Control Valves

IN COMPLIANCE WITH 2014/68/UE PED DIRECTIVE

GENERAL DESCRIPTION

The control valve is an essential element in an automatic control system and its correct choice and sizing are required in order to ensure:

- high accuracy and control stability when load changes occur
- operating economy
- long-lasting efficiency, operation without any vibrations, noise and faults.
- low ordinary and extraordinary maintenance costs

The control valve is composed of an engine part (actuator and linkage) and a valve body.

The drawing on the right, related to a 3-way mixing valve, shows the following basic parts:

BODY (1) valve body which includes all the other components

CONNECTIONS (2) connections of valve body for fluid inlet and outlet

SEAT (3) fixed part which determines the section of the inside passage, on which the plug moves

PLUG (4) moving part which defines, according to its position, the flow rate of the fluid passing through the valve

STEM (5) together with the plug, it is connected to the actuator linkage group to enable the plug positioning

GUIDE (6) grants a perfect alignment of plug and seat

STEM PACKING (7) grants the fluid tight inside the valve body

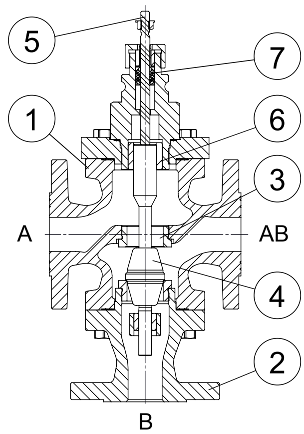
The valve bodies, for particular applications, can be equipped with:

Bellows tight: stainless steel bellows welded to the stem end to avoid every contact between the controlled fluid and the outside.

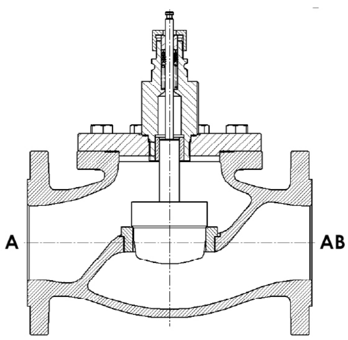
Extended neck: with forced lubrication device for applications with high temperature fluid (350 °C max)

Stem heater: accessory for applications with temperature below zero to avoid ice formation on the stem

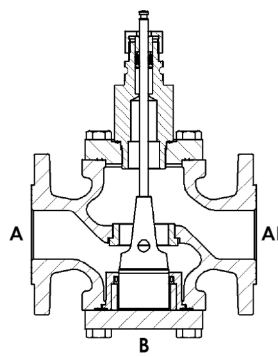
All Controlli valves are in compliance with PED directive and, therefore, satisfy all safety and quality requirements provided by CEE directives.



3-WAY MIXING VALVE (3FAA)



2-WAY SIMPLE SEAT VALVE (2FGA/2FAA)



2-WAY BALANCED VALVE (2FAA.B)

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TERMS

Nominal Diameter (DN)
Valve passage diameter, which corresponds to the inside diameter of the connections.

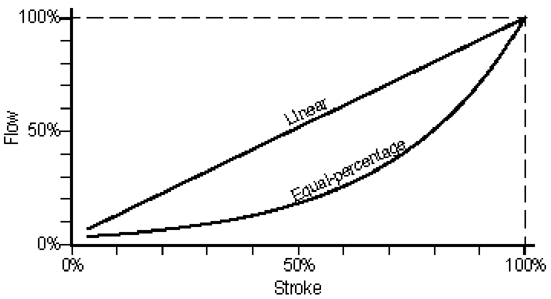
Nominal Pressure (PN) (Ref. UNI1284)
Pressure (bar), referred to a 20°C temperature, which constitutes the base for valve thickness calculation.

Operating Pressure (P max) (Ref. UNI1284)
Max pressure (bar), to which the valve body can be subjected; a particular PN depends also on the fluid temperature and characteristics of the material employed (at 20° it coincides with PN-see Table 4).

Pressure Drop DP
Difference of pressure (kPa) through a completely open valve to achieve the required flow rate.

Control characteristic
Curve, which represents the relationship between the valve flow rate and the plug stroke, from completely closed valve to completely open valve. There are two types of control curves:

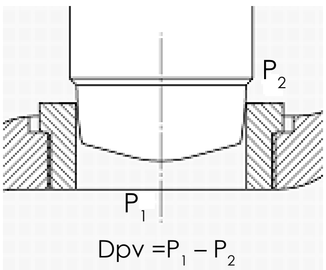
- linear control curve: equal stroke increments correspond to equal flow increments
- equal-percentage control curve: equal stroke increments correspond to flow percentage increment.



Flow rate coefficient Kvs
It indicates the flow rate (m^3/h) of water passing through a completely open valve under 1 bar pressure drop.

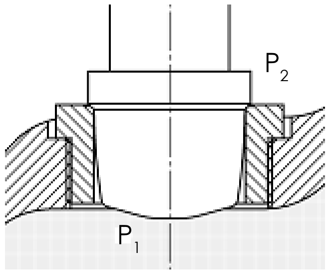
Leakage
It represents, as a percentage of Kvs, the leakage of a control valve in completely closed position, under a 1bar DP.
Leakage is measured according to the EN1349 standard.

Control Differential Pressure (DPv)
Max. differential pressure supported by an operating valve. Such value depends on the valve structure characteristics (seat, plug, valve body).



If the valve operates continually near close-off (i.e. is over-dimensioned) with Dpv values higher than the ones indicated on documentation, the fluid speed in the passage section between seat and plug becomes extremely high. This can cause wear phenomena, which can prejudice the valve functioning and duration and causing vibrations and noise.
We therefore recommend following the values indicated in the MAX REGULATION DIFFERENTIAL PRESSURE paragraph (page 7).

Close-off Differential Pressure (DPc)
Max. differential pressure supported by the valve in closed position. Such value depends on the performances of the actuator, which motorizes the valve.



GUIDELINES FOR CONTROL VALVES SELECTION

A control valve is composed of:

Valve body: fluid control device with connections, seat, stem and tight gasket.

Actuator: electromechanical or pneumatic device for the stem/plug movement. It is equipped with a board for the processing of the input signal coming from the controller.

Connection: mechanical assembly and linkage device between the valve body and the actuator; it is composed of brackets and drive gears.

The control valves can be supplied already assembled and calibrated.

A control valve can be chosen according to the following criteria:

1) Fluid characteristics. In particular:

- Fluid temperature: see Table 1
- Operating pressure: see Table 1 and Table 4 (for Δpv values, see Table 5)
- Fluid suitability to valve materials (see Table 2)

2) Actuator requirements according to:

- stroke (see Table 3)
- max. differential close-off pressure, see Table 5

See the paragraph "Sizing" for the valve diameter selection.
See the data sheets for details about actuator models.

Controlli offers a complete range of globe valve bodies able to satisfy the requirements of the several applications in both civil and industrial air conditioning, thermoventilation and heating plants and in industrial thermal process.

Model	Type	PN	Connections	DN	Fluid temperature [°C]*	Control characteristic	Leakage % of Kvs	Lowered stem action
VSBPM	2-way	16	threaded	1/2"-2"	-5÷95	equal percentage	0	normally open
2FAA		40	flanged	15÷80mm	-10÷230		0,02	normally closed
2FAAT					-20÷230		0,02	normally closed
2FAAP					-10÷350		0,02	normally closed
2FGA		16		15÷100mm	-10÷200		0,02	normally closed
VSB			threaded	1/2"-2"	-10÷150		0,03	normally open
VSBF			flanged	15÷65mm			0,03	normally open
VSBT / VSB.T			threaded	3/4" - 1"1/2	5÷95	linear	0,03	normally open
2FGB			flanged	25÷150mm	-10÷150	equal percentage	0,03	normally open
2FSA		25		25÷65mm	-10÷230		0,02	normally open
2TBB / 2TBB.T		16	threaded	1/2" - 2"	2÷120		0,1	normally open
2TGB.B			threaded	1/2"	-5÷140		0,1	normally open
2TGB.F			threaded		-5÷140		0,1	normally open
2FGA.B	2-way double seat		flanged	200mm	-10÷200		0,12	normally closed
2FAA.B		25		150mm	-10÷230		0,02	normally closed
2FSA.B	2-way balanced			25÷80mm			0,02	normally open
2FAA.B		40		25÷125mm	-20÷230		0,02	normally closed
2FGB.B		16		65÷150mm	-10÷150		0,02	normally open
2TGA.B			threaded	3/4" - 2"	-5÷120		0,03	normally open
3FAA	3-way mixing	40	flanged	25÷125mm	-10÷230	linear	0,02	normally open
3FAAT**					-20÷230		0,02	normally open
3FAAP**					-20÷350		0,02	normally open
3FSA		25		80mm	-10÷230		0,02	normally open
3FSA.S				80mm	-20÷300		0,02	normally open
VMBPM		16	threaded	1/2" - 2"	-5÷95	equal percentage	0,02	normally open
VMB					-10÷150	equal percentage direct way and linear angle way	0,03/2***	normally open
3FGB			flanged	25÷150mm			0,03/2***	normally open
VMBF				15÷65mm			0,03/2***	normally open
VMBT / VMB.T			threaded	3/4" - 1"1/2	5÷95	linear	0,03/2***	normally open
3FSA		25	flanged	25÷65mm	-10÷230	equal percentage direct way and linear angle way	0,02	normally open
3FSA.S					-10÷300		0,02	normally open
3TBB / 3TBB.T		16	threaded	1/2" - 2"	2÷120		0,1	normally open
3TGB.B				1/2"	-5÷140		0,1	normally open
3TGB.F					-5÷140		0,1	normally open

* For fluid temperature below 0 and in case of ice on the stem, use the stem heater (see 240 series models).
** Models 3FAA125P and 3FAA125T are PN25
*** Wherever two values are indicated, the first refers to the direct-way A-AB and the second to the angle-way B-AB.

MANUFACTURING CHARACTERISTICS (Table 2)

MODEL	MATERIAL			CONNECTIONS
	BODY	SEAT	PLUG	
VSBP.M/VMBP.M	Cast iron EN-GJL-250- UNI EN 1561		Rubber	Threaded PN16 UNI ISO 228
VSB/VMB/VSBT/VMBT/VSB.F/VMB.F/ VSB.T/VMB.T			Brass	
2FGB/2FGB.B/3FGB			Brass	Flanged PN16
2FGA/2FGA.B	EN-GJL-250 UNI EN 1561	AISI304 stainless steel		
2FSA.B/2FSA/3FSA/3FAS.S	EN GJS400-15 spheroidal cast-iron	AISI304 stainless steel		Flanged PN25
2FAA/2FAA.B/2FAA.P/2FAA.T/ 3FAA/3FAAP/3FAA.T*	ASTM A216 WCB steel	AISI304 stainless steel		Flanged PN40
2-3TBB/2-3TBB.T	Bronze		Brass	Threaded PN16
2TGA.B	Grey cast iron EN1561 GJL-250	Stainless steel		Threaded PN16
2-3TGB.B/2-3TGB.F	Grey cast iron EN1561 GJL-250		Brass	Threaded PN16

VALVE STROKE FOR NOMINAL DIAMETERS [mm] (Table 3)

MODEL	DN FLANGED											
	15	20	25	32	40	50	65	80	100	125	150	200
	DN THREADED											
	1/2"	3/4"	1"	1 ¼"	1 ½"	2						
VSBP.M/VMBP.M	16,5											
VSB/VMB	16,5											
VSB.F/VMB.F	16,5						20					
VSBT/VMBT/VSB.T/VMB.T		5,5										
3FGB/2FGB	16,5			25				45				
2FGB.B							25	45				
2FSA.B/2FSA/3FSA/3FSA.S			16,5	25				45				
2FGA/2FAA/2FAA.P	16,5			25				45				
2FGA.B/2FAA.B											45	
3FAA/3FAA.P			16,5	25				45				
3FSA/3FSA.S								45				
2FAA.B			16,5	25				45				
2-3TBB	9,5			15,9								
2-3TBB.T	12											
2TGA.B	8,5											
2-3TGB.B/2-3TGB.F	11,5											

MAX. OPERATING PRESSURE ACCORDING TO TEMPERATURE (UNI1284) [kPa] (Table 4)

FLUID TEMPERATURE [°C]	VSBP.M/VMBP.M VMBT/VSBT (UP TO 95°C)	VSB/VMB VSB.F/VMB.F 2FGB/3FGB 2FGB.B	2FGA 2FGA.B	2FAA 2FAA.B 3FAA	2FAA.P 3FAA.P*	2FAA.T 3FAA.T*	2FSA/3FSA 2FSA.B	3FSA.S (BELLOWS TIGHT)	2-3TBB	2-3TGB.B 2-3TGB.F (UP TO 140°)	2TGA.B
	PN16	PN16	PN16	PN40	PN40	PN40	PN25	PN25	PN16	PN16	PN16
-20÷-10				4000		4000					
-10÷120	1600	1600	1600		4000		2500	500	1600	1600	1600
120÷150		1400	1400	3700	3700	3700	2300				
150÷200			1300	3200	3200	3200	2000				
200÷230				3000	3000	3000	1900				
230÷250					2800						
250÷300					2400						
300÷350					2200						

* Models 3FAA125P and 3FAA125T are PN25

MAX. CONTROL (Dpv) AND CLOSE-OFF (Dpc) DIFFERENTIAL PRESSURE [kPa] FOR TWO/THREE-WAY VALVES AND RELEVANT KV
(Table 5)

U-Bolt Connection	DN	MVH 1500 N		MVHEA/C 700 N		MVH3K 3000 N		MVB 450 N		MVT 200 N		MVT.03S 300 N		MVC.03 300 N		MVC503R 300 N		MVE.06		MVE.10		MVE.15		MVE.22	
		A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA
	15 (all)	1600		1600		1600												1600		1600		1600		1600	
	20	1600		1510		1600												1250		1600		1600		1600	
	25	1600		920		1600												760		1410		1600		1600	
	32	1600		920		1600												760		1410		1600		1600	
2FGA	40	1340	-	620	-	1600	-	-	-	-	-	-	-	-	-	-	-	510	-	950	-	1500	-	1600	-
	50	870		400		1600												330		620		980		1480	
	65	350		160		830												130		250		400		610	
	80	230		100		550												80		160		260		400	
	100	140		60		350												50		100		160		250	
	15R2	3000		4000		4000												4000		4000		4000		4000	
	15	3000		1880		4000												1450		3210		4000		4000	
	20	2840		1110		4000												850		1900		3220		4000	
	25	1740		670		4000												520		1170		1980		3119	
2FAA 2FAA.P 2FAA.T	32	1740	-	670	-	4000	-	-	-	-	-	-	-	-	-	-	-	520	-	1170	-	1980	-	3119	-
	40	1170		450		2920												340		780		1330		2109	
	50	760		290		1910												220		510		870		1377	
	65	310		110		790												80		200		350		569	
	80	200		70		520												50		130		230		373	
	25R4	1600	1600	1100	840	1600	1600											940	705	1590	1270	1600	1600	1600	1600
	25R7	1600	1600	1100	840	1600	1600											940	705	1590	1270	1600	1600	1600	1600
	25	1600	1600	1100	840	1600	1600											940	705	1590	1270	1600	1600	1600	1600
	40R19	1170	990	590	470	1600	1600											500	397	860	710	1300	1110	1600	1600
	40	1170	990	590	470	1600	1600											500	397	860	710	1300	1110	1600	1600
2FGB 3FGB	50	730	630	360	300	1600	1440	-	-	-	-	-	-	-	-	-	-	310	254	530	450	810	710	1200	1069
	65	430	370	210	170	960	850											180	150	310	270	480	420	716	633
	80	280	240	130	110	620	560											110	99	200	170	310	270	462	418
	100	170	150	80	70	390	360											70	63	120	110	190	170	290	267
	125	100	100	50	40	240	230											40	41	70	70	120	110	182	171
	150	70	70	30	30	160	160											30	28	50	50	80	70	124	119
	25R4	2500	2500	2150	1250	2500	2500											1850	952	2500	2220	2500	2500	2500	2500
	25R7	2150	1690	1090	630	2500	2500											930	474	1580	1120	2390	1930	2500	2500
	25	2150	1690	1090	630	2500	2500											930	474	1580	1120	2390	1930	2500	2500
2FSA 3FSA	32	1450	1140	730	420	2500	2500	-	-	-	-	-	-	-	-	-	-	620	315	1060	750	1610	1300	2390	2078
	40	1040	820	520	300	2310	2080											440	223	760	540	1160	940	1722	1497
	50	660	520	330	180	1470	1330											280	138	480	340	740	590	1097	953
	65	390	300	190	100	860	780											160	78	280	190	430	340	645	560
2FSA80	80	250	220	120	90	570	530	-	-	-	-	-	-	-	-			100	73	180	150	280	220	423	367

U-Bolt Connection	DN	MVH 1500 N		MVHEA/C 700 N		MVH3K 3000 N		MVB 450 N		MVT 200 N		MVT.03S 300 N		MVC.03 300 N		MVC503R 300 N		MVE.06		MVE.10		MVE.15		MVE.22	
		A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA
3FSA.S	25 (all)	500	500	500	500	500	500											500	500	500	500	500	500	500	500
	32	500	500	500	500	500	500											500	480	500	500	500	500	500	500
	40	500	500	500	420	500	500	-	-	-	-	-	-	-	-	-	-	440	347	500	500	500	500	500	500
	50	500	500	330	270	500	500											280	222	480	420	500	500	500	500
	65	390	350	190	160	500	500											160	131	280	250	430	400	500	500
3FSA80S	80	250	230	120	100	500	500											100	87	180	160	280	260	423	500
VSB VMB VSB.F VMB.F	3/4"	1600	1600	1600	1560			1080	260									1600	1311	1600	1600	1600	1600	1600	1600
	1"	1600	1600	1380	1030			680	170									1190	871	1600	1570	1600	1600	1600	1600
	1 ¼"	1600	1380	840	650	-	-	410	110	-	-	-	-	-	-	-	-	720	549	1220	990	1600	1540	1600	1600
	1 ½"	1170	990	590	470			290	80									500	397	860	710	1300	110	1600	1600
	2"	870	750	440	350			210	60									370	300	640	540	960	840	1430	1263
VSBT VMBT	3/4"									240	150	240	150			240	150								
	1"	-	-	-	-	-	-	-	-	150	100	150	100	-	-	150	100	-	-	-	-	-	-	-	-
	1 ¼"									90	60	90	60			90	60								
	1 ½"									50	30	60	40			60	40								
VSB.T VMB.T	3/4"													900	700	900	700								
	1"													550	450	550	450								
	1 ¼"	-	-	-	-	-	-	-	-	-	-	-	-	350	300	350	300	-	-	-	-	-	-	-	-
	1 ½"													250	200	250	200								
	2"													190	160	190	160								
3FAA 3FAA.P	25 (all)	2150	1920	1090	770	4000	4000											930	604	1580	1300	2390	2170	3533	3400
	32	1450	1210	730	480	3200	2960											620	381	1060	820	1610	1370	2390	2144
	40	950	790	470	310	2090	1940											400	250	690	530	1050	900	1561	1405
	50	660	560	330	220	1470	1370	-	-	-	-	-	-	-	-			280	176	480	380	740	630	1097	991
	65	390	330	190	130	860	810											100	104	280	220	430	370	645	587
	80	250	210	120	80	570	530											100	69	180	140	280	240	423	387
	100	160	140	70	50	360	340											60	44	110	90	170	150	268	248
	125	100	90	40	30	230	210											40	28	70	60	110	100	170	159
2FSA.B	25R4	2500	-	2500														2500		2500		2500		2500	
	25R7	2500		2500														2500		2500		2500		2500	
	25	2500		2500														2500		2500		2500		2500	
	32	2500		2500	-	-	-	-	-	-	-	-	-	-	-			2500	-	2500	-	2500	-	2500	-
	40	2500		2500														2490		2500		2500		2500	
	50	2500		2500														1830		2500		2500		2500	
	65	2500		1760														1220		2500		2500		2500	
	80	2500		1280														830		2500		2500		2500	
2FGB.B	65	1600	-	1400														1080		1600		1600		1600	
	80	1600		1060														800		1600		1600		1600	
	100	1600		740	-	-	-	-	-	-	-	-	-	-	-			530	-	1400	-	1600	-	1600	-
	125	1600		510														350		1040		1600		1600	
	150	1290		350														210		780		1500		1600	
2FAA150B	150	1710	-	290	-	-	-	-	-	-	-	-	-	-	-			-	-	950	-	2030	-	3540	-

U-Bolt Connection	DN	MVH 1500 N		MVHEA/C 700 N		MVH3K 3000 N		MVB 450 N		MVT 200 N		MVT.03S 300 N		MVC.03 300 N		MVC503R 300 N		MVE.06		MVE.10		MVE.15		MVE.22	
		A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA	A-AB	B-BA
2FGA200B	200	1600		370	-	-	-	-	-	-	-	-	-	-	-			-	-	1200	-	1600	-	1600	-
2FAA.B	25R4	4000	-	4000	-	-	-	-	-	-	-	-	-	-	-	-	-	4000	-	4000	-	4000	-	4000	-
	25R7	4000		4000														4000		4000		4000		4000	
	25	4000		4000														4000		4000		4000		4000	
	32	4000		4000														3340		4000		4000		4000	
	40	4000		3650														2760		4000		4000		4000	
	50	4000		2810														2100		4000		4000		4000	
	65	4000		2040														1490		3770		4000		4000	
	80	4000		1550														1100		2960		4000		4000	
	100	3030		950														650		1910		3490		3492	
	125	2330		660														420		1430		2700		2700	
2-3TBB	1/2"	1600	1600	1600	1600	-	-	-	-	-	-	-	-	-	-	-	-	1600	1600	1600	1600	1600	1600	1600	1600
	3/4"	1600	1600	1600	1600													1600	1600	1600	1600	1600	1600	1600	1600
	1"	1600	1600	1320	1170													1130	980	1600	1600	1600	1600	1600	1600
	1 ¼"	1600	1560	840	730													710	618	1220	1120	1600	1600	1600	1600
	1 ½"	1150	1080	570	500													490	424	840	770	1280	1210	1600	1600
	2"	640	600	320	280													270	233	470	430	710	670	1061	1021
2-3TBB.T	1/2"	-	-	-	-	-	-	-	-	-	-	-	-	1430	1030	1430*	1030*	-	-	-	-	-	-	-	-
	3/4"													990	670	990*	670*								
	1"													540	380	540*	380*								
	1 ¼"													340	230	340*	230*								
	1 ½"													230	160	230*	160*								
	2"													120	80	120*	80*								
2-3TGB.F	1/2" (all)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1600	1600	1600	1600	1600	1600	1600	1600
2-3TGB.B	1/2" (all)	-	-	-	-	-	-	1370	1240	-	-	-	-	1160*	1600*	1160*	1600*	-	-	-	-	-	-	-	-
2-3TGBT	3/4"	-	-	-	-	-	-	-	-	-	-	-	-	910	700	-	-	-	-	-	-	-	-	-	-
	1"													580	460										
	1 ¼"													350	290										
	1 ½"													250	210										

* with AG74-03 linkage

MAX REGULATION DIFFERENTIAL PRESSURE [kPa]

The max regulation differential pressure, it means the pressure which can be used during the stroke, is conditioned by wear between seat and plug and by the performance guaranteed by the actuator for the evaluated valve. So we recommend not to overcome the differential pressure whose value corresponds to the minimum between the one here following (maximum admitted value not to cause wear) and the one shown in the previous table (max close-off differential pressure).

MODEL	MATERIAL			DP max [kPa]
	BODY	SEAT	PLUG	
VSBP.M/VMBP.M	Cast iron EN-GJL-250- UNI EN 1561		Rubber	200
VSB/VMB/VSBT/VMBT/VSB.F/VMB.F/ VSB.T/VMB.T			Brass	
2FGB/2FGB.B/3FGB			Brass	
2FGA/2FGA.B	EN-GJL-250 UNI EN 1561	AISI304 stainless steel		600
2FSA.B/2FSA/3FSA/3FAS.S	EN GJS400-15 spheroidal cast-iron	AISI304 stainless steel		800
2FAA/2FAA.B/2FAA.P/2FAA.T/ 3FAA/3FAAP/3FAA.T*	ASTM A216 WCB steel	AISI304 stainless steel		1200
2-3TBB/2-3TBB.T	Bronze		Brass	200
2TGA.B	Grey cast iron EN1561 GJL-250	Stainless steel		600
2-3TGB.B/2-3TGB.F	Grey cast iron EN1561 GJL-250		Brass	200

Note: The max operating pressures at different temperatures for various PN classes must correspond to the following standards: UNI 1092-02 and UNI 12516-1.

VARIANTS

A150-2 ANSI (ASA) 150 drilling for two-way valves
A150-3 ANSI (ASA) 150 drilling for three-way valves
A300-2 ANSI (ASA) 300 drilling for two-way valves
A300-3 ANSI (ASA) 300 drilling for three-way valves

ACCESSORIES

244 Stem heater for V.B valves with MVB (24 V~ - 25 VA) not applicable to V.BF DN15
248 24 V~ stem heater, 50 W for all valve bodies except V.B with MVH-MVE

INSTALLATION

Hydraulic connections

Respect the fluid direction as shown by the following diagrams:

Three way valves

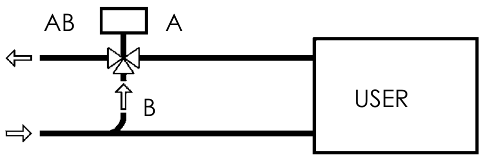


Fig. 1 - Variable flow mixing to the user

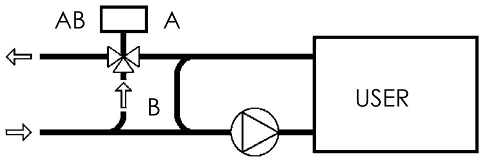


Fig. 2 - Constant flow mixing to the user in injection or tapping circuits

Two way valves

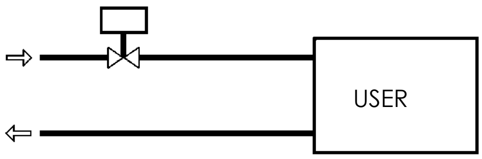


Fig. 3 - Variable flow control to the user.

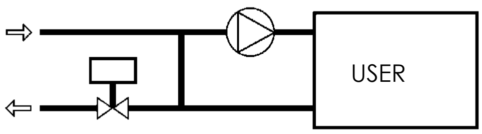


Fig. 4 - Constant flow control to the user in injection or tapping circuits

The flow direction must correspond to the information printed on the valve body.

MOUNTING

Before assembling the valve, make sure that pipes are clean and free from slags of any type, in order to avoid damages to the valve internal parts (it is advisable to use filters upstream). It is essential that pipes are perfectly aligned with the valve body and not subjected to vibrations.

For applications with fluid temperature above 200°C (steam, overheated water, diathermic oil) provide suitable expansion joints to avoid the dilatation of pipes to overload the valve body. The control valve can be assembled in any position within the upper 180°.Warning: The valve stem with bellows tight must never rotate with respect to the valve body it is connected to by the bellows.
It is necessary to assemble the valve so that the actuator remains in horizontal position in all applications where the fluid temperature (steam, overheated water, diathermic oil) contributes, together with the room temperature, to create a temperature around the actuator below -5 and above 50°C. Moreover, the actuators must not be exposed to steam jets or dripping.

Leave sufficient space above the actuator (10÷15 cm at least) to allow the disassembling from the valve body for eventual commissioning.

REMARKS

It is advisable to mount the valves downstream (except for steam plants) because the lower fluid temperature ensures a longer lasting of the gaskets.
Controlli three-way valves are designed for use as mixing, two inlets A and B and one outlet AB and not as diverting, one inlet AB and two outlets A and B.
In closed circuit plants, the mixing valve mounted downstream corresponds perfectly to a diverting one assembled on supply. Only in open circuit plants it may be necessary to use diverting valves: Controlli mixing valves can be used as diverting, considering that the max. advisable differential pressure must be reduced to one third of the specified value.

START-UP

Before the control valve start up, verify:

FLOW DIRECTION

It must correspond to the information printed on the valve body.

CLOSING AND OPENING ACTION OF THE VALVE BODY

It must correspond to the plant specification, in particular it is necessary to consider the following information:

TWO-WAY	stem down=	fluid passing (intercepted only on 2FGA, 2FAA, 2FGA200B, 2FAA150B series)
	stem up =	fluid intercepted (passing only on 2FGA, 2FAA, 2FGA200B, 2FAA150B series)
THREE-WAY	stem down=	fluid passing through A - AB
	stem up =	fluid passing through B - AB

OPERATING CONDITIONS

Temperature, nominal pressure and differential pressure applied to the valve must correspond to the value ranges indicated for each valve model, see Tables 1-4-5 and/or the performances on the data sheets.

PIPE FLUSHING

Anomalies in valve leakage is, in almost all cases, due to the welding slags or foreign bodies interposing between seat and plug, often causing damages to such parts.
To avoid such inconvenience, it is necessary to use filters upstream the valve.

It is necessary to carry out an accurate pipe flushing by positioning the valve at half stroke; such operation must be performed at the first plant start up or after a prolonged shut-down of the fluid circulation.

MAINTENANCE

Maintenance of valves should be carried out by qualified personnel.

ORDINARY MAINTENANCE

<u>Stem packing tight check</u>
<u>2-3FGB, 2FGB.B, V.B, V.BF, V.BPM, V.BT PN16 valves - Fig. 1*</u>
Controlli PN16 valves have a stem packing with double O-Ring and, therefore, do not need any ordinary maintenance operation.

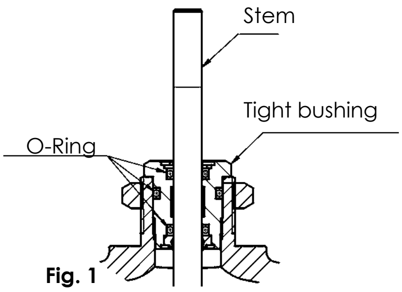


Fig. 1

<u>2FGA, 2FGA.B, 2-3TBB, 2-3TGB.F, 2-3TGB.B PN16 valves, PN25 valves (all models), PN40 valves (all models) - Fig. 2*</u>
These valves have a stem packing with Teflon or graphite rings (extended neck versions for high temperatures).
The valves having a stem packing with teflon rings do not need any ordinary maintenance.
The valves having a stem packing with graphite rings need a periodical tight check, both at high and low temperatures and under high and low operating pressures.
In case of leakage, it is necessary to tighten the gland nut until dripping ceases.
Be careful not to overtighten the nut since this may cause the stem blocking.

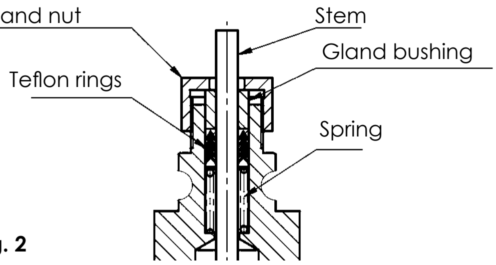


Fig. 2

<u>Valve stem lubrication (extended neck) - Fig. 3*</u>
For extended neck valves provided with lubrication device, periodically rotate the greaser screw, in order to grant a suitable stem lubrication. At the stroke end of the pressure screw, loosen completely the greaser screw, refill with silicon grease and screw back.

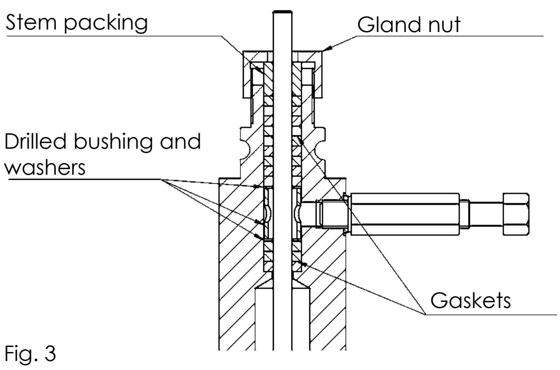


Fig. 3

<u>Bellows tight valves (3FSA.S) - Fig. 4*</u>
These valves are free from ordinary maintenance.
If any dripping occurs the trouble is due to the bellows, which they are drilled. in this case it is advisable to contact Controlli for repair or replacement of the valve.

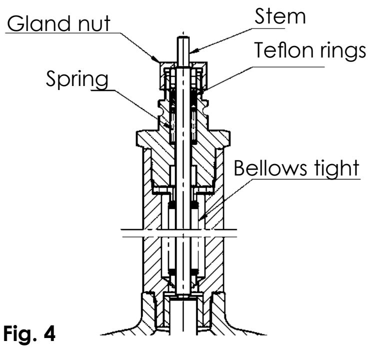


Fig. 4

* Images are being used for illustrative purposes only.

EXTRAORDINARY MAINTENANCE

PN16 VALVES
2-3FGB, 2FGB.B, V.B, V.BF, V.BPM, V.BT
In case of leakage, it is necessary to replace the stem packing assembly.

2FGA, 2FGA.B PN16 VALVES
In case of leakage, it is necessary to replace the stem packing assembly.

PN25 VALVES - PN40 (with teflon stem packing)
In case of leakage, it is necessary to replace the stem packing assembly.

PN25 VALVES - PN40 (with stem packing in graphite)
- The stem packing nut could not be screwed enough. Tight the stem packing nut
- In case of further dripping , it is necessary to replace the stem packing.

<u>Poor tight between plug and seat</u>
- Faulty stroke adjustment. Adjust the stroke among the connection parts - valve stem (see actuator mounting instructions).
- Actuator - bracket assembly is not linked to the valve body: tighten the fixing ring nut.
- Foreign bodies as slags, limestone, etc. between plug and seat.

<u>Plug and stem vibrations</u>
- Check that the flow direction is in compliance with the information contained in the technical instructions, if not, carry out the hydraulic connections correctly.
- Excessively high differential pressure. Verify that the value of control differential pressure, the valve is subjected to, does not overcome the one shown on the data sheet or in the Table 5.

<u>Attention:</u> In case one of the problems above should occur with 2-3TBB, 2TGA.B, 2-3TGB.F or 2-3TGB.B valves, please contact our Technical Dept. before proceeding with any operation.

STEM PACKING GASKET REPLACING

Switch off the actuator power supply. Intercept the fluid upstream the valve. Disassemble the actuator from the valve body (see mounting instructions). Follow the below-mentioned instructions according to the valve type.

PN16 valves
3FGB, 2FGB, 2FGB.B, V.B, V.BF, V.BPM, V.BT
With reference to Fig. 1, unscrew and remove the tight bushing. Using a metallic point, extract the O-Rings from their position, being careful not to damage the bushing.
Insert the new O-Rings onto the bushing. Reassemble the tight bushing on the valve, screwing it tightly.
It is advisable to order the complete stem packing assembly (bushing+OR): in such case, unscrew the old bushing and assemble the new one, screwing it tightly.

2FGA, 2FGA.B PN 16 Valves
PN25 valves - PN40 (all models)
Referring to Fig.2 at page 8, unscrew and remove the gland nut. Slip off the stem packing bushing.

Using a metallic point, extract the Teflon gaskets, being careful not to scratch the valve stem and the tight chamber. During this step, it is advisable to check the stem packing spring and, if necessary, replace it. Mount the washer above the spring, then insert the new gaskets into the valve stem, placing them with the V-notch vertexes upwards.

Insert the stem packing bushing.

Reassemble the gland nut and screw it only partially, ensuring that the stem moves freely without being braked excessively.

At plant start up, verify the stem packing tight and, if necessary, screw tight the nut.

For extended neck PN40 valves

Referring to Fig. 5 , unscrew and remove the gland nut. Slip off the stem packing bushing. Using a metallic point, extract the gasket top series, the two washers and the bushing drilled sideways (the so-called "lantern"), then take out the gasket (bottom series) being careful not to scratch the valve stem and the tight chamber. Insert the new gasket bottom series.

Note: The gasket rings must be lubricated with silicon grease and each gasket must be inserted with the cut turned 90° between one ring and the other, in order to achieve a better tight.

Assemble the first washer, remount the "lantern", ensuring the holes are lined up with the greaser to allow lubrication, then mount the other washer and insert the new gasket top series.

Insert the bushing, screw back the gland nut and screw it only partially, ensuring that the stem moves freely without being braked excessively. Fill the greaser with silicon grease and partially tighten the relevant screw. Carry out the actuator assembling as shown in the technical instructions.

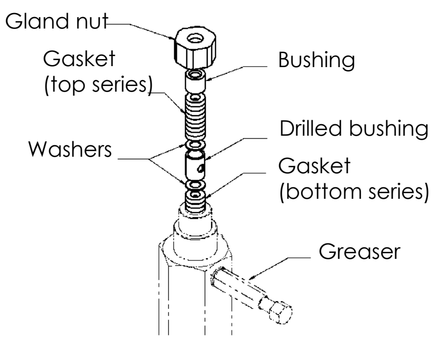


Fig. 5

SIZING

A correct valve sizing is essential in engineering a control system since the valve represents the end device of the system.

If the valve is correctly selected and sized, the system will be able to react to load changes as foreseen, achieving an optimal control, otherwise:

a undersized valve

- does not give the plant the necessary calories or the refrigeration units

an oversized valve

- provokes disturbances to the control system with an anomalous oscillations of the controlled unit.
- causes overloads and a higher wear of some plant components

The nominal diameter "DN" of the control valves is obtained calculating the value of the Kvs flow rate coefficient of the valve according to the following operating plant conditions:

- Fluid flow through the valve
- Fluid pressure upstream the valve
- Pressure drop through the valve

PRESSURE DROP

The valve diameter must be proportioned so that, at the max. flow rate value required, the valve pressure drop depends on the total pressure drop value of the plant.

It is difficult to determine exactly the value of the Δp pressure drop through the valve for a particular plant. Approximately, it is possible to suppose that the pressure drop through the valve should be:

- equal to the load pressure drop, for liquids
- between 30% and 50% of the pressure available upstream the valve, for water steam.

KVS CALCULATION

The flow rate coefficient "Kvs" can be calculated according to two methods:

1) graphically, using the diagrams shown in this document
2) analytically, using the following formulas:

LIQUIDS

Kvs is the flow rate expressed in m³/h of water at a temperature between 5 and 40°C passing through a valve open at nominal stroke under a 100 kPa (1 bar) differential pressure.

$$Kvs = 0 \times Q \times \sqrt{\frac{\rho}{\Delta p}}$$

where

Q = flow rate (m³/h)

DP = pressure drop (kPa)

ρ = volume (kg/dm³)

The ΔP pressure drop should be calculated as follows:

- Equal or higher than the DP of the circuit under control for circuits with variable flow rate to the user.
- Equal or higher than the DP of the supply circuit for circuits with constant flow rate to the user.

WATER STEAM

$$K = \frac{100 \times G \times C}{0,3 \times \sqrt{p_2 \times \Delta p}}$$

where

G = flow rate (Kg/h)

C = 1 + 0,0013 (t-ts)

t = water steam temperature in operating conditions

ts = saturated steam temperature under a P_2 pressure

P_2 = absolute pressure downstream the valve (kPa)

DP = pressure drop (kPa)

The DP pressure drop through the valve must be the 30% min. and 50% max. of the pressure available upstream the valve.

A DP higher than 50% could generate thermodynamic phenomena limiting the steam passing, causing vibrations and damages to the valve components.

NOMINAL DIAMETER SELECTION

The values of the "Kvs" flow rate coefficients are not a continuous value series, but they correspond to standard DN.

Therefore, the valve should be selected considering the nearest "Kvs" value with respect to the calculated one.

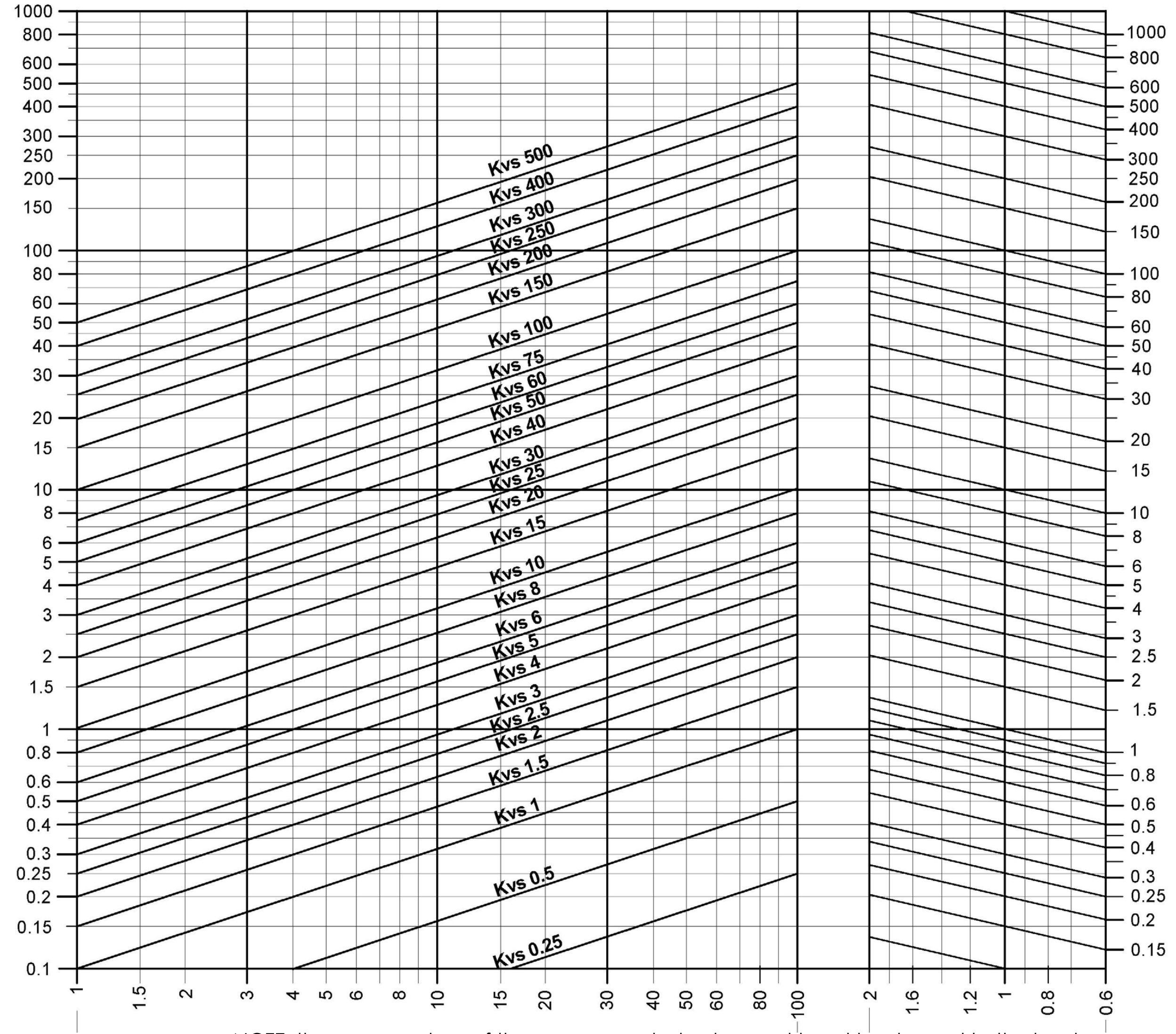
For Kvs values of each valve, see Table 5.

$$Kvs = \frac{Q \times 10}{\sqrt{\Delta pv}}$$

Q = flow rate [m³/h]

Δpv= valve pressure drop [kPa]

FOR LIQUIDS



NOTE: the pressure drop of the recommended valve must be at least equal to the load.

Example for liquids having 1 kg/dm³ volume mass (water)
If it is necessary to size a control valve with:

FLOW RATE: 7,5m³/h of water
PRESSURE DROP: 55kPa

Use the diagram as follows:

- Identify the point of intersection between the two perpendicular lines having origin from values of flow rate (7,5 m³/h) and pressure drop (55 kPa).

This point corresponds to the flow rate coefficient required: Kvs 10; the valve will have Kvs 10.

Example for liquids having volume different from 1kg/dm³
If it is necessary to size a control valve with:

FLOW RATE: 150 m³/h of liquid with volume mass (0,9kg/dm³), PRESSURE DROP: 80kPa

Use the diagram as follows:

- Identify the point of intersection (right side of the diagram) between the line originating from the volume mass value (0,9kg/dm³) and the inclined line corresponding to the flow rate value (150m³/h).
- Identify the point of intersection between the horizontal line originating from the intersection point defined above and the vertical one corresponding to the pressure drop value (80 kPa).

This point corresponds to the flow rate coefficient required: the valve will have approximately Kvs 160.

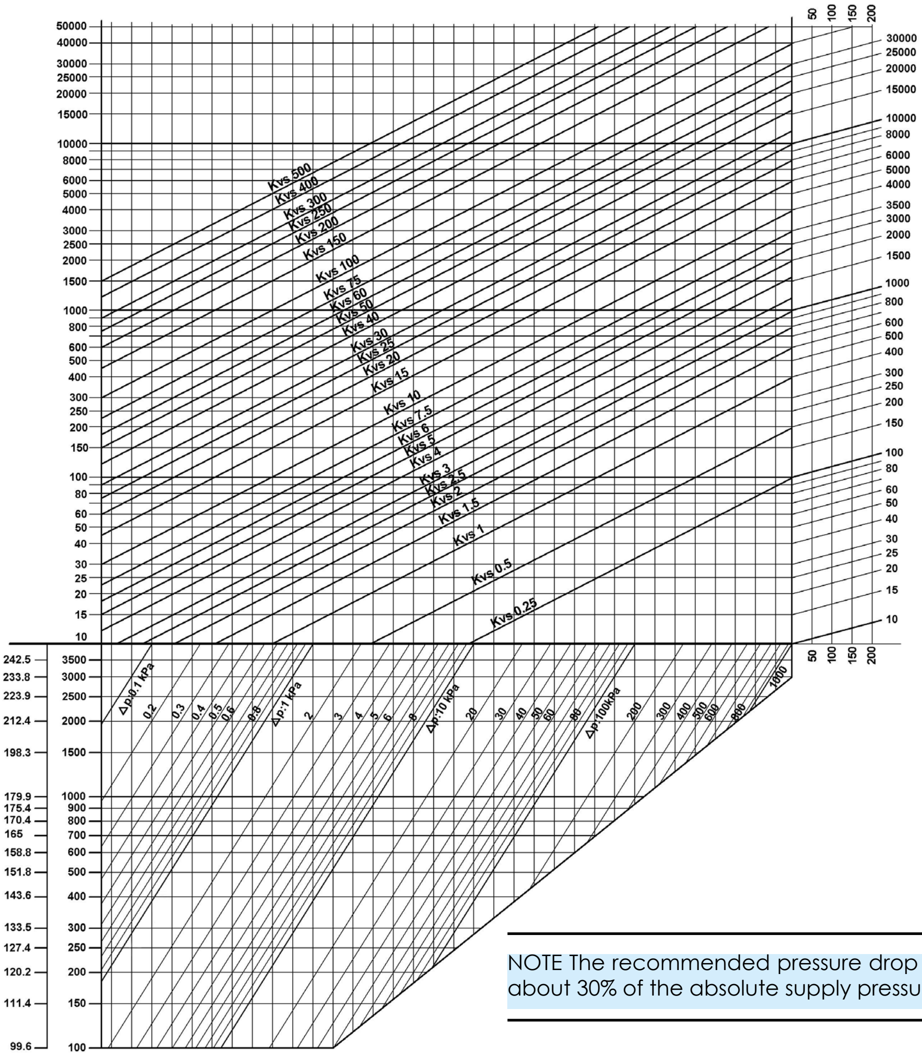
Example diathermic oil
It could be convenient to size the valve on diathermic oil, using the water fluid diagram. It is necessary to use the following conversion formula, which takes into account the “average” mass and specific heat of diathermic oil.

$$\text{Equivalent water flow rate} = \frac{\text{K calories}}{\text{DT 500}} \ [m^3/h]$$

$$Kvs = \frac{Q}{22{,}8 \cdot \sqrt{\Delta pu \cdot P_1}}$$

Q = flow rate [kg/h]
Δpv = pressure drop value
Pu = absolute pressure (bar) downstream the valve

Saturated steam flow rate [kg/h] | Overheated steam flow rate [kg/h]



NOTE The recommended pressure drop of the valve is about 30% of the absolute supply pressure

Example for saturated steam:

FLOW RATE	4700kg/h saturated steam
ABSOLUTE PRESSURE UPSTREAM	850kPa
LOAD PRESSURE	160kPa

Use the diagram as follows:
- Identify the point of intersection between the line originating from the value of absolute pressure upstream (850kPa) and the inclined line corresponding to the pressure drop value (160kPa).
- Identify the point of intersection of the two lines one originating from the point of intersection defined above and the other from the flow rate value (4700kg/h)

This point corresponds to the flow rate coefficient required: Kvs 63;

Example for overheated steam:

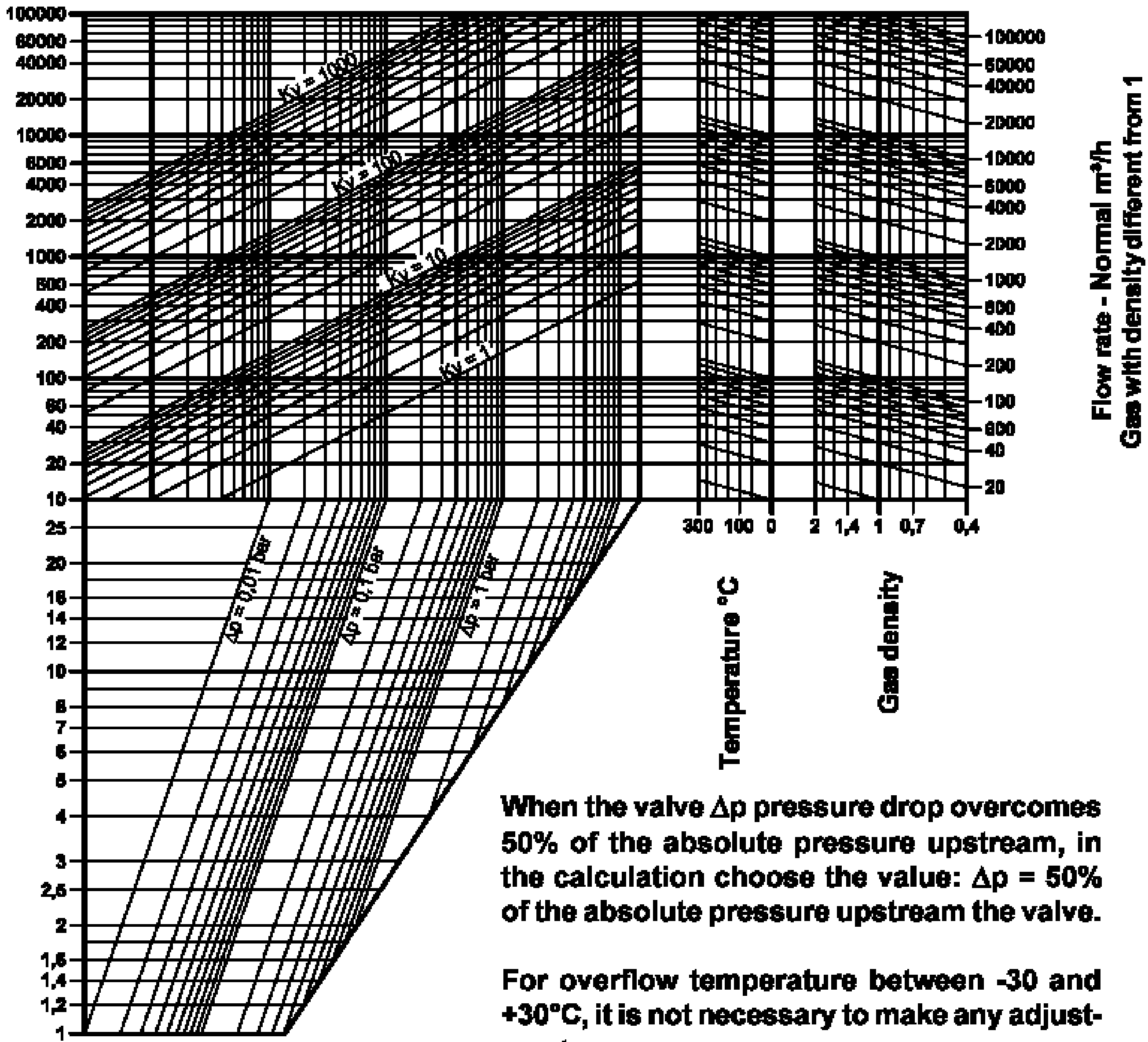
FLOW RATE	140kg/h heated steam water
ABSOLUTE PRESSURE UPSTREAM	350kPa
TEMPERATURE	209°C
PRESSURE DROP	100kPa

First, state the overheating degree of the steam as follows:
- Read the value (139°C) on the temperature range related to the absolute pressure value upstream the valve (350kPa on the left side of the diagram). The overheating degree is: 209 – 139 = 70°C

Use the diagram as follows:
- Identify the point of intersection “A” (right side of the diagram) between the line originating from the overheating degree value (70°C) and the inclined line corresponding to the flow rate value (140kg/h).
- Identify the point of intersection “B” between the line originating from the pressure value upstream the valve (350kPa) and the inclined line corresponding to the pressure drop (100kPa).
- Identify the intersection point between the two lines originating from the points “A” and “B”.

Absolute pressure upstream [bar]

Flow rate - Normal [m³/h] (air at 0°C and 1bar)



When the valve Δp pressure drop overcomes 50% of the absolute pressure upstream, in the calculation choose the value: Δp = 50% of the absolute pressure upstream the valve.

For overflow temperature between -30 and +30°C, it is not necessary to make any adjustment.

The diagram is subdivided into three parts: the top part with flow rate values in m³/h and the valve Kv; the bottom part with the absolute pressure upstream the valve [kg/cm²] and the Δp pressure drop through the valve. Finally, on the right, there are two auxiliary diagrams: the first for the flow rate correction of gases having density different from air and the second for the flow rate correction of gases having outflow temperature different from the room temperature. It is not necessary to carry out the latter correction if the gas outflow temperature is between –30 and +30°C.

Example with air:

The flow rate required is 750m³/h of air with absolute pressure upstream of 7,5kg/cm²; the pressure drop required is 2kg/cm².

1. On the top part of the diagram, near the 750m³/h flow rate, draw an horizontal line;
2. On the bottom-left diagram, near the 7,5kg/cm² value, draw an horizontal line until it crosses the Dp=2kg/cm² (1,961bar) inclined line; from this point of contact originates a vertical line crossing the horizontal described at point 1;
3. The point of intersection corresponds to a Kv included between 6 and 7.

As shown on Table 5, the valve can be, for example, a DN25 with Kv 6,3.

The performances stated in this sheet can be modified without any prior notice