

GENERAL DESCRIPTION

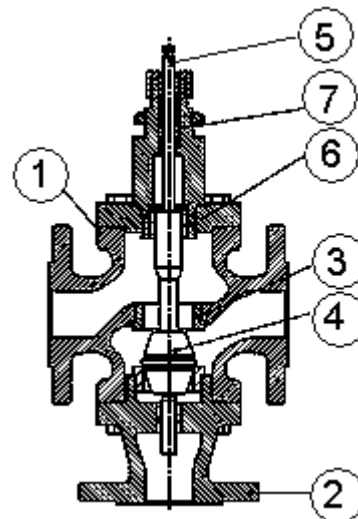
The control valve is an essential element in an automatic control system and its correct choice and sizing are required in order to ensure:

- 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

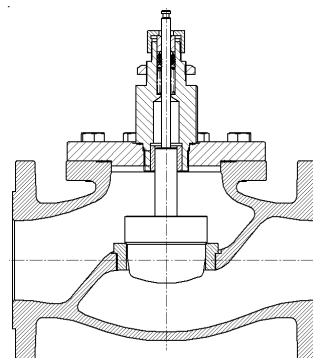


3-WAY MIXING VALVE (3V)

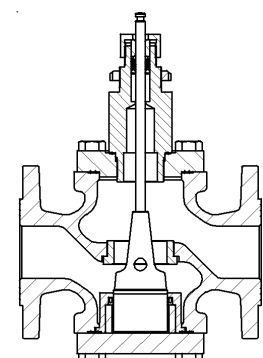
The valve bodies, for particular applications, can be equipped with:

- 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.



2-WAY SIMPLE SEAT VALVE (SS)



2-WAY BALANCED VALVE (VBAA)

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).

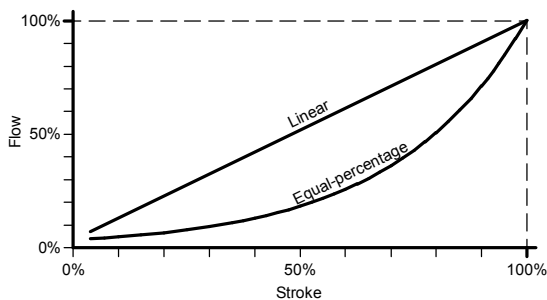
Pressure drop DP

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

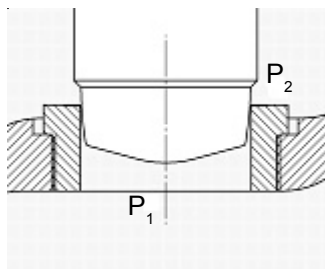
It indicates the flow rate (m³/h) of water passing through a completely open valve under 1 bar pressure drop.

Leakage

It represents, as a percentage of Kvs, the leakage of a control valve in completely closed position, under a 1 bar ΔP.

Control differential pressure (DPv)

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



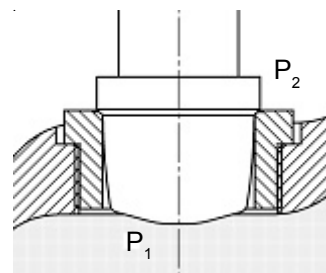
$$\Delta p_v = P_1 - P_2$$

If the valve operates continually near close-off (i.e. is over-dimensioned) with Δpv 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 to keep to the values indicated on Tables 5 and 6.

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.



$$\Delta p_c = P_1 - P_2$$

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 Tables 5 e 6)
- Fluid suitability to valve materials (see Table 2)

2) *Actuator requirements according to:*

- stroke (see Table 3)
- max. differential close-off pressure, see Tables 5 and 6

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

VALVE BODIES (Table 1)

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	Conenctions	DN	Fluid temperature °C *	Control characteristic	Leakage % of Kvs
VSBPM	Two-way	16	threaded	1/2"-2"	-5÷95	-	0
SSAA		40	flanged	15-80	-10÷230	equal percentage	0,02
SSAACP		40	flanged	15-80	-10÷350		0,02
SSGA		16	flanged	15-100	-10÷200		0,02
VSB		16	threaded	1/2"-2"	-10÷150		0,03
VSBF		16	flanged	15-65	-10÷150		equal percentage (VSB9F linear)
VSBT		16	threaded	3/4"-1 1/2"	5÷ 95	linear	0,03
VSG		16	flanged	25-150	-10÷150	equal percentage	0,03
VSS		25	flanged	25-65	-10÷230		0,02
DSGA		Two-way	16	flanged	200		-10÷200
DSAA	double seat	40	flanged	150	-10÷230		0,12
VBS	Two-way balanced	25	flanged	25-80	-10÷230		0,02
VBAA		40	flanged	25-125	-20÷230		0,02
VBG		16	flanged	65-150	-10÷150		0,03
3VAA	three-way mixing	40	flanged	25-125	-10÷230		linear
3VAACP		40	flanged	25-125	-20÷350	0,02	
3VSA		25	flanged	80	-10÷300	0,02	
3VSATS		25	flanged	80	-20÷300	0,02	
VMBPM		16	threaded	1/2"-2"	-5÷95	-	0
VMB		16	threaded	1/2"-2"	-10÷150	equal percentage direct-w ay and linear angle-w ay	0,03 / 2**
VMB16		16	flanged	25-150	-10÷120	equal percentage direct-w ay and linear angle-w ay (linear - linear VMB9F)	0,03 / 2**
VMBF		16	flanged	15-65	-10÷150	linear	0,03 / 2**
VMBT		16	threaded	3/4"-1 1/2"	5÷95	equal percentage direct-w ay and linear angle-w ay	0,02
VMS		25	flanged	25-65	-10÷230	equal percentage direct-w ay and linear angle-w ay	0,02
VMSTS	25	flanged	25-65	-10÷300		0,02	

* For fluid temperature below 0 and in case of ice on the stem, use the stem heater (see 240 series models).

** 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	
VSBPM/VMBPM	EN-GJL-250 UNI EN 1561		Rubber	Threaded PN16 UNI-ISO 228
VSB/VMB/VSBT/VMBT/VSBF/VMBF	EN-GJL-250 UNI EN 1561		Brass	
VMB16/VBG/VSG	EN-GJL-250 UNI EN 1561		Brass	PN16 flanged
SSGA/DSGA	EN-GJL-250 UNI EN 1561	stainless steel		
3VSA/3VSATS/VMS VMSTS/VBS/VSS	EN GJS400-15 spheroidal cast-iron	stainless steel		PN25 flanged
SSAA/DSAA 3VAA/3VAACP/VBAA	A216 WCB steel	stainless steel		PN40 flanged

VALVE STROKE FOR NOMINAL DIAMETERS (Table 3)

Model	Flanged DN											
	15	20	25	32	40	50	65	80	100	125	150	200
	Threaded DN											
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"						
VSBBPM/VMBBPM/VSBPBMF/VMBPBMF	16,5											
VSBB/VMBB	16,5											
VSBF/VMBF	16,5						20					
VMBT/VSBT	5,5											
VMB16-VSG	16,5			25			45					
VBG							25	45				
VBS/VSS/ VMS-VMSTS				16,5		25		45				
SSGA/SSAA/SSAACP	16,5			25			45					
DSGA/DSAA										45		
3VAA/3VAACP				16,5		25		45				
3VSA-3VSATS							45					
VBAA	16,5			25			45					

MAX. OPERATING PRESSURE (bar) ACCORDING TO TEMPERATURE (UNI1284) (Table 4)

Fluid temperature °C	Models						
	VSBBPM/VMBBPM VMBT/VSBT (up to 95°C only)	VSBB/VMBB/ VMB16/VSG/VBG VSBF/VMBF	SSGA DSGA	SSAA DSAA 3VAA VBAA	SSAACP 3VAACP	3VSA VMS/VSS VBS	3VSATS/VMSTS (bellows tight)
	PN16	PN16	PN16	PN40	PN40	PN25	PN25
-20 ÷ -10				40	40		
> -10 ÷ 120	16	16	16			25	5
> 120 ÷ 150			14	37	37	23	
> 150 ÷ 200			13	32	32	20	
> 200 ÷ 230			12	30	30	19	
> 230 ÷ 250					28		
> 250 ÷ 300					24		
> 300 ÷ 350					22		

MAX. CONTROL (D_{pv}) AND CLOSE-OFF (D_{pc}) DIFFERENTIAL PRESSURE [bar] FOR TWO-WAY VALVES AND RELEVANT K_v (Table 5)

Model	DN	K_v	Δp_v	Δp_c							
				MVL	MVLA/C	SH	MVB	MVT	PL	MVF54	MVF58
SSGA PN16	15R	1,6	8	16	16	16	-	-	16	-	16
	15	4		16	16	16			16		16
	20	6,3		16	14,5	16			10,5		16
	25	10		16	9	16			6,3		10
	32	16		16	9	16			6,3		10
	40	24		13,5	6	11,5			4,3		6,8
	50	40		9	3,8	7,5			2,7		4,3
	65	63		3,5	1,5	3,1			1		1,7
	80	110		2	1	2			-		1,1
100	140	1,5	0,6	1,2	-	0,7					
SSAA SSAACP PN40	15R	1,6	12	30	30	30	-	-	30	-	30
	15	4		30	18	30			11		20
	20	6,3		29	10	24			6,5		11,5
	25	10		18	6,5	15			3,9		7,5
	32	16		18	6,5	15			3,9		7,5
	40	24		12	4,3	10			2,5		4,9
	50	32		8	2,7	7			1,6		3
	65	63		3	1,1	3			0,6		1,2
	80	110		2	0,7	2			-		0,8
VSG PN16	25R	4	2	16	10,5	16	-	-	8	-	12
	25I	6,3		16	10,5	16			8		12
	25	10		16	10,5	16			8		12
	40R	19		12	5,8	10,4			4,4		6,6
	40	25		12	5,8	10,4			4,4		6,6
	50	40		7,5	3,6	6,5			2,7		4,1
	65	63		4,5	2,1	3,8			1,6		2,4
	80	100		2,5	1,3	2,5			-		1,5
	100	130		1,8	0,8	1,5			-		0,9
	125	200		1,1	0,5	0,9			-		0,6
150	300	0,8	0,3	0,6	-	0,35					
VSS PN25	25R	4	8	25	21	25	-	-	16	-	24
	25I	6,3		22	10,6	19			8		12
	25	10		22	10,6	19			8		12
	32	16		14,5	7,1	13			5,4		8
	40	25		10,5	5,1	9			3,8		5,8
	50	40		6,5	3,2	6			2,4		3,7
	65	63		4	1,8	3,4			1,4		2
VSB VSBF PN16	1/2"	1-1,6-2,5-4	2	16	16	16	13,5	-	16	11	16
	3/4"	6,3		16	16	16	11		16	9,5	16
	1"	8		16	13,5	16	7		10,2	6	15,5
	1 1/4"	16		16	8,2	14,5	4,2		6,2	3,5	9,4
	1 1/2"	22		12	5,7	10	3		4,4	2,5	6,5
	2"	30-40		9	4,3	7,7	2,1		3,2	1,8	4,9
	2" 1/4 (V_B9F)	63		-	-	-	1		-	-	-
VSBT PN16	3/4"	6,3	2	-	-	-	-	2,5	-	-	-
	1"	10						1,5			
	1 1/4"	13						0,9			
	1 1/2"	16						0,6			
VBS PN25	25R	4	8	25	25	25	-	-	25	-	25
	25I	6,3		25	25	25			25		25
	25	10		25	25	25			25		25
	32	16		25	25	25			21,5		25
	40	25		25	25	25			17		25
	50	40		25	23,5	25			12		25
	65	63		25	16	25			7		25
80	100	25	18	25	-	20					
VBG PN16	65	63	2	16	13	16	-	-	-	-	15
	80	100		16	10	16			-		11,5
	100	130		16	7	16			-		8
	125	200		16	4,7	13,7			-		5,4
	150	300		13	3	10,5			-		3,4
DSAA PN40	150	300	12	17,5	2,5	13,5	-	-	-	-	2,9
DSGA PN16	200	500	8	11,6	1,6	9	-	-	-	-	1,8
VBAA PN40	25	10	12	30	30	30	-	-	30	-	30
	32	16		30	30	30			30		30
	40	25		30	30	30			26		30
	50	40		30	30	30			21		30
	65	63		30	22	30			15		25
	80	100		30	18	30			-		20
	100	160		28	11	22			-		12,5
	125	200		22	8	17			-		9
VSBPM VSBPMF PN16	1/2"	4	2	-	-	-	11	-	-	9,5	-
	3/4"	6,3					8,8			7,5	
	1"	10					5,5			5	
	1 1/4"	16					3,5			3	
	1 1/2"	25					2,5			2,2	
	2"	36					1,8			1,5	

MAX. CONTROL (Dpv) AND CLOSE-OFF (Dpc) DIFFERENTIAL PRESSURE [bar] FOR THREE-WAY VALVES AND RELEVANT Kv (Table 6)

Model	DN	Kv	Dpv	Dpc							
				MVL	MVLA/C - SP	SH	MVB	MVT	PL	MVF54	MVF58
VMB16 PN16	25R	4	2	16	8,1	15,5	-	-	5,9	-	9
	25I	6,3		16	8,1	15,5			5,9		9
	25	10		16	8,1	15,5			5,9		9
	40R	19		10	4,6	8,7			3,3		5,2
	40	25		10	4,6	8,7			3,3		5,2
	50	40		6,5	3	5,6			2,1		3,4
	65	63		3,8	1,7	3,3			1,2		2
	80	100		2,5	1,1	2,1					1,2
	100	130		1,6	0,7	1,4					0,8
	125	200		1	0,4	0,9					0,4
150	300	0,7	0,3	0,6		0,3					
VMS PN25	25R	4	8	25	12	25	-	-	7	-	14
	25I	6,3		17	6	14,5			3,4		7
	25	10		17	6	14,5			3,4		7
	32	19		11,5	4	9,5			2,2		4,5
	40	25		8	2,8	7			1,6		3,2
	50	40		5	1,8	4,5			1		2
	65	63		3	1	2,5			0,5		1,1
3VSA PN25	80	110		2,2	0,9	1,9		-		1	
VMSTS PN25	25R	4	5	5	5	5	-	-	5	-	6
	25I	6,3		5	5	5			5		6
	25	10		5	5	5			5		6
	32	19		5	5	5			3,5		6
	40	25		5	3,8	5			2,5		4,3
	50	40		5	2,4	5			1,5		2,7
	65	63		3,5	1,3	2,9			0,9		1,5
3VSATS PN25	80	110		2,2	0,8	1,9		-		0,9	
VMB VMBF PN16	1/2"	1-1,6-2,5-4	2	16	16	16	4,1	-	16	11	16
	3/4"	6,3		16	15,2	16	2,7		11	9,5	16
	1"	8		16	10	16	1,8		7,3	6	11,5
	1 1/4"	16		14	6,3	12	1,1		4,5	3,5	7
	1 1/2"	22		10	4,6	8,5	0,8		3,3	2,5	5,2
	2"	30-40		7,5	3,5	6,6	0,6		2,5	1,8	4
	2" 1/4 (V_B9F)	63		-	-	-	0,8		-	-	-
VMBT PN16	3/4"	6,3	2	-	-	-	-	1,7	-	-	-
	1"	10						1			
	1 1/4"	13						0,7			
	1 1/2"	16						0,5			
3VAA 3VAACP PN40	25 (tutte)	4-6,3-10	12	19	7	16	-	-	4,1	-	8
	32	16		12	4,3	10			2,5		5
	40	22		7,5	2,8	6,5			1,6		3,2
	50	32		5,5	1,9	4,5			1,1		2,2
	65	70		3,2	1,1	2,6			0,6		1,2
	80	110		2	0,7	1,7					0,8
	100	140		1,3	0,4	1					0,4
	125	250		0,8	0,3	0,6					0,3
VMBPM VMBPMF PN16	1/2"	4	2	-	-	-	-	11	-	-	9,5
	3/4"	6,3						8,8			7,50
	1"	10						5,5			5
	1 1/4"	16						3,5			3
	1 1/2"	25						2,5			2,2
	2"	36						1,8			1,5

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
- 245 24 V~ stem heater, 50 W for all valve bodies except V.B
- 246 24 V~ stem heater, 50 W for V.B valves with SH-MVL

INSTALLATION

Hydraulic connections

Respect the fluid direction as shown by the following diagrams:

Three-way valves

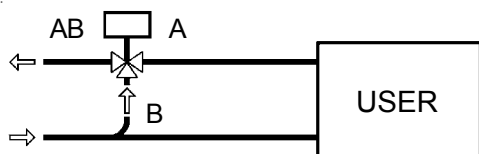


Fig. 1 - Variable flow mixing to the user.

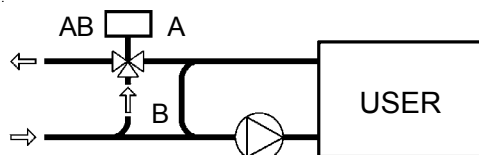


Fig. 2 - Constant flow mixing to the user in injection or tapping circuits

Two-way valves

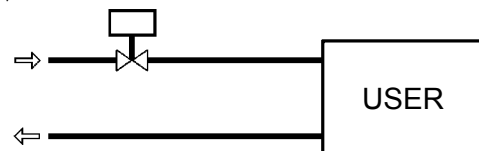


Fig. 3 - Variable flow control to the user.

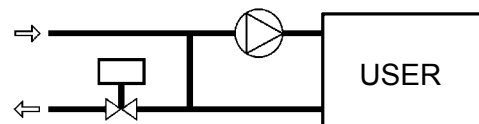


Fig. 4 - Constant flow control to the user in injection or tapping circuits

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

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.**

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.

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:

<i>two-way</i>	stem down=	fluid passing (intercepted only on SS and DS series)
	stem up =	fluid intercepted (passing only on SS and DS series)
<i>three-way</i>	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 1-4-5-6 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 shutdown of the fluid circulation.

ORDINARY MAINTENANCE

Stem packing tight check

VMB16-VSG-VBG-V.B-V.BF-V.BPM-V.BPMF-V.BT PN16 valves
Fig. 1

Controlli PN16 valves have a stem packing with double O-Ring and, therefore, do not need any ordinary maintenance operation.

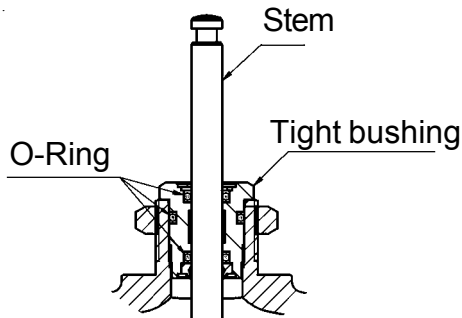


Fig. 1

SSGA-DSGA PN16 valves

PN25 valves (all models) - PN40 valves (all models) - Fig. 2

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.

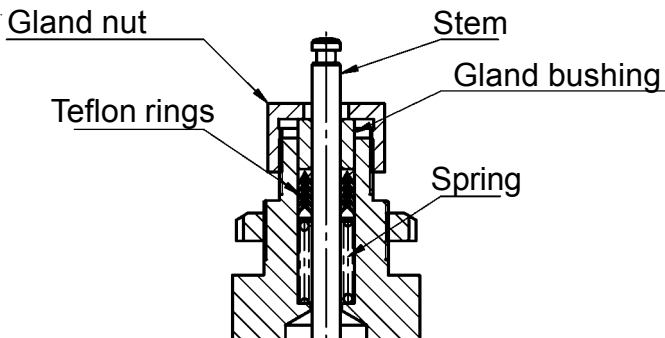


Fig. 2

Valve stem lubrication (extended neck) - Fig. 3

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.

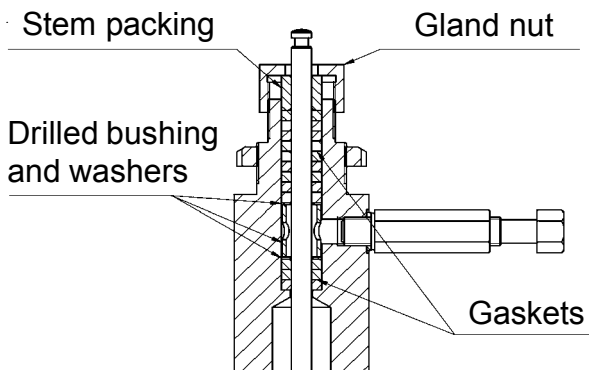


Fig. 3

Bellows tight valves (VMSTS/3VSATS) - Fig. 4

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 send the valve back to the factory for repair.

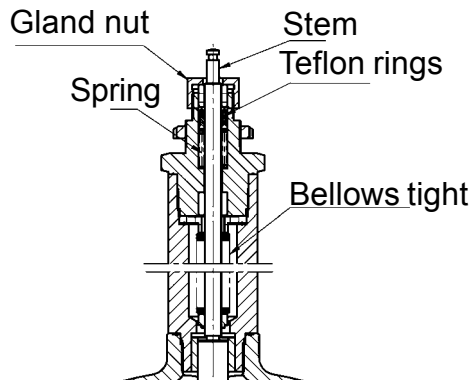


Fig. 4

EXTRAORDINARY MAINTENANCE

PN16 VALVES

VMB16-VSG-VBG-V.B-V.BF-V.BPM-V.BPMF-V.BT

In case of stem packing dripping, replace the tight bushing.

SSGA-DSGA PN16 Valves

Stem packing leakage

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.

Poor tight between plug and seat

- 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.

Plug and stem vibrations

- 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 Tables 5-6.

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

VMB16-VSG-VBG-V.B-V.BF-V.BPM-V.BPMF-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.

SSGA - DSGA 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.

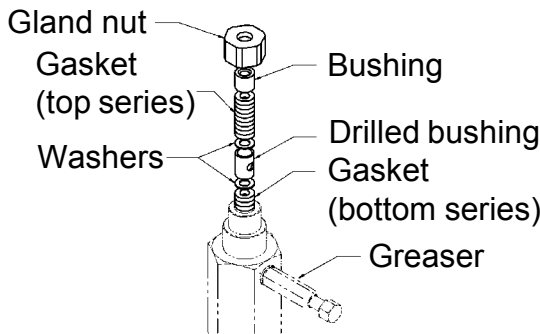


Fig. 5

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.

where

- Q = flow rate (m³/h)
- ΔP = pressure drop (kPa)
- ρ = volume (kg/dm³)

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

The ΔP pressure drop should be calculated as follows:

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

Water steam

$$Kv = \frac{100 \times G \times C}{20,3 \times \sqrt{p_2 \times \Delta p}}$$

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 P₂ pressure
- P₂ = absolute pressure downstream the valve (kPa)
- ΔP = pressure drop (kPa)

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

A ΔP 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 Tables 5 and 6 on previous pages.

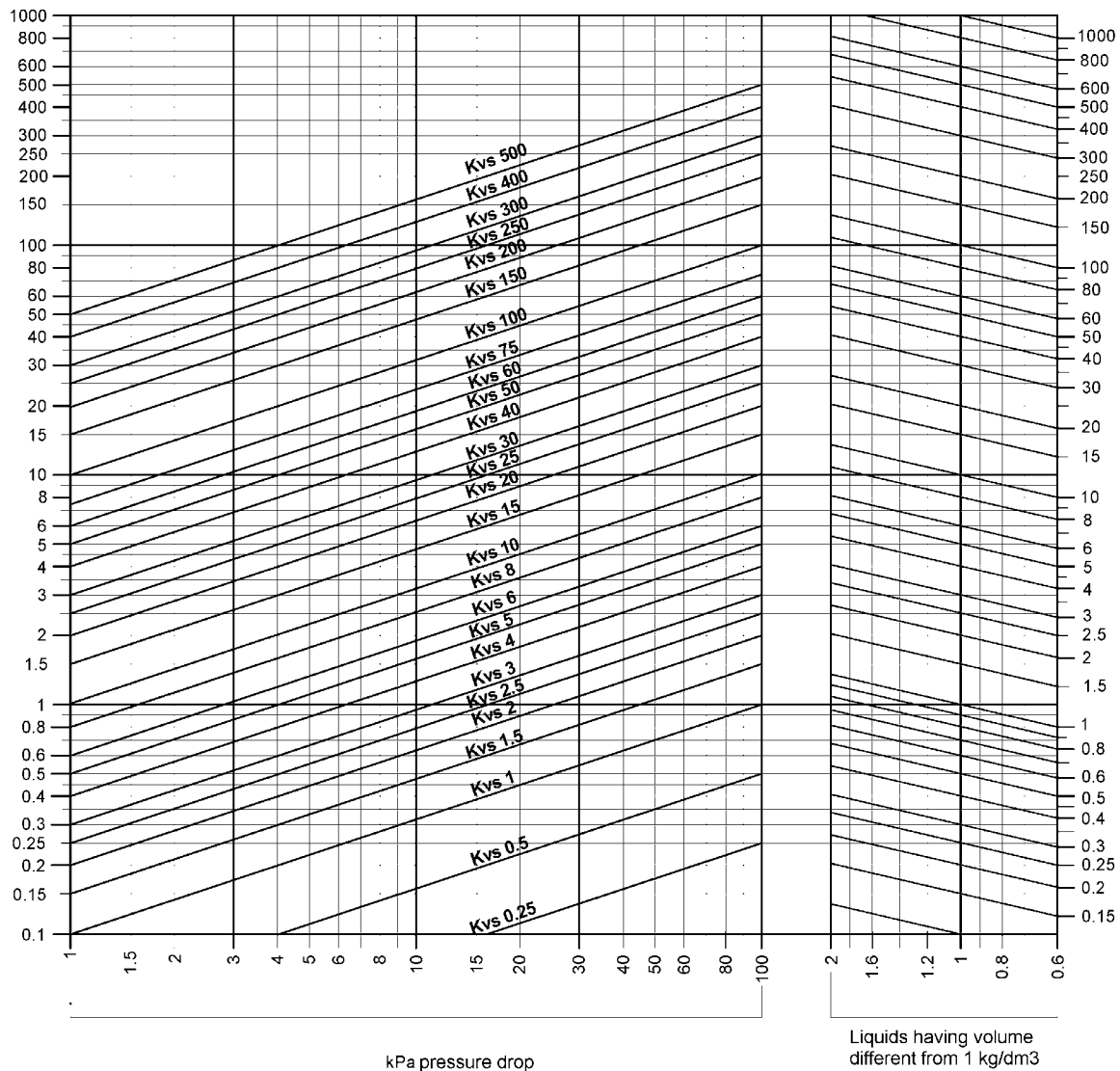
SIZING DIAGRAMS OF CONTROL VALVES

FOR LIQUIDS

m³/h water flow rate

$$Kvs = \frac{Q \cdot 10}{\sqrt{\Delta p_v}} \quad \begin{matrix} Q = \text{flow rate (m}^3/\text{h)} \\ \Delta p_v = \text{valve pressure drop [kPa]} \end{matrix}$$

m³/h flow rate



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: 7,5 m³/h of water

PRESSURE DROP: 55 kPa

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 1 kg/dm³

If it is necessary to size a control valve with:

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

PRESSURE DROP: 80 kPa

Use the diagram as follows:

- Identify the point of intersection (right side of the diagram) between the line originating from the volume mass value (0,9 kg/dm³) and the inclined line corresponding to the flow rate value (150 m³/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.

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

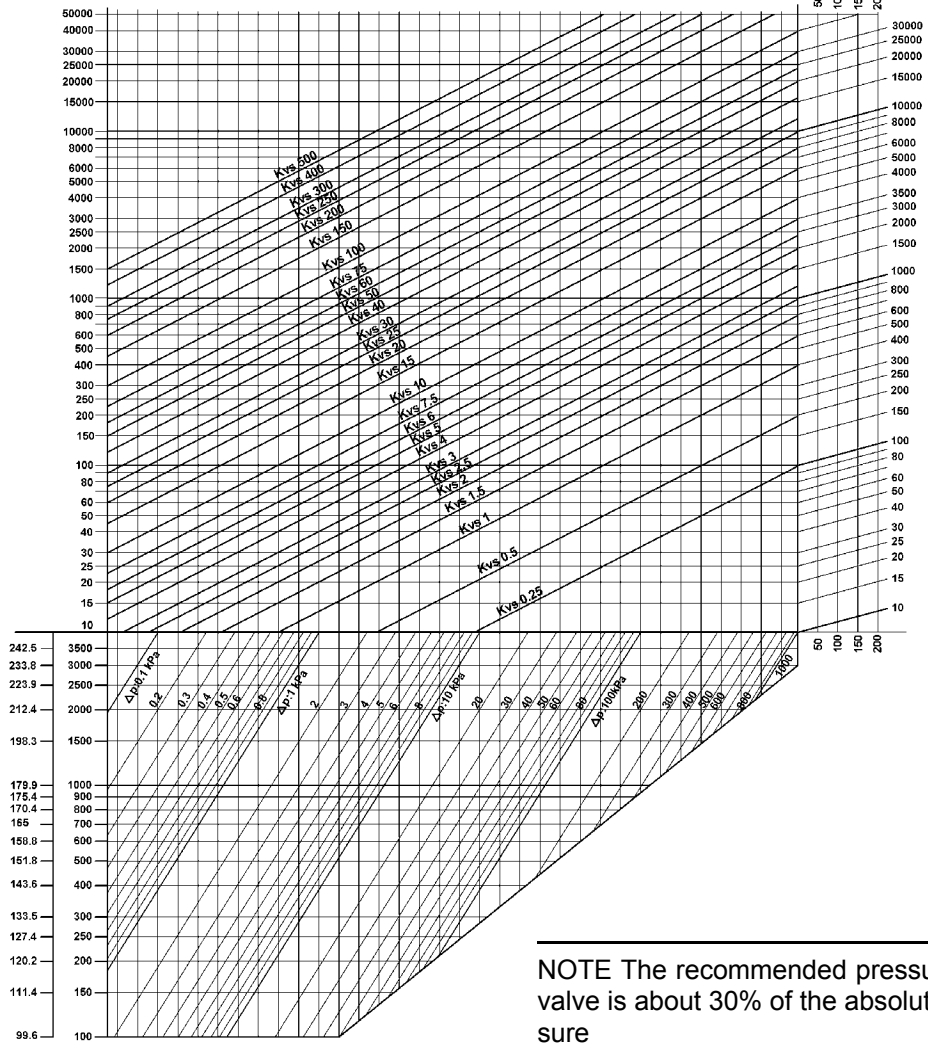
PRESSURE DROP DIAGRAMS FOR WATER STEAM

$$K_{vs} = \frac{Q}{22,8 \cdot \sqrt{\Delta p_v \cdot P_u}}$$

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 4700 Kg/h saturated steam
 ABSOLUTE PRESSURE UPSTREAM 850 kPa
 LOAD PRESSURE 160 kPa

Use the diagram as follows:

- Identify the point of intersection between the line originating from the value of absolute pressure upstream (850 kPa) and the inclined line corresponding to the pressure drop value (160 kPa).
- 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 (4700 Kg/h)

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

Example for overheated steam:

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

First, state the overheating degree of the steam as follows:

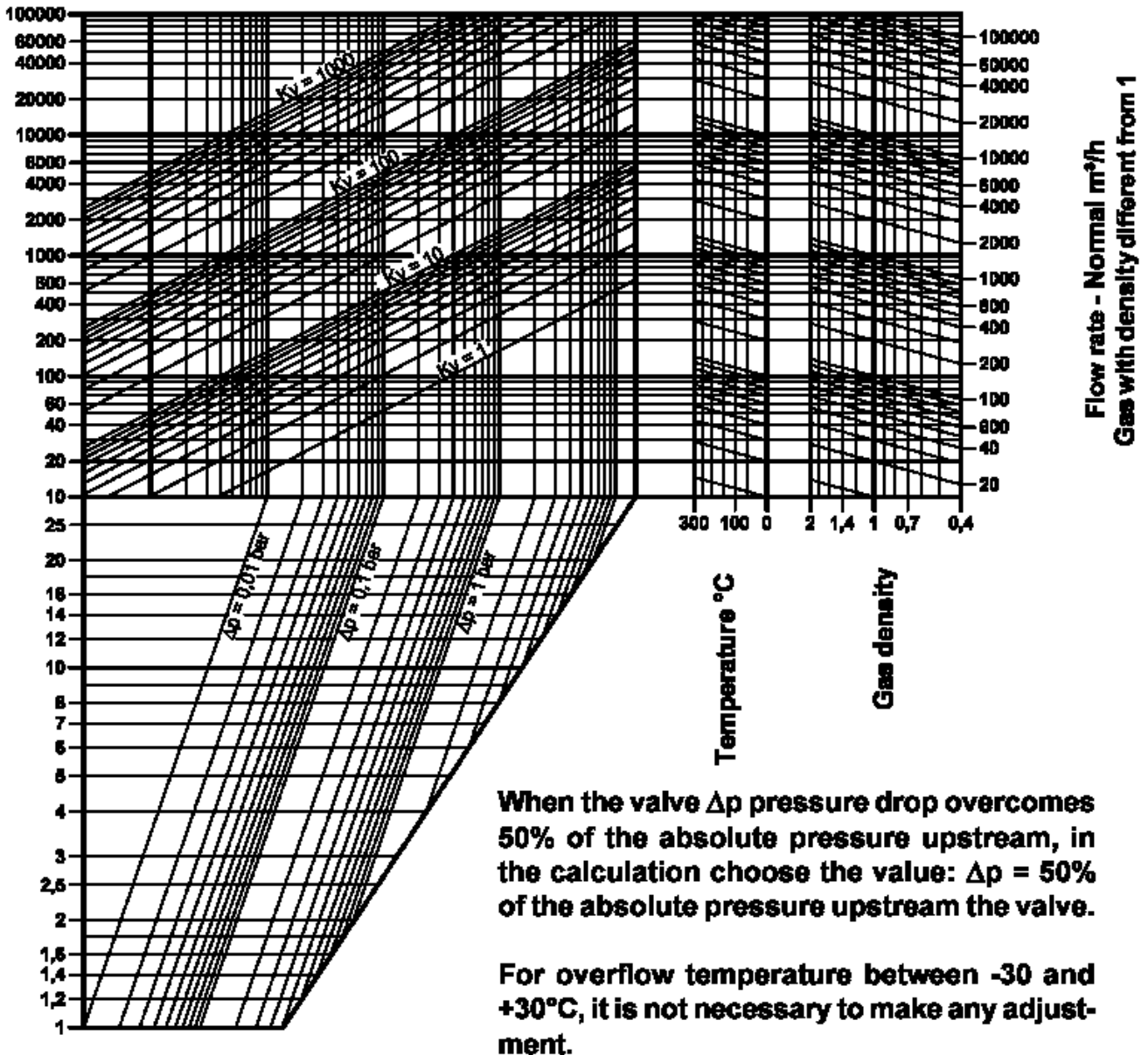
- Read the value (139 °C) on the temperature range related to the absolute pressure value upstream the valve (350 kPa on the left side of the diagram). The overheating degree is: 209 – 139 = 70 °C

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 (140 Kg/h).
- Identify the point of intersection "B" between the line originating from the pressure value upstream the valve (350 kPa) and the inclined line corresponding to the pressure drop (100 kPa).
- Identify the intersection point between the two lines originating from the points "A" and "B".

PRESSURE DROP DIAGRAM FOR GAS

Absolute pressure upstream - bar Flow rate - Normal m³/h (air at 0°C and 1 bar)



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 in 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 $+30^\circ\text{C}$.

Example with air:

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

1. On the top part of the diagram, near the 750 m³/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 $\Delta p=2\text{Kg/cm}^2$ (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 Tables 5 and 6, the valve can be, for example, a DN25 with Kv 6,3.

The performances stated on this sheet can be modified without any prior notice due to design improvements.