



MIL 21000 - Heavy Top Guided Single Seated Control Valves





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Introduction

MIL 21000 series single ported, heavy top guided control valves are designed with built-in versatility making them the most widely used control valve, well-suited to handle a wide variety of process applications.

Features

Heavy Post Guiding

Rugged, heavy top guiding provides maximum support to ensure plug stability. Valve plug shank is guided by the guide bush location within the lower portion of the bonnet and such guiding minimises the effect of lateral thrust on the valve plug and eliminates trim vibration.

It provides rigid guiding and ensures stable operations even in high pressure service. It also eliminates the need for a larger stem by allowing large guide surface. This is an outstanding feature of MIL 21000 series valves in comparison with conventional stem guided valves.



Reduced Capacity

Series of reduced area trim is available to provide wide flow range capabilities in all valve sizes. Reduced trim also permits larger outlet-to-orifice area relationship which result in lower exit velocities.

Hardened / Exotic Trims

For severe service, in lieu of standard 410 SST/ 316 SST trims, hard faced trims, precipitation hardened stainless steel 17.4 PH, martensitic stainless steel CA6NM, 440 C etc. are used. For corrosive service, trims in Alloy 20, Monel, Hastelloy, Nickel, Urea Grade SS316LN, Ferralium-255, HVD1, APX etc. are used. Other special materials are available on request.

Quick-Change Trim

Optional clamped seat ring facilitates easy seat removal. The retaining cage and seat ring are held in place by the bonnet.

Double Stage Anti-cavitation / Lo-dB trim

21800 and 21900 series double stage valves combine the principle of Anti-cavitation/Lo-dB plug and cage. Simultaneous throttling in the plug and cage all along the plug travel results in considerably lower sound pressure levels and excellent cavitation control.

Tight Shut-off

Class IV leakage is standard. Optional constructions meet FCI 70.2 Class V and Class VI leakage.

Extension Bonnet

Standard bonnet for 21000 series valves are designed for a temperature range of -27°C to 427°C . Optional constructions with extension bonnet are used up to 566°C and down to -196°C .

Bellows Sealed Valves

Bellows sealed valve are used in critical applications where the process fluid is of hazardous, flammable, unstable, toxic and costly in nature. Nowadays, industries are gearing up itself for better environmental protection. Here

comes the application of bellows sealed valves for providing zero stem leakage.

Steam Jacketing

Steam jacketing can be provided for services where process fluid has tendency to solidify. Steam jacketing designs suitable for steam pressure up to 25 kg/cm^2 are available.

Bottom Flange

Bottom flange is provided in cases where fluid streams carry sediments. Bottom flange can be removed and the valve body housing can be cleared of debris. The sediments can be removed by opening the bottom flange.

Purge Connection

$\frac{1}{2}$ " NPT or $\frac{3}{4}$ " NPT purging connection can be provided with optional flushing for the plug or body.

Angle Body

Optional angle body design with venturi seat is particularly suitable for handling slurries and corrosive liquids. The angle design provides flow surfaces that slopes down permitting the valve to self drain. Smoothly contoured surfaces minimise turbulence and prevents entrapment of particles, which can cause valve clogging. These valves are also ideally suited for special applications like flashing liquids, choked flow conditions and high pressure hydrocarbon service.

Typical Applications

MIL 21000 heavy duty top guided control valves are designed to handle fluids like air, water, steam, gas, oil and other fluids having wide flow range requirements. It can be used for moderate pressure drops allowing small particles. Typical applications in power plants where MIL 21000 series valves comes into picture are heater drain valves, make up level control valves, HFO level control valves, deaerator level control valves etc. Also MIL 21000 series valves are the best suitable one to handle viscous fluids in refineries and petrochemicals.



Technical Information

Model Decodification

1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	
-	-	-	-	-	-	-	
ACTUATOR TYPE		BODY SERIES		PLUG TYPE	TRIM TYPE	SEAT TYPE	
20.	Hand Operated	21.	Top Guided Globe Control Valve	0.	Undefined	0.	Undefined
37.	Direct Spring Diaphragm		70.	Top Guided Angle Control Valve	1.	Contoured	4.
38.	Reverse Spring Diaphragm	67.		Direct Piston Cylinder	7.	Single Stage Anti-cavitation /Lo-dB	5.
68.	Reverse Piston Cylinder		90.	Electrical Actuator	8.	Double Stage Anti-cavitation	6.
					9.	Double Stage Lo-dB	

Standard Sizes / Ratings

RATING (ASME CLASS)	VALVE SIZE (inch)									
	0.5	0.75 & 1	1.5	2	2.5	3	4	6	8	10
150# - 600#	*	*	*	*		*	*	*	*	*
900# - 1500#		*	*	*		*				
2500#		*	*	*	*	*				

* - Available

Standard End Connections

VALVE SIZE (inch)	RATING (ASME CLASS)		
	150# to 600#	900# to 1500#	2500#
0.5	F S T	-	-
0.75 to 2	F B S T	FBS	FBS
2.5	-	-	B
3	F B	F B	F B
4 to 10	F B	-	-

F : Flanged (RF, RTJ, T&G, FF) B : Butt Weld S : Socket Weld T : Threaded



General Data

BODY			BONNET		
Type	:	High capacity Globe or Angle	Type	:	Stud bolted
Recommended flow directions	:	Flow to open (except Anti-cav design). Anti-cav design : Flow to close	Temperature range	:	
			Standard bonnet	:	-27° C to 427° C
			Extension bonnet (AB)	:	-100° C to 566° C
			Cryogenic bonnet (CB)	:	-196° C to -100° C
GLAND SEAL			TRIM		
Type	:	Adjustable double sealed packing box with PTFE or Graphite moulded split rings	Type	:	Top guided
Option	:	Eco lock (varying density for low emission, PTFE or Graphite) or PTFE V rings	Plug Type	:	Contoured / Anti-cavitation / Lo-dB/ with PTFE inserts for Class VI Leakage (if Cv > 6)
Temperature range	:	≤ 180° C PTFE, > 180° C Graphite	Seat type	:	Threaded / Clamped (Quick Change)/ Soft seat with PTFE inserts, for Class VI leakage (if Cv ≤ 6)
			Guiding	:	Top guiding
			Rangeability	:	50 : 1
			Characteristic	:	
			Standard	:	Linear / Equal % / Quick Opening
			Anti-cav / Lo-dB	:	Linear

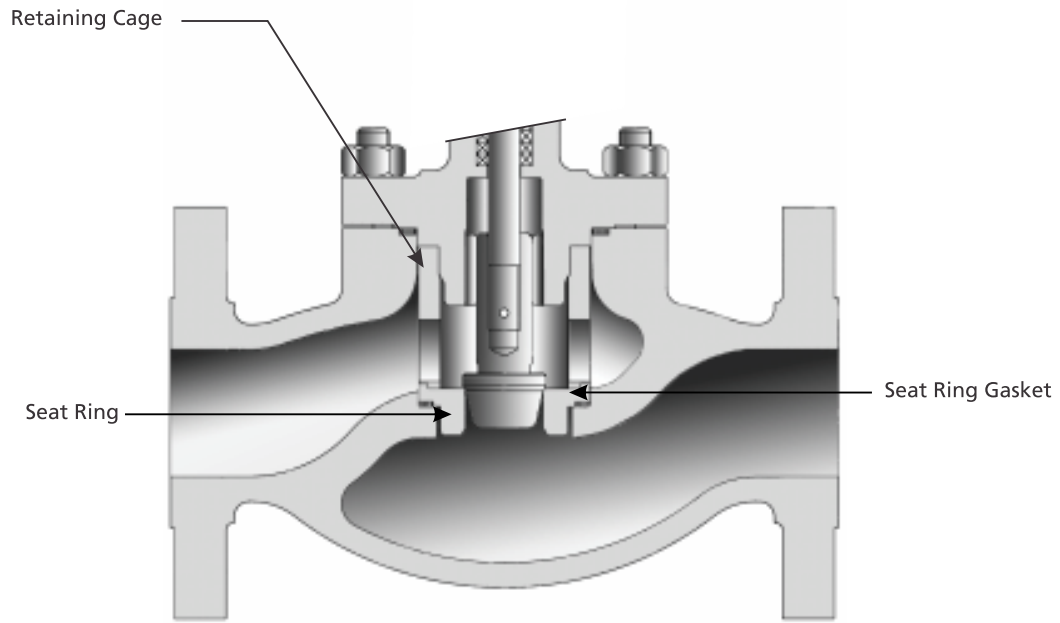
Seat Leakage Class / Temperature Range

VALVE TYPE	RATING (ASME Class)	TEMPERATURE RANGE (°C)				SEAT LEAKAGE CLASS (FCI 70.2)	
		STANDARD BONNET		EXTENDED BONNET			
		MIN.	MAX.	MIN.	MAX.	STANDARD	OPTIONAL
21000 Standard	150# - 600#	-27	427	-100	566	IV	V
	900# - 2500#	-27	427	-100	566	IV	V
21700/21800/21900 Anti-cav / Lo-dB	150# - 600#	-27	427	-100	566	IV	V
21006 Soft Seat	150# - 600#	-27	232	-100	232	VI	
21000 Bellows Sealed	150# - 300#	-	-	-33	450	IV	V
				-33	232	VI	

Class IV : 0.01% of maximum rated capacity at 50 psig to atmosphere

Class V : 5×10^{-4} ml per minute of water per inch of orifice diameter per psi differential

Class VI : Bubble tight



MIL 21104 (Low Pressure)

Flow coefficients (Rated Cv)

21100 Series (Linear / Equal% / On-off)

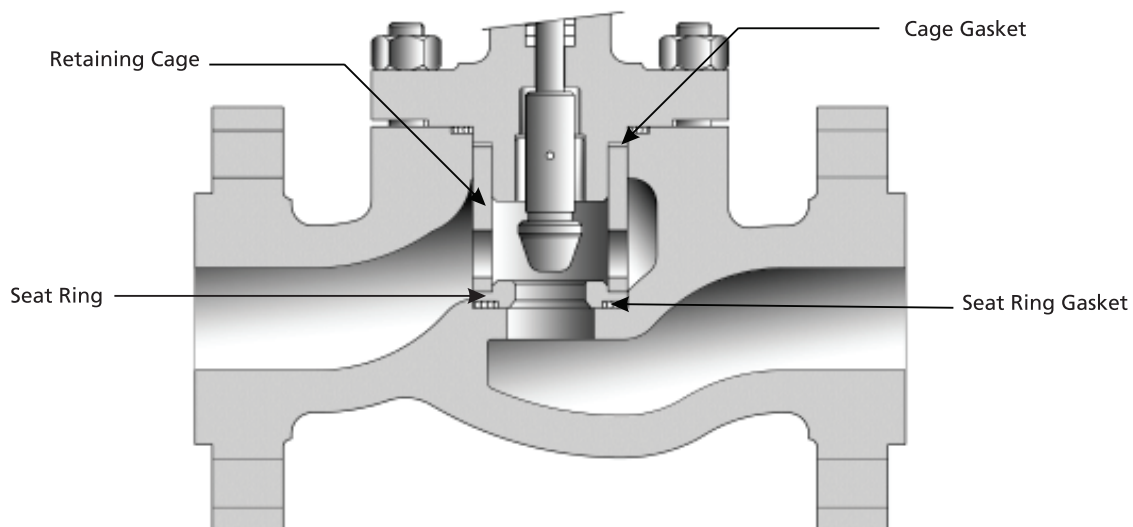
Critical Flow Factor (C_f or F_f): 0.90

RATING	VALVE SIZE (inch)	STROKE (inch)	ORIFICE DIAMETER (inch) Vs RATED Cv														
			0.25 (min.)	0.375	0.5	0.812	1.25	1.625	2	2.625	2.95	3.5	4	5	6.25	7	8
150# - 600#(ASME Class)	0.5	0.75	0.006,0.025, 0.04, 0.06, 0.1, 0.25,0.3 ⁽¹⁾ , 0.4, 0.6, 1, 1.7	2.5, ⁽²⁾ 3.8 ⁽²⁾	6	-	-	-	-	-	-	-	-	-	-	-	-
	0.75	0.75	0.025, 0.04, 0.06, 0.1, 0.25, 0.3 ⁽¹⁾ , 0.4, 0.6, 1, 1.7	2.5, 3.8	6	9, 12	-	-	-	-	-	-	-	-	-	-	-
	1	0.75	0.002,0.011,0.025, 0.04, 0.06, 0.1, 0.25,0.3 ⁽¹⁾ , 0.4, 0.6, 1, 1.7	2.5, 3.8	5,2, 6	9,10, 12	16	-	-	-	-	-	-	-	-	-	-
	1.5	0.75	0.025, 0.04, 0.06, 0.1, 0.25, 0.3 ⁽¹⁾ , 0.4, 0.6, 1, 1.7	2.5, 3.8	6	10, 13	20, 25	35	-	-	-	-	-	-	-	-	-
	2	0.75	0.025, 0.04, 0.06, 0.1, 0.25, 0.3 ⁽¹⁾ , 0.4, 0.6, 1, 1.7	2.5, 3.8	6	10,11, 12,15	21, 26	35, 46	-	-	-	-	-	-	-	-	-
	3	1.5	-	-	-	-	31	47	65	75,80, 110	-	-	-	-	-	-	-
	4	1.5	-	-	-	-	-	49	66	95,110 113	140	195	-	-	-	-	-
	6	2	-	-	-	-	-	-	68	126	-	208	275	300, 320, 400	-	-	-
	8	2	-	-	-	-	-	-	-	-	-	224	275	415	640	-	-
	10	3	-	-	-	-	-	-	-	-	-	-	-	-	650	750	1000 ⁽³⁾

⁽¹⁾ : $C_v \leq 0.3$ with linear characteristic only

⁽²⁾ : with 0.443" orifice diameter

⁽³⁾ : with stroke 3.5 for equal % characteristics



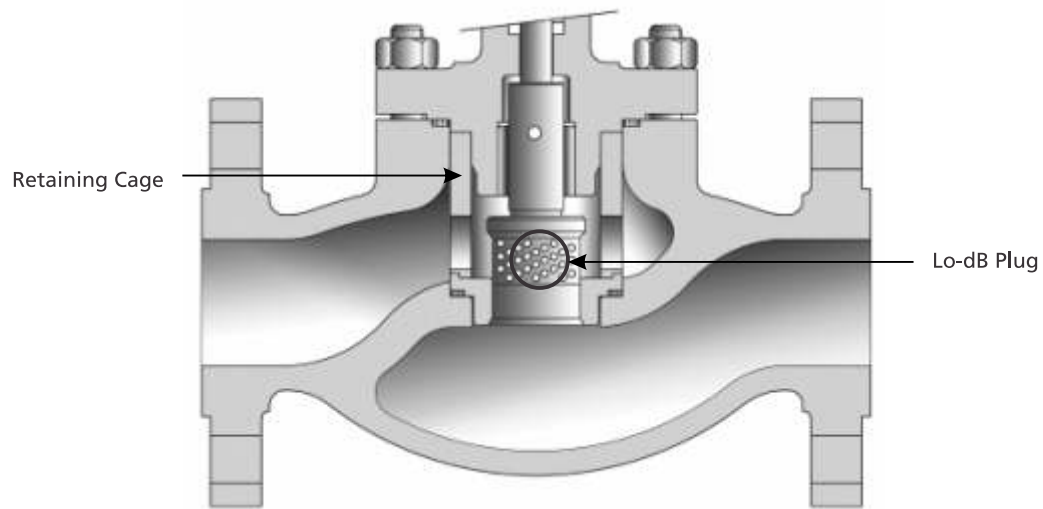
MIL 21104 (High Pressure)

21100 Series (Linear / Equal% / On-off)

Critical Flow Factor (C_r or F_L) : 0.90

RATING	VALVE SIZE (inch)	STROKE (inch)	ORIFICE DIAMETER (inch) Vs RATED Cv								
			0.25 (min)	0.375	0.5	0.812	1.25	1.625	2	2.625	3
900# - 1500# (ASME Class)	0.75 & 1	0.75	0.025, 0.04, 0.06, 0.1, 0.25, ⁽¹⁾ 0.3,0.4, 0.6, 1, 1.7	2.5, 3.8	6	11	-	-	-	-	-
	1.5	0.75	0.025, 0.04, 0.06, 0.1, 0.25, ⁽¹⁾ 0.3,0.4, 0.6, 1, 1.7	2.5, 3.8	6	11,13	15,20	-	-	-	-
	2	0.75	0.025, 0.04, 0.06, 0.1, 0.25, ⁽¹⁾ 0.3,0.4, 0.6, 1, 1.7	2.5, 3.8	6	11	15	⁽⁴⁾ 26	⁽⁴⁾ 46	-	-
	3	1.5	-	-	-	-	15	26	31	65	110
	4	1.5	-	-	-	-	-	-	-	80	140
2500# (ASME Class)	0.75 & 1	0.75	0.025, 0.04, 0.06, 0.1, 0.25, ⁽¹⁾ 0.3,0.4, 0.6, 1, 1.7	2.5, 3.8	6	11	-	-	-	-	-
	1.5	0.75	0.025, 0.04, 0.06, 0.1, 0.25, ⁽¹⁾ 0.3,0.4, 0.6, 1, 1.7	2.5, 3.8	6	11,13	15,20	-	-	-	-
	2 & 2.5	0.75	1.7	2.5, 3.8	6	11	15	-	⁽⁴⁾ 26	-	-
	3	1.5	-	-	-	-	-	-	-	46	80

⁽⁴⁾ : with 1.5" stroke

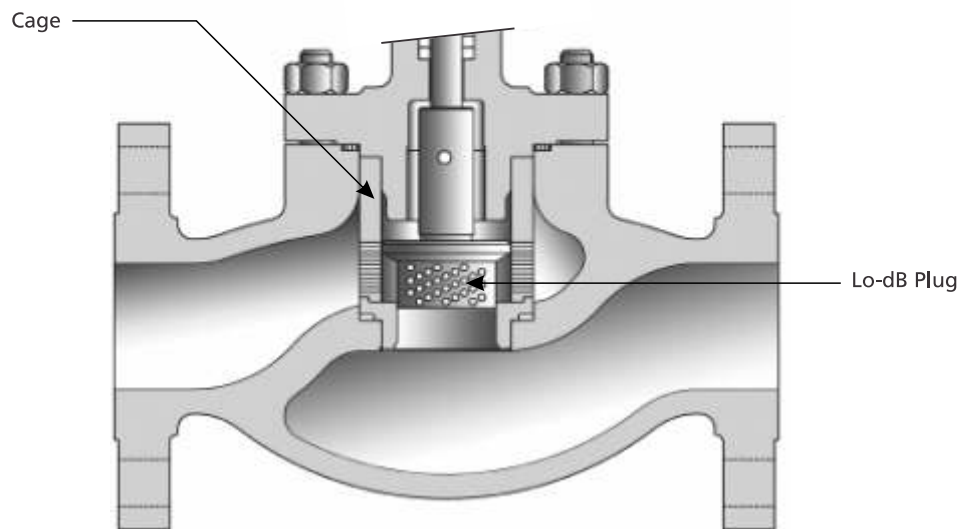


**MIL 21700 (Single Stage
Anti-cavitation/ Lo-dB)**

21700 Series (Single Stage Anti-cavitation / Lo-dB)

Critical Flow Factor(C_v or F_v): 0.95

RATING	VALVE SIZE (inch)	STROKE (inch)	ORIFICE DIAMETER (inch) Vs RATED C_v							
			1.25	1.625	2	2.25	2.625	3.5	5	6.25
ASME 150# THROUGH 600#	0.75	0.75	2.5, 4, 6, 8	-	-	-	-	-	-	-
	1	0.75	2.5, 4, 6, 8 1.7, 0.6	-	-	-	-	-	-	-
	1.5	0.75	1.7, 2.5, 4, 6, 8, 15	20, 25	-	-	-	-	-	-
	2	0.75	1.7, 2.5, 4, 6, 8, 15	20, 25, 30	-	-	-	-	-	-
	3	1.5	-	10, 15, 25	30	45, 35	40, 50, 60, 75	-	-	-
	4	1.5	-	-	30	45	40, 65, 75	100	---	-
	6	2	-	-	-	-	-	100	200, 240, 225	-
	8	2	-	-	-	-	-	-	-	300, 415



**MIL 21800/ 21900 (Double Stage
Anti-cavitation/ Lo-dB)**

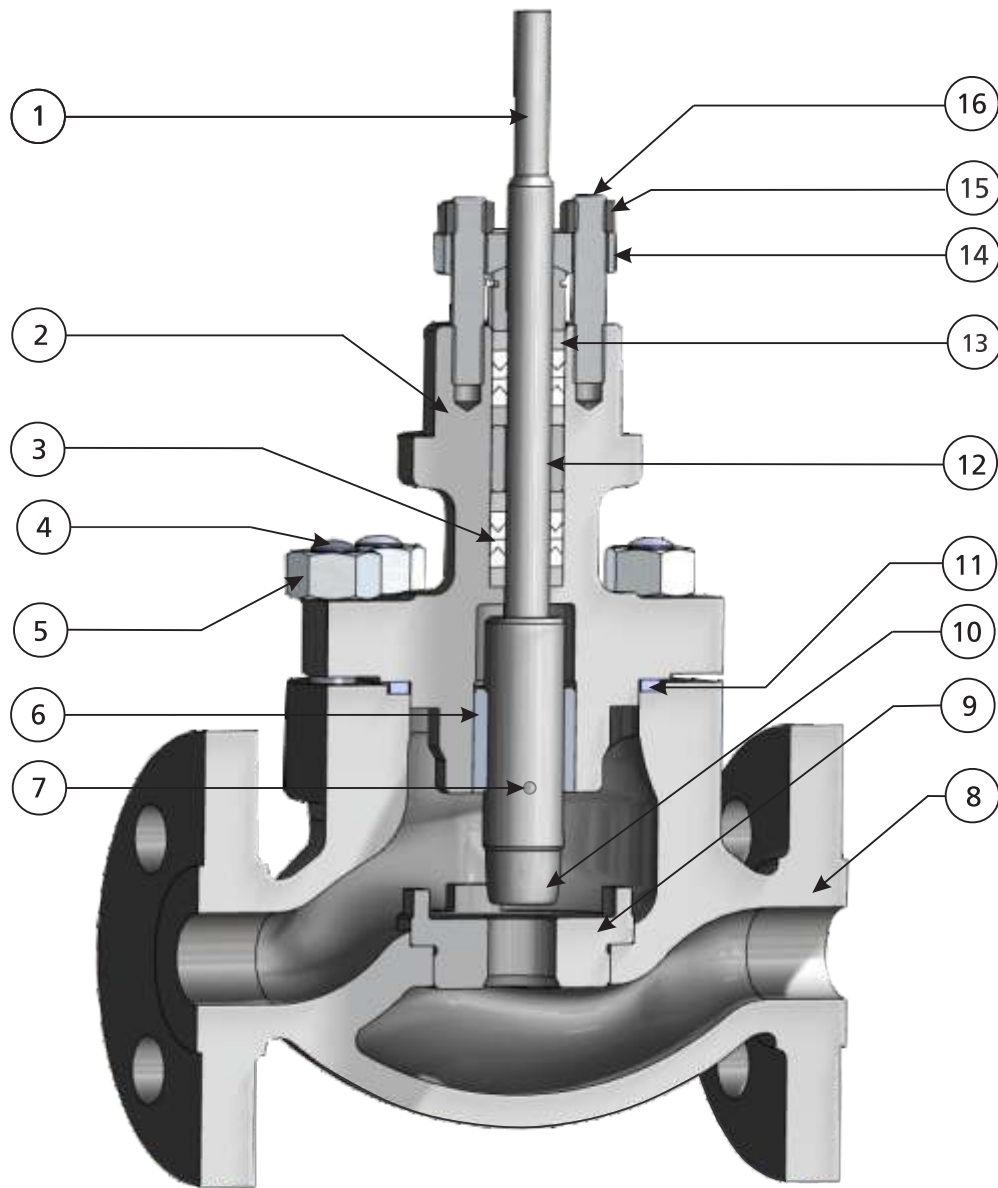
21800 Series (Double Stage Anti-cavitation) , 21900 Series (Double Stage Lo-dB)

Critical Flow Factor (C_v or F_L) : 0.975

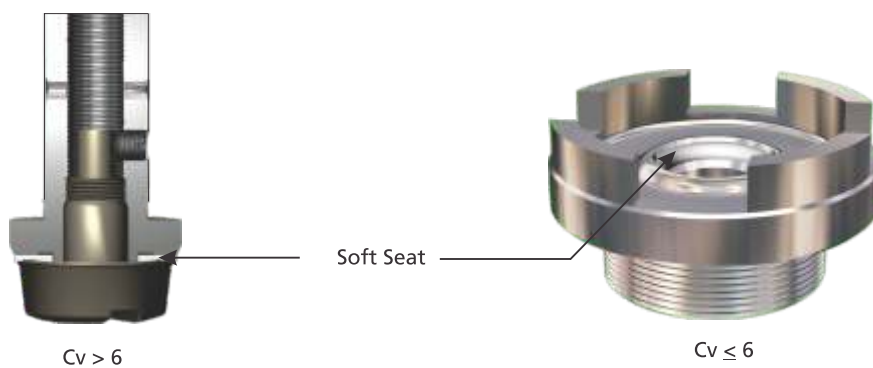
RATING	VALVE SIZE (inch)	STROKE (inch)	ORIFICE DIAMETER (inch) Vs RATED Cv			
			1.25	1.625	2.625	3.5
150# - 600# (ASME Class)	21800 Series Double Stage Anti-cavitation					
	0.75	0.75	1.7, 2.3, 4.5	-	-	-
	1	0.75	1.7, 2.3, 3.5, 4.5	-	-	-
	1.5	0.75	1.7, 2.3, 4.5, 4.6, 8.5	-	-	-
	2	0.75	1.7, 2.3, 4.5, 4.6, 8.5	-	-	-
	3	1.5	-	-	27,42	-
	21900 Series Double Stage Lo-dB					
	1	0.75	3.5, 7, 8.5	-	-	-
	1.5	0.75	4.5,7, 13	-	-	-
	2	0.75	13	15, 21	-	-
	3	1.5	-	21	40, 63	-
	4	1.5	-	-	40, 53, 90	83
	6	2	-	-	-	125



Construction



MIL 21000 Standard Construction



Soft seated plug and seat construction



Material of Construction

DRAWING REF No.	PART NAME	STANDARD MATERIAL ⁽⁵⁾
1	Valve Plug Stem	316 SST
		17.4 PH SST H 1075
		Super Alloy (ASTM A 638 Gr. 660)
2,8	Bonnet, Body	Carbon Steel : ASTM A 216 Gr. WCC
		Alloy Steel : ASTM A 217 Gr. WC6
		Alloy Steel : ASTM A 217 Gr. WC9 / C5
		Stainless Steel : ASTM A 351 Gr. CF8 / CF8M / CF3 / CF3M
3	Gland Packing	PTFE $\leq 180^{\circ}\text{C}$
		Graphite $> 180^{\circ}\text{C}$
4	Body Stud	ASTM A 193 Gr. B7
5	Body Nut	ASTM A 194 Gr. 2H
6	Guide Bush	440 C SST Heat Treated
		316 SST Stellite
7	Plug Pin	316 SST
9	Seat Ring	410 SST / 316 SST
10	Valve Plug	410 SST
		316 SST
		316 SST Stellite No.6
		17.4 PH SST H 900
		ASTM A 743 Gr. CA6NM, Nitrided
11	Body Gasket	316L SST + Graphite
12	Packing Spacer / Lantern Ring	304 SST
13	Packing Follower	304 SST
14	Packing Flange	ASTM A 105
15	Packing Flange Nut	ASTM A 194 Gr. 8
16	Packing Flange Stud	ASTM A 193 Gr. B8
17	Seat Ring / Cage Gasket ⁽⁶⁾	316L SST + Graphite
18	Retaining Cage ⁽⁶⁾	304 SST
		CA6NM, Nitrided
19	Anti-cav / Lo-dB Cage ⁽⁷⁾	ASTM A 351 Gr. CF8M
		CA6NM, Nitrided

⁽⁵⁾ : Material indicated above are for reference only. MIL reserves the right to supply alternate material/ forms due to constant product upgradation.
Other specific material are available on request.

⁽⁶⁾ : Applicable for 21004 series only, refer page 5 & 6.

⁽⁷⁾ : Applicable for 21800 /21900 series only, refer page 8.



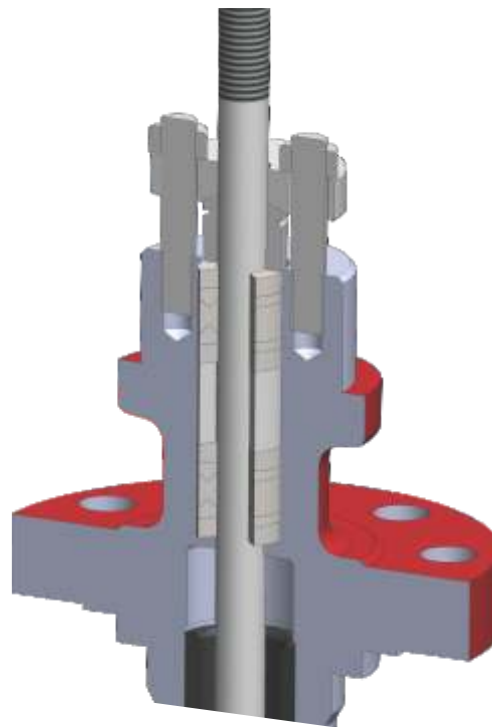
Eco-lock Packing

Packing is a resilient material, which is forced into the void between the stem and the packing box. Any leakage should pass through the space between the packing and the stem. Modern packing systems with PTFE or Graphite is virtually impermeable and arrests the primary leakage that occurs between the stem and the packing.

For limiting the Fugitive emission, MIL employs its Eco-lock packing system which offers exceptional sealing capabilities. Disc or coil springs are provided in gland studs or in the gland itself in the stuffing box to maintain a constant load. The springs exert a constant load on the packing that eliminates the need for packing box adjustments.

MIL has successfully provided such designs to various customers including The Nuclear Power Corporation of India Ltd., where the valves handle radioactive fluids. In such cases emission control requirements are very stringent and live loading is mandatory.

The 21000 series control valves with eco lock packing has qualified fugitive emission test as per ISO 15848-1 standard.



Eco-Lock Packing

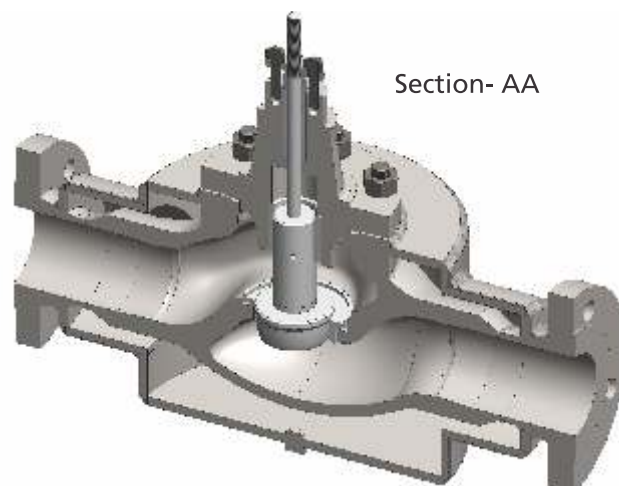
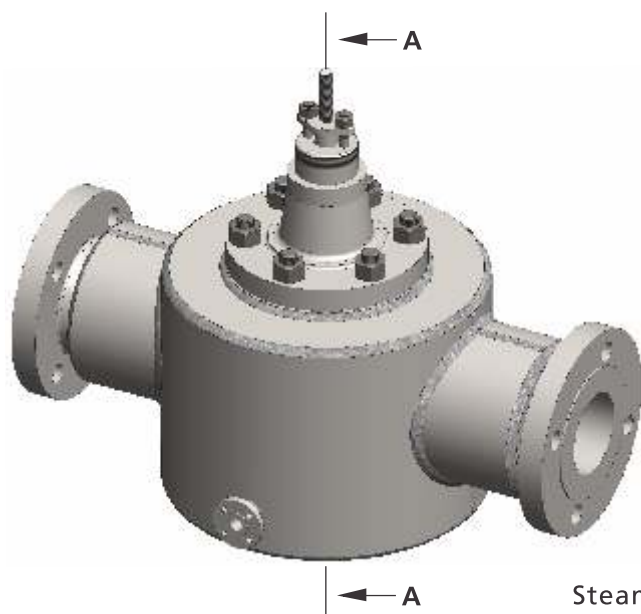
Bellows Sealed Bonnet

Precision engineered, formed, seamless bellows and helicoflex gaskets ensures zero leakage for service where no stem leakage can be tolerated or where the line fluid cannot be contained by any packing. This may be the case when the process fluid is flammable, toxic, explosive, expensive or it rapidly destroys packing. They may also be used to prevent leakage in vacuum service.

The bellow is a critical component which forms the soul of the bellows sealed valves. Metal bellows offers elegant solutions for most piping design problems involving thermal expansion, volume compensation, vibration isolation, etc. The bellow cartridge is welded to both the valve bonnet and the valve stem. It has a number of convolutions and these convolutions become compressed or expanded depending upon the movement of valve stem. Scientifically speaking, the bellow gets compressed when the valve is in the open position and expanded when it is in the closed condition. The most important is to properly install the valve bodies. Standard Material of construction of our bellow is 316L SST and other special materials like SS316+Ti, Inconel 600, Monel, Hastelloy C are also available. Bellow selection will depend upon the process fluid temperature and pressure.



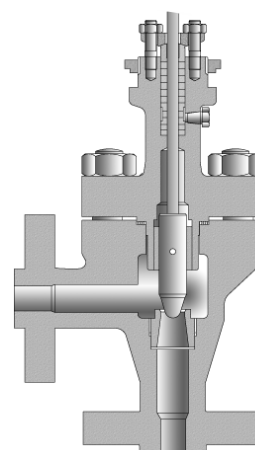
Bellows Sealed Bonnet



Steam Jacketed Construction



Micro-flow high pressure drop plug and seat construction with extra guiding



MIL 70000
High Pressure Angle Body
Construction

Dimensions and Weights

VALVE SIZE (inch)	UNPACKED WEIGHT (Kg)							
	FLANGED				WELD END			
	300#	600#	1500#	2500#	300#	600#	1500#	2500#
0.5	13	15	-	-	20	20	-	-
0.75	16	19	29	29	21	21	26	26
1	16	19	29	29	21	21	29	29
1.5	22	25	35	35	25	25	35	35
2	26	29	46	78	29	29	46	78
3	57	62	-	-	33	45	80	-
4	88	98	-	-	55	61	90	-
6	160	203	-	-	109	123	145	-
8	318	410	-	-	287	-	-	-
10	600		-	-		-	-	-

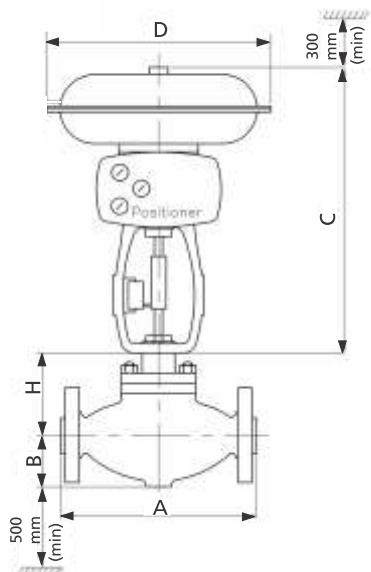


Dimensions for MIL 21000 Low Pressure Rating Valves

VALVE SIZE (inch)	A(mm)							B(mm)		H(mm)			
	RAISED FACE (RF)			RING TYPE JOINT (RTJ)			WELD END	≤300#	600#	STANDARD BONNET		EXTENDED BONNET	BELLOWS SEALED
	150#	300#	600#	150#	300#	600#	≤600#			≤300#	600#	≤300#	≤300#
0.5	190	190	203	195	202	206	200	37.5	37.5	142	142	-	-
0.75	184	194	206	195	206	206	209.5	51	51	142	142	352	266
1	184	197	209	197	209	209	209.5	51	51	142	142	352	266
1.5	223	235	251	235	248	251	251	64	64	142	142	352	266
2	254	267	286	267	283	289	286	76	76	142	142	352	266
3	299	318	337	311	333	340	404	94	114	205	298	388	429
4	353	368	394	365	384	397	444	117	140	206	266	402	432
6	451	473	508	463	489	511	540	159	187	288	303	519	550
8	543	569	610	556	584	613	626	184	216	436	436	576	655
10	673	708	752	-	-	-	-	225	232	489	-	-	747

Dimensions for MIL 21000 High Pressure Rating Valves

VALVE SIZE (inch)	A(mm)						B(mm)		H(mm)	
	RAISED FACE		RING TYPE JOINT		WELD END		900#-1500#	2500#	STANDARD BONNET	
	900#-1500#	2500#	900#-1500#	2500#	900#-1500#	2500#			900#-1500#	2500#
0.75	292	318	292	318	292	292	65	65	175	175
1	292	317.5	292	317.5	292	292	65	65	175	175
1.5	333.5	362	333.5	362	292	292	65	65	175	175
2	311	394	315	397	311	394	96	111	234	259
2.5	-	-	-	-	-	394	-	111	-	259



Dimensions and Weights (Spring Diaphragm Actuators)

ACTUATOR SIZE	ACTUATOR TYPE : 37 DIRECT			ACTUATOR TYPE : 38 REVERSE		
	DIMENSIONS (mm)		UNPACKED WEIGHT (Kg)	DIMENSIONS (mm)		UNPACKED WEIGHT (Kg)
	C	D		C	D	
11	421	330	21	617	330	25
13	516	381	32	782	381	40
15	654	445	55	943	445	75
18	848*	527	82	1360*	527	178
24	870*	686	170	1505*	686	210

* Actuator height varies with spring range/ stroke. Maximum height is indicated. Contact MIL for exact height.



Product Highlights

Challenging Performance

- Precise control over wide range of flow

Design Features

- Heavy top guiding (shank guiding)
- Tight shut off capability
- Customized valve trim to meet emerging demands

Optional Characters

- Steam jacketing
- Clamped seat ring
- Extended bonnet design

Field Proven Material

- High Performance material for better longevity

Easy Maintenance

- Fewer internal trim parts
- Quick change trim



Sales & Service offices

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