

KOSO **PARCOL**

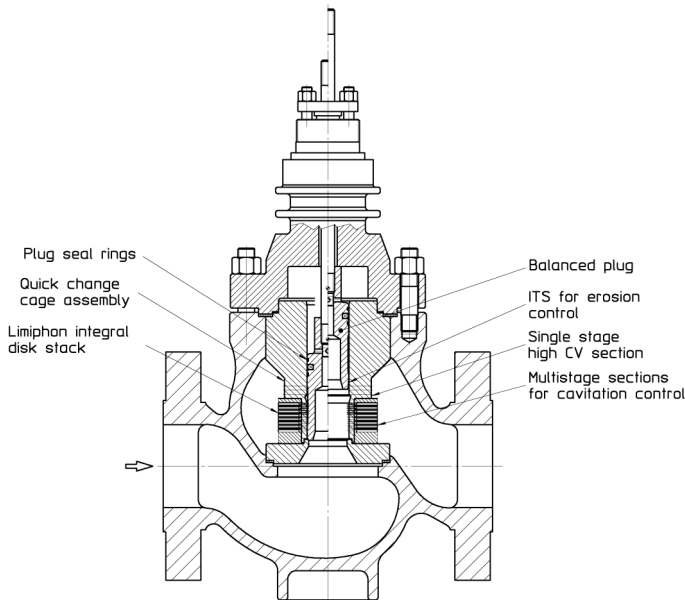
**1-6962 SERIES
VARISTEP
CONTROL VALVES**

PARCOL-8"E
1-69-CN



1-6962 SERIES VARISTEP CONTROL VALVES

Introduction



Cavitation is a well-known phenomenon which frequently occurs when high liquid pressure drops associated with relatively high temperatures are handled in a control valve.

The microjets produced by the reversion of steam into water downstream the vena contracta are generating very high local stresses on the metal surfaces. The resulting damage appears as an extended pitting or cratering and no defence is known against this fluid impingement. Hard metals use only increases the time for destruction of the surfaces.

The ideal solution to this problem is to use a multistep trim with an appropriate pressure drop distribution to avoid or strongly limit the formation of internal vapour bubbles. This perfectly comply with the widely used Limiphon trim.

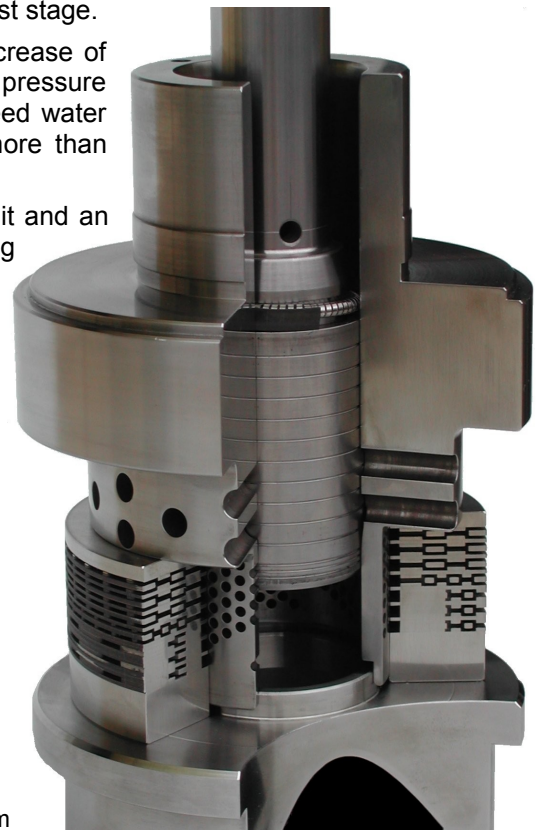
For the specific case of boiler feedwater application, two conflicting conditions have to be met with:

- protection from cavitation at low flows;
- high capacity at large flows.

Varistep, an extrapolation of Limiphon design, has been engineered by PARCOL in order to better prevent cavitation phenomenon, without limiting the capacity at regimes not subject to cavitation.

What is new in Varistep compared with basic Limiphon design?

- 1 - radial section expansion is designed both to minimize the pressure drop at last stage (the most sensitive to cavitation) and, at the same time, to limit the pressure drop at first stage.
- 2 - less stages from bottom to top of the stack, resulting in an increase of the incremental Cv along the travel. This to comply with the pressure drop decrease at high flow rates, usually occurring in boiler feed water applications where the cavitation control is needed on not more than 20% to 30% of rated capacity.
- 3 - the stack disks are welded together to form a solid, rugged unit and an internal cage is fitted around the plug to ensure the best guiding and clearance control.



Varistep trim

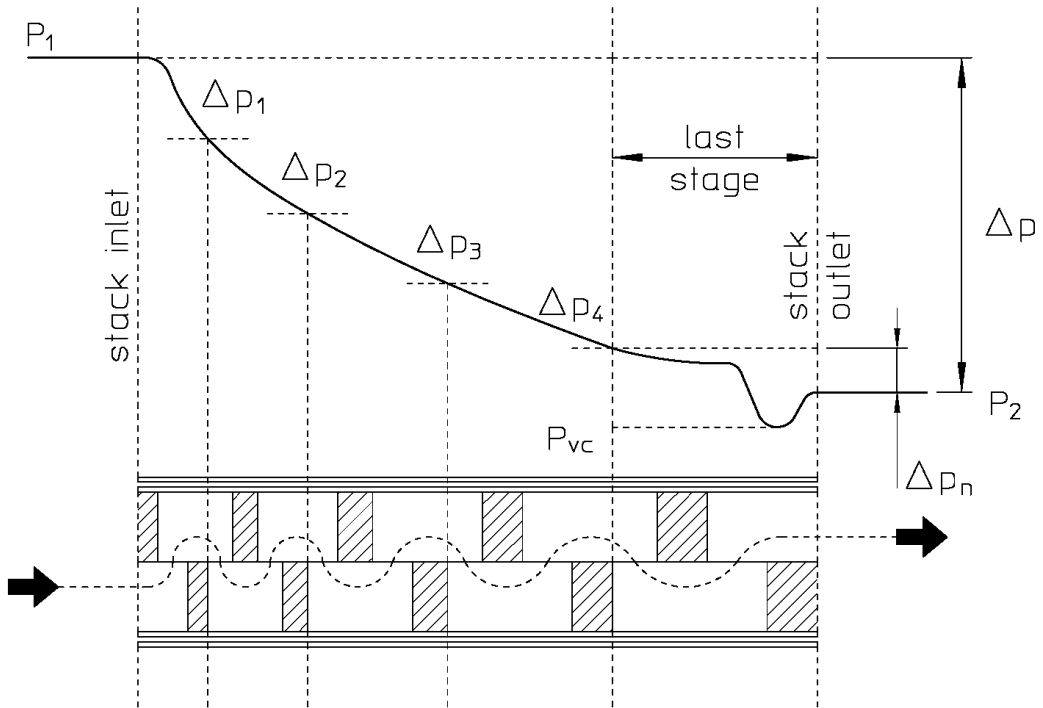


Fig. 1 - Pressure profile inside a Varistep disk stack: compared to high total Δp the individual pressure drops are low and the corresponding cavitation index $x_F = \Delta p / (p_1 - p_v)$ is greatly reduced.

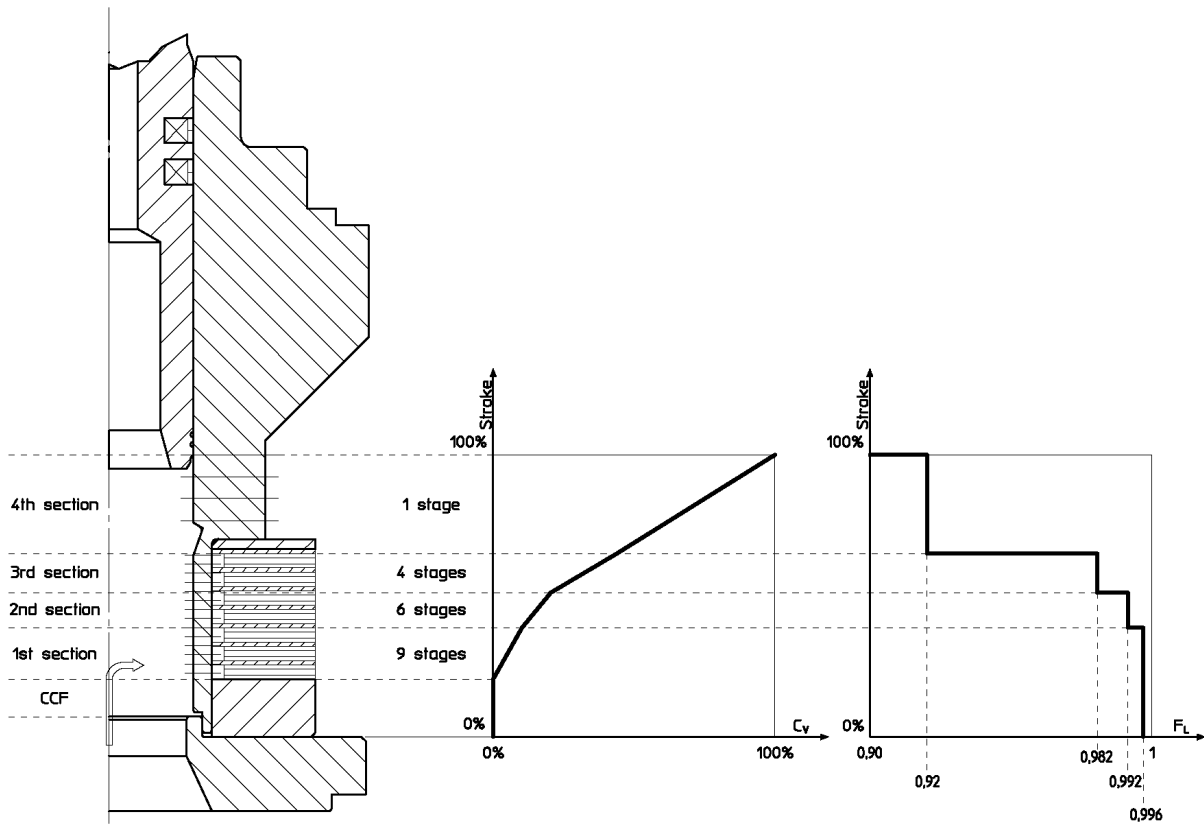


Fig. 2 - Three sections with different staging are provided, to minimize pressure recovery at low flow rates, where the Δp is high, without limiting the maximum valve flow capacity. The intrinsic flow characteristic shows a modified percentage shape which allows smooth and stable flow control near the closed position.

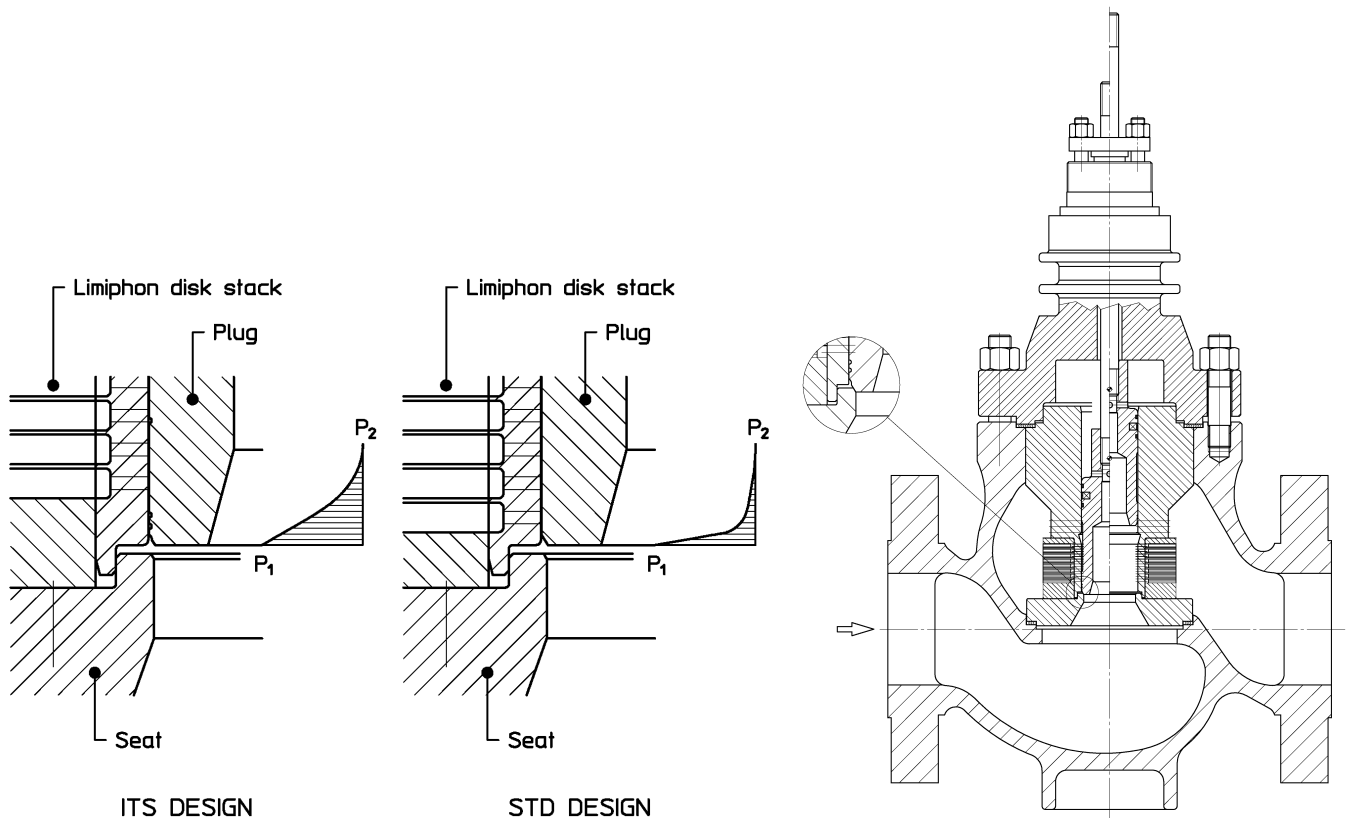


Fig. 3 - ITS labyrinth design modifies the pressure profile through the clearance flow passage avoiding abrupt pressure drops close to seating surfaces.

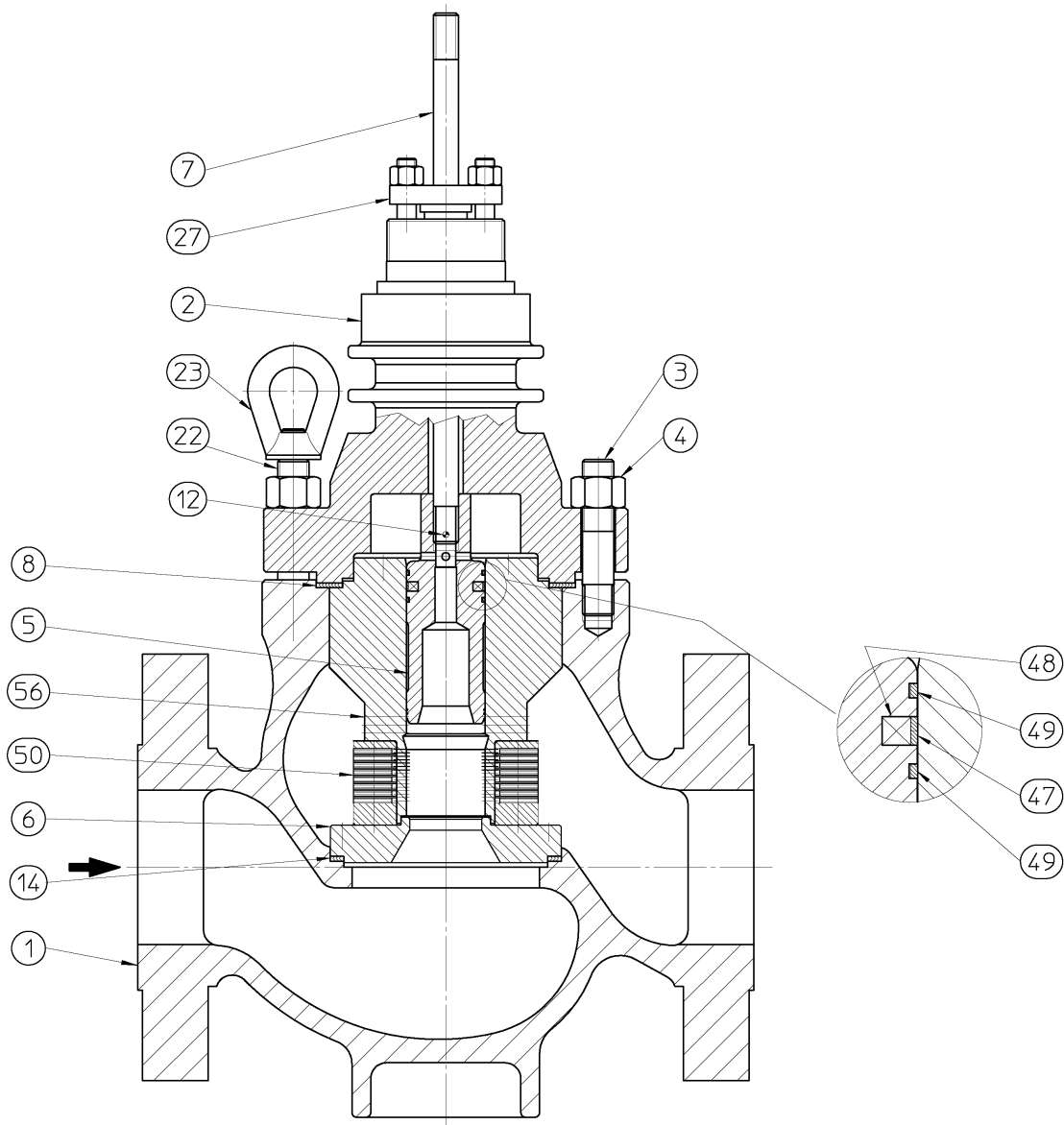
TECHNICAL FEATURES

- body**
- straight-way globe same as 1-6940 series – cast construction with bolted bonnet
 - available sizes: 2" through 16".
 - ratings: ANSI 150÷2500 for sizes up to 12" – ANSI 150÷600 for DN 14" and 16".
 - connections: flanged and butt welding.
- trim**
- quick change design including drilled cage, Limiphon stack, seat, ITS shaped plug.
- flow direction**
- flow-to open.
- max temperature**
- 350°C.
- max differential pressure**
- 200 bar (up to 10% of rated Cv) with downstream pressure 1 bar above vapour pressure;
 - 350 bar in closed position.
- materials**
- Trim materials and body material availability are reported on material classes tables. When CrMo valve has to be fitted in carbon steel piping, transitional pieces (or reducers) made of carbon steel can be supplied welded to the valve body;
 - Limiphon stack is made of AISI 304 or DIN 17240 X19CrMoVNb11.1 accordingly to working conditions.
- leakage class**
- sealing classes IV, IVS1 and V according to IEC 60534-4 are available both for balanced and unbalanced plugs (see plug inserts summary table for more details).
 - For erosive/corrosive fluids applications, special sealing class with High Seating force (VHS) is available to prevent wear of sealing surfaces.

Special applications

For some very critical boiler start-up applications, **flashing** condition at low flow rates may occur. Varistep trim can be sized to withstand such a severe operation by a multistage velocity-controlled section. However this can be accomplished for limited flow rates involving only the first section of stack (max 10% of rated Cv). The valve sizing for this application generally leads to special trims or to oversized bodies different from those published in this bulletin.

VALVE ASSEMBLY



ITEM	PART NAME
1	BODY
2	BONNET
3	STUD
4	NUT
5	PLUG
6	SEAT
7	STEM
8	BONNET GASKET
12	PIN

ITEM	PART NAME
14	SEAT GASKET
22	SPECIAL STUD
23	EYE BOLT
27	PACKING BOX
47	"C" type SEAL RING
48	BACK SEAL
49	SEAL RING
50	LIMIPHON DISK STACK
56	CAGE

1-6962 SERIES VARISTEP CONTROL VALVES

MATERIALS OF CONSTRUCTION

BASIC CLASS		A	D
Temperature range		-29 / + 350 °C	-29 / + 350 °C
Item	Part name	(ASME)	
1	BODY	SA 216 WCC	SA 217 WC9
2	BONNET	SA 105 or SA 350 LF2	
3	STUD	SA 193 B7	
4	NUT	SA 194 Gr. 2H	
5	PLUG	A 182 F6NM nitrided	
6	SEAT	A 479 316 Seat joint stellite gr.6	
7	STEM	A 479 XM-19	
8-14	GASKET	AISI 321+GRAPHITE	
12	PIN	A 479 304	
22	SPEC. STUD	SA 193 B7	
23	EYE BOLT	CARBON STEEL	
25	PLATE	A 479 304	
26	RIVET	ALUMINIUM	
27	PACKING	refer to "Packings for control valves" Parcol bulletin	
56	CAGE	A 487 CA6NM nitrided	

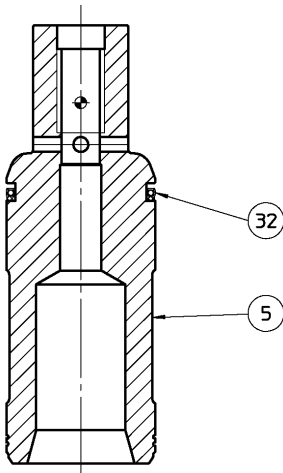
BASIC CLASS		L	M
Temp. range		-29 / + 350 °C	-29 / + 350 °C
Item	Part name	(EN)	
1	BODY	GP240GH	G17CrMo9-10
2	BONNET	P265GH	P265GH

LIMIPHON DISK STACK item 50		
Max temp.	01	02
≤ 300 °C	A 479 304	-
> 300 °C	-	DIN17240 X19CrMoVNbN111

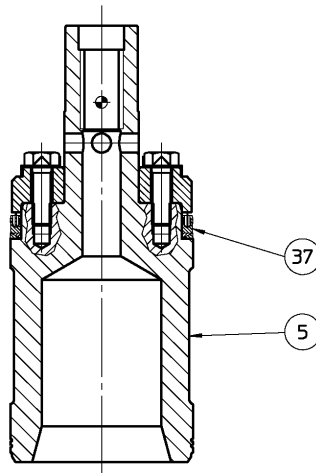
Insert code			N	S	B	R	C	F
Type			Not balanced	Graphite loaded pressure energized PTFE ring	Graphite loaded pressure energized PTFE ring + double B-up	Metallic C-ring balanced plug	Carbon graphite rings energized with flexible graphite back seal	Metal seal ring
Port - inches			1+4	1.1/2+13	1+13	1.1/2+13	1.1/2+13	2+13
Temperature Range			-129 + 350C	-50 + 280°C	-50 + 280°C	-196 + 350C	-120 + 350C	-150 + 350C
Item	Part name	Notes	For differential pressures please refer to Parcol Technical Dept.					
32	SEAL RING	/	-	Graphite loaded PTFE	-	-	-	-
33	STOP RING	Ports ≤ 2.1/2"	-	A 182 F6NM Hardened		-	-	-
34	CIRCLIPS		-	INCONEL X-750	INCONEL X-750	-	-	-
37	SEAL RING	/	-	-	Graphite loaded PTFE (FLY 36)	-	-	-
42	RING NUT	Ports ≤ 2.1/2"	-	-	-	A 182 F6NM Hardened	-	-
47	SEAL RING	/	-	-	-	-	Carbon graphite	-
48	BACK SEAL	/	-	-	-	-	Flexible graphite	-
49	ROD SEAL	/	-	-	-	A 182 F6NM Hardened	A 182 F6NM Hardened	A 182 F6NM Hardened
110	METALLIC C-RING	/	-	-	-	INCONEL X 750 Silver plated	-	-
111	PLUG FLANGE	/	-	-	A 182 F6NM Hardened		-	-
112	SCREW	Ports ≥ 3"	-	-	SA 198 B8 cl.1	SA 198 B8 cl.1	-	-
113	SEEGER RING	Only port 1"	-	-	Spring steel	-	-	-
114	STOP WASHER	/	-	-	A 479 304	A 479 304	-	-

PRESSURE / TEMPERATURE RATINGS FOR BALANCED PLUG

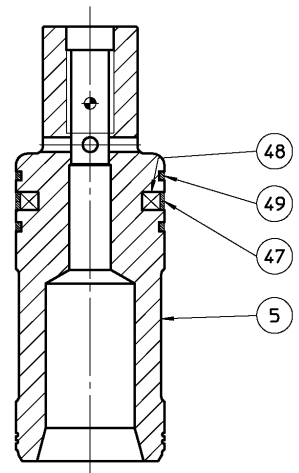
PLUG CODE "S"
SPRING LOADED FILLED PTFE



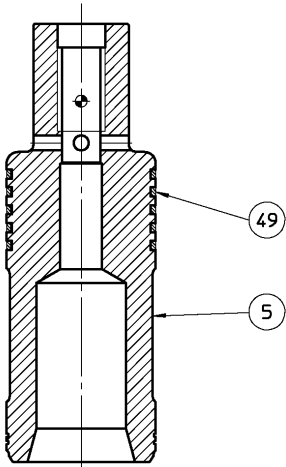
PLUG CODE "B"
SPRING LOADED FILLED PTFE
WITH BACKUP RING



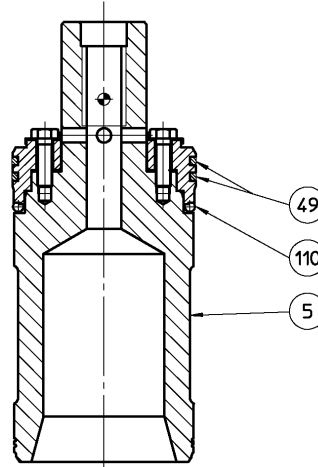
PLUG CODE "C"
CARBON-GRAPHITE SEAL RING



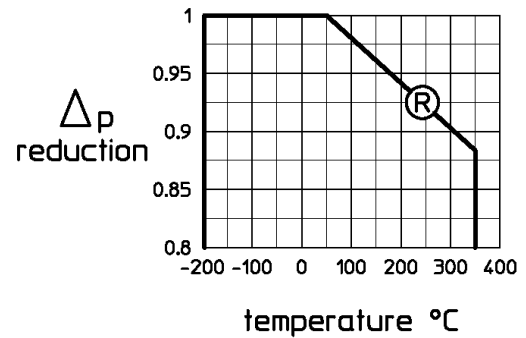
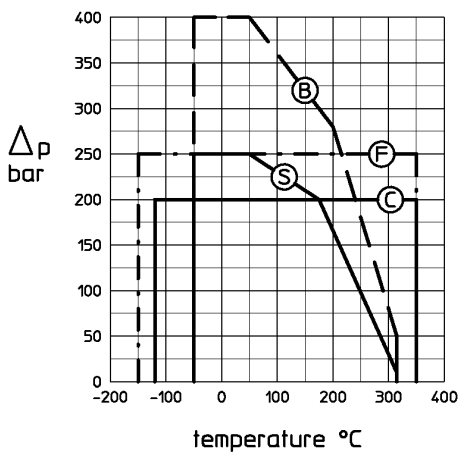
PLUG CODE "F"
METAL SEAL RINGS



PLUG CODE "R"
METALLIC C-RING



Port inches	Δp max bar
1.1/2	350
2	350
2.1/2	350
3	350
4	296
5	350
6	219
7	192
8	173
10	153
12	136
14	113
16	97
20	76
24	64



PLUG INSERTS SUMMARY TABLE

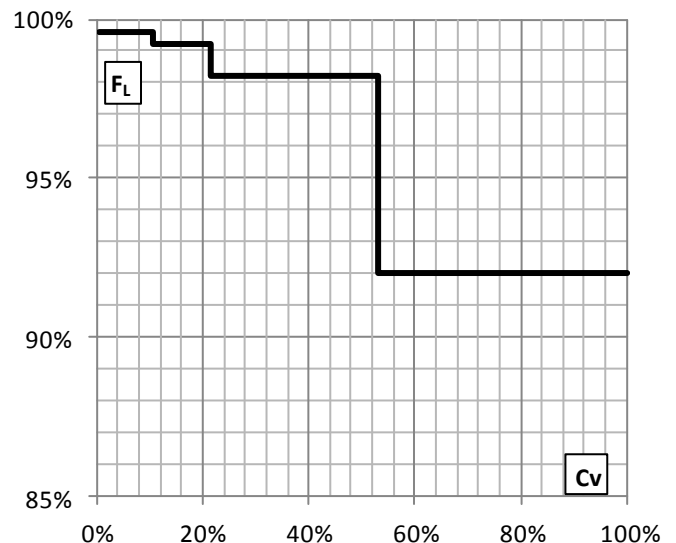
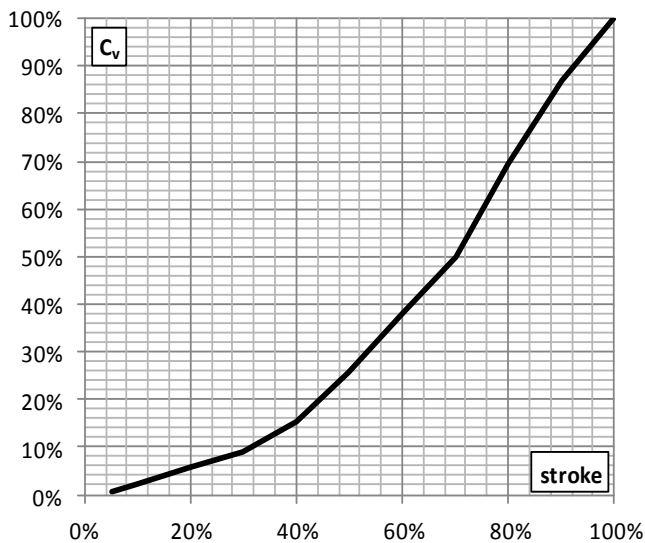
Port inches	IEC Sealing class	Rating	Temperature	Description	Code
1.1/2 ÷ 13	V	ANSI 150÷1500	-50 ÷ 315 °C	Spring loaded filled PTFE seal ring	S
1 ÷ 10	V	ANSI 2500	-50 ÷ 315 °C	Spring loaded filled PTFE seal ring with backup ring	B
1.1/2 ÷ 13	IV S1	ANSI 150÷2500	-120 ÷ 350 °C	Carbon-graphite + Expanded Graphite	C
2 ÷ 13	IV	ANSI 150÷2500	-150 ÷ 350 °C	Metal seal rings	F
1.1/2 ÷ 10	V	ANSI 150÷2500	-196 ÷ 350 °C	Metallic C-ring	R

1-6962 SERIES VARISTEP CONTROL VALVES

Flow coefficients C_v

DN inches	port inches	seat dia. mm	stroke mm	Stroke %										
				5	10	20	30	40	50	60	70	80	90	100
2	1.1/2	37,5	60	0.3	0.3	2.54	4.65	8.67	14.8	20.5	27.9	34.4	39	43
	1	27,5	50	0.2	0.2	1.37	2.76	6.02	10.7	15.1	19.9	23.5	26.2	28
3	2	46	60	0.57	0.57	3.1	5.16	7.22	13.3	21	28.4	39.9	49.9	57.5
	1.1/2	37,5	60	0.3	0.3	2.55	4.66	8.72	15.1	21.2	29.7	38.1	44.7	50
	1	27,5	50	0.2	0.2	1.37	2.76	6.03	10.8	15.4	20.5	24.6	27.7	30
4	3	72	76	1.06	2.31	6.01	9.72	13.4	23.8	38.9	53.4	75.4	97	114
	2.1/2	56	76	0.68	1.9	5.04	8.17	15.2	25.4	36.6	49.6	67.5	82.2	94
	2	46	60	0.57	0.57	3.1	5.16	7.22	13.3	21.1	28.6	40.7	51.4	60
	1.1/2	37,5	60	0.30	0.30	2.55	4.66	8.72	15.1	21.3	30.0	38.8	45.8	52
6	4	94	100	1.42	3.71	9.88	16	23.8	41.5	66.5	91.1	125	164	195
	3	72	76	1.06	2.31	6.01	9.72	13.4	23.8	39.2	54.1	77.6	102	122
	2.1/2	56	76	0.68	1.9	5.04	8.18	15.2	25.5	36.9	50.2	69.1	85.2	98
8	6	125,5	150	2.37	9.02	22.1	35.2	59.4	98.3	146	192	268	334	385
	5	110,5	100	2.02	3.95	12.4	20.9	36.9	61.8	92	122	167	209	245
	4	94	100	1.42	3.71	9.9	16	23.8	41.6	66.8	91.8	127	168	203
10	8	160,5	165	3.60	12.1	30	47.9	76.7	133	201	266	376	475	556
	7	145,5	165	3.27	11.5	29.5	47.5	75.0	127	189	249	354	446	520
	6	125,5	150	2.37	9.02	22.1	35.2	59.5	98.7	147	194	275	348	408
12	10	214,5	200	5.74	17	38.7	60.3	81.9	133	213	308	406	597	756
	8	160,5	165	3.60	12.1	30	47.9	76.7	133	202	268	382	486	574
14	13	263,5	250	8.65	27.8	65.5	103	166	271	414	553	777	1040	1252
	12	242,5	225	7.75	22.4	55.2	88.1	121	208	330	452	634	872	1070
	10	214,5	200	5.74	17.0	38.7	60.3	81.9	133	214	310	410	610	784
16	13	263,5	250	8.65	27.8	65.5	103	166	271	416	556	787	1060	1293
	12	242,5	225	7.75	22.4	55.3	88.1	121	208	331	454	639	886	1100
	10	214,5	200	5.74	17	38.7	60.3	81.9	133	214	310	411	614	793

STAGE				
	1 st	2 nd	3 rd	CAGE
F_L	1	0.992	0.982	0.92



DN 8" port 6" flow characteristic

1-6962 SERIES VARISTEP CONTROL VALVES

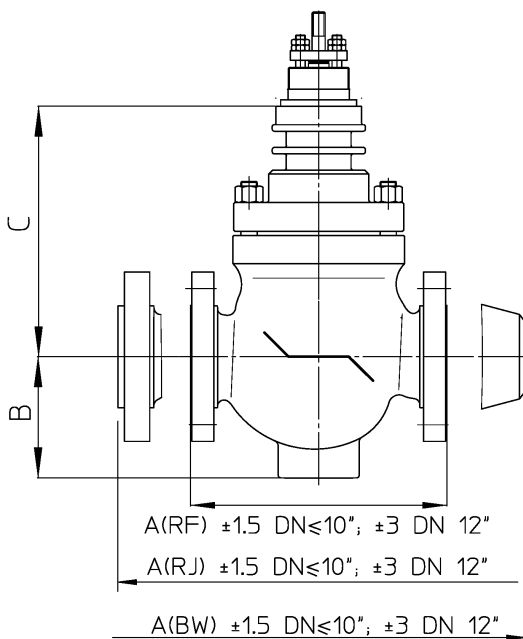
OVERALL DIMENSIONS (mm)

DN inches	FLANGED BODY - A ^{(1) (2)}											
	RF						RJ					
	ANSI 150	ANSI 300	ANSI 600	ANSI 900	ANSI 1500	ANSI 2500	ANSI 150	ANSI 300	ANSI 600	ANSI 900	ANSI 1500	ANSI 2500
2	254	267	286	375	375	413	267	283	289	378	378	416
3	298	317	337	441	460	660	311	334	340	444	463	666
4	352	368	394	511	530	737	365	384	397	514	533	747
6	451	473	508	714	768	864	464	489	511	717	774	877
8	543	568	610	781	838	1022	556	584	613	784	848	1038
10	673	708	752	864	991	1270	686	724	755	867	1001	1292
12	737	775	819	1016	1130	1575	750	791	822	1019	1146	1597
14	889	927	972	-	-	-	902	943	982	-	-	-
16	1016	1057	1108	-	-	-	1029	1073	1111	-	-	-

DN inches	BW ENDS BODY - A ⁽¹⁾					
	ANSI 150	ANSI 300	ANSI 600	ANSI 900	ANSI 1500	ANSI 2500
2	286	286	286	375	375	400
3	337	337	337	460	460	498
4	394	394	394	530	530	575
6	508	508	508	768	768	819
8	610	610	610	832	832	1029
10	752	752	752	991	991	1270
12	819	819	819	1130	1130	1422
14	1029	1029	1029	-	-	-
16	1108	1108	1108	-	-	-

DN inches	B					
	ANSI 150	ANSI 300	ANSI 600	ANSI 900	ANSI 1500	ANSI 2500
2	122	122	122	135	135	152
3	150	150	150	170	170	165
4	160	160	160	200	200	190
6	200	200	205	210	220	250
8	200	200	220	250	260	290
10	258	258	265	300	335	360
12	290	290	300	330	370	433
14	330	335	345	-	-	-
16	360	378	440	-	-	-

DN inches	port inches	stroke mm	actuator type	C ⁽¹⁾		
				ANSI 150-600	ANSI 900-1500	ANSI 2500
2	1.1/2	60	D46	330	353	365
	1	50				
3	2	60	D46	328	367	396
	1.1/2					
4	3	76	D63	367	401	439
	2.1/2					
	2	D46	375	409	447	
6	1.1/2	100	D63	451	478	565.5
	4					
	2.1/2	150	D63	598	605	641.5
8	5	100	D63	506	525	
10	4	165	D63	701	711	711
	8					
12	7	200	D63	821	865	984
	6					
14	10	250	C450	925	-	-
	8					
	12	200	D63	808	-	-
16	13	250	C 450	985	-	-
	10					
	12	200	D63	868	-	-



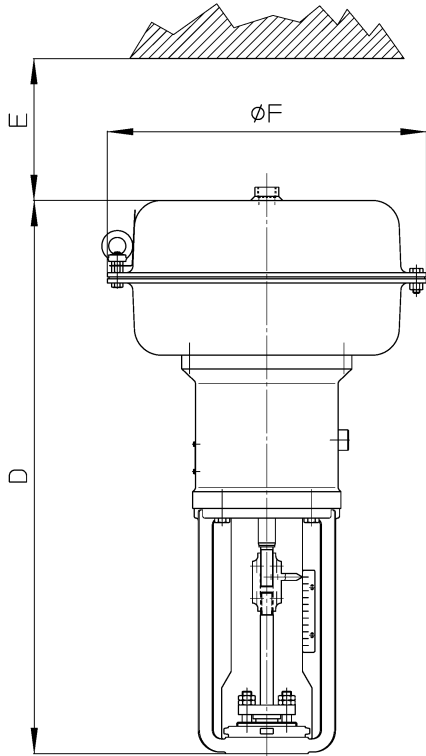
WEIGHTS (kg)

DN inches	FLANGED BODY					
	ANSI 150	ANSI 300	ANSI 600	ANSI 900	ANSI 1500	ANSI 2500
2	45	55	55	100	100	130
3	65	85	85	165	165	280
4	105	105	120	235	235	350
6	200	230	245	410	540	890
8	280	320	430	640	840	1470
10	440	530	680	1120	1570	2300
12	620	720	950	1470	1880	3650
14	950	1140	1470	-	-	-
16	1480	1480	1900	-	-	-

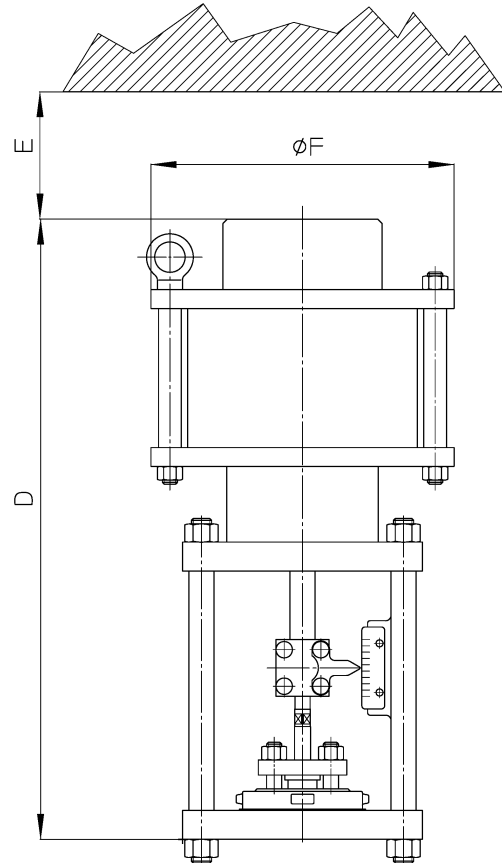
DN inches	BW ENDS BODY					
	ANSI 150	ANSI 300	ANSI 600	ANSI 900	ANSI 1500	ANSI 2500
2	40	40	40	75	75	90
3	55	75	75	120	120	190
4	80	80	95	165	165	300
6	170	170	170	320	390	590
8	260	260	320	490	620	1080
10	450	450	520	920	1320	1700
12	600	600	740	1360	1600	2550
14	1020	1020	1280	-	-	-
16	1380	1380	1600	-	-	-

PNEUMATIC ACTUATORS OVERALL DIMENSIONS (mm) and WEIGHTS (kg)

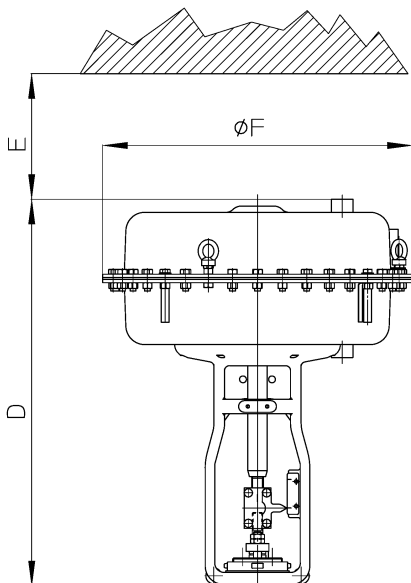
Actuator type	stroke mm	D ⁽¹⁾		E	ØF	Weight - kg ⁽¹⁾	
		Direct	Reverse			Direct	Reverse
Diaphragm - 1-X-290 D46	50-60	644		250	465	54	
Diaphragm - 1-X-290 D63	50-60-76	796		300	640	120	
Diaphragm - 1-X-250 D63	150÷200	1370	1407	350	640	220	250
Cylinder - 1-X-400 C450	225-250	2010	1975	260	575	540	
Cylinder - 1-X-400 C600	225-250	2090	2055	350	748	1016	



1-X-250 Pneumatic diaphragm actuator



1-X-400 Pneumatic cylinder actuator



1-X-290 Multispring pneumatic diaphragm actuator

(1) Without manual operator

