FCC

Series 10
Globe Control Valve

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Foreword

Series 10 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. Designed to exceed customer expectations on Compactness & light weight and be-spoke solutions are available for specific needs

Model Numbering

Series	Rating	Trim Type	Temperature
10	1 - 150	10 – Contour Unbalanced	1 - Warm Service
	2 - 300	20 – Micro Spline	2 - High Temperature
	3 - 600	30 – Cage, Unbalanced*	3 - Ultra High Temperature
		40 – Cage, Balanced*	4 - Cryogenic
		50 – Stack Trims	
		60 – Double Seated, Contour	
		70 – Double Seated, V - Port	
		X1 – Tungsten Carbide Trims	
		X2 – Ceramic Trims	

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

Engineering Data

Body Style	Globe Straight, Globe Angle, Globe Double Seated
Design Standard	ASME B16.34
Sizes, Pressure rating	1" to 24", ASME Class 150-600
Trim Type	Micro Spline Contoured Multi Hole Cage (MHC) Anti-Cavitation Trim Low dB Trim Stack Trims
Trim Characteristics	Equal Percentage Linear
Flow Co-efficient	Refer Flow coefficients Table, Consult factory for customized Cv / Trim Characteristics.
Guiding	Top Guided Cage Guided
Seat Leakage	As per ANSI / FCI 70.2 / IEC 60534-4 Standard : Class IV Optional : Class V & VI
Flow Direction	For Anti-Cavitation and Low dB Trims Flow Under is recommended for Low dB Trims Flow Over is recommended for Anti-Cavitation Trims For standard Trims in General service 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), Normalizing Bonnet (> 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 4", Balanced 1" to 24"
End Connection Styles	Standard Flanged RF as per ASME B16.5 Optional Flanged RTJ as per ASME B16.5, Socket Welding as per ASME B16.11 (0.5" to 2"), Butt welding ends as per ASME B 16.25
Face To Face	Globe Straight: ISA 75.08.01 (Up to 16") & FCC standard (above 16") Globe Angle: ISA 75.08.08 (Up to 8") Globe Double Seated: ISA 75.08.01 (Up to 16") For RTJ the "X" factor from B16.10 should be added with ISA

Cross Sectional View

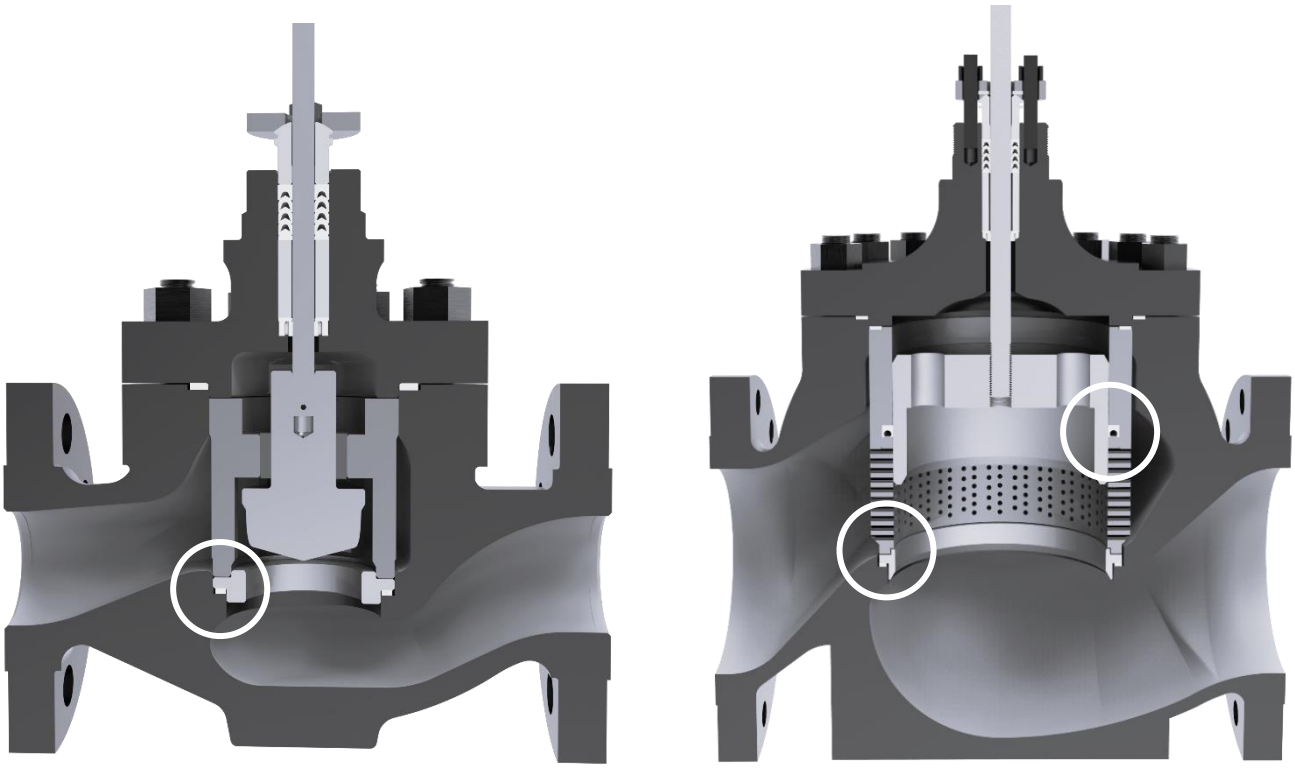


Fig 1: Globe Valve

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.

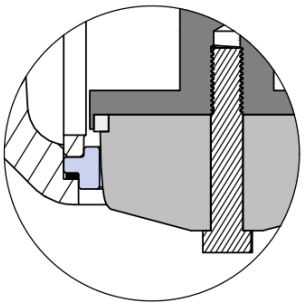


Fig 2a: Soft Seal for Contour Trim

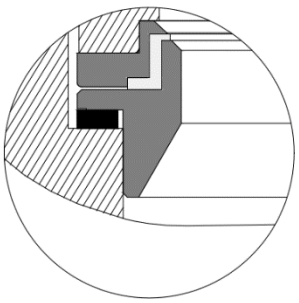


Fig 2b: Soft Seal for Cage guided Trim

Balance Seal

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

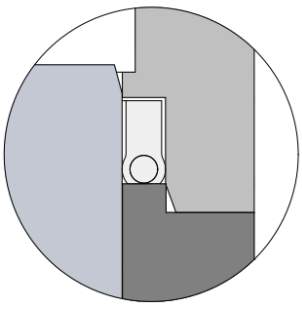


Fig 3a: PTFE Balance Seal

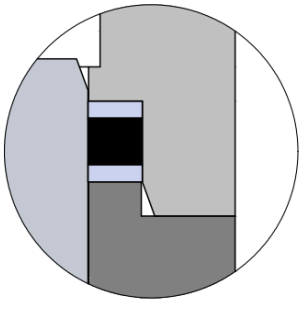


Fig 3b: Graphite Balance Seal

Bonnet Designs

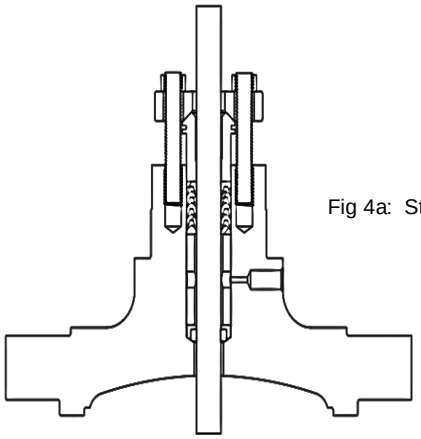


Fig 4a: Standard Bonnet

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.

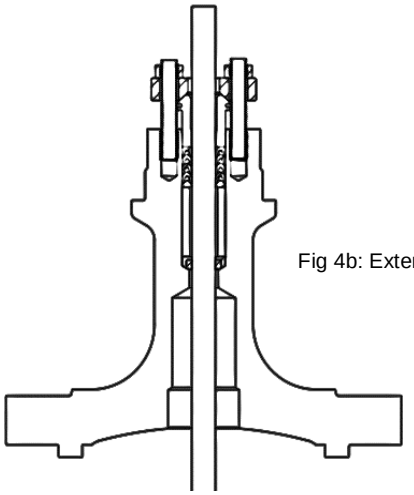


Fig 4b: Extension Bonnet

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.

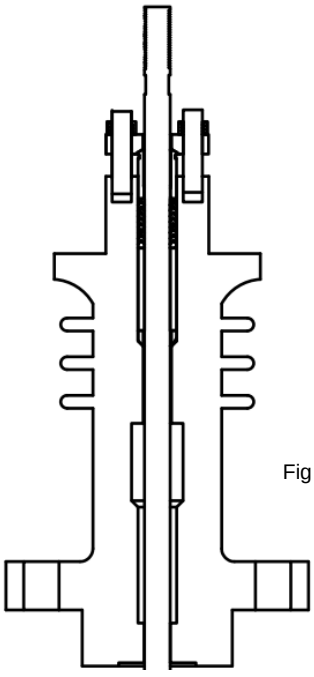


Fig 4c: Normalizing Bonnet

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.

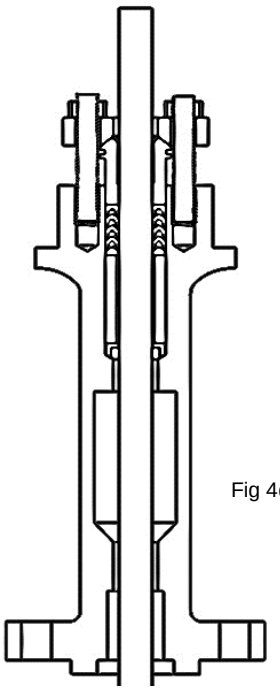


Fig 4d: Cryogenic Bonnet

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 use 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.

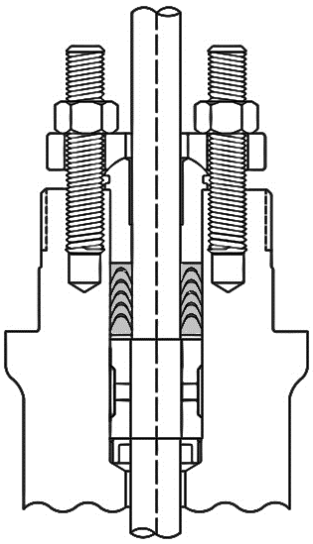


Fig 5a: Single PTFE

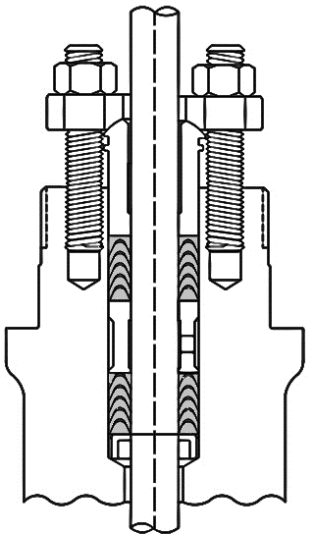


Fig 5b: Double PTFE

Double PTFE

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

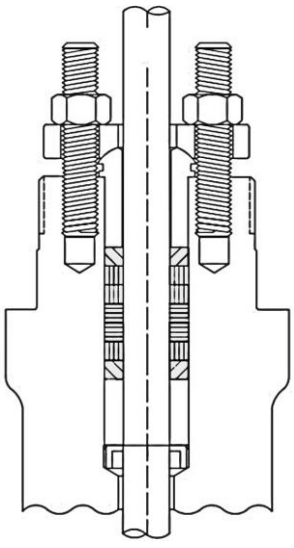


Fig 5c: Graphite

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

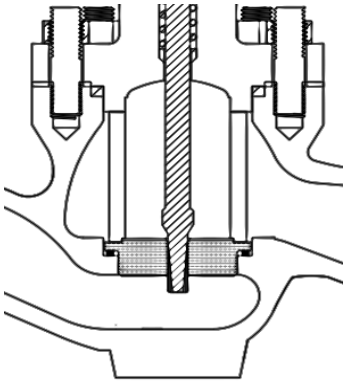


Fig 6a: Micro spline

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.

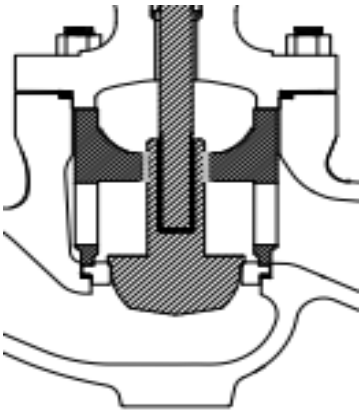


Fig 6b: Contoured

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.

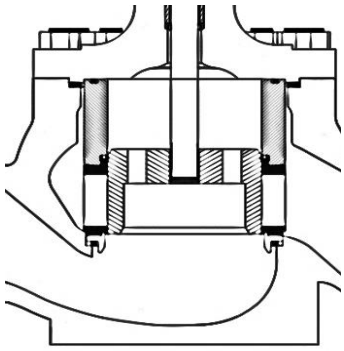


Fig 6c: Ported Cage

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.

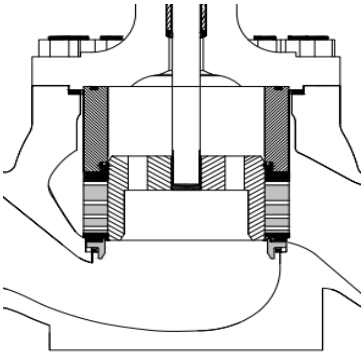


Fig 6d: Multi Hole Cage

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)

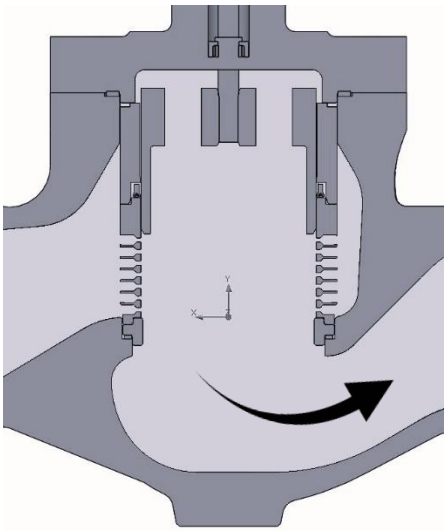


Fig 7: Anti-Cavitation Trim

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
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.

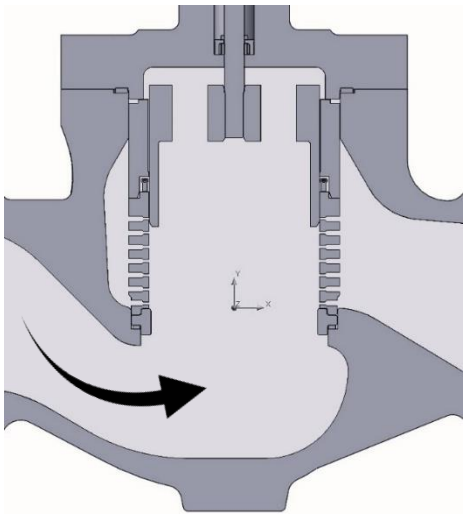


Fig 8: Low dB Trim

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.

Material Specifications & Temperature Limits for Body-Bonnets

Body, Bonnet Materials	Bonnet Type	NACE MR0175/0103	Stud, Nut Material[2]	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	-29	232
	Extension		B7M / 2HM, B8M / 8MA		-46	427

Note: 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
Seat	Metal	PTFE, 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 (inch)	Seat Bore (inch)	Travel (inch)	Flow Direction	Cv, Eq %
1/2 to 2	1/4	3/4	Under	1.08
1/2 to 2	1/4	3/4	Under	0.351
1/2 to 2	3/16	3/4	Under	0.177
1/2 to 2	3/16	3/4	Under	0.073

Contoured Trim

Valve Size (inch)	Seat Bore (inch)	Travel (inch)	Flow Direction	Cv, Eq %	Cv, Lin
1	1	3/4	Under	13.1	13.2
1	3/4	3/4	Under	8.79	-
1	1/2	3/4	Under	4.96	-
1	3/8	3/4	Under	3.05	-
1	1/4	3/4	Under	1.53	-
1 1/2	1 1/2	3/4	Under	27.8	30.8
1 1/2	1	3/4	Under	16.9	16.4
1 1/2	3/4	3/4	Under	9.98	-
1 1/2	1/2	3/4	Under	5.21	-
1 1/2	3/8	3/4	Under	3.15	-
2	2	1 1/8	Under	53.6	51.8
2	2	3/4	Under	45.8	45.1
2	1	3/4	Under	16.2	14.8
2	3/4	3/4	Under	9.98	-
2	1/2	3/4	Under	5.21	-
2	3/8	3/4	Under	3.15	-
3	3	1 1/2	Under	109	110
3	2	1 1/8	Under	71.8	81.2
4	4	2	Under	192	210
4	4	1 1/2	Under	175	181
4	2	1 1/8	Under	71.9	85.2

Flow Coefficients

Ported cage, MHC (1CC)

Valve Size (inch)	Seat Bore (inch)	Travel (inch)	Flow Direction	Ported Cage		MHC -1	
				Cv, Eq %	Cv, Lin	Cv, Eq %	Cv, Lin
1	1 13/64	3/4	Over	15.8	17.2	12	13.8
1 1/2	1 7/8	3/4	Over	36.2	39.5	29	31.6
1 1/2	1 5/16	3/4	Over	22.7	28.7	18.2	23.0
2	2 5/32	1 1/8	Over	55.1	65.5	44	52.4
2	2 5/32	3/4	Over	47.6	58.6	37	45
2	1 5/16	3/4	Over	23.8	32.2	19.0	25.8
3	3 7/32	1 1/2	Over	137	149	110	119
3	2 5/16	1 1/8	Over	70.4	103	56.3	82.4
4	4 5/32	2	Over	219	229	175	183
4	4 5/32	1 1/2	Over	195	210	156	168
4	2 7/8	1 1/2	Over	110	109	88	87.2
6	7	2	Over	395	428	316	342
6	4 5/32	2	Over	257	303	205	242
8	8	3 3/8	Over	850	875	738	751
8	8	2 1/2	Over	692	767	589	651
10	8	3 3/8	Over	975	1023	846	880
10	8	2 1/2	Over	770	809	616	648
12	11	4	Over	1261	1402	1179	1229
14	13 1/4	6	Over	1825	1927	1707	1730
14	11	4	Over	1397	1508	-	-
14	11	5	Over	-	-	1217	1345
16	15 1/4	6	Over	2309	2472	2139	2117
16	13 1/4	4	Over	1719	1900	-	-
16	13 1/4	5	Over	-	-	1551	1713
18	17 1/4	8	Over	3454	3606	3086	3201
18	15 1/4	5	Over	2470	2811	1956	2203
20	19 1/4	9	Over	4209	4456	3796	3947
20	17 1/4	5	Over	2882	3265	-	-
20	17 1/4	6	Over	-	-	2622	2882
24	21 1/4	12	Over	5429	5797	4880	5073
24	19 1/4	6	Over	3848	4229	-	-
24	19 1/4	8	Over	-	-	3451	3895

Flow Coefficients

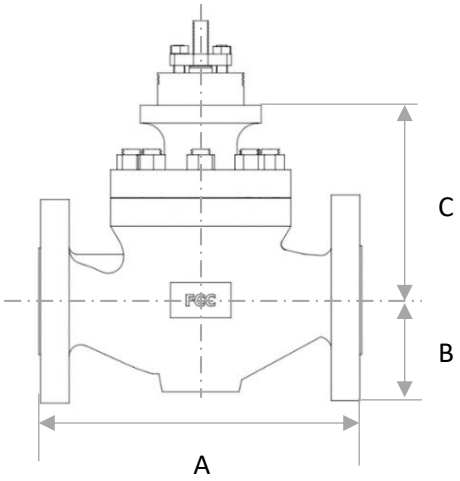
Anti-Cavitation Trim for Liquids

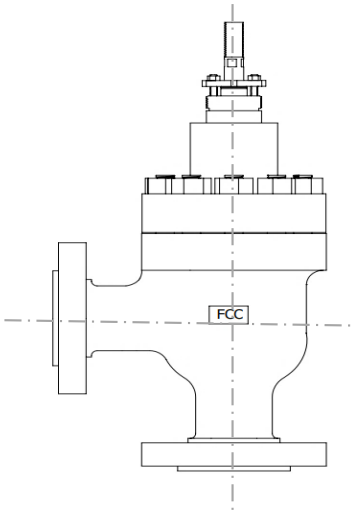
Valve Size (inch)	Flow Direction	1-Stage			2-Stage		
		Seat Bore (inch)	Travel (inch)	Cv	Seat Bore (inch)	Travel (inch)	Cv
1	Over	1 13/64	1	13.6	1	1	5.8
1 1/2	Over	1 7/8	7/8	22.5	1 5/16	7/8	6.3
2	Over	2 5/32	1 1/4	33.8	1 7/8	1 1/4	14.4
3	Over	3 7/32	1 5/8	79.5	2 7/8	1 5/8	26.5
4	Over	4 5/32	2 1/8	141	2 7/8	2 1/8	43.2
6	Over	7	2 1/4	259	5 3/8	2 1/4	90
8	Over	8	3 3/8	457	7	3 3/8	149
10	Over	8	3 3/8	473	-	-	-
12	Over	11	4	580	-	-	-
14	Over	11	6	947	-	-	-
16	Over	14 3/4	6	1363	-	-	-
18	Over	14 3/4	8	1745	-	-	-
20	Over	18 1/4	9	2434	-	-	-
24	Over	18 1/4	12	3489	-	-	-

Low dB Cage Trim for Gases

Valve size (inch)	Seat bore (inch)	Travel (inch)	Flow direction	A1	A3	B1	B3	C1	C3
1	1 13/64	1	Under	18.6	-	-	-	-	-
1 1/2	1 7/8	7/8	Under	30.1	-	-	-	-	-
1 1/2	1 5/16	7/8	Under	-	25.2	20.1	14.6	-	-
1 1/2	3/4	7/8	Under	-	-	-	-	5.92	6.64
2	2 5/32	1 1/4	Under	43	-	-	-	-	-
2	1 5/16	1 1/4	Under	-	29.3	24.4	19.5	14.2	14
3	3 7/32	1 1/2	Under	93.1	-	-	-	-	-
3	2 5/16	1 1/2	Under	-	88.9	67.1	74.4	45.1	44.7
4	4 5/32	2	Under	156	-	-	-	-	-
4	3 7/16	2	Under	-	138	110	99.4	75.9	73.3
6	7	2	Under	285	-	-	-	-	-
6	5 3/8	2 1/4	Under	222	225	182	174	96	107
8	8	2 1/2	Under	357	-	-	-	-	-
8	8	3 3/8	Under	567	570	367	364	248	229
10	8	3 3/8	Under	578	581	371	367	249	230
12	11	4	Under	834	761	518	518	363	350
14	11	6	Under	1464	1310	821	814	536	525
16	14 3/4	6	Under	1587	1541	1194	1162	834	840
18	14 3/4	8	Under	2127	2043	1559	1500	1038	1036
20	18 1/4	9	Under	2678	2643	2165	2113	1544	1507
24	18 1/4	12	Under	4133	3801	2737	2625	1862	1813

Dimensions & Weights

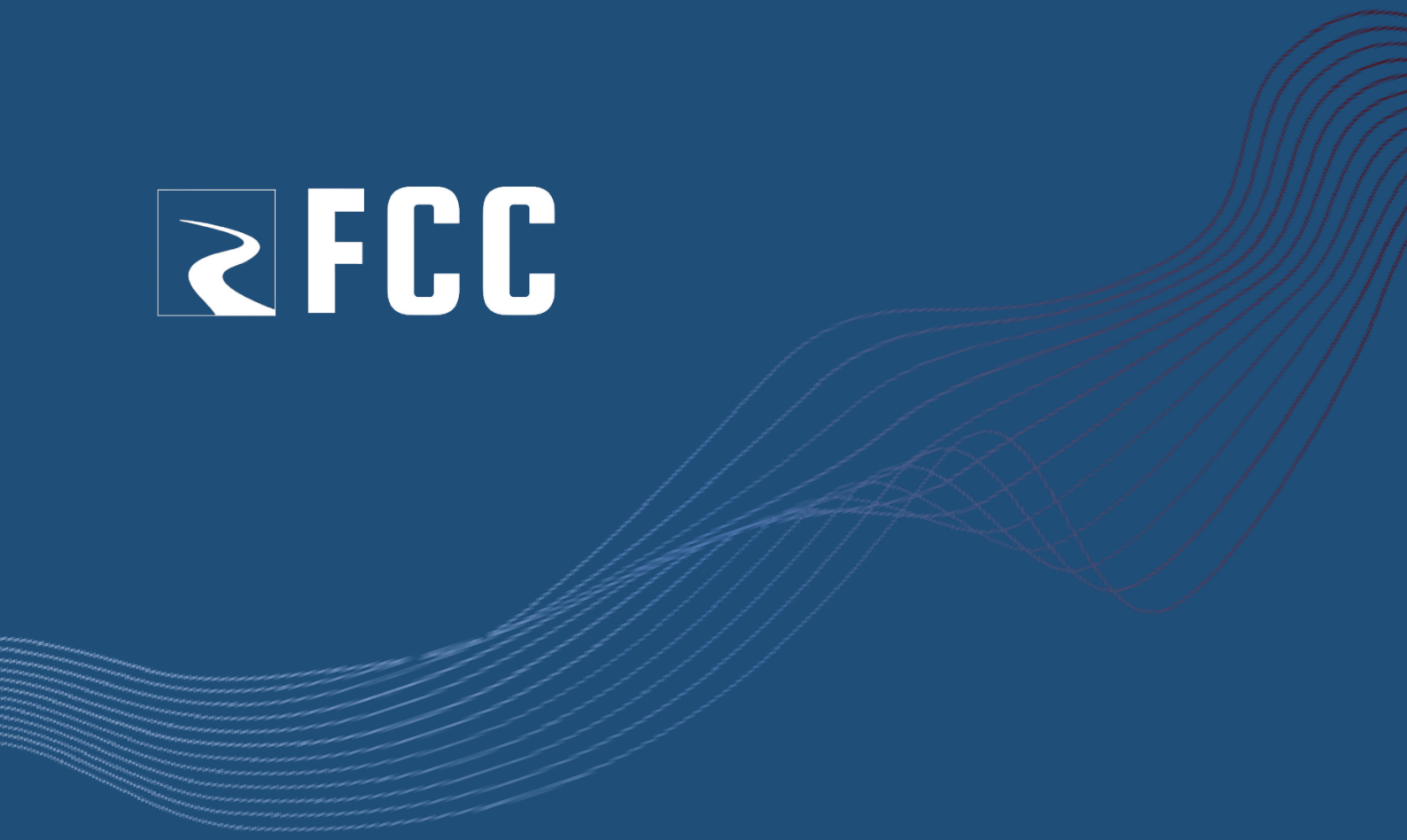




Consult factory for angle valves and double seated valve dimensions and weights

Valve Size	Stem Dia	A (mm)			B (mm)			C[1]	Weight (kg)		
(inch)	(inch)	150#	300#	600#	150#	300#	600#	(mm)	150#	300#	600#
1	3/8	184	197	210	60			129	16		18
	1/2							152			
1 1/2	3/8	222	235	251	71			125	22		24
	1/2							144			
2	1/2	254	267	286	78			168	36		37
	3/4							162			
3	1/2	298	317	337	97			195	60		62
	3/4							192			
4	1/2	353	368	394	129			226	73		75
	3/4							219			
6	3/4	451	473	508	140			255	155		160
	1							268			
8	3/4	543	568	610	191			379	413		417
	1							430			
10	3/4	673	708	752	275			379	570		749
	1							430			
12	1 1/2	737	775	819	254	270	286	393	448	590	899
14	1 1/2	889	927	972	302	314	330	565	873	1040	1432
16	1 1/2	1016	1057	1108	343	350	359	570	1196	1438	2183
18	1 1/2	1146	1184	1257	406	419	438	682	1817	2126	2917
20	1 1/2	1267	1308	1372	445	454	483	760	2134	2780	3881
24	1 1/2	1556	1600	1676	559	565	584	885	2728	3630	5208

Note1: Applicable only for standard bonnets.



Factory Address

Flow Control Commune
9 Multi Industrial Estate, Gerugambakkam
Chennai 600122, India

Contact details

Phone: +91 44 3500 1197
Email: info@fccommune.com
Website: www.fccommune.com