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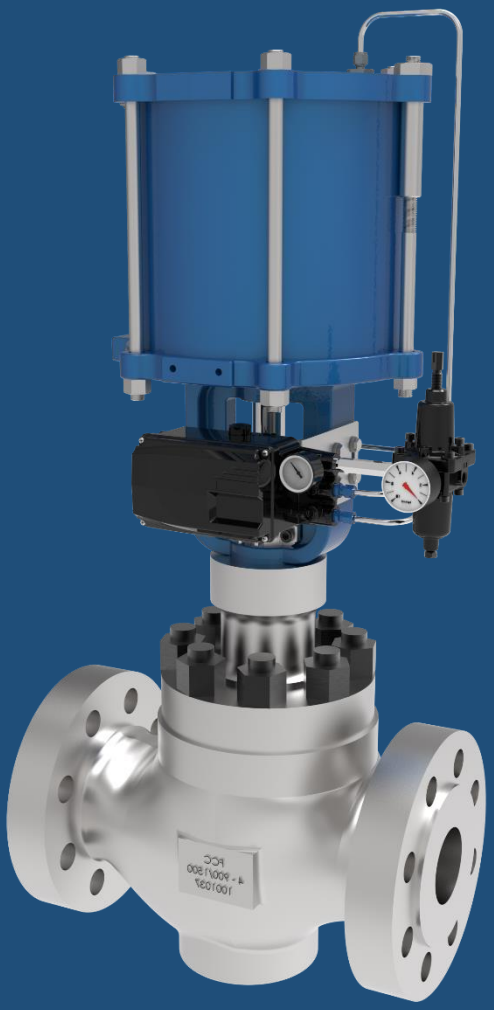


Series 11
Globe Control Valve

Contents

Foreword

Series 11 Globe Control Valves are versatile go to product for flow control applications and it offers precise flow regulation, apart from offering solutions for high pressure drop, cavitation, noise and flashing. Variety of Trim options and Characteristics is unique to Globe control valves. With optional bonnets, seals and trim combination Globe valves can be used for wide range of temperatures.

FCC offer standard as well as bespoke products.
CFD reports and flow testing may be offered when requested by customers.

Model Numbering

Series	Rating	Trim Type	Temperature
11	4 - 900	10 – Contour unbalanced	1 - Warm Service
	5 - 1500	20 – Micro Spline	2 - High Temperature
	6 - 2500	30 – Cage, Unbalanced*	3 - Ultra High Temperature
		40 – Cage, Balanced*	4 - Cryogenic
		50 – Stack Trims	
		X1 – Tungsten carbide Trims	
		X2 – Ceramic Trims	

*Ported Cage, MHC, Anti-cavitation and Low Noise Trims

Engineering Data

Body Style	Globe Straight, Globe Angle
Design Standard	ASME B16.34
Sizes, Pressure rating	1" to 12", ASME Class 900-1500 1" to 8", ASME Class 2500
Trim Type	Micro Spline Contoured Multi Hole Cage (MHC) Low dB Trim Anti-cavitation Trim Stack Trims
Trim Characteristics	Equal Percentage Linear Modified Equal Percentage
Flow Co-efficient	Refer Flow Coefficient Table, Consult factory for customized Cv / Trim Characteristics.
Guiding	Cage Guided
Seat Leakage	As per ANSI / FCI 70.2 / IEC 60534-4 Standard: Class IV Optional: Class V & VI
Flow Direction	For Anticavitation and Low dB Trims Flow Under is recommended for Low dB Trims Flow Over is reccomended for Anti Cavitation Trims For standard Trims in General serivice Unbalanced Trims | Flow Under for Contoured, Micro spline, MHC Trims Balanced Trims | Flow Over is standard for MHC and Ported cage Trims
Bonnet Design	Standard (-29° to 232°C), Extension (-46° to 427°C) Cryogenic (-46°C to -196°C)
NACE Conformance	NACE conformance shall be offered for Body, Bonnet & Bolting material when requested
Trim Balancing	Unbalanced 1" to 2" Balanced 1" to 12"
End Connection Styles	Standard Flanged RTJ as per ASME B16.5 Optional Butt welding ends as per ASME B 16.25, Socket Welding as per ASME B16.11 (0.5" to 2")
Face To Face	Globe Straight: ISA 75.08.06 (Up to 12") & B16.10, FCC standard for Globe Angle For RTJ the "X" factor from B16.10 should be added with ISA

Cross Sectional View

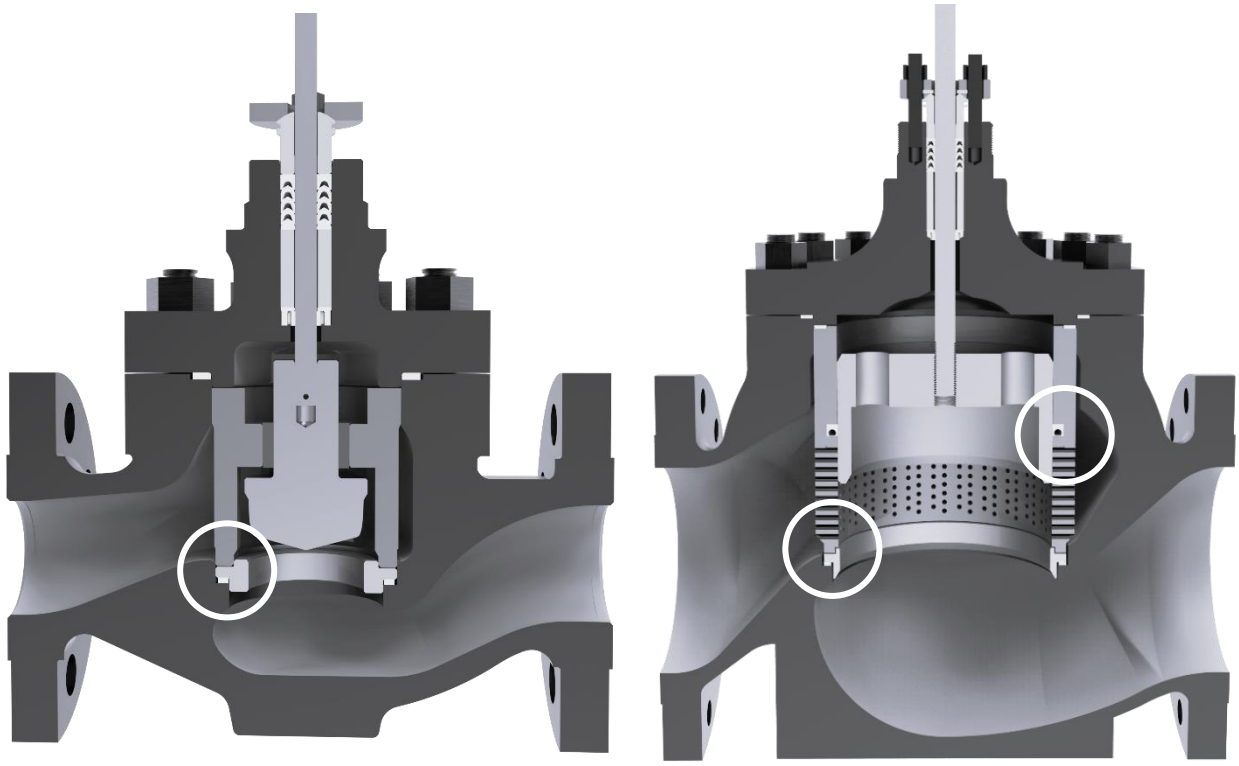


Fig 1: Globe Valve

Soft Seat & Balance Seal

Soft Seat

Soft Seat is recommended for applications where tight shut off is required with minimal actuator force for temperature less than 232°C.

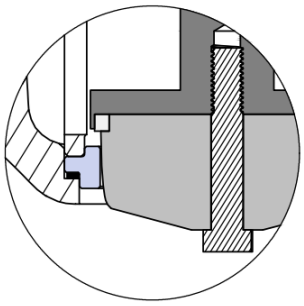


Fig 2a: Soft Seal for Contour Trim

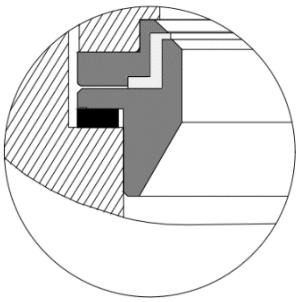


Fig 2b: Soft Seal for Cage guided Trim

Balance Seal

A balance seal is used to arrest the leakage through the clearance between plug and cage.

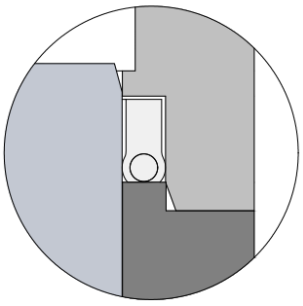


Fig 3a: PTFE Balance Seal

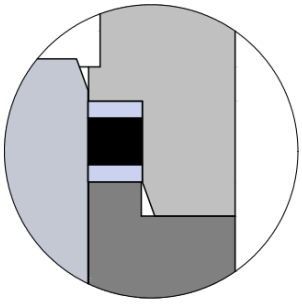


Fig 3b: Graphite Balance Seal

Bonnet Designs

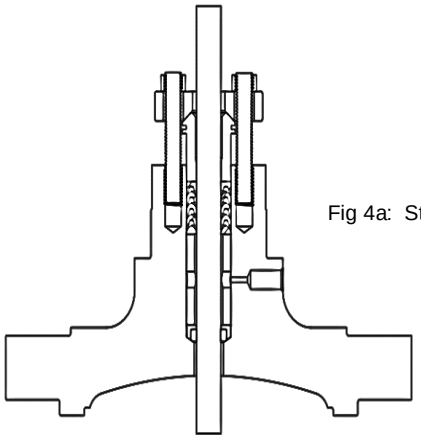


Fig 4a: Standard Bonnet

Standard Bonnet

Standard bonnets with graphite packing may be used for higher temperature. The packing box is suitable for both single, double packing and with or without tapping for leak-off connection.

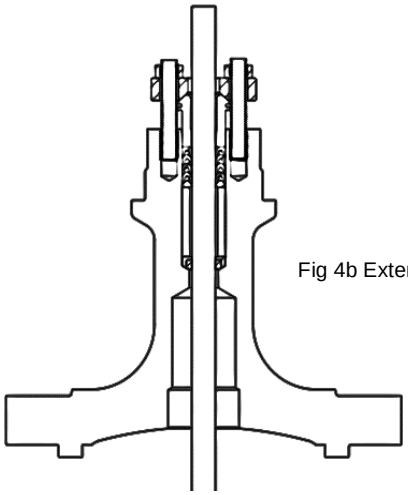


Fig 4b Extension Bonnet

Extension Bonnet

Its construction protects the packing from high temperature. It accommodates all types of packing boxes that is required to meet stringent emission levels.

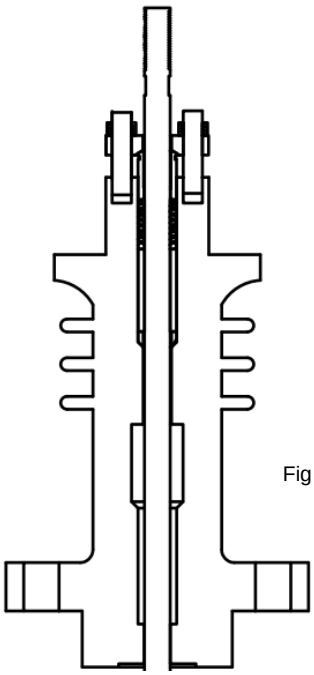


Fig 4c: Normalizing Bonnet

Normalizing Bonnet

The fins in the bonnet provide the sufficient surface area for the heat conduction, to keep the stem packing within the acceptable temperature limits.

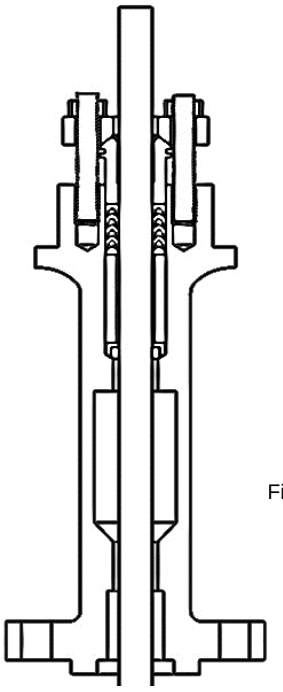


Fig 4d: Cryogenic Bonnet

Cryogenic Bonnet

The length of the extension is sufficient to maintain the stem packing at temperature that is within normal operating conditions of the packing.

Packing Box Options

Single PTFE
Single PTFE arrangement uses a positioning springs, this packing arrangement offers very good seal performance with lowest packing friction. This packing set consists of box ring, positioning spring, anti-extrusion rings & set of V-rings.

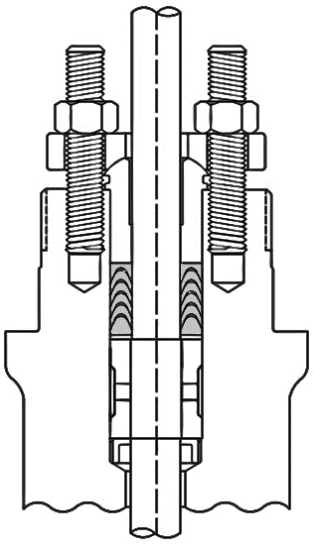


Fig 5a: Single PTFE

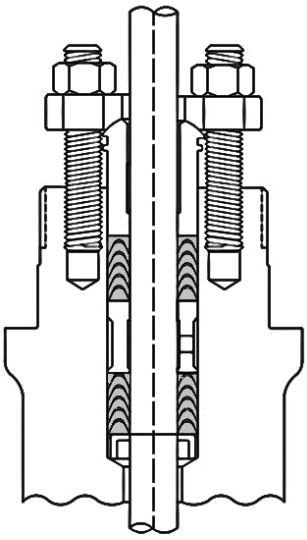


Fig 5b: Double PTFE

Double PTFE
Double PTFE arrangement has similar with single PTFE arrangement .This consists of two packing sets this gives better performance for controlling leakage.

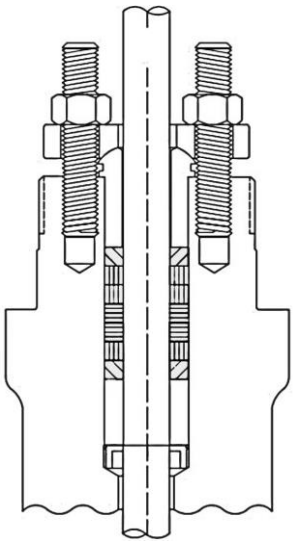


Fig 5c: Graphite

Graphite
Graphite packing system operate at higher stress levels and have higher friction values for a given level of sealing. It will be withstand with high temperature and pressure.

Trim Designs

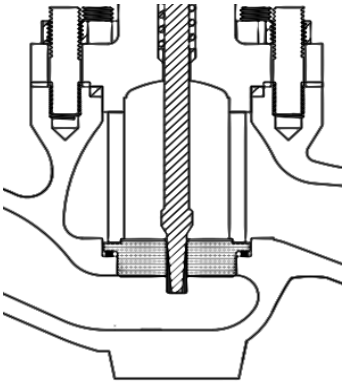


Fig 6a: Micro spline

Micro Spline

Micro splined trims are suitable for very low Cv applications that require precise control. The plug and seat are manufactured as a matched pair. Flow under is preferred.

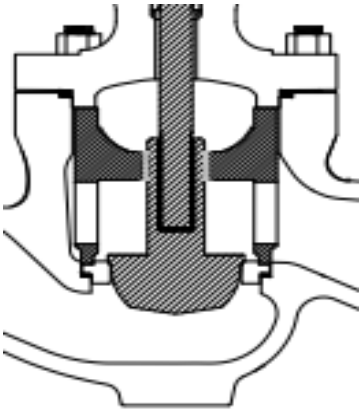


Fig 6b: Contoured

Contoured

Contoured plug with post guiding enables perfect alignment of the trim components. The trim offers wide range of Cv and characteristics. This design is suitable for viscous, dirty fluid and non-lubricating process.

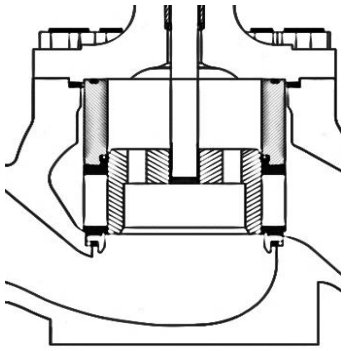


Fig 6c: Ported Cage

Ported Cage

Ported Cages offer massive guiding and high flow capacity even with shorter travels. These Trims are suitable for low pressure drop general service applications. Ported cages are often investment cast and are manufactured from standard stock parts.

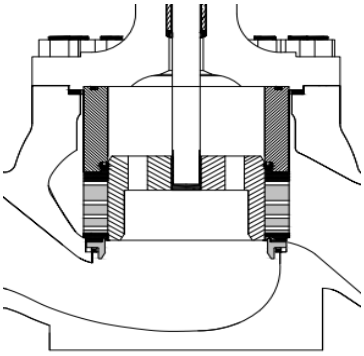


Fig 6d: Multi Hole Cage

Multi Hole Cage

Single and multiple heavy section ‘drilled hole’ cage design offers low pressure recovery that reduce the potential for excessive noise, cavitation, vibration and erosion. The MHC trim range has been designed to operate on all fluid combinations, both clean and dirty service.

The MHC range of trims are preferred choice for medium to relatively high pressure drop applications. Also, MHC trims are easily available in various special material combinations.

Cavitation Service

Anti-Cavitation Trim

To eliminate cavitation the static pressure of the fluid shall be maintained above the vapour pressure. In high pressure drop applications, it is necessary to drop the pressure in multiple stages to keep the static pressure of the fluid above the vapour pressure of the fluid.

This design uses either Single cage or Multiple-concentric cages with many small drilled holes to achieve staged pressure drop. Numerous small holes and colliding flow jets at the cage's core result in achieving a low recovery trim that will eliminate cavitation.

Follow the equation below & select suitable Trim
Ki > pressure drop / (P1-Pv)

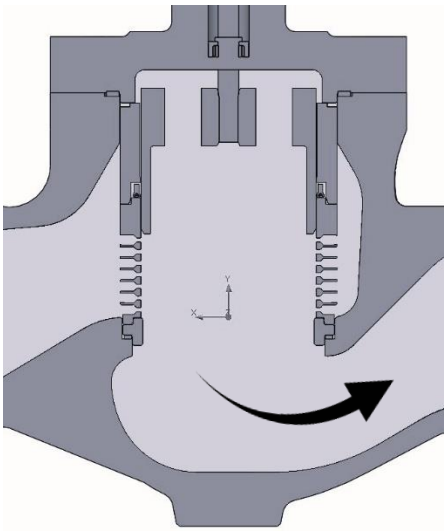


Fig 7: Anti-Cavitation Trim

Cavitation Index, Ki for Anti-Cavitation Trim

No of Pressure reduction stages	Valve Size (inch)	Pressure Drop (psid)	Cavitation Index
1-stage	1- 2	< 600	1
	1- 2	600 to 1440	FI^2
	3 - 6	< 500	1
	3 - 6	500 to 1440	FI^2
	8 - 24	< 400	1
	8 - 24	400 to 1440	FI^2
2-stage	1 - 2	< 2160	1
	3 - 6	< 1800	1
	3 - 6	1800 to 2160	FI^2
	8 - 24	< 1200	1
	8 - 24	1200 - 2160	FI^2
3-stage	1 - 24	< 3000	1
4-stage	1 – 12	< 3000	1
	1 - 12	3000 to 4000	0.99
Microspline, Anti Cav-2	1 - 2	< 2160	1
Microspline, Anti Cav-2	1 - 2	< 3000	1

VCL - Velocity Controlled Labyrinth Trim

Compact packaging of many pressure let-down stages in this design offers the possibility of velocity control throughout the flow passage. VCL is the go-to Trim for extremely high pressure drop applications and custom designs are available in terms of flow passage design, material options and manufacturing practice

Required number of stages shall be calculated based on the following equation

Liquid Trim Exit velocity = K X sqrt (pressure drop/SG)

Trim exit Velocity Limits for Liquids
30 m/s for non-cavitating, non-flashing liquids
12 m/s for flashing service

Liquid TE velocity factor, K

No of turns in VCL Trim	K, Factor
8 Turns	1.864196
12 Turns	1.254847
16 Turns	0.961509
20 Turns	0.778152
24 Turns	0.778152

Noise Service

Low dB Trim

Low dB trim combines the fact that the noise generated in standard trim designs fall in audible range with the fact that flow through small holes shifts the frequency beyond audible frequencies. Selection of suitable hole configuration (hole size, hole profile and the distance between the holes) based on dp/P1 is vital for efficient performance.

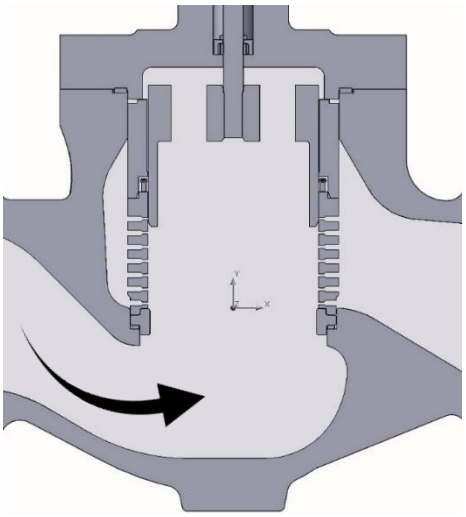


Fig 8: Low dB Trim

Pressure drop ratio ((P1-P2) / P1)	Cage Hole Configuration
0.6	A1, A3
0.75	B1, B3
0.85	C1, C3
0.99	D1, D3

The pipeline velocity and valve outlet velocity shall be limited to 0.3 Mach maximum. Use of baffles and diffusers shall be considered to decrease the valve outlet velocity to the desired level.

VCL – Velocity Controlled Labyrinth Trim

The VCL stack trim technology is based on the MHC design, but offers scope for manufacturing the trim with much higher number of pressure let-down stages.

Body Bonnet Temperature Limits

Body, Bonnet Materials	Bonnet Type	NACE MR0175/0103	Stud, Nut Material	Body, Bonnet Gasket	Temperature Limits (°C)	
					Min.	Max.
WCB / WCC	Standard	NA	B7 / 2H	316L spiral wound	-29	232
	Extension				-29	427
	Standard	Yes	B7M / 2HM		-29	232
	Extension				-29	427
LCB / LCC	Standard	NA	L7 / 7L	316L spiral wound	-29	232
	Extension				-46	232
	Extension				-46	343
	Standard	Yes	L7M / 7ML		-29	232
	Extension				-46	232
	Extension				-46	343
WC6, WC9	Standard	NA	B7 / 2H	316L spiral wound	-29	232
	Extension				-29	427
CF8M, CF3M	Standard	NA	B7 / 2H, B8M / 8M	316L spiral wound	-29	232
	Extension		B7 / 2H, B8M / 8M		-46	232
	Extension		B7 / 2H, B8M / 8M		-46	427
	Standard	Yes	B7M / 2HM, B8M / 8MA		-29	232
	Extension		B7M / 2HM, B8M / 8MA		-46	232
	Extension		B7M / 2HM, B8M / 8MA		-46	427
Duplex 4A Sup.duplex 6A	Standard	NA	L7 / 7L, B8M / 8M	32760 spiral wound	-29	232
	Extension		L7 / 7L, B8M / 8M		-46	232
	Extension		L7 / 7L, B8M / 8M		-46	316
	Standard		S32760		-29	232
	Extension		S32760		-46	232
	Extension		S32760		-46	316
	Standard	Yes	B8M / 8MA		-29	232
	Extension		B8M / 8MA		-46	232
	Extension		B8M / 8MA		-46	316
Monel, Inconel, HTB1, Al. Bronze	Standard	Yes	B7M / 2HM, B8M / 8MA	Inconel spiral wound	-198	482
	Standard		B7M / 2HM, B8M / 8MA		-198	232

Notes
1. All alloy steel bolting (B7, L7, B16) are supplied with phosphating as standard.
2. Zinc plating option available on request and its temperature is limited to 200°c.
3. Forged construction and other custom material options available on request.

Material Specifications & Temperature Limits for Trim Parts

This table shall be read in conjunction with temperature range tables for other parts

Trim Type	Trim No	Plug	Clamp / Cage	Seat Ring (Metal Seat)	Guide bush	Stem	Temperature °C	
							min	max
Micro spline (1-2")	101(1)	410	316	410	-	17-4PH	-29	427
	102(1)	316 + CoCr-A Tip	316	316 + CoCr-A (S&G)	-	17-4PH	-	427
	103(1)	32760 + CoCr-A Tip	32760	32760 + CoCr-A (S&G)	-	17-4PH	-51	316
Contoured (1-4")	201	410	410	410	17-4PH	17-4PH	-29	427
	202	316	316	316	17-4PH	17-4PH	-	427
	203	316 + CoCr-A	316	316 + CoCr-A	316 +CoCr-A	17-4PH	-	427
	204	31803 + CoCr-A	32760	31803 + CoCr-A	32760 +CoCr-A	32760	-51	316
	205	32760 + CoCr-A	32760	32760 + CoCr-A	32760 +CoCr-A	32760	-51	316
Cage Guided (1-24")	301	410	17-4PH	410	-	17-4PH	-29	427
	302(2)	420	17-4PH (H900)	17-4PH (H900)	-	17-4PH	-29	427
	303	316	17-4PH	316	-	17-4PH	-	427
	304	316	316 Cr Plated	316	-	17-4PH	-	427
	305	316 + CoCr-A	316 Cr Plated	316 + CoCr-A	-	17-4PH	-	427
	306	316 + CoCr-A S&G	316	316 + CoCr-A	-	17-4PH	-	427
	307(2)	316 + CoCr-A S&G	17-4PH (H900)	316 + CoCr-A	-	17-4PH	-	427
	308(2)	31803 + CoCr-A S&G	31803	31803 + CoCr-A	-	32760	-51	316
	309(2)	32760 + CoCr-A S&G	32760	32760 + CoCr-A	-	32760	-51	316

Note:
1. Plug is guided by the seat bore.
2. Suitable for Anti-cavitation service, as the trim MOC meets high hardness requirements.
3. Optional PTFE soft seat is available in various Trim combinations, consult factory more details.
4. Positive sliding clearence is ensured, for Temperatures >230 °C, by controlling machining tolerances.
5. The maximum allowable thrust for 17-4PH stem, is derated for Sour service.
6. For Temperatures > 427 °C, consult Factory.

Soft Parts

Item	Standard	Optional
Soft Seat	PTFE	Graphite, Kel-F
Balance seals	Spring energized PTFE lip seal (-196°C to 232°C)	Graphite Piston rings (232°Cto427°C)
Packing	PTFE Chevrons	Graphite Packing High integrity packing
Gaskets	316L spiral wound with graphite filler	32760 spiral wound with graphite filler Inconel spiral wound with graphite filler

Flow Coefficients

Micro Spline Trim

Valve Size	Seat Bore	Travel	Flow Direction	Cv, Eq %
1	1/2	3/4	Under	4.29
1	1/4	3/4	Under	1.03
1	1/4	3/4	Under	0.349

Contoured Trim

Valve Size	Seat Bore	Travel	Flow Direction	Cv, Eq % (900 - 2500 #)	Cv, Mod. Eq % (900 - 1500 #)
1	1	1 1/8	Under	-	17.5
1	3/4	3/4	Under	9.13	-
1	3/4	1 1/8	Under	-	12.0
1	1/2	3/4	Under	5.47	-
1	1/4	3/4	Under	1.59	-
2	1 1/2	1 1/2	Under	-	52.5
2	1 1/4	1 1/8	Under	-	33.2
2	1	1 1/8	Under	-	23.6
2	3/4	3/4	Under	11.4	-
2	1/2	3/4	Under	5.42	-
2	1/4	3/4	Under	1.54	-

Ported cage

Valve Size	Seat Bore	Travel	Flow Direction	Cv, Eq %		Cv, Mod. Eq %		Cv, Lin	
				(900-1500#)	(2500#)	(900-1500#)	(2500#)	(900-1500#)	(2500#)
2	1 7/8	1 1/2	Over	-	-	48.4	-	52	-
2	1 7/8	1 1/8	Over	41.2	-	-	37.7	-	
2	1 7/8	1	Over	-	34.8	-	-	-	38.1
3	2 7/8	2	Over	92.5	-	114	-	122	-
3	2 1/4	1 1/2	Over	-	-	-	83.7	-	87.8
4	3 5/8	2	Over	-	-	201	-	201	-
4	3 5/8	1 1/2	Over	163	-	-	-	-	-
4	2 9/10	2	Over	-	-	-	131	-	151
6	5 3/8	3	Over	-	-	377	-	422	-
6	5 3/8	2 1/2	Over	320	-	-	-	-	-
6	4 1/6	3	Over	-	-	-	311	-	322

Flow Coefficients

MHC (1CC)

Valve Size	Seat Bore	Travel	Flow Direction	Cv, Eq %		Cv, Mod. Eq %		Cv, Lin	
				(900-1500#)	(2500#)	(900-1500#)	(2500#)	(900-1500#)	(2500#)
2	1 7/8	1 1/2	Over	-	-	38.72	-	41.6	-
2	1 7/8	1	Over	-	27.84	-	-	-	30.5
2	1 7/8	1 1/8	Over	33.0	-	-	30.1	-	
3	2 7/8	2	Over	74	-	91.2	-	97.6	-
3	2 1/4	1 1/2	Over	-	-	-	67.0	-	70.2
4	3 5/8	2	Over	-	-	161	-	161	-
4	3 5/8	1 1/2	Over	130	-	-	-	-	-
4	2 9/10	2	Over	-	-		105		121
6	5 3/8	3	Over	-	-	302	-	338	-
6	5 3/8	2 1/2	Over	256	-	-	-	-	-
6	4 1/6	3	Over	-	-		249	-	257

Anti-Cavitation Trim for Liquids

Valve Size	Seat Bore	Travel	Flow Direction	Cv, Lin (900 – 1500#)		Cv, Lin (2500#)	
				2 Stage	3 stage	2 Stage	3 stage
1	7/8	1 1/2	Over	7.41	-	7.5	-
2	1 3/4	2	Over	13.4	-	13.4	-
2	1	2	Over	-	6.13	-	6.13
3	2 1/2	2 1/2	Over	32.4	-	-	-
3	1 7/8	2 1/2	Over	-	15.7	-	-
3	2 1/4	2 1/2	Over	-	-	31.1	-
3	1 3/8	2 1/2	Over	-	-	-	12.4
4	3 7/16	3	Over	57.65	-	-	-
4	2 7/8	3	Over	-	28.2	-	-
4	2 9/10	2 3/4	Over	-	-	40.3	-
4	2 1/4	2 3/4	Over	-	-	-	22.4
6	5 1/4	4	Over	120	-	-	-
6	4 9/16	4	Over	-	64.1	-	-
6	4 1/6	3 3/4	Over	-	-	83.9	50.7

Flow Coefficients

Low dB Cage Trim for Gases

Valve Size	Seat Bore	Travel	Flow Direction	Cv Linear (900 &1500#)						
				1.1	1.3	2.1	2.3	3.1	3.3	4.3
2	1 7/8	1 1/2	Under	42.1	-	-	-	-	-	-
2	1 7/8	1 1/2	Under	40.9	-		-	-	-	-
3	2 7/8	2	Under	107	-	47.9	-	-	-	-
3	2 7/8	2	Under	110	-	44.4	-	-	-	-
4	3 5/8	2	Under	162	-	-	86.8	-	55.9	-
4	2 7/8	2	Under	-	-	-	-	-	-	37.1
4	3 3/5	2	Under	134	131	101	105	72.8	72.8	-
6	5 3/8	3	Under	322	-	-	162	-	108	-
6	4 3/8	3	Under	-	-	-	-	-	-	69.6
6	5 2/5	3	Under	263	271	216	237	162	162	-

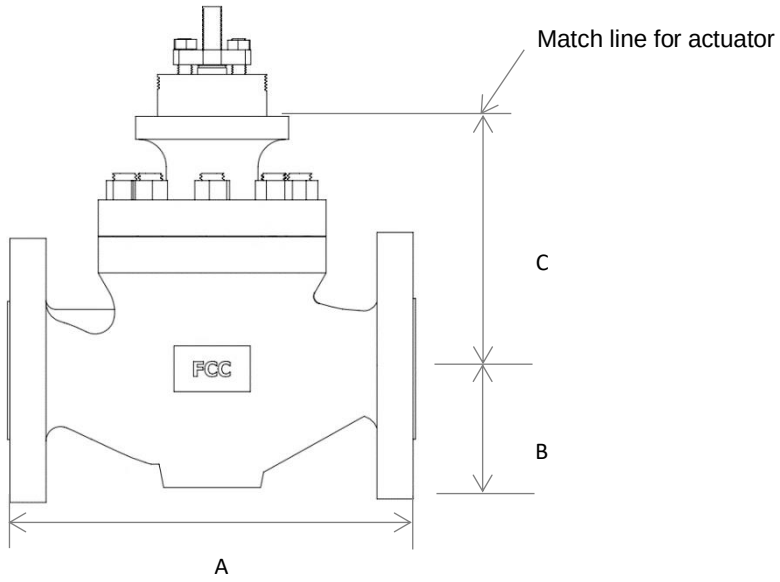
Note: Here 1st Digit A indicate the distance between the holes. And 2nd Digit here indicate the hole size (or) diameter.

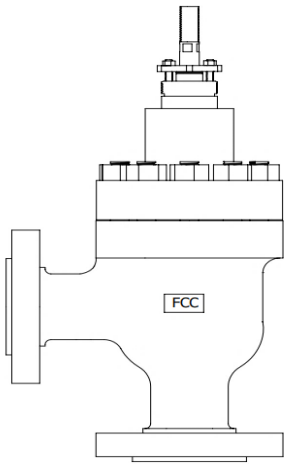
Low dB Cage Trim for Gases

Valve Size	Seat Bore	Travel	Flow Direction	Cv Linear (2500 #)						
				1.1	1.3	2.1	2.3	3.1	3.3	4.3
2	1 7/8	1 1/2	Under	35.2	-	-	-	-	-	-
3	2 1/4	1 1/2	Under	65.3	69.6	39.8	48.7	37.2	37.2	
3	1 3/8	2	Under	-	-	-	-	-	-	26.1
4	2 9/10	2	Under	121	123	80.3	81.2	53.7	53.6	-
4	2 1/4	2	Under	-	-	-	-	-	-	40.3
6	4 1/6	3	Under	262.23	254	172	177.24	106.21	115.7	115.7

Note: The 1st Digit here indicate the distance between holes. And 2nd Digit here indicate the hole size (or) diameter.

Dimensions & Weights

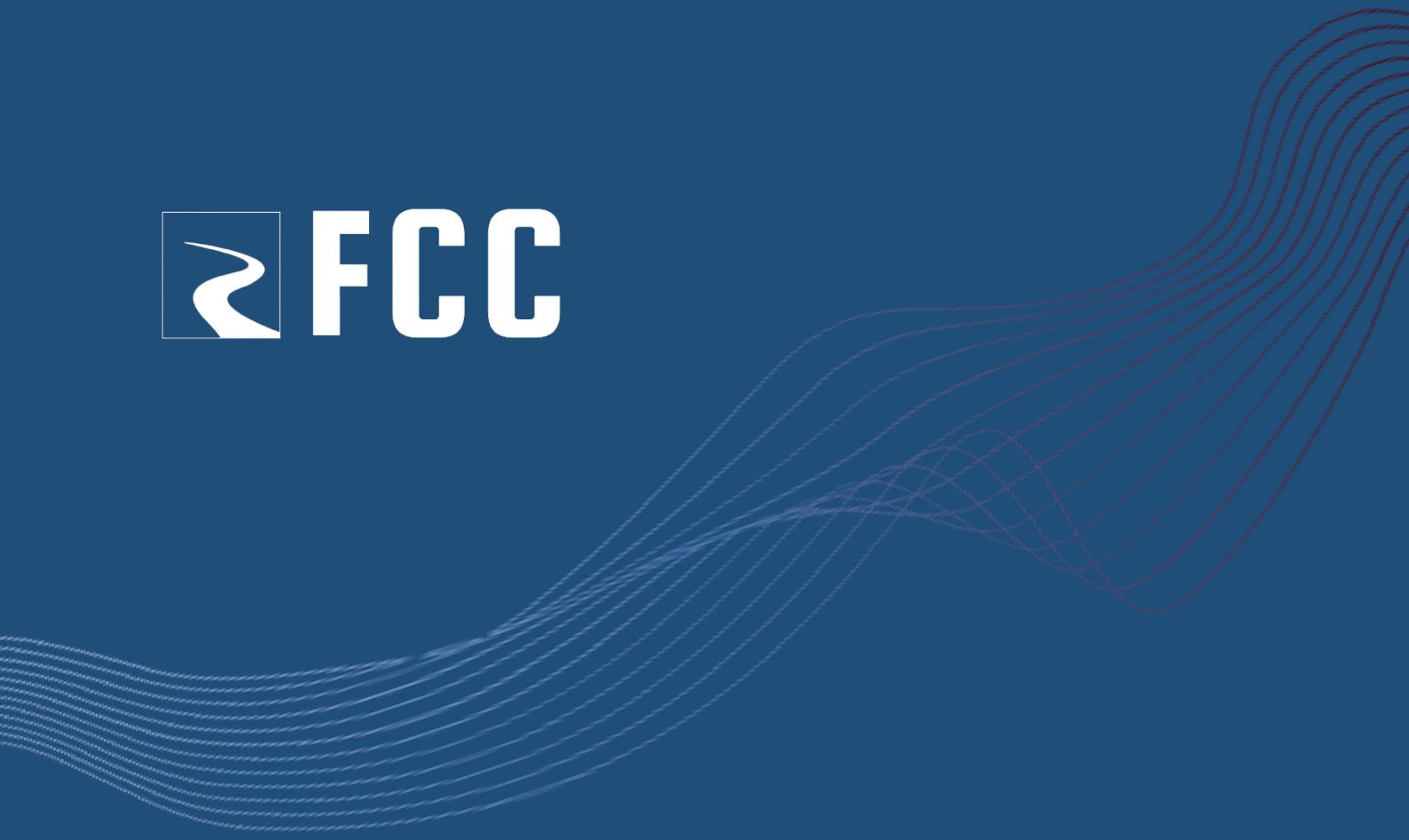




Consult factory for angle valve dimensions and weights

Valve Size (inch)	Stem Dia (inch)	A (mm)			B (mm)		C (mm) Std Bonnet	Weight (kg)		
		900#	1500#	2500#	900-1500#	2500#		900#	1500#	2500#
1	1/2	292	292	318	52	63	260	42	42	45
1	3/4	292	292	318	52	63	267	42	42	45
2	1/2	378	378	416	77	84	279	72	72	104
2	3/4	378	378	416	77	84	286	72	72	104
2	1	378	378	416	77	84	344	72	72	104
3	1/2	445	464	667	121	120.4	322	125	129	228
3	3/4	445	464	667	121	120.4	311	125	129	228
3	1	445	464	667	121	120.4	370	125	129	228
4	3/4	514	533	747	175	136.8	300	230	249	480
4	1	514	533	747	175	136.8	368	230	249	480
6	3/4	718	775	877	248	204.7	365	511	557	1080
6	1	718	775	877	248	204.7	402	511	557	1080

Note1: Applicable only for standard bonnets



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