF2		MF3		MF4		MF5		MF6		MF7		MF8	
	(mm)	=%	LIN	=%	LIN	=%	LIN	=%	LIN	=%	LIN	=%	LIN	=%	LIN	=%	LIN
1 1/2" 40mm	28.5mm					32	35	26	28	21	22	12	14	9	9		
2" 50mm	28.5mm	53	55	40	45	32	35	26	28	21	22	12	14	9	9		
3" 80mm	38mm	125	145	105	124	86	104	70	86	55	66	37	43	21	27	15	15
4" 100mm	38mm	180*	235	166	200	142	168	125	116	86	106	61	72	45	45	25	30
6" 150mm	57mm	410*	455	350	420	298	385	240	315	193	243	120	162	100	130	80	100
8" 200mm	89mm	760*	760*	680	720	610	610	520	520	385	445	250	305	190	190	120	162
10" 250mm	89mm	1050	1200	900	1050	720	750	585	600	360	420	275	300	220	260		
12" 300mm	89mm	1200	1400	1050	1150	725	800	570	625	420	450	400					
	127mm	1520	1600	1400													
14" 350mm	152mm					1940	2200										
	127mm							1750	1900	1400	1600						
	89mm											980	1100				
16" 400mm	178mm	2500	2750														
	152mm			2200	2400	1940	2200										
	127mm							1750	1900	1400	1600						
	89mm											980	1100				
18" 450mm	254mm			3100	3500												
	178mm					2170	2450										
	152mm							1830	2100								
	127mm									1550	1750						
20" 500mm	254mm	3900	4300	3100	3500												
	178mm					2170	2450										
	152mm							1830	2100								
	127mm									1550	1750						
24" 600mm	305mm	5700	6000														
	254mm			4750	5000												
	178mm					3330	3500										
	152mm							2840	2990								

* INDICATES MODIFIED =% TRIM

TABLE 9 – BV500 SERIES VALVE – CASCADE TRIM DESIGN CV

VALVE SIZE	CS 2		CS 3		CS 4		CS 5		YOKE MOUNTING	VALVE TRAVEL
	MOD =%	LINEAR	MOD =%	LINEAR	MOD =%	LINEAR	MOD =%	LINEAR		
1 1/2" 40mm & 2" 50mm	14	25	7	12					2 1/8" 54mm	1 1/8" 28.5mm
	20	33	10	16					2 13/16" 71mm	1 1/2" 38mm
3" 80mm	40	48	20	24	10	12			2 13/16" 71mm	1 1/2" 38mm
	60	72	30	36	15	18			3 9/16" 90mm	2 1/4" 57mm
4" 100mm	64	64	32	32	16	16	8	8	2 13/16" 71mm	1 1/2" 38mm
	96	96	48	48	24	24	12	12	3 9/16" 90mm	2 1/4" 57mm
6" 150mm	108	144	54	72	27	36	13	18	3 9/16" 90mm	2 1/4" 57mm
	168	224	84	112	42	56	21	28	3 9/16" 90mm	3 1/2" 89mm
8" 200mm	200	263	100	132	50	66	25	33	3 9/16" 90mm	3 1/2" 89mm
	282	450	141	225	70	112	35	56	5" 125mm	5" 127mm
	340	450	170	225	85	112	42	56	5" 125mm	6" 152mm
10" 250mm	370	495	185	248	92	124	46	62	5" 125mm	3 1/2" 89mm
	530	708	265	354	132	177	66	88	5" 125mm	5" 127mm
	640	850	320	425	160	212	80	106	5" 125mm	6" 152mm
12" 300mm	470	625	235	312	117	156	60	78	5" 125mm	3 1/2" 89mm
	670	893	335	446	167	223	83	112	5" 125mm	6" 152mm
	940	1250	470	625	235	312	117	156	5" 125mm	7" 178mm

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TABLE 10 – BV990 AND BV992 SERIES VALVE – MULTI-FLOW TRIM DESIGN CV

VALVE SIZE	MF1		MF2		MF4		MF6		VALVE
	=%	LINEAR	=%	LINEAR	=%	LINEAR	=%	LINEAR	TRAVEL
1 1/2" 40mm	30	30	20	20	14	14	8	8	1 1/8" 28.5mm
2" 50mm	38	45	32	32	23	23	13	13	1 1/8" 28.5mm
3" 80mm	84	100	72	72	50	50	29	29	1 1/2" 38mm
4" 100mm	155	200	130	130	90	90	52	52	2 1/4" 57mm
6" 150mm	-	360	280	280	195	195	112	112	2 1/4" 57mm
	400	450							3 1/2" 89mm
8" 200mm	550	620	520	520	365	365	210	210	3 1/2" 89mm
	600	700							5" 127mm
10" 250mm	830	830	750	750	525	525	300	300	3 1/2" 89mm
	900	1100							5" 127mm
12" 300mm	-	-	1100	1100	770	770	440	440	3 1/2" 89mm
	1400	1600							5" 127mm
14" 350mm	1940	2200	1600	1600	1400	1400	1200	1200	7" 175mm
16" 400mm	2500	2750	2200	2200	1750	1750	1400	1400	7" 175mm
18" 450mm	3100	3500	2800	280	2200	2200	1750	1750	10" 250mm
20" 500mm	3900	4430	3100	3100	2800	2800	2200	2200	10" 250mm
24" 600mm	5700	6000	3900	3900	3100	3100	2800	2800	12" 300mm
30" 750mm	CF	CF	CF	CF	CF	CF	CF	CF	

CF = CONSULT FACTORY.

TABLE 11 – BV990 AND BV992 SERIES VALVE – CASCADE TRIM DESIGN CV

VALVE SIZE	RATIING	CS 2		CS 3		CS 4		CS 5		VALVE
		MOD =%	LINEAR	MOD =%	LINEAR	MOD =%	LINEAR	MOD =%	LINEAR	TRAVEL
1 1/2" 40mm	ALL	20	33	10	12					1 1/18" 28.5mm
2" 50mm	900, 1500 & 2000LB	20	33	10	12					1 1/2" 38mm
	2500LB & 4500LB	20	33	12	16					1 1/2" 38mm
3" 80mm	900, 1500 & 2000LB	40	48	8	10					1 1/2" 38mm
	2500LB & 4500LB	40	48	20	24	10	12			1 1/2" 38mm
	900, 1500 & 2000LB	60	72	12	16					2 1/4" 57mm
	2500LB & 4500LB	60	72	30	36	15	18			2 1/4" 57mm
4" 100mm	900, 1500 & 2000LB	72	96	36	36	18	18	9	9	2 1/4" 57mm
	2500LB & 4500LB	96	96	48	48	24	24	12	12	2 1/4" 57mm
6" 150mm	ALL	108	144	54	72	27	36	13	18	2 1/4" 57mm
	ALL	168	224	84	112	42	56	21	28	3 1/2" 89mm
8" 200mm	900, 1500 & 2000LB	200	263	84	112	42	56	21	28	3 1/2" 89mm
		340	450	140	188	70	94	35	47	6" 150mm
	2500LB & 4500LB	200	263	100	132	50	66	25	33	3 1/2" 89mm
		340	450	170	225	85	112	42	56	6" 150mm
10" 250mm	ALL	370	495	185	248	92	124	46	62	3 1/2" 89mm
	ALL	640	850	320	425	160	212	80	106	6" 150mm
12" 300mm	ALL	470	625	235	312	117	156	58	78	3 1/2" 89mm
	ALL	670	893	335	446	167	223	83	112	6" 150mm
	ALL	940	1250	470	625	235	312	117	156	7" 175mm

TABLE 12 – APPROXIMATE WEIGHT KG WITH MULTI-FLOW CAGES

SIZE	BONNET STYLE	UP TO 300LB (PN 40)		600LB RATING (PN 100)		900 & 1500LB RATING (PN150 & PN250)		2000LB RATING (PN 330)		2500LB RATING (PN 420)	
		FLG	BW	FLG	BW	FLG	BW	FLG	BW	FLG	BW
40mm 1 1/2	Plain	20	18	22	18	24	20	N/A	24	32	27
	Norm	23	21	25	21	29	25	N/A	29	37	32
	Bellow	30	28	32	28	N/A	N/A	N/A	N/A	N/A	N/A
50mm 2"	Plain	21	18	30	18	42	34	N/A	42	51	43
	Norm	24	21	33	21	47	39	N/A	47	56	48
	Bellow	31	28	40	28	N/A	N/A	N/A	N/A	N/A	N/A
80mm 3"	Plain	58	30	60	30	61	50	N/A	57	84	70
	Norm	62	34	64	34	71	60	N/A	67	93	79
	Bellow	76	48	78	48	N/A	N/A	N/A	N/A	N/A	N/A
100mm 4"	Plain	67	52	88	52	205	177	N/A	197	292	242
	Norm	72	58	94	58	215	187	N/A	207	310	260
	Bellow	96	81	117	81	N/A	N/A	N/A	N/A	N/A	N/A
150mm 6"	Plain	148	108	179	108	320	279	N/A	430	577	495
	Norm	153	114	185	114	340	299	N/A	480	622	540
	Bellow	185	145	216	145	N/A	N/A	N/A	N/A	N/A	N/A
200mm 8"	Plain	230	316	331	316	702	655	N/A	805	1150	999
	Norm	235	323	338	323	735	685	N/A	860	1208	1057
	Bellow	282	368	383	368	N/A	N/A	N/A	N/A	N/A	N/A
250mm 10"	Plain	400	510	545	510	1300	1198	N/A	1670	CF	CF
	Norm	452	588	630	588	1367	1265	N/A	1789	CF	CF
	Bellow	495	612	690	612	N/A	N/A	N/A	N/A	N/A	N/A
300mm 12"	Plain	540	495	597	548	1800	1655	N/A	2098	CF	CF
	Norm	605	562	679	610	1900	1755	N/A	2199	CF	CF
	Bellow	640	598	739	689	N/A	N/A	N/A	N/A	N/A	N/A
400mm 16"	Plain	1571	1440	1709	1610	2200	CF	N/A	CF	CF	CF
	Norm	1602	1471	1752	1652	2290	CF	N/A	CF	CF	CF
	Bellow	1740	1609	CF	CF	N/A	N/A	N/A	N/A	N/A	N/A
500mm 20"	Plain	CF	CF	3370	CF	CF	CF	N/A	CF	CF	CF
	Norm	CF	CF	3440	CF	CF	CF	N/A	CF	CF	CF
	Bellow	CF	CF	CF	CF	N/A	N/A	N/A	N/A	N/A	N/A
600mm 24"	Plain	CF	CF	5010	CF	CF	CF	CF	CF	CF	CF
	Norm	CF	CF	5090	CF	CF	CF	CF	CF	CF	CF
	Bellow	CF	CF	CF	CF	CF	CF	CF	CF	CF	CF

CF = CONSULT FACTORY

TABLE 13 – END CONNECTION DETAILS FOR BUTT WELD END VALVES (mm)

VALVE SIZE	BV500 – ALL RATINGS		BV990 – UP TO & INCLUDING 1500LB (PN 250)		BV990 – 2000LB RATING (PN 330)		BV990 – 2500LB RATING (PN 420)	
	ID	OD	ID	OD	ID	OD	ID	OD
40mm (1 1/2")	20	70	38	89	38	89	38	89
50mm (2")	38	80	38	85	38	95	38	95
80mm (3")	65	105	65	115	75	130	75	145
100mm (4")	90	145	85	155	85	145	90	185
150mm (6")	145	200	140	205	125	235	130	265
200mm (8")	185	255	190	310	200	340	195	350
250mm (10")	250	315			255	390	255	450
300mm (12")	300	370			325	515		
400mm (16")	370	460						
500mm (20")								
600mm (24")								
750mm (30")								

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