Series 240 · 250 · 280 · 290 · Series V2001 · PFEIFFER
Electric and Pneumatic Control Valves
Information Sheet Part 1

DN 6 to 500	·	PN 10 to 400	·	–196 to +550 °C
NPS ¼ to 20	·	Class 125 to 2500	·	–325 to +1022 °F
DN 10A to 250A	·	JIS 10K/20K	·	–196 to +500 °C

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Information Sheet T 8000-1 EN

Contents

SAMSON control valves

Series 240, 250, 280 and 290 Control Valves include pneumatic and electric globe valves, three-way valves and angle valves. Their application range covers control tasks in process engineering and industrial applications as well as in supply and power plant engineering.

The modular system allows easy retrofitting and servicing.

The control valves consist of a valve and (pneumatic, electric, electrohydraulic or hand-operated) actuator.

For controlling purposes and travel indication, accessories, such as positioners, limit switches and solenoid valves, can either be attached directly or according to IEC 60534-6 (NAMUR rib) (see Information Sheet ▶T 8350 EN).

The valve bodies are available in cast iron, spheroidal graphite iron, cast steel, cast stainless steel, cold-resisting steel, forged steel or forged stainless steel as well as special alloys. All parts of the valve and the pneumatic actuator housing in the completely corrosion-resistant version are made of stainless steel. Refer to the associated data sheets for details.

Series 240

Series 240 Control Valves are primarily used in the chemical industry. The valves are available as globe and three-way valves in valve sizes ranging from DN 15 to 300 (NPS ½ to 12) and up to a pressure rating of PN 40 (Class 300).

Standard versions of the valves are suitable for temperature ranges between −10 and +220 °C (15 and 430 °F). An insulating section allows the temperature range to be extended to −196 and +450 °C (ANSI: −325 and +840 °F).

The plug stem is sealed either by a self-adjusting PTFE V-ring packing or an adjustable packing. To meet stricter emissions control requirements, a stainless steel bellows is used. The Type 3241 Valve can be equipped with a heating jacket that may also include the bellows seal.

Series 250

Series 250 Control Valves are used when large valve sizes and/or high pressures are involved in process engineering, power plant or supply engineering.

They are manufactured in valve sizes DN 15 to 500 (NPS ½ to 20) and pressure ratings of PN 16 to 400 (Class 150 to 2500). In addition to globe, three-way and angle valves, customized valve constructions can be engineered.

Standard versions of the valves are suitable for temperature ranges between −10 and +220 °C (15 and 430 °F). The temperature range can, however, be extended by using an adjustable high-temperature packing to a temperature range between −10 and +350 °C (15 and 660 °F) and by using a bellows seal or an insulating section to a temperature range between −196 and +550 °C (ANSI: −325 and +1022 °F).

Series 250 Valves can be equipped with a heating jacket.

Series 280

Series 280 Steam-converting Valves are used to reduce both the steam pressure and steam temperature to optimize plant operation and heat efficiency in process plants, for example, in refineries, food and beverage, tobacco or pulp and paper industries.

Steam-converting valves are based on Series 250 Valves fitted with a flow divider St III and an additional cooling water connection.

Steam-converting valves are available in valve sizes ranging from DN 50 to 500 (NPS 2 to 20), for pressure ratings of PN 16 to 160 (Class 150 to 900) and for temperatures up to 500 °C (930 °F).

Series 290

Series 290 Control Valves are primarily used in the petrochemical industry and process engineering due to their maintenance-friendly properties. The seat is clamped into the valves to facilitate maintenance.

Series 290 Valves are only available in ANSI versions in valve sizes NPS ½ to 8 and pressure ratings of Class 150 to 900. A bellows seal or insulating section allows the valves to be used in temperature ranges between −196 and +450 °C (−325 and +842 °F) depending on the material used.

Additional equipment includes flow dividers, heating jackets and balanced plugs. Furthermore, Series 290 Valves can be designed to meet NACE requirements for sour gas.

Series V2001

The Series V2001 Valves are available as globe valves or as three-way valves for mixing or diverting service. They are manufactured in valve sizes DN 15 to 100 (NPS ½ to 4) and pressure ratings of PN 16 to 400 (Class 150 and 300). The standard versions of these valves are suitable for temperature ranges from −10 to +220 °C (14 to 430 °F). The use of an insulating section extends the temperature range to 300 °C (572 °F).

Series V2001 Valves are primarily designed for use in mechanical and plant engineering. A special attribute of the Type 3531 and Type 3535 Valves is their use in heat transfer applications using organic media (e.g. heat transfer oil). The Type 3321 and Type 3323 Valves are suitable for liquids, gases and steam up to 350 °C (660 °F).

The standard version can also be fitted with additional equipment, such as bellows seals, insulating sections and flow dividers.

Valves for special applications

These valves are designed for special requirements. Such valves include cryogenic, food processing, diaphragm and micro-flow valves.

The K 30 EN Catalog on components for the food processing and pharmaceutical industries contains details on hygienic and aseptic valves.

Technical data

Table 1: *Series 240 Valves and valves for special applications*

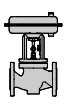
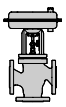
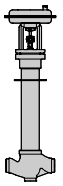
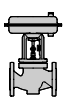
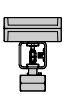
Valve			Series 240						For special applications			
Type			3241 -DIN	3241 -ANSI	3241 -Gas	3241 -Oil	3241 -TÜV	3244	3248	3246	3351	3510
Data Sheet T … EN			8015	8012	8020	8022	8016	8026	8093	8046	8039	8091
Globe valve			•	•	•	•	•		•	•	•	•
Three-way mixing or diverting valve								•		•		
Angle valve									•			•
Standard version		DIN	•		•	•	•	•	•		•	•
		ANSI		•	•			•	•	•	•	•
		JIS	•	•								
Special applications	Low flow rates											•
	Tested for gas, DIN EN 161				•							
	Liquid fuels (ISO 23553)					•						
	Tested according to DIN EN 14597						•					
	On/off valve										•	
	Food/pharmaceutical industry											
	Cryogenic applications								•	•		
Valve size		DN	15 to 300		15 to 150	15, 25	15 to 150	15 to 150	25 to 150		15 to 100	10, 15, 25
		NPS		½ to 12	½ to 6	½, 1		½ to 6	1 to 6	½ to 10	½ to 4	¼, ¾, 1
Pressure rating		PN	10 to 40		40	16, 40	16 to 40	10 to 40	16 to 100		10 to 40	40 to 400
		Class		125 to 300	300	150, 300		125 to 300	150 to 600	150 to 600	150 to 300	150 to 2500
		JIS	10/20 K	10/20 K								
Permissible temperatures and differential pressures			See associated Data Sheet									
Body material	Cast iron, EN-JL1040		•				•	•			•	
	Spheroidal graphite iron, EN-JS1049		•				•				•	
	Cast steel, 1.0619		•		•	•	•	•			•	
	Cast stainless steel, 1.4408		•		•	•	•	•	1.4308		•	
	Forged steel, 1.0460		•		•	•	•					
	Cast stainless steel, 1.4571		•		•	•	•					•
	ASTM A126 B, cast iron			•								
	ASTM A216 WCC, cast steel			•	•			•			•	
	ASTM A351 CF8M, cast stainless steel			•	•			•	A351 CF8	•	•	
	GX5CrNi19-10, 1.4308		•						•			
	G20Mn5, 1.6220/1.1138/LCC		•									
	Special material		•	•				•	•			•
Plug	Metal seal		•	•			•	•	•	•	•	•
	High-performance metal seal		•	•		•			•	•		•
	Soft seal		•	•	•	•			•		•	
	Balanced		•	•			•					
	Diaphragm seal											
Options	Insulating section		•	•			•	•	•	•	•	•
	Metal bellows seal		•	•	•	•		•	•		•	•
	Heating jacket		•	•				•				
	Low-noise (flow divider)		•	•	•		•					
Connection	Flange		•	•	•	•	•	•		•	•	•
	Welding ends		•	•			•		•	•		•
	Special connections											•
												
Data Sheet T … EN			8015	8012	8020	8022	8016	8026	8093	8046	8039	8091

Table 2: *Series 250 Valves*

(see Catalog K 12 EN Control Valves for Process Engineering · Volume 2)

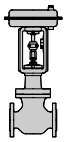
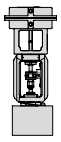
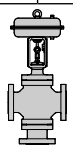
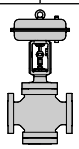
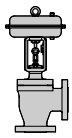
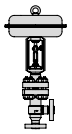
Valve		**Series 250**									
Type		**3251**		**3252**	**3253**		**3254**		**3256**		**3259**
Data Sheet T … EN		8051	8052	8053	8055	8056	8060	8061	8065	8066	8059
Globe valve		•	•	•			•	•			
Three-way mixing or diverting valve					•						
Angle valve				•					•	•	•
Standard version	DIN	•		•	•		•		•		IG
	ANSI		•	•	•			•		•	
Valve size	DN	15 to 500		15 to 25	15 to 500		80 to 500		15 to 300		16 to 90
	NPS		½ to 20	½ to 1		½ to 20		3 to 20		½ to 12	
Pressure rating	PN	16 to 400		40 to 400	10 to 400		16 to 400		16 to 400		325
	Class		150 to 2500	300 to 2500		150 to 2500		150 to 2500		300 to 2500	
Permissible temperatures and differential pressures		See associated data sheet									
Body material	Cast steel, 1.0619	•			•		•		•		
	G17CrMo5-5, 1.7357	•			•		•		•		
	Cast stainless steel, 1.4408	•		1.4404	•		•		•		
	ASTM A216 WCC		•			•		•		•	
	ASTM A217 WC6		•			•		•		•	
	ASTM A351 CF8M		•	A316 L		•		•		•	
	Special material	•	•		Cast iron EN-JL1040	•	•	•			RA 4 (1.4571)
Plug	Metal seal	•	•	•	•	•	•	•	•	•	•
	High-performance metal seal	•	•	•			•	•	•	•	•
	Soft seal	•	•	•			•	•	•	•	
	Balanced	•	•				•	•	•	•	
	Ceramic trim	•	•						•	•	
Options	Insulating section	•	•	•	•	•	•	•	•	•	•
	Metal bellows seal	•	•	•	•	•	•	•	•	•	•
	Heating jacket	•	•	•			•	•	•	•	•
	Low-noise (flow divider)	•	•				•	•	•	•	
Connection	Flanges	•	•	•	•	•	•	•	•	•	•
	Welding ends	•	•	•			•	•	•	•	
	Special connections	•	•	•			•	•	•	•	
											
Data Sheet T … EN		8051	8052	8053	8055	8056	8060	8061	8065	8066	8059

Table 3: *Series 280 Steam-converting Valves*

(see Catalog K 12 EN Control Valves for Process Engineering · Volume 2)

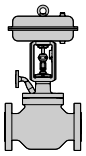
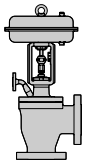
Type		**3281**		**3286**	
Data Sheet T … EN		8251	8252	8256	8257
Globe valve		•			
Angle valve				•	
Standard version	DIN	•		•	
	ANSI		•		•
Valve size	DN	50 to 500		50 to 300	
	NPS		2 to 20		2 to 12
Pressure rating	PN	16 to 160		16 to 160	
	Class		150 to 900		150 to 900
Body material	Cast steel, 1.0619	•		•	
	Cast steel, 1.7357	•		•	
	Cast steel, A216 WCC		•		•
	Cast steel, A217 WC6		•		•
					

Table 4: *Series 290 Valves*

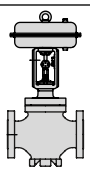
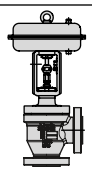
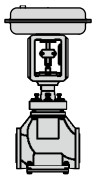
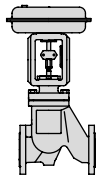
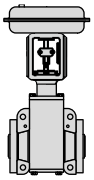
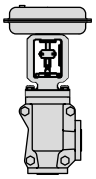
Type		**3291**	**3296**
Data Sheet T … EN		8072-1	8074-1
Globe valve		•	
Angle valve			•
Standard version	ANSI	•	•
Valve size	NPS	½ to 8	½ to 8
Pressure rating	Class	150 to 900	150 to 900
Body material	Cast steel, A352 LCC	•	•
	Cast steel, A216 WCC	•	•
	Cast steel, A217 WC6	•	•
	Cast stainless steel, A351 CF3M	•	•
	Cast stainless steel, A351 CF8M	•	•
Plug	Metal seal	•	•
	High-performance metal seal	•	•
	Soft seal	•	•
	Balanced	•	•
Options	Insulating section	•	•
	Metal bellows seal	•	•
	Heating jacket	•	•
	Low-noise (flow divider)	•	•
Connec-tion	Flanges	•	•
	Welding ends	•	•
	Special connections	•	•
			

Table 5: *PFEIFFER Valves*

Valve			**PFEIFFER valves**			
Type			**Type 1a**	**Type 1b**	**Type 6a**	**Type 8a**
Data sheet			TB 01a	TB 01b	TB 06a	TB 08a
Globe valve			•	•	• (micro-flow valve)	
Three-way mixing or diverting valve			Type 1d*			
Angle valve						•
Standard version		DIN	•	•	•	
		ANSI	•	•		•
Valve size		DN	25 to 150	25 to 100	6 to 15	
		NPS	1 to 6	1 to 4		½ to 2
Pressure rating		PN	10/16	10/16	10/16	
		Class	150	150		150
Permissible temperatures and differential pressures			See associated data sheet			
Body material	EN-JS1049		•	•	•	•
	ASTM A352 LCC		• (DN 150/NPS 6)	•		
	Special material		0.7043/PTFE	0.7043/PFA	0.7043/PTFE	0.7043/PTFE
Plug	Metal seal					
	High-performance metal seal		•			
	Soft seal		•	•	•	•
	Balanced					
	Ceramic trim		•			
Options	Insulating section					
	Metal bellows seal		PTFE	PTFE		
	Heating jacket		•	•		
	Low-noise (flow divider)					
Connection	Flanges		•	•	•	•
	Welding ends					
	Special connections				•	•
						
Data sheet			TB 01a	TB 01b	TB 06a	TB 08a

Valve details

Valve styles

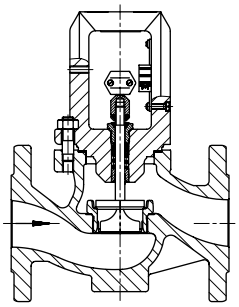
The valve body, valve bonnet and, in some cases, the bottom flange are subject to internal stress caused by the process medium flowing through the valve. Consequently, the valves must be designed to be sufficiently resistant to mechanical and chemical stress.

Under the influence of the operating temperature, the material strength changes. This behavior can be improved by combining certain alloys. For this reason, heat-resisting materials are used at high temperatures (e.g. according to DIN EN 10213) and cold-resisting materials are used for cryogenic service. The materials table (Table 7) and the Information Sheet ▶ T 8000-2 EN provide a summary.

Globe valve

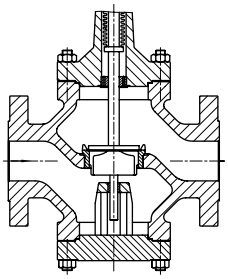
Globe valves allow easy installation in straight pipelines. For nominal pressures up to PN 40 and nominal sizes up to DN 300, three-flanged bodies of the Series 240 are mainly used. The plug stem is guided in the valve bonnet and the V-port plug in the screwed seat.

The ports of the V-port plug are asymmetric in order to suppress any oscillations. Unguided parabolic plugs are used for small K_{VS} coefficients.



Type 3241 Globe Valve

To handle higher loads and when larger seat diameters are used, the Type 3254 Globe Valve (Series 250) is provided with an additional plug stem guide in the bottom flange.

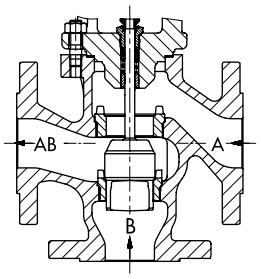


Additional plug stem guide in Type 3254

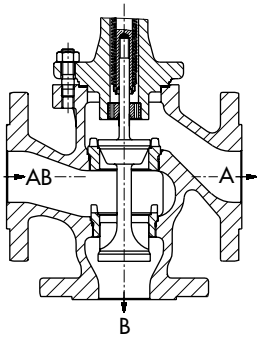
More details on globe valves in Data Sheets ▶ T 8015 EN and ▶ T 8060 EN

Three-way valve

Three-way valves are used for mixing or flow-diverting service. The mode of operation depends on how the two plugs are arranged. The direction of flow is indicated by arrows.



Mixing service with Type 3244 Three-way Valve



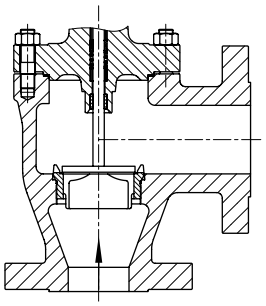
Flow-diverting service with Type 3244 Three-way Valve

More details on three-ways valves in Data Sheet ▶ T 8026 EN

Angle valve

Angle valves are ideally installed when a vertical pipeline and a horizontal pipeline need to be connected. The process medium is only diverted once. Angle valves allow the condensate to be optimally treated and are practically entirely self draining.

In case the process medium flows in the flow-to-close direction, wear in the valve outlet can be reduced by the use of an anti-wear sleeve.



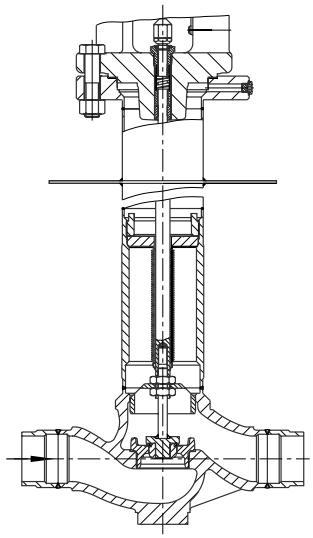
Type 3256 Angle Valve

More details on angle valves in Data Sheet ▶ T 8065 EN

Cryogenic valve

Plants that produce liquefied, cryogenic air separation gases, often use vacuum-insulated pipelines to prevent environmental heat being transferred to the medium. The valves can be integrated into the vacuum jacket using a connecting flange. The valve is designed to widely prevent thermal conduction to the effect that the stem remains free of ice. A bellows seal serves as the primary sealing. The jacketed pipeline is evacuated of air and sealed off after installation of the components. The cryogenic extension bonnet of the valve is often welded to the jacketed pipeline over a flange, meaning considerable work is

involved to remove the valve from the pipeline. However, to make maintenance possible, the internal parts can be accessed through the cryogenic extension bonnet without having to remove the valve from the pipeline.

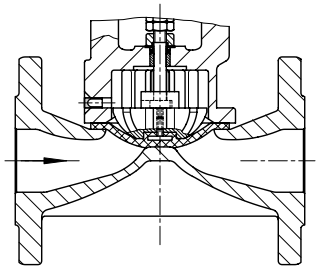


Type 3248 Cryogenic Valve

More details on cryogenic valves in Data Sheet ▶ T 8093 EN

Diaphragm valve

For viscous or corrosive media possibly containing solids, diaphragm valves that are free of dead space and without stuffing boxes are an economical solution. The diaphragm may be made of rubber, nitrile, butyl or PTFE. The valve body may additionally be lined with rubber or PTFE.

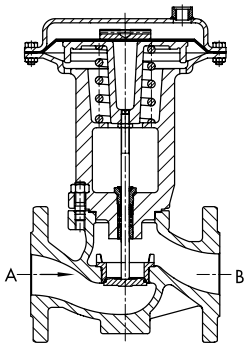


Type 3345 Diaphragm Valve

More details on diaphragm valves in Data Sheet ▶ T 8031 EN

On/off valve

The valve for on/off service is used for tight shutoff of liquids, non-flammable gases and steam. As the valve plug is equipped with both a metal seal and a soft seal, the leakage class VI is achieved.

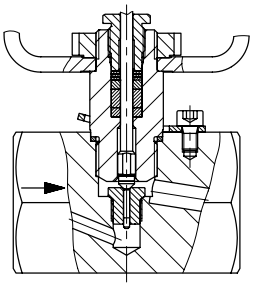


Type 3351 On/off Valve

More details on on/off valves in Data Sheet ▶ T 8039 EN

Micro-flow valve

Micro-flow valves are used for very low flow rates (K_V coefficients <1.6 to 10^{-5} m³/h). The parts exposed to the process medium are made of stainless steel (1.4404). All valve parts are made of semi-finished products. As a result, special materials can be used in a particularly cost-effective manner, and the valve covers a wide range of applications.

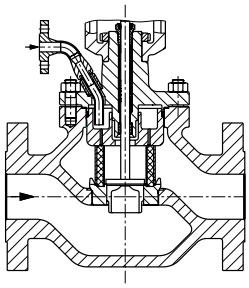


Type 3510 Micro-flow Valve

More details on micro-flow valves in Data Sheet ▶ T 8091 EN

Steam-converting valve

Steam-converting valves are used to reduce the steam pressure and the steam temperature simultaneously. A connecting pipe supplies the cooling water to the flow divider St III. At its inner wall, the cooling water comes into contact with the steam flow. The steam flow and the entrained water are mixed in the narrow wire mesh of the flow divider. As the supplied cooling water does not come into contact with the valve body, neither erosion nor thermal shock occur. The flow divider ensures low-noise and low-vibration operation.



Type 3281 Steam-converting Valve

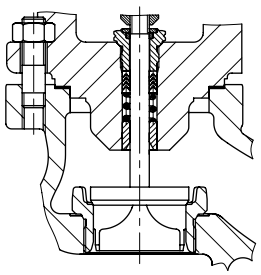
More details on steam-converting valves in Data Sheets ▶ T 8251 EN and ▶ T 8254 EN

Valve bonnet

The valve bonnet seals off the valve at the top and accommodates the packing and the plug stem guide. The valve bonnet and the yoke of Series 240 Valves are incorporated in one piece. The valve bonnet and the yoke of Series 250 and 280 Valves are bolted together. The NAMUR rib standardized in IEC 60534-6 located on the yoke allows easy, standardized attachment of a positioner or other accessories. The valve bonnet is a pressure-bearing part that is exposed to the process medium, therefore its material is subject to the same design requirements as the valve body.

Packing

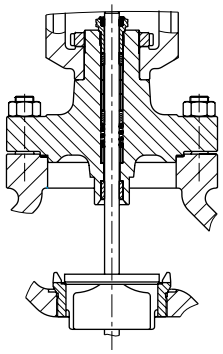
The plug stem is sealed by the packing. The standard packing is used for standard versions, versions with bellows seal or insulating section or when the packing functions as a backup packing.



Valve bonnet of Series 240 Valves

The temperature range of the standard packing is between –10 and 220 °C and can be extended by the use of an insulating section on the valve bonnet.

Other packings can be installed for special applications.



Valve bonnet of Series 250 Valves

The packings meet the fugitive emission requirements according to VDI 2440 and, as a result, fulfill the requirements of TA Luft (German technical instructions on air quality control). Our ISO packings are tested based on DIN EN ISO 15848 and maintain the external leakage rates depending on the temperature, load and pressure even in continuous operation.

SAMSON issues corresponding manufacturer's declarations for the valve series and models.

Packing forms

Standard packing form

Temperature range: –10 to +220 °C

Self-adjusting, spring-loaded V-ring packing made of PTFE-carbon for nominal sizes DN 15 to 150. Self-adjusting PTFE compound and PTFE-silk packing for nominal sizes DN 200 to 500.
Suitable for all applications that require a high level of sealing performance, yet requiring hardly any maintenance.

Form A

Adjustable, cavity-free PTFE-silk/PTFE-carbon packing.
Especially suitable for process media that crystallize out or polymerize.

Form B

Adjustable, cavity-free PTFE-silk/pure PTFE packing. PTFE-silk for nominal sizes DN 200 to 500.
Suitable for process media that crystallize out or polymerize and in cases where the carbon particles would contaminate the process medium.

Form C

Adjustable, cavity-free packing made of woven PTFE-silk.
Application for all chemicals including hot acids and alkaline solutions.

Form D

Spring-loaded V-ring packing made of pure PTFE.
Suitable for pure process media where the carbon particles would contaminate the process medium.

Form W

Adjustable, cavity-free packing made of PTFE-graphite thread and carbon for fresh and service water. The carbon bushings serve as wipers.
Especially suitable for hard water and any process media that may cause deposits to form on the plug stem.

NACE standard

Spring-loaded V-ring packing made of PTFE-carbon according to NACE standard.
Suitable for sour gas or sour water.

ADSEAL

Spring-loaded V-ring packing made of PTFE-carbon with ADSEAL emergency adjusting function.

ZELETEC 4.000

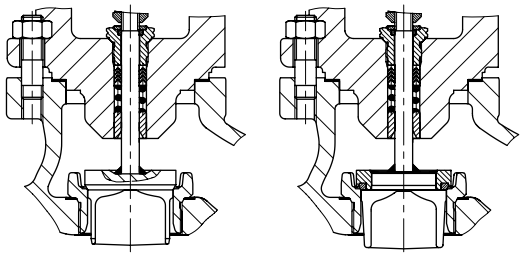
Self-adjusting, spring-loaded packing made of pure PTFE with intermediate FFKM V-rings for nominal sizes DN 200 and larger.
The ZELETEC (**Ze**ro **Le**akage **Tec**hnology) packing is maintenance-free and is especially designed for valves that are difficult to access and must have a high level of sealing performance.

Packing versions for extended operating conditions available on request.

Seat and plug

The design of the seat and the plug determines the K_{VS} (C_V) coefficient, the characteristic and the seat leakage of a valve.

The drawings show seat-guided V-port plugs with asymmetric ports with metal seal and soft seal.



Metal seal Soft seal

The seat, plug and plug stem are made of stainless steel. In some cases, the trims are subject to high stress due to high differential pressures, cavitation, flashing, or in cases where the process media contains solids. In order to increase the service life, seats and metal-seated plugs can have a Stellite facing, and plugs up to DN 100 can be made of solid Stellite.

The seats are screwed into place, allowing them to be easily exchanged. They may also be made of other materials.

Perforated plug

An optimized trim with perforated plug is available for Series 240 and 250 Valves. Perforated plugs are mainly used in severe service, e.g. in steam applications, two-phase medium flows, liquid media which vaporize on the outlet side (flashing valves) or emergency relief valves (blow-off valves) involving gas relief. In these applications, flow velocities lower than 0.3 Mach cannot usually be kept. The medium flows through the perforated plug, splitting up the jet stream into numerous smaller jets to ensure low-noise energy transfer to the surrounding medium.

More details on valves with perforated plugs in Data Sheet
▶ T 8086 EN

Clamped-in seat

Type 3291 Valves are fitted with a clamped-in seat, which has two major benefits: in comparison to screwed seats, it cannot come undone. Furthermore, the clamped-in seat can be quickly removed and reinstalled using standard tools. This facilitates maintenance to meet the requirements of the oil and gas industry. Most plants in this industry cannot be shut down for maintenance, meaning maintenance-friendly components are required. Furthermore, these seats are suitable for use in applications involving steam and condensate.

More details on Type 3291 Valve in Data Sheet
▶ T 8072-1 EN

Seat leakage

The seat leakage is determined according to IEC 60534 which specifies the maximum amount of the test process medium (gas or water) that may flow through the closed control valve under test conditions.

For special applications (e.g. using Type 3241-Gas or Type 3241-Oil) or with shut-off valves (Type 3351), a high leakage class can be achieved by using a high-performance metal seal or a soft seal for seat and plug.

Table 6: *Plug seal and seat leakage rate*

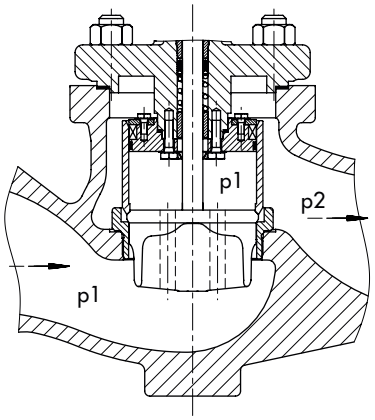
Seat/plug seal	Leakage class IEC 60534-4 ANSI/FCI 70-2	Seat leakage % of K_{VS} (C_V)
Metal seal	IV	≤0.01
High-performance metal seal	V	See IEC 60534-4, table 3
Soft seal	VI	$0.3 \cdot \Delta p \cdot f_L$ [1]
Pressure balancing with PTFE ring	V	See IEC 60534-4, table 3
Pressure balancing with graphite ring	IV	≤0.01

[1] Leakage factor IEC 60534-4, section 5.5

Pressure balancing

If the actuator thrust is not sufficient to handle the differential pressure, pressure-balanced plugs are a good solution. The plug is designed to function as a piston. The upstream pressure p_1 is transferred to the back of the plug through a hole in the bottom of the plug. The forces acting on the plug are compensated for, with exception of the area around the plug stem.

Pressure-balanced plugs are additionally sealed with a PTFE ring or a graphite ring. The pressure-balanced components are subject to wear. As a result, the seat leakage rate (see Table 6) and the amount of maintenance needed for these valves increase. Pressure-balanced plugs should not be used, if at all possible, for high-temperature process media or for media that contain solids or crystallize out. In these cases, we recommend to use a more powerful actuator.



Plug with pressure balancing

Carbide or ceramic trims

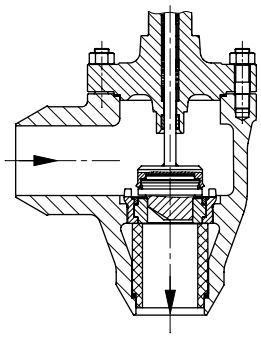
Control valves with extremely resistant carbide or ceramic trims are used when the valve body and trim are subject to considerable erosion and abrasion.

The following valves can be fitted with carbide or ceramic trims:

- Type 3251 Globe Valve
- Type 3256 Angle Valve

The Type 3256 Angle Valve can be fitted with a ceramic wear-resistant pipe. When the process medium flows in the flow-to-close (FTC) direction, this version is suitable for extreme erosive and abrasive conditions caused by process medium containing solids.

Details on ceramic materials and their properties are available on request.



Type 3256 Angle Valve with ceramic trim and ceramic anti-wear pipe

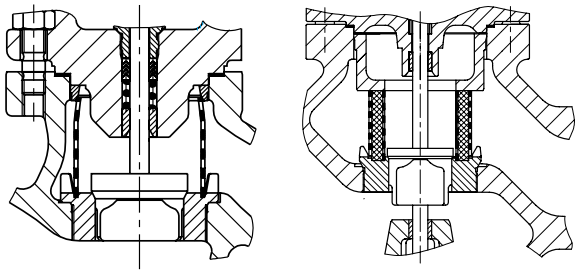
More details on ceramic trims in Data Sheet ▶ T 8071 EN

Low-noise operation

Flow dividers

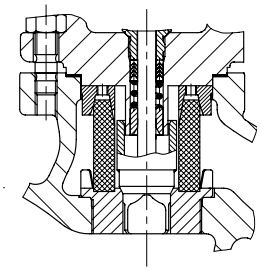
The flow dividers serve to reduce the noise emission of gases and vapors. The process medium reaches its maximum velocity after passing the restriction between seat and plug. Before it starts to create a noise-intensive, turbulent mixing zone, the process medium hits the inner wall of the flow divider. The flow is divided and a low-noise impulse exchange with the surrounding medium takes place.

The flow divider St I has a single-ply perforated sheet steel and flow divider St II a two-ply perforated sheet steel.



Flow divider St I Flow divider St II

The flow divider St III consists of a corrosion-resistant wire mesh, which can be additionally fitted with an internal and external perforated sheet steel for Series 250 Valves.



Flow divider St III

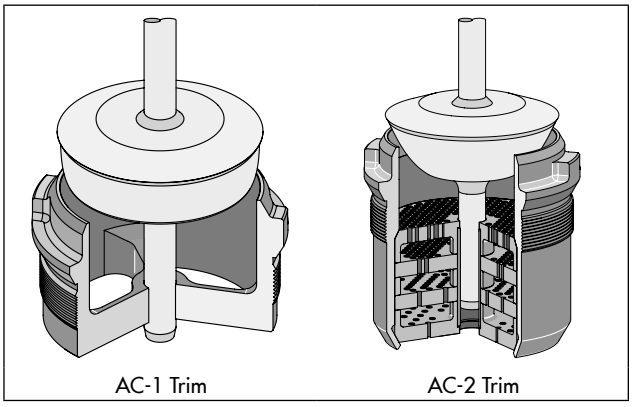
The valve-specific correction values for gases and vapors are required for noise calculation according to VDMA 24422, Edition 1989 and IEC 60534 when flow dividers are used. Refer to the diagrams in section on vValve sizing for details.

The K_{VS} (C_V) coefficient of the valve trim is reduced by the flow divider. The K_{VS} (C_V) coefficients for the flow dividers St I, St II and St III are listed in the associated data sheet.

More details on flow dividers in Data Sheet ▶ T 8081 EN

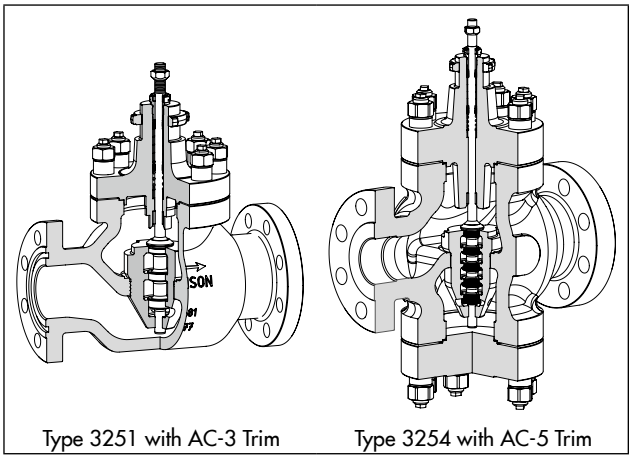
AC trims

AC-1 and AC-2 Trims are optimized trims for low-noise pressure letdown of liquids at differential pressures up to 40 bar. The seat is raised and the parabolic plug is additionally guided in the seat. The AC-2 Trim additionally has up to four attenuation plates.



AC-1 Trim AC-2 Trim

The three-staged AC-3 Trim is used for differential pressures up to 100 bar. Optionally, Stellite facings or hardened trims are available. For differential pressures over 100 bar, the five-staged AC-5 Trim is available.

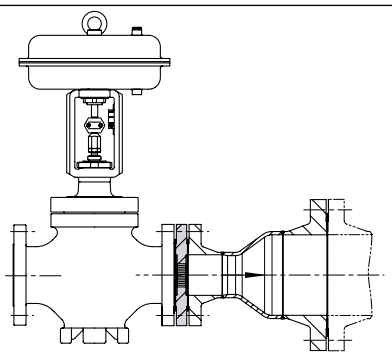


Type 3251 with AC-3 Trim Type 3254 with AC-5 Trim

More details on AC trims in Data Sheets ▶ T 8082 EN and ▶ T 8083 EN

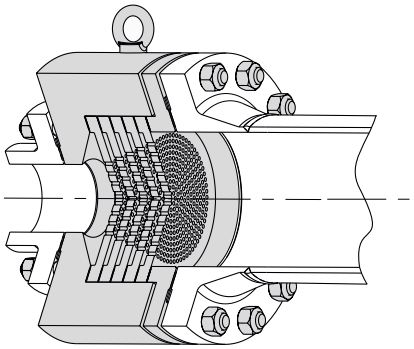
Silencer

The silencer acts as a fixed restrictor package that can be installed downstream of the valve with one to five attenuation plates for applications with gases or vapors. The silencer increases the backpressure downstream of the valve which leads to a reduction in the valve outlet velocity and sound pressure level. Additionally, the nominal outlet size can be extended. A pipe expander may be required depending on the version.

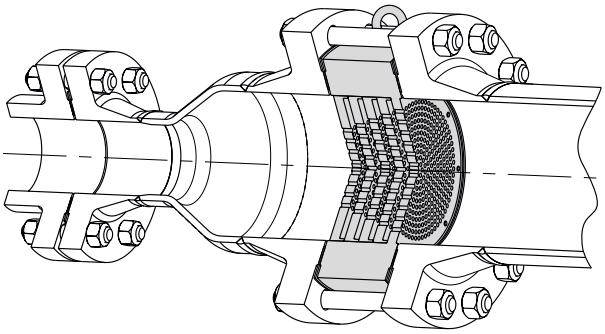


Type 3381-1: Single attenuation plate on the valve upstream of a possible pipe expander

In Type 3381-3-X, two to five attenuation plates can be installed one after the other in a housing integrated into the pipe expander.



Type 3381-3-5: Five attenuation plates in a housing



Type 3381-4-5: Five attenuation plates clamped between the pipe expander and pipeline (wafer-type version)

More details on silencers in Data Sheet ▶ T 8084 EN

Additional components

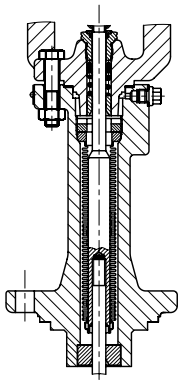
Metal bellows seal

In case, stricter emissions control requirements must be met, e.g. TA Luft or in vacuum applications, a metal bellows is used to seal the plug stem. The plug stem is additionally sealed with a packing at the top flange. This packing serves as a backup packing.

The metal bellows can be monitored for leakage or a sealing medium can be applied by means of a test connection.

The bellows seal can be used for valves of Series 240 and 290 from −196 to +450 °C, and Series 250 and 280 from −196 to +550 °C.

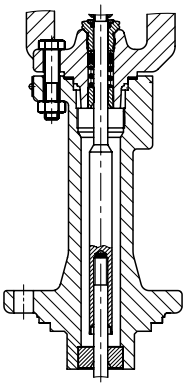
Higher temperatures for Series 250 and 280 on request



Metal bellows seal

Insulating section

The application range of a standard packing can be extended to an operating temperature of less than −10 °C or over +220 °C by using an insulating section.



Insulating section

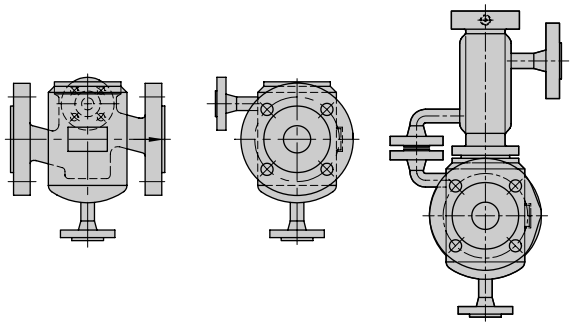
The temperature ranges of the various valves series are:

Series 240:	−196 to +450 °C with long insulating section −50 to +450 °C with short insulating section
Series 250:	−196 to +550 °C
Series 280:	Max. 500 °C
Series 290:	−196 to +450 °C

The specified temperature ranges may be restricted by the materials used as specified in the pressure-temperature diagram (Information Sheet ▶ T 8000-2 EN).

Heating jacket

Some process media only flow easily above a certain temperature. Below this temperature they start to solidify or crystallize out. The valve bodies are fitted with a heating jacket to ensure that the process medium remains at a certain temperature and can flow freely. The valve bonnet may also be equipped with a heating jacket when the plug stem is sealed by a bellows seal.



Type 3241 with heating jacket and with bellows heating

A heat transfer medium flowing between valve body and heating jacket ensures that the process medium is kept at a certain temperature. If steam is used as heating transfer medium, proper condensate discharge must be ensured.

Versions with heating of the connecting flanges or with heating of larger connecting flanges for the body are available on request.

Face-to-face dimensions

SAMSON valves with flanges have the same face-to-face dimensions as valves with welding ends.

Face-to-face dimensions according to DIN EN

PN	Types 3241, 3251, 3254, 3281 and 3284 Globe Valves
10 to 40	DIN EN 558, Series 1
63 to 100	DIN EN 558, Series 2
160	DIN EN 558, Series 2
250	DIN EN 558, Series 2
320	DIN EN 558, Series 2
400	Based on ASME B16.10 Class 2500, column 4
	Types 3256 and 3286 Angle Valves
10 to 40	DIN EN 558, Series 8
63 to 100	DIN EN 558, Series 9
160	DIN EN 558, Series 9
250	DIN EN 558, Series 93
320	DIN EN 558, Series 93
400	Based on ASME B16.10 Class 2500, column 6

Face-to-face dimensions according to ANSI

Class	Types 3241, 3251, 3254, 3281 and 3291 Globe Valves [1]
125/150	ANSI/ISA-75.08.01
250/300	ANSI/ISA-75.08.01
600	ANSI/ISA-75.08.01
900	ASME B16.10 Class 900, column 5
1500	ASME B16.10 Class 1500, column 5
2500	ASME B16.10 Class 2500, column 4
	Types 3256 and 3296 Angle Valves [1]
125/150	0.5 · ANSI/ISA-75.08.01
250/300	0.5 · ANSI/ISA-75.08.01
600	0.5 · ANSI/ISA-75.08.01
900	ASME B16.10 Class 900, column 7
1500	ASME B16.10 Class 1500, column 7
2500	ASME B16.10 Class 2500, column 6

1) Depending on the valve series, the pressure ratings are restricted as follows:
Series 240: only up to Class 300
Series 280 and 290: only up to Class 900

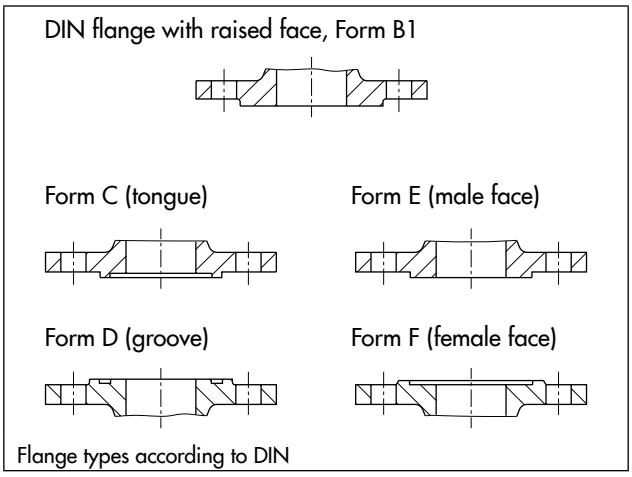
Versions with welding-neck ends are not standardized. Consult SAMSON first concerning their face-to-face dimensions.

Types of pipe connections

Flanged connections are most frequently used in industrial plants as they allow easy mounting and removal of valves and their milled facings provide excellent sealing reliability and quality.

A summary of flanges according to DIN EN standards, their connection dimensions and types of flange faces is provided in DIN EN 1092-1 for steel flanges and DIN EN 1092-2 for cast iron flanges.

The standard version of SAMSON valves has flanges with raised faces (Form B1). Other flange types are available on request.



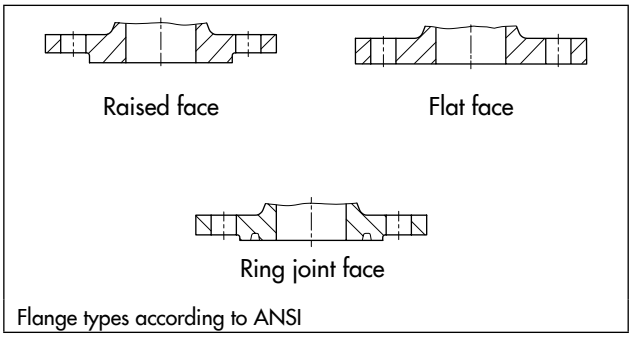
Flange types according to DIN

The US standard for cast iron flanges is ASME B16.1, ASME B16.42 for spheroidal graphite iron flanges and ASME B16.5 for steel flanges.

The standard version of cast iron valves with a pressure rating of Class 125 has flanges with flat faces.

Valves with a pressure rating of Class 300 have flanges with raised faces (0.06″ height), and valves with higher pressure ratings have flanges with raised faces (0.25″ height).

Other versions are available. Details available on request.



Flange types according to ANSI

For critical process media and/or high pressure ratings, the valve bodies can be supplied with welding ends or welding-neck ends. For control valves according to DIN standards, the welding ends conform to DIN EN 12627. For control valves according to US standards, the welding ends are specified in ASME B16.25.

For installation methods according to US standards, valves of the Series 240 are available with NPT female thread in sizes ½″ to 2″.

Valve-specific parameters

K_{VS} or C_V coefficient

The K_V (C_V) coefficient is calculated according to IEC 60534 from the specified operating data.

The K_{VS} (C_V) coefficient is specified in the data sheets to identify the valves. It corresponds to the K_V coefficient at the rated travel H_{100}. In order to increase control accuracy and with regard to manufacturing tolerances, the selected K_{VS} (C_V) coefficient must be higher than the K_V coefficient.

Rangeability

The rangeability is the quotient of K_{VS}/K_{VR}. K_{VR} being the smallest K_V where the characteristic still lies within the permissible gradient tolerance of the characteristic (IEC 60534 Part 2-4). Refer to Information Sheet ▶ T 8000-3 EN.

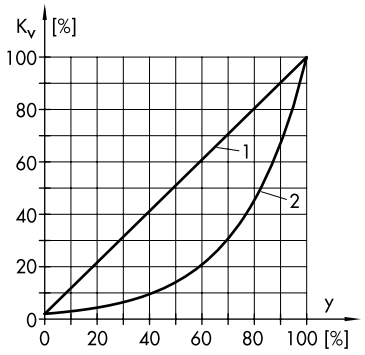
Inherent characteristic

The characteristic shows the relationship between the K_V flow coefficient and the travel (H).

Valves are either designed with an equal percentage or with a linear characteristic.

The equal percentage characteristic can be identified by equal increments of travel that yield equal percentage increments of the K_V flow coefficient.

Whereas, in a linear characteristic, equal increments of travel yield equal increments of the K_V flow coefficient.



Valve characteristic: 1 - linear; 2 - equal percentage

Actuators

Actuators convert the control signal from, for example, a positioner into a travel motion carried out by the control valve (plug stem with valve plug).

Pneumatic, electric and electrohydraulic actuators as well as hand-operated actuators are available (see Information Sheet ▶ T 8300 EN).

Pneumatic actuators

Pneumatic actuators are used for pneumatic or electropneumatic instrumentation. The pneumatic actuators are diaphragm actuators with a rolling diaphragm and internally fitted springs. The benefits of pneumatic actuators include their low overall height, powerful thrust and stroking speed.

Different signal pressure ranges are available. Pneumatic actuators are suitable for use in hazardous areas and feature fail-safe action (upon air supply failure, the control valve is either closed or opened).

The Type 3277 Pneumatic Actuators allow direct attachment of positioners or limit switches. The travel linkage is protected as it is located within the yoke below the diaphragm cases.

Pneumatic actuators can additionally be equipped with a handwheel (▶ T 8310-1 EN and ▶ T 8310-2 EN).

Electric actuators

If compressed air is not available, electric actuators with powerful thrust and large travels can be used. These actuators are self-locking.

Electric actuators are connected to three-step controllers, electric positioners issuing analog signals or over a reversing contactor unit.

Electrohydraulic actuators

Electrohydraulic actuators are connected to an analog signal over three-step controllers or electric positioners. Versions with fail-safe action are available (▶ T 8340 EN).

Hand-operated actuators

These actuators are mounted onto Series 240 and 250 Valves, which are used as hand-operated control valves with 15 or 30 mm rated travels (▶ T 8312 EN). Hand-operated actuators for larger travels are available on request (Type 3273-5/-6).

Valve accessories

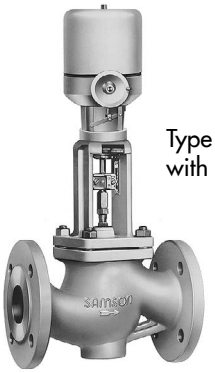
Selection and use of valve accessories are described in more detail in Information Sheet ▶ T 8350 EN.

Type 3277 Pneumatic Actuator

Type 3271 Pneumatic Actuator with additional handwheel

Type 3275 Pneumatic Piston Actuator

Type 3374 Electric Actuator



Type SAM Electric Actuator with manual override

Type 3274 Electrohydraulic Actuator

Type 3273 Hand-operated Actuator

Valve sizing

Calculation of the K_V coefficient

The K_V coefficient is calculated according to IEC 60534. The data sheets contain the necessary device-specific terms.

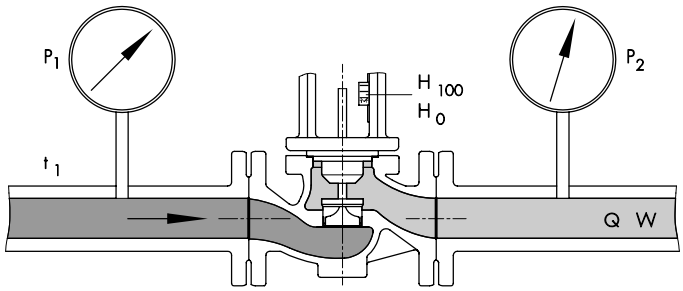
A preliminary, simplified calculation may be made with the help of the working equations listed below. They do not take into account the influence of the connecting fittings or choked flow at critical flow velocities.

Valve selection

After calculating the K_V (C_V) coefficient, the corresponding K_{VS} (C_V) coefficient of the valve model is to be selected from the data sheet.

In case, real operating data are used in the calculation, the following generally applies: (also for C_V):
$K_{Vmax} \approx 0.7$ to $0.8 \cdot K_{VS}$

Further details on calculation of the K_V coefficient are listed in the Application Notes ▶ AB 04 EN.



p_1	Upstream pressure
p_2	Downstream pressure
H	Travel
Q	Flow rate in m³/h
W	Flow rate in kg/h
ρ	Density in kg/m³ (generally also for liquids)
ρ_1	Upstream density in kg/m³ (for gases and vapors)
t_1	Upstream temperature in °C

Medium	Liquids		Gases		Steam
Pressure drops	m³/h	kg/h	m³/h	kg/h	kg/h
$p_2 > \frac{p_1}{2}$	$K_V = Q \cdot \sqrt{\frac{\rho}{1000 \cdot \Delta p}}$	$K_V = \frac{W}{\sqrt{1000 \cdot \rho \cdot \Delta p}}$	$K_V = \frac{Q_G}{519} \cdot \sqrt{\frac{\rho_G \cdot T_1}{\Delta p \cdot p_2}}$	$K_V = \frac{W}{519} \cdot \sqrt{\frac{T_1}{\rho_G \cdot \Delta p \cdot p_2}}$	$K_V = \frac{W}{31.62} \cdot \sqrt{\frac{v_2}{\Delta p}}$
$\Delta p < \frac{p_1}{2}$					
$p_2 < \frac{p_1}{2}$			$K_V = \frac{Q_G}{259.5 \cdot p_1} \cdot \sqrt{\rho_G \cdot T_1}$	$K_V = \frac{W}{259.5 \cdot p_1} \cdot \sqrt{\frac{T_1}{\rho_G}}$	$K_V = \frac{W}{31.62} \cdot \sqrt{\frac{2 \cdot v^*}{p_1}}$
$\Delta p > \frac{p_1}{2}$					

Including:

p_1	[bar]	Absolute pressure p_{abs}		[kg/m³]	Density of liquids
p_2	[bar]	Absolute pressure p_{abs}		[kg/m³]	Density of gases at 0 °C and 1013 mbar
Δp	[bar]	Absolute pressure p_{abs}	v_1	[m³/kg]	Specific volume (v′ from steam table) at t_1 and p_1
T_1	[K]	273 + t_1	v_2	[m³/kg]	Specific volume (v′ from steam table) at t_1 and p_2
Q_G	[m³/h]	Flow rate of gases based on 0 °C and 1013 mbar	v*	[m³/kg]	Specific volume (v′ from steam table) at t_1 and $\frac{p_1}{2}$

Calculation of noise emission

Gases and vapors

The noise emitted by gases in single-stage and multi-stage valves is determined according to IEC 60534-8-3. This calculation method, however, does not apply to valves containing noise-reducing elements, such as flow dividers St I to St III. In this case, calculation is performed according to VDMA 24422, Edition 1989.

The calculation is based upon the jet power reached on expansion. The noise emission is determined by means of an acoustical conversion coefficient η_G.

Diagram 1 illustrates the difference between the conversion coefficients η_G depending on the differential pressure ratio. Assuming a differential pressure ratio of x = 0.5, the difference in sound pressure level is –20 dB between a valve without flow divider and a valve with a flow divider St III. The sound pressure level can be reduced considerably by the use of flow dividers.

Liquids

The noise emissions produced by valves used in throttling service of liquids are calculated according to IEC 60534, part 8-4. This calculation is consistent with the calculation according to VDMA 24422, Edition 1989. It is based on the jet power reached in the valve and also on the valve-specific acoustical conversion coefficient η_F empirically determined according to VDMA 24423 for turbulent flows as well as the valve-specific pressure ratio x_{Fz} for incipient cavitation.

The sound power level and the sound pressure level difference at a distance of 1 m for the valves with different x_{Fz} values can be seen in the diagram 2.

For a pressure ratio of $x_F = 0.5$ and a valve with $x_{Fz} = 0.6$, the sound pressure level is 20 dB less than that of a valve with $x_{Fz} = 0.3$.

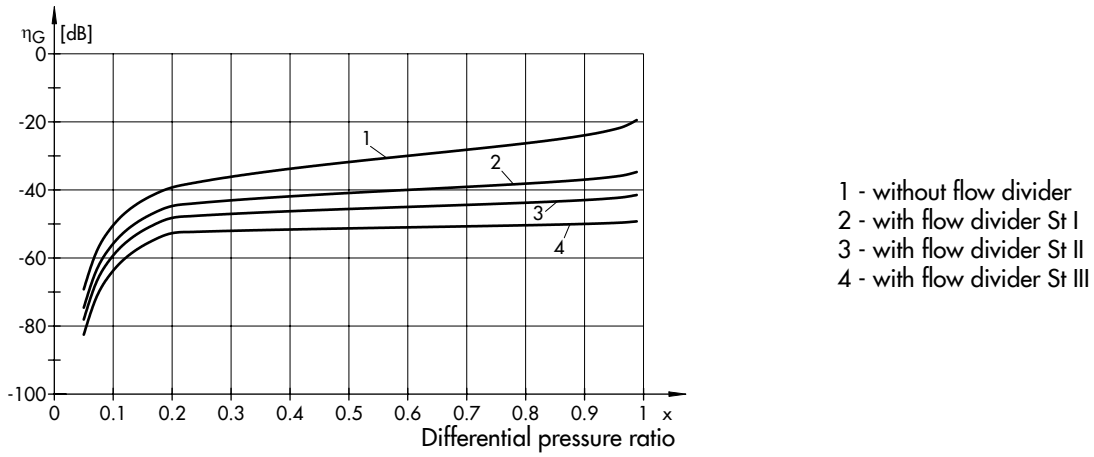


Diagram 1: Noise reduction with gases depending on the differential pressure using flow dividers

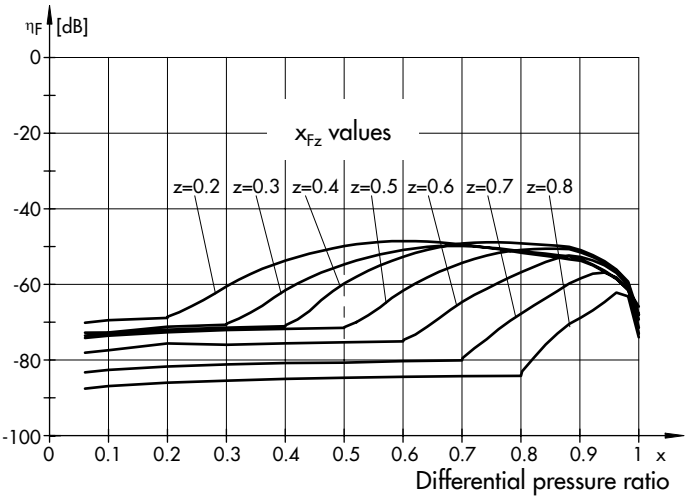


Diagram 2: Noise reduction with liquids depending on the differential pressure using flow dividers

Materials according to DIN and ANSI/ASME

The body materials mainly used and their temperature ranges are listed in the table below.

The associated pressure-temperature diagrams in Part 2 of this Information Sheet (▶ T 8000-2 EN) include the materials' limits of application.

Table 7: *Body materials and temperature ranges*

Temperature in °C		−200	−150	−100	−50	0	+50	+100	+150	+200	+250	+300	+350	+400	+450	+500	+550	+600
Body materials																		
Cast iron	EN-JL1040																	
	A 126 B																	
Spheroidal graphite iron	EN-JS1049																	
Cast steel	1.0619																	
	1.5638																	
	1.6220																	
	1.7357																	
	1.7379																	
	A216 WCC																	
	A217 WC6																	
	A217 WC9																	
	A352 LCC																	
	A352 LC3																	
Cast stainless steel	1.4408																	
	1.4581																	
	1.4308																	
	A351 CF8M																	
	A351 CF8																	
Forged steel	1.0460																	
Forged stainless steel	1.4404																	
	1.4571																	
	A316 L																	
Seat/plug seal																		
Metal Leakage class IV																		
Metal Leakage class V																		
Soft Leakage class VI																		
Pressure balancing																		
PTFE																		
Graphite																		
Cryogenic																		
Bonnet																		
Standard																		
Short insulating section																		
Long insulating section																		
Short bellows seal																		
Long bellows seal																		

Selection and ordering

Selection and sizing of the control valve

1. Calculate the required K_V (C_V) coefficient according to IEC 60534. You may use, for example, the SAMSON valve sizing software. This sizing usually is carried out by SAMSON. If real operating data are used for the calculation, the following generally applies:
   K_{Vmax} = 0.7 to 0.8 · K_{VS}
2. Select the K_{VS} coefficient and the valve size according to the table in the corresponding data sheet.
3. Select the appropriate valve characteristic on the basis of the behavior of the controlled system.
4. Determine the permissible differential pressure Δp and select a suitable actuator using the differential pressure tables included in the associated data sheet.
5. Select the materials to be used with regard to corrosion, erosion, pressure and temperature using the materials tables and the associated pressure-temperature diagram.
6. Select the additional equipment, such as positioner and/or limit switch.

Ordering data

Order specifications:

Valve model	... *)
Valve size	... *)
Pressure rating	... *)
Body material	... *)
Type of end connections	Flanges, welding ends, welding-neck ends
Plug *)	Standard, balanced, metal seal, soft seal, high-performance metal seal Hard facing, if required
Characteristic	Equal percentage or linear
Pneumatic actuator	Version according to ▶ T 8310-1 EN or ▶ T 8310-2 EN
Fail-safe position	Fail-open or fail-close
Transit time	Specifications only for special stroking speed requirements
Process medium	Density in kg/m³ in standard or operating state
Pressure	p_1 in bar (absolute pressure p_{abs}) p_2 in bar (absolute pressure p_{abs}) with minimum, normal and maximum flow rate
Valve accessories	Positioner and/or limit switch, position transmitter, solenoid valve, lock-up valve, volume booster, supply pressure regulator

*) When no specifications are made, we provide possible specifications

Specification sheet for control valves

				Specification sheet for control valves according to IEC 60534-7 X · Details that must be specified to select and size the valve				
	1		Operating data	Installation site				
	2			Control task				
	7	X		Pipeline	DN	PN	NPS	Class
	8			Pipe material				
	12	X		Process medium				
	13	X		State at the valve inlet	Liquid	Vapor	Gas	
	15				Min.	Usual	Max.	Unit
	16	X		Flow rate				
	17	X		Input pressure p_1				
	18	X		Output pressure p_2				
	19	X		Temperature T_1				
	20	X		Input density ρ_1 or M				
	21	X		Vapor pressure P_V				
	22	X		Critical pressure P_C				
	23	X		Kinematic viscosity v				
	31			Calculation of max. flow coefficient K_V (C_V)				
	32			Calculation of min. flow coefficient K_V (C_V)				
	33			Selected flow coefficient K_{VS} or C_V				
	34			Calculated sound pressure level	dB(A)			
	35		Valve body	Type ... Valve				
	36			Style				
	38			Pressure rating	PN	Class		
	39			Valve size	DN	NPS		
	40			Type of end connections	Flanges	Welding ends	Welding-neck ends	DIN/ ANSI
	43			Type of bonnet	Normal	Insulating section	Bellows seal	Heating jacket
	45			Body/bonnet material				
	47			Characteristic	Linear	Equal percentage		
	48			Plug/stem material				
	49			Bushing/seat material				
	52			Facing	None	Stellite® facing	Completely of Stellite®	Hardened
	54			Leakage class	% K_{VS}	Class		
	55			Packing material	Standard	Form		
	57		Actuator	Actuator type	Pneumatic			
	60			Actuator area	cm^2			
	62			Supply pressure	Min.	Max.		
	63			Bench range				
	64			Fail-safe action	Fail-close	Fail-open	Fail in place	
	66			Other actuator types	Electric	Electrohydraulic	Hand-operated	
	67			Fail-safe position for three-way valves				
	68			Additional manual override	No	Yes		
	70		Positioners	Positioner type				
	71			Input signal	Pneumatic	Electric		
	72			Control valve OPEN at	bar	mA		
	73			Control valve CLOSED at	bar	mA		
	76			Air connection, max.	bar			
	78			Explosion protection	Ex i	Ex d		
	80		Limit switch	Limit switch type				
	81			Limit switch	Electric	Inductive	Pneumatic	
	82			Switching position	Closed	% travel	Open	
	83			Switching function	Closing	Opening		
	84			Explosion protection	Ex i	Ex d		

Specifications subject to change without notice

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