

SIEMENS



Acvatix – the comprehensive range for greater energy efficiency

Reliable and economical valves and actuators for any type of application

iF product
design award
2012:
SAX and SAL



Answers for infrastructure.



Acvatix – the crucial components for every economical and efficient HVAC plant

With Acvatix™, you decide for a comprehensive range of valves and actuators that stand for maximum control accuracy, energy efficiency and easy handling. Whether you select valves with electrohydraulic actuators, with magnetic actuators or combi valves, Acvatix significantly reduces energy consumption and thus operating costs.

The extensive Acvatix product range offers you valves and actuators with a long service life that meet any control or hydraulic requirements when it comes to the generation, distribution and usage of heating or cooling energy. For you, this means that you are ideally prepared for any type of application with very small to very high volumetric flows or differential pressures.

Sophisticated valves and actuators – long-lasting, convenient and accurate

A safe investment thanks to high quality and backward compatibility

With Acvatix, you decide for a rugged design, high level of reliability and low maintenance. Thanks to the unique backward compatibility of more than 30 years, the range also offers you long-term investment protection. This means that you can exchange any installed valve actuator combination with a replacement product, thus saving both time and money. At the same time, you benefit from state-of-the-art technology – and increased energy efficiency.

Intelligent comfort for optimal plant operation

Acvatix enables quick commissioning and efficient plant control. For example, you can quickly and easily install and commission the actuators of the new generation thanks to their user-friendly handling. Clearly visible operating status and position indication speed up commissioning, testing and plant maintenance and support fault tracing.

Full support in every respect

Whether for planning, commissioning or service, Siemens offers you a variety of tools. For example, the Combi Valve Sizer app and the HVAC Integrated Tool (HIT) support you in selecting the appropriate products. HIT also provides all available documents like data sheets and mounting instructions for the respective product. Moreover, valve slide rules and product exchange tools make your daily work easier. Practice-oriented trainings bring you up to date. And the global Siemens' sales and service network supports you in every project phase – competently and reliably.

Best quality based on many years of experience

Acvatix valves and actuators come from Siemens' own development and production facilities. They are further developed based on the many years of field experience and tested intensively in Siemens' own HVAC laboratory. The result: For decades, Acvatix products have been used successfully millions of times worldwide. Therefore, you will receive the best quality and greatest reliability.

Highlights

- Comprehensive range with easy product selection, installation and commissioning
- Unique variety for the entire hydraulic circuit and all types of application (heating, cooling, chilling, refrigeration, drinking water and steam)
- Investment protection through rugged design, high level of reliability and backward compatibility
- Intelligent comfort thanks to easy handling and visible operating status and position indication
- Full support during planning, engineering and service
- High, tested quality based on many years of experience plus own development and production

Using the Combi Valve Sizer app for iPhones*, it is very easy to select the right Acvatix combi valve and matching actuator. This way, the design of energy-efficient HVAC plants becomes very straightforward.



*iPhone and iPad are trademarks of Apple Inc.

Recommendation: water treatment according to VDI 2035

1) Sealed bypass

2) Open circuits

³⁾ E.g. ethylene and propylene glycols

⁴⁾ As zone valve for floor heating systems

5) Not for drinking water circuit (open circuit)

IT = internally threaded connection, ET = externally threaded connection, F = flanged connection, S = soldered connection, W = welded connection

Permissible medium temperature [°C]										Generation		Distribution		Consumption/Use															
-40	-25	-20	-10	0	1	..	90	100	110	120	130	150	180	220	350	Boiler plants	District heating	Chiller plants	Cooling towers ²⁾	Domestic hot water (DHW) ⁵⁾	Heating groups	Air handling units	Floor heating	Radiators	Zone control	Fan coil units	Chilled ceilings	Variable air volume (VAV)	
																									M3P.. FY				
																									M3P.. FYP				
																									MXF461..				
																									MXF461..P				
																									MXG461..				
																									MXG461B..				
																									MXG461..P				
																									MXG461S..				
																									MXG462S..				
																									MVF461H..				
																									VAI60..				
																									VAI61..				
																									VBF21..				
																									VBG31..				
																									VBI31..				
																									VBI60..				
																									VBI61..				
																									VCI31..				
																									VKF41..				
																									VKF46..				
																									VPF43..				
																									VPF53..				
																									VVF21..				
																									VVF31..				
																									VVF40..				
																									VVF43..				
																									VVF53..				
																									VVF61..				
																									VVF61..2				
																									VVG41..				
																									VVG44..				
																									VVG55..				
																									VXF21..				
																									VXF31..				
																									VXF40..				
																									VXF43..				
																									VXF53..				
																									VXF61..				
																									VXF61..2				
																									VXG41..				
																									VXG41..01 ¹⁾				
																									VXG44..				
																									VD1..CLC				
																									VDN../VEN../VUN..				
																									VMP45..				
																									VMP47..				
																									VPD../VPE..				
																									VPI45.. ⁴⁾				
																									VPI46.. ⁴⁾				
																									VPP46.. ⁴⁾				
																									VVI46..				
																									VVP45..				
																									VVP47..				
																									VXI46..				
																									VXP45..				
																									VXP47..				
																									M2FP03GX				
																									M3FB..LX..				
																									M3FK..LX..				
																									MVL661..				
																									MVS661..N				

Refrigeration systems

Central HVAC plants

TRV line							
Typical applications	Actuators	Data sheet					
– Radiators	RTN..	N2111					
					RTN51/RTN51G	RTN71	RTN81
Typical applications	Actuators	Data sheet			4.5 mm	2.5 mm	4.5 mm
– Radiators	STA23../73../63.. SSA..	N4884 N4893			100 N	100 N	90 N
	Operating voltage	Positioning signal	Positioning time [s]				
	AC 230 V	2-position	210			STA23	–
		3-position	150			–	SSA31
	AC 24 V	3-position	150			–	SSA81
		0...10 V	30			STA63	–
	AC/DC 24 V	2-position/PDM	270			STA73	–
		2-position/PDM	180			–	STA73HD ¹⁾
		0...10 V	34			–	SSA61
	Normally open/normally closed (for radiator valves)				NC	–	–
PN 10	1...120 °C	DIN	NF	DN	Rp/R [inch]	k _v [m ³ /h]	Δp _{max} [kPa]
Data sheet		N2105	N2106				
	VDN110	VDN210	10	Rp/R 3/8	0.09...0.63		60
	VDN115	VDN215	15	Rp/R 1/2	0.10...0.89		60
	VDN120	VDN220	20	Rp/R 3/4	0.31...1.41		60
	VEN110	VEN210	10	Rp/R 3/8	0.09...0.63		60
	VEN115	VEN215	15	Rp/R 1/2	0.10...0.89		60
	VEN120	VEN220	20	Rp/R 3/4	0.31...1.41		60
	–	VUN210	10	Rp/R 3/8	0.14...0.60		60
	–	VUN215	15	Rp/R 1/2	0.13...0.77		60
PN 10	1...110 °C	DIN	Rp/R [inch]	k _v [l/h]		Δp _{max} [kPa]	
Data sheet		N2103					
	VD115CLC	15	Rp/R 1/2	0.25...1.9		150	
	VD120CLC	20	Rp/R 3/4	0.25...2.6		150	
	VD125CLC	25	Rp/R 1	0.25...2.6		150	

Presettings for radiator valves VEN.., VDN.., VUN..

k_v values [m³/h] at the different preadjusted positions

Control range with electromotoric and electrothermic actuators SSA.., STA..		■	■	■	■	■	■	–
Control range with thermostatic head RTN..		■	■	■	■	■	–	■
Reference numbers for preadjustment		1	2	3	4	5	N	N
VDN110/VDN210/VEN110/VEN210		0.09	0.18	0.26	0.33	0.48	0.63	0.43
VDN115/VDN215/VEN115/VEN215		0.1	0.2	0.31	0.45	0.69	0.89	0.52
VDN120/VDN220/VEN120/VEN220		0.31	0.41	0.54	0.83	0.91	1.41	0.71
VUN210		0.14	0.28	0.38	0.49	0.53	0.6	0.43
VUN215		0.13	0.23	0.34	0.52	0.66	0.77	0.5

¹⁾ Optimized for floor heating systems

k_v = nominal flow rate of cold water (5...30 °C) through the valve at the respective stroke and a differential pressure of 100 kPa (1 bar)
The selected k_v values of the radiator valves can be easily and precisely set on the valve head in 5 steps + N (fully open)

Elite line								
Typical applications	Actuators	Data sheet				5.5 mm		
– Terminal units – Induction units – Chilled ceilings	SSB..	N4891				200 N	200 N	
		Operating voltage	Positioning signal	Positioning time [s]	Auxiliary switch			
		AC 230 V	3-position	150	– ✓	SSB31	SSB31.1	
		AC 24 V	3-position	150	– ✓	SSB81	SSB81.1	
		AC/DC 24 V	0...10 V	75	– –	SSB61	–	
		PN 16	1...110 °C	DN	G [inch]	k _{vs} [m ³ /h]	Δp _s [kPa]	
		Data sheet	N4845				Δp _{max} [kPa]	
		 	VVP45.10...	10	G ½B	0.25 / 0.4 / 0.63	725	400
			VVP45.10...	10	G ½B	1 / 1.6	725	400
		 	VXP45.15...	15	G ¾B	2.5	350	350
			VXP45.20...	20	G 1B	4	350	350
		 	VVP45.25...	25	G 1¼B	6.3	300	300
			VXP45.10...	10	G ½B	0.25 / 0.4 / 0.63	–	400
		 	VXP45.10...	10	G ½B	1 / 1.6	–	400
			VXP45.15...	15	G ¾B	2.5	–	350
		 	VXP45.20...	20	G 1B	4	–	350
			VXP45.25...	25	G 1¼B	6.3	–	300
		 	VMP45.10...	10	G ½B	0.25 / 0.4	–	400
			VMP45.10...	10	G ½B	0.63 / 1	–	400
		 	VMP45.10...	10	G ½B	1.6	–	400
			VMP45.15...	15	G ¾B	2.5	–	350
		 	VMP45.20...	20	G 1B	4	–	350
Standard line								
Typical applications	Actuators	Data sheet				4.5 mm	2.5 mm	
– Terminal units – Induction units – Chilled ceilings	STP23../73../63.. SFP.. SSP..	N4884 N4865 N4864					 	
		Operating voltage	Positioning signal	Positioning time [s]				
		AC 230 V	2-position	210		STP23	–	
			2-position	10		–	SFP21/18	
			3-position	150		–	SSP31	
		AC 24 V	2-position	10		–	SFP71/18	
			3-position	43		–	SSP81.04	
			3-position	150		–	SSP81	
			0...10 V	30		STP63	–	
		AC/DC 24 V	2-position/PDM	270		STP73	–	
			2-position/PDM	180		–	–	
			0...10 V	34		–	SSP61	
PN 16								
Data sheet	1...110 °C	DN	G [inch]	k _{vs} [m ³ /h]	Δp _s [kPa]	Δp _{max} [kPa]	Δp _s [kPa]	
 	N4847	VVP47.10...	10	G ½B	0.25 / 0.4	700	400	
		VVP47.10...	10	G ½B	0.63 / 1	250	250	
		VVP47.10...	10	G ½B	1.6	150	150	
		VVP47.15...	15	G ¾B	2.5	150	150	
		VVP47.20...	20	G 1B	4	100	100	
		 	VXP47.10...	10	G ½B	0.25 / 0.4	–	
			VXP47.10...	10	G ½B	0.63 / 1	–	
		 	VXP47.10...	10	G ½B	1.6	–	
			VXP47.15...	15	G ¾B	2.5	–	
		 	VXP47.20...	20	G 1B	4	–	
			VMP47.10...	10	G ½B	0.25 / 0.4	–	
			VMP47.10...	10	G ½B	0.63 / 1	–	
			VMP47.10...	10	G ½B	1.6	–	
			VMP47.15...	15	G ¾B	2.5	–	
Union nuts for threaded valves								
Union nuts for threaded valves				See page 15				

VVP45..S, VMP45..S with Conex® compression fittings, k_{vs} = 0.63 / 1 / 1.6 / 2.5 m³/h
 VVP47..S, VMP47..S with Conex® compression fittings, k_{vs} = 0.63 / 1 / 1.6 / 2.5 m³/h

.. = k_{vs} value

On/Off line												
Typical applications	Actuators	Data sheet	Actuators	Data sheet	2.5 mm		4.5 mm	2.5 mm				
– Terminal units – Domestic hot water storage tank charging – Zone control	SFA..	N4863	SSA31.04 ¹⁾	N4860	200 N		150 N		100 N			
	SUA21/1	N4830										
	STA21../73../63..	N4884										
	Operating voltage	Positioning signal	Positioning time [s]		SFA21/18		–	–	–			
	AC 230 V	2-position	10		SFA21/18		–	–	–			
		2-position	210		–		–	STA23	–			
		2-position/SPST ²⁾	10		–		SUA21/1	–	–			
		3-position/SPDT ²⁾	43		–		–	–	SSA31.04			
	AC 24 V	2-position	10		SFA71/18		–	–	–			
		0...10 V	30		–		–	STA63	–			
	AC/DC 24 V	2-position/PDM	270		–		–	STA73	–			
		2-position/PDM	180		–		–	–	–			
PN 16		1...110 °C	DN		R _p [inch]	k _{vs} [m ³ /h]	Δp _s [kPa]	Δp _{max} [kPa]	Δp _s [kPa]	Δp _{max} [kPa]		
Data sheet		N4842										
		VVI46.15	15	R _p 1/2	2	300	300	300	300	200		
		VVI46.20	20	R _p 3/4	3.5	300	300	300	300	200		
		VVI46.25	25	R _p 1	5	300	300	250	250	200		
		VXI46.15 ³⁾	15	R _p 1/2	2	–	300	–	300	–		
		VXI46.20 ³⁾	20	R _p 3/4	3.5	–	300	–	300	–		
		VXI46.25 ³⁾	25	R _p 1	5	–	300	–	300	–		
		VXI46.25T ⁴⁾	25	R _p 1	5	–	200	–	200	–		

Thermal actuators and connecting cables for combinable range, STx..3..									
Color	White						Black		
Equipped with	–	Function module DC 0...10 V		Auxiliary switch for STA	Auxiliary switch for STP	LED	–	Function module DC 0...10 V	
Positioning signal	2-position (ON/OFF)	DC 0...10 V	DC 0...10 V	2-position (ON/OFF)	2-position (ON/OFF)	2-position (ON/OFF)	2-position (ON/OFF)	DC 0...10 V	DC 0...10 V
	[STA.., NC]	[STA.., NC]	–	[STA.., NC]	–	[STA.., NC]	[STA.., NC]	[STA.., NC]	–
Standard PVC cables	[STP.., NO]	–	[STP.., NO]	–	[STP.., NO]	[STP.., NO]	[STP.., NO]	–	[STP.., NO]
	0.8 m	ASY23L08							
	1 m	ASY23L10							
	2 m	ASY23L20	ASY6AL20	ASY6PL20	ASA23U10	ASP23U10			
	3 m	ASY23L30						ASY6AL20B	ASY6PL20B
	4 m	ASY23L40							
	5 m	ASY23L50	ASY6AL50	ASY6PL50			ASY23L50LD	ASY23L50B	ASY6AL50B
	6 m	ASY23L60							
	7 m	ASY23L70	ASY6AL70	ASY6PL70				ASY6AL70B	
	10 m	ASY23L100						ASY23L100B	
Halogen-free cables	15 m	ASY23L150							
	2 m	ASY23L20HF	ASY6AL20HF	ASY6PL20HF					
	5 m	ASY23L50HF	ASY6AL50HF	ASY6PL50HF					
	7 m		ASY6AL70HF	ASY6PL70HF					
	10 m	ASY23L100HF							
Actuator									
STA73/00	■	■		■		■			
STA23/00	■			■					
STP73/00	■		■		■	■			
STP23/00	■			■	■				
STA73PR/00 ⁵⁾	■			■		■			
STP73PR/00 ⁵⁾	■			■	■	■			
STA73MP/00 ⁶⁾	■	■		■		■			
STA23MP/00 ⁶⁾	■			■					
STA73B/00							■	■	
STA23B/00							■		
STP73B/00							■		
STP23B/00							■		■

¹⁾ Not suited for radiator valves

²⁾ SPST = single-pole single-throw, SPDT = single-pole double-throw

³⁾ 70% k_{vs} in bypass, leakage rate in bypass 2...5% of k_{vs} value

⁴⁾ 100% k_{vs} in bypass, leakage rate in bypass 0.05% of k_{vs} value. For noiseless operation, the value of 100 kPa should not be exceeded.

⁵⁾ Actuators ideal for parallel running. Pulse duration modulation (PDM) in connection with Siemens room controllers of the Desigo™ range and room thermostats.

⁶⁾ Multipack with 50 actuators (OEM) NC: normally closed, NO: normally open

Threaded combi valves with actuators

Typical applications		Actuators	Data sheet						4.5 mm		2.5 mm			
– Radiators		RTN..	N2111							100 N				
		STA23.. /73.. /63..	N4884							100 N				
		SSA..	N4893											
		Operating voltage	Positioning signal	Positioning time [s]		Spring return function					–			
		AC 230 V	2-position	210		✓			–		STA23			
			3-position	150		–			–		–			
		AC 24 V	3-position	150		–			–		–			
			0...10 V	30		✓			–		STA63			
		AC/DC 24 V	2-position/PDM	270		✓			–		STA73			
			0...10 V	34		–			–		–			
PN 10		1...90 °C	DIN	DN	Rp/R [inch]	V [l/h]	V _{nom} ¹⁾ [l/h]		Δp _{min} [kPa]		Δp _{max} [kPa]			
Data sheet			N2185											
			VPD110A-.. ¹⁾	10	Rp/R ½	25...318	45	90	145	6 ²⁾	8 ²⁾	10 ²⁾	60	
			VPD115A-.. ¹⁾	15	Rp/R ½	25...318	45	90	145	6 ²⁾	8 ²⁾	10 ²⁾	60	
			VPD110B-200	10	Rp/R ¾	95...483	200				20		60	
			VPD115B-200	15	Rp/R ½	95...483	200				20		60	
			VPE110A-.. ¹⁾	10	Rp/R ¾	25...318	45	90	145	6 ²⁾	8 ²⁾	10 ²⁾	60	
			VPE115A-.. ¹⁾	15	Rp/R ½	25...318	45	90	145	6 ²⁾	8 ²⁾	10 ²⁾	60	
			VPE110B-200	10	Rp/R ¾	95...483	200				20		60	
			VPE115B-200	15	Rp/R ½	95...483	200				20		60	
Typical applications		Actuators	Data sheet			Spring return function	4.5 mm		2.5 mm		2.5 / 5 mm			
– Terminal units – Air handling units – Chilled ceilings		SSA..	N4893				100 N	150 N	200 N		100 N			
		STA..	N4884											
		SFA..	N4863											
		SUA..	N4830											
		Operating voltage	Positioning signal	Positioning time [s]										
		AC 230 V	3-position	150/300		–		–		–		SSA31		
			2-position	210		✓		STA23		–		–		
			2-position	10		✓		–		–		SFA21/18		
			2-position/SPST ³⁾	10		–		–		SUA21/1		–		
		AC 24 V	2-position	10		✓		–		–		SFA71/18		
			0...10 V	30		✓		STA63		–		–		
		AC/DC 24 V	3-position	150/300		–		–		–		SSA81		
			2-position/PDM	270		✓		STA73		–		–		
			0...10 V	34/70		–		–		–		SSA61		
PN 25		1...110 °C	Without pressure testing points	With pressure testing points		DN	G [inch]	V _{min} [l/h]	V ₁₀₀ [l/h]	Δp _{min} [kPa]		Δp _{max} [kPa]		
Data sheet			N4855											
			VPP46.10L0.2	VPP46.10L0.2Q		10	½	30	200	15		400		
			VPP46.15L0.2	VPP46.15L0.2Q		15	¾	30	200	15		400		
			VPP46.15L0.6	VPP46.15L0.6Q		15	¾	100	575	15		400		
			VPP46.20F1.4	VPP46.20F1.4Q		20	1	220	1330	–		–		
PN 25		1...110 °C	Without pressure testing points	With pressure testing points		DN	G [inch]	V _{min} [l/h]	V ₁₀₀ [l/h]	Δp _{min} [kPa]		Δp _{max} [kPa]		
Data sheet			N4855											
			VPI46.15L0.2	VPI46.15L0.2Q		15	½	30	200	15		400		
			VPI46.15L0.6	VPI46.15L0.6Q		15	½	100	575	15		400		
			VPI46.20F1.4	VPI46.20F1.4Q		20	¾	220	1330	–		–		

¹⁾ .. = insert V_{nom}

V_{nom} = factory setting = volumetric flow at 0.5 mm stroke or setting mark 3 of the presetting

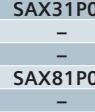
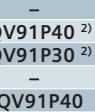
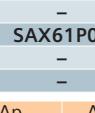
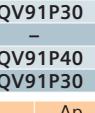
²⁾ Δp_{min} is valid for V_{nom} 45/90/145 l/h

³⁾ SPST = single-pole single-throw

Threaded combi valves with actuators

Typical applications		Actuators	Data sheet						5.5 mm	6.5 mm				
– Terminal units – Air handling units – Chilled ceilings		SSD.. SQD..	N4861 N4540						250 N	400 N				
		Operating voltage	Positioning signal	Positioning time [s]		Spring return function								
				SSD..	SQD..	SSD..	SQD..							
AC 230 V		3-position	150	170	–	–	–	SSD31		SQD35.00				
AC 24 V		3-position	150	43	–	–	–	SSD81		SQD85.03				
0...10 V		–	43	–	–	–	–	–		SQD65				
AC/DC 24 V		0...10 V	75	–	–	–	–	SSD61		–				
0...10 V		75	–	–	–	–	–	SSD61EP ¹⁾		–				
2...10 V		75	–	–	–	–	–	SSD61.2		–				
PN 25	1...120 °C	Without pressure testing points	With pressure testing points	DN	Rp [inch]	V _{min} [l/h]	V ₁₀₀ [l/h]	Δp _{min} [kPa]	Δp _{max} [kPa]	Δp _{min} [kPa]	Δp _{max} [kPa]			
Data sheet		N4853		 	VPI45.15F0.5	VPI45.15F0.5Q	15	Rp 1/2	90	620	16	400	–	–
		 	VPI45.15F1.5	VPI45.15F1.5Q	15	Rp 1/2	290	1730	18	400	–	–		
		 	VPI45.20F0.9	VPI45.20F0.9Q	20	Rp 3/4	160	1050	16	400	–	–		
		 	VPI45.20F2	VPI45.20F2Q	20	Rp 3/4	350	2040	22	400	–	–		
		 	VPI45.25F1.5	VPI45.25F1.5Q	25	Rp 1	280	1720	16	400	–	–		
		 	VPI45.25F2	VPI45.25F2Q	25	Rp 1	350	2040	22	400	–	–		
		 	VPI45.32F3	VPI45.32F3Q	32	Rp 1 1/4	560	3050	18	400	–	–		
		 	VPI45.40F7	VPI45.40F7Q	40	Rp 1 1/2	2355	7105	–	–	26	400		
		 	VPI45.50F8.5	VPI45.50F8.5Q	50	Rp 2	2664	8586	–	–	32	400		

Flanged combi valves with actuators

Typical applications		Actuators	Data sheet						Spring return function	800 N	1100 N	
– Heating plants – Ventilation plants – Air conditioning plants		SAX..P.. SQV91P..	N4509 N4833									
		Operating voltage	Positioning signal	Positioning time [s]		Stroke [mm]						
				SAX	SQV	SAX	SQV					
AC 230 V		3-position	30	–	20	–	–	SAX31P03		–		
		3-position	–	40/80	–	20/40	✓	–		SQV91P40 ²⁾		
		3-position	–	40/80	–	20/40	✓	–		SQV91P30 ²⁾		
AC/DC 24 V		3-position	30	–	20	–	–	SAX81P03		–		
		3-position	–	40/80	–	20/40	✓	–		SQV91P40		
		3-position	–	40/80	–	20/40	✓	–		SQV91P30		
0...10 V, 4...20 mA		30	–	20	–	–	–	SAX61P03		–		
0...10 V, 4...20 mA		–	40/80	–	20/40	✓	–	–		SQV91P40		
0...10 V, 4...20 mA		–	40/80	–	20/40	✓	–	–		SQV91P30		

PN 16	1...120 °C	DN	V _{min} [m ³ /h]	V ₁₀₀ [m ³ /h]	Δ _{min} [kPa]	Δ _s [kPa]	Δ _{max} [kPa]	Δ _s [kPa]	Δ _{max} [kPa]	
Data sheet	N4315	 	65	4.4	24	35	600	600	600	600
	VPF43.65F35	 	65	6	35	70	600	600	600	600
	VPF43.80F35	 	80	5.3	34	35	600	600	600	600
	VPF43.80F45	 	80	7	43	70	600	600	600	600
PN 25	1...120 °C	DN	V _{min} [m ³ /h]	V ₁₀₀ [m ³ /h]	Δ _{min} [kPa]	Δ _s [kPa]	Δ _{max} [kPa]	Δ _s [kPa]	Δ _{max} [kPa]	
Data sheet	N4316	 	65	4.4	24	35	600	600	600	600
	VPF53.65F35	 	65	6	35	70	600	600	600	600
	VPF53.80F35	 	80	5.3	34	35	600	600	600	600
	VPF53.80F45	 	80	7	43	70	600	600	600	600

¹⁾ For equal-percentage valve characteristic

²⁾ For AC 230 V use of accessorie ASP1.1 required

Flanged 2-port and 3-port valves with 20/40 mm actuators

Typical applications	Actuators	Data sheet			Spring return function	20 mm			40 mm		
		800 N	1000 N	2800 N		2800 N			2800 N		
- Heating plants - Ventilation and air conditioning plants - Heat and cooling generation - Heat and cooling distribution	SAX..	N4501									
	SKD..	N4561									
	SKB..	N4564									
	SKC..	N4566									
	Operating voltage	Positioning signal	Positioning time [s]			Spring return function	SAX31.00	SKD32.50	SKB32.50	SKC32.60	
	AC 230 V	3-position	120	120	120		—	—	—	—	
		3-position	—	120	120		—	SKD32.51	SKB32.51	SKC32.61	
		3-position	30	—	—		SAX31.03	—	—	—	
		3-position	—	30	—		—	SKD32.21	—	—	
	AC 24 V ¹⁾	3-position	120	120	120		SAX81.00	SKD82.50	SKB82.50	SKC82.60	
		3-position	—	120	120		—	SKD82.51	SKB82.51	SKC82.61	
		3-position	30	—	—		SAX81.03	—	—	—	
		0...10 V, 4...20 mA	—	30	120		—	SKD60	SKB60	SKC60	
		0...10 V, 4...20 mA	—	30	120		—	SKD62	SKB62	SKC62	
	AC/DC 24 V	0...10 V, 4...20 mA	30	—	—		SAX61.03	—	—	—	
PN 6	-10...150 °C										
Data sheet	N4310		N4410	DN	k _{vs} [m ³ /h]	Δp _s [kPa]	Δp _{max} [kPa]	Δp _s [kPa]	Δp _{max} [kPa]	Δp _s [kPa]	Δp _{max} [kPa]
	VVF21.22..25 ²⁾			25	1.9/3/5/7.5	600	300	600	300	600	300
	VVF21.25... ³⁾			25	2.5/4/6.3/10	600	300	600	300	600	300
	VVF21.39..40 ²⁾			40	12/19	500	300	600	300	600	300
	VVF21.40...			40	16/25	500	300	600	300	600	300
	VVF21.50			50	31	300	300	450	300	600	300
	VVF21.50-40			50	40	300	300	450	300	600	300
	VVF21.65			65	49	175	175	275	275	600	300
	VVF21.65-63			65	63	175	175	275	275	600	300
	VVF21.80			80	78	100	100	175	175	500	300
	VVF21.80-100			80	100	100	100	175	175	500	300
	VVF21.90			100	124	—	—	—	—	300	200
	VVF21.100-160			100	160	—	—	—	—	300	200
PN 10	-10...150 °C										
Data sheet	N4320		N4420	DN	k _{vs} [m ³ /h]	Δp _s [kPa]	Δp _{max} [kPa]	Δp _s [kPa]	Δp _{max} [kPa]	Δp _s [kPa]	Δp _{max} [kPa]
	VVF31.15... ³⁾			15	2.5/4	1000	300	1000	300	1000	300
	VVF31.24..25 ²⁾			25	5/7.5	1000	300	1000	300	1000	300
	VVF31.25...			25	6.3/10	1000	300	1000	300	1000	300
	VVF31.39..40 ²⁾			40	12/19	525	300	775	300	1000	300
	VVF31.40...			40	16/25	525	300	775	300	1000	300
	VVF31.50			50	31	325	300	475	300	1000	300
	VVF31.50-40			50	40	325	300	475	300	1000	300
	VVF31.65			65	49	175	175	275	275	750	300
	VVF31.65-63			65	63	175	175	275	275	750	300
	VVF31.80			80	78	100	100	175	175	500	300
	VVF31.80-100			80	100	100	100	175	175	500	300
	VVF31.90			100	124	—	—	—	—	300	200
	VVF31.100-160			100	160	—	—	—	—	300	200
	VVF31.91			125	200	—	—	—	—	200	150
	VVF31.125-250			125	250	—	—	—	—	200	150
	VVF31.92			150	300	—	—	—	—	125	100
	VVF31.150-315			150	315	—	—	—	—	125	100
PN 16	-10...150 °C										
Data sheet	N4330		N4430	DN	k _{vs} [m ³ /h]	Δp _s [kPa]	Δp _{max} [kPa]	Δp _s [kPa]	Δp _{max} [kPa]	Δp _s [kPa]	Δp _{max} [kPa]
	VVF40.15... ³⁾			15	1.9/2.5/3/4	1600	300	1600	300	1600	300
	VVF40.25...			25	5/6.3/7.5/10	1550	300	1600	300	1600	300
	VVF40.40...			40	12/16/19/25	525	300	775	300	1600	300
	VVF40.50...			50	31/40	325	300	475	300	1300	300
	VVF40.65...			65	49/63	175	175	275	275	750	300
	VVF40.80...			80	78/100	100	100	175	175	500	300
	VVF40.100...			100	124/160	—	—	—	—	300	200
	VVF40.125...			125	200/250	—	—	—	—	200	150
	VVF40.150...			150	300/315	—	—	—	—	125	100
PN 16	-20...220 °C										
Data sheet	N4404		N4404	DN	k _{vs} [m ³ /h]	Δp _s [kPa]	Δp _{max} [kPa]	Δp _s [kPa]	Δp _{max} [kPa]	Δp _s [kPa]	Δp _{max} [kPa]
	VVF43.65-50			65	50	—	—	—	—	700	650
	VVF43.65-63			65	63	—	—	—	—	700	650
	VVF43.80-80			80	80	—	—	—	—	450	400
	VVF43.80-100			80	100	—	—	—	—	450	400
	VVF43.100-125			100	125	—	—	—	—	300	250
	VVF43.100-160			100	160	—	—	—	—	300	250
	VVF43.125-200			125	200	—	—	—	—	175	160
	VVF43.125-250			125	250	—	—	—	—	175	160
	VVF43.150-315			150	315	—	—	—	—	125	100
	VVF43.150-400			150	400	—	—	—	—	125	100
	VVF43.65-63K			65	63	—	—	—	—	1600	800
	VVF43.80-100K			80	100	—	—	—	—	1600	800
	VVF43.100-160K			100	160	—	—	—	—	1600	800
	VVF43.125-250K			125	250	—	—	—	—	1600	800
	VVF43.150-360K			150	360	—	—	—	—	1600	800

¹⁾ SAX81...: AC/DC 24 V; ²⁾ For 22...25, 24...25, 39...40 = insert number in place of k_{vs} value; ³⁾ .. = insert k_{vs} value

VVF43.., VXF43..: For DN 15...50 and k_{vs} values ≤ 40 m³/h see V.F53..

Flanged 2-port and 3-port valves with 20/40 mm actuators

Typical applications	Actuators	Data sheet					Spring return function	20 mm			40 mm		
		Positioning time [s]			SAX	SKD	SKB/SKC	800 N	1000 N	2800 N	2800 N		
- Heating plants	SAX..	N4501											
- Ventilation and air conditioning plants	SKD..	N4561											
- Heat and cooling generation	SKB..	N4564											
- Heat and cooling distribution	SKC..	N4566											
Operating voltage	AC 230 V	Positioning signal	Positioning time [s]			SAX	SKD	SKB/SKC	SAX	SKD	SKB/SKC	SKC	
		3-position	120	120	120				-	SAX31.00	SKD32.50	SKB32.50	SKC32.60
		3-position	-	120	120				-	SKD32.51	SKB32.51	SKC32.61	
		3-position	30	-	-				-	SAX31.03	-	-	-
	AC 24 V ¹⁾	3-position	-	30	-				-	SKD32.21	-	-	-
		3-position	120	120	120				-	SAX81.00	SKD82.50	SKB82.50	SKC82.60
		3-position	-	120	120				-	SKD82.51	SKB82.51	SKC82.61	
		3-position	30	-	-				-	SAX81.03	-	-	-
		0...10 V, 4...20 mA	-	30	120				-	SKD60	SKB60	SKC60	
		0...10 V, 4...20 mA	-	30	120				-	SKD62	SKB62	SKC62	
PN 25	Data sheet	Positioning signal			SAX	SKD	SKB/SKC	SAX	SKD	SKB/SKC	SKC	SAX	
		0...10 V, 4...20 mA	30	-									
		-	-	-									
		VVF53.15-.. ²⁾	-	15				2500	1200	2500	1200	2500	1200
		VVF53.15-..	-	15				2500	1200	2500	1200	2500	1200
		VVF53.15-..	-	15				2500	1200	2500	1200	2500	1200
		VVF53.15-..	-	15				2500	1200	2500	1200	2500	1200
		VXF53.15-.. ²⁾	15	1.6/2.5/4				2500	1200	2500	1200	2500	1200
		VXF53.20-6.3	20	6.3				2500	1200	2500	1200	2500	1200
		VVF53.25-..	-	25	5/8			1600	1200	2100	1200	2500	1200
PN 40	Data sheet	VVF53.25-..	25	6.3/10	1600			1200	2100	1200	2500	1200	
		VVF53.32-16	32	16	900			750	1200	1100	2500	1200	
		VVF53.40-..	-	40	12.5/20			550	500	750	650	2000	1200
		VVF53.40-..	40	16/25	550			500	750	650	2000	1200	
		VVF53.50-31.5	-	50	31.5			350	300	450	400	1200	1150
		VVF53.50-40	50	40	350			300	450	400	1200	1150	
		VVF53.65-63	65	63	-			-	-	-	-	700	
		VVF53.80-100	80	100	-			-	-	-	-	450	
		VVF53.100-160	100	160	-			-	-	-	-	300	
		VVF53.125-250	125	250	-			-	-	-	-	175	
PN 40	Data sheet	VVF53.150-400	150	400	-			-	-	-	-	125	
		VVF53.50-40K	-	50	40			2500	1200	2500	1200	2500	1200
		VVF53.65-63K	-	65	63			-	-	-	-	-	2500
		VVF53.80-100K	-	80	100			-	-	-	-	-	2500
		VVF53.100-160K	-	100	160			-	-	-	-	-	2500
		VVF53.125-250K	-	125	250			-	-	-	-	-	2500
		VVF53.150-360K	-	150	360			-	-	-	-	-	2500
		VVF61.09..11 ³⁾	-	15	0.19/0.3/0.45			-	-	4000	1600	4000	1600
		VVF61.12..13 ³⁾	-	15	0.7/1.2			-	-	4000	1600	4000	1600
		VVF61.14..15 ³⁾	15	1.9/3	-			-	4000	1600	4000	1600	
PN 40	Data sheet	VVF61.23..25 ³⁾	25	3/5/7.5 5/7.5	-			-	2250	1600	4000	1600	
		VVF61.39..40 ³⁾	40	12/19	-			-	-	4000	1600	1200	
		VVF61.49..50 ³⁾	50	19/31	-			-	-	4000	1600	1000	
		VVF61.65	65	49	-			-	-	-	-	4000	
		VVF61.80	80	78	-			-	-	-	-	4000	
		VVF61.90	100	124	-			-	-	-	-	4000	
		VVF61.91	125	200	-			-	-	-	-	4000	
		VVF61.92	150	300	-			-	-	-	-	4000	
					-			-	-	-	-	200	
					-			-	-	-	-	125	

¹⁾ SAX81...: AC/DC 24 V

²⁾ .. = insert k_{vs} value

³⁾ For 09...15, 14...15, 23...25, 24...25, 39...40, 49...50 = insert number in place of k_{vs} value

Threaded 2-port and 3-port valves with 5.5 mm actuators

Typical applications		Actuators		Data sheet					5.5 mm		
– Heating plants – District heating – Ventilation and air conditioning plants		SQS..		N4573					400 N	400 N	
		Operating voltage		Positioning signal	Positioning time [s]		Spring return function				
		AC 230 V		3-position	150	150	✓	–	SQS35.50	SQS35.00	
				3-position	35	35	✓	–	SQS35.53	SQS35.03	
		AC 24 V		3-position	–	150	–	–	–	SQS85.00	
				3-position	–	35	–	–	–	SQS85.03	
				0...10 V	35	35	✓	–	SQS65.5	SQS65	
				2...10 V	–	35	–	–	–	SQS65.2	
PN 16		1...120 °C									
Data sheet		N4364		N4464		DN	G [inch]	k_{vs} [m³/h]	Δp_s [kPa]	Δp_{max} [kPa]	
		VVG44.15..				VVG44.15..	15	G 1B	0.25/0.4/0.63	1600	400
		VVG44.15..				VVG44.15..	15	G 1B	1/1.6	725	400
		VVG44.15..				VVG44.15..	15	G 1B	2.5/4	400	400
		VVG44.20-6.3				VVG44.20-6.3	20	G 1½B	6.3	750	400
		VVG44.25-10				VVG44.25-10	25	G 1½B	10	400	400
		VVG44.32-16				VVG44.32-16	32	G 2B	16	250	250
		VVG44.40-25				VVG44.40-25	40	G 2¼B	25	125	125
PN 25		1...130 °C					DN	G [inch]	k_{vs} [m³/h]	Δp_s [kPa]	Δp_{max} [kPa]
Data sheet		N4379									
		VVG55.15..				15	G ¾B	0.25/0.4/0.63	2500	1200	
		VVG55.15..				15	G ¾B	1/1.6/2.5	2000	1200	
		VVG55.20-4				20	G 1B	4	1000	1000	
		VVG55.25-6.3				25	G 1¼B	6.3	800	800	
Typical applications		Actuators		Data sheet					5.5 mm		
– Heating plants – Ventilation plants		SSC..		N4895					300 N		
		Operating voltage		Positioning signal	Positioning time [s]		Spring return function				
		AC 230 V		3-position	150	–	–	–	SSC31	–	
		AC 24 V		3-position	150	–	–	–	SSC81	–	
		AC/DC 24 V		0...10 V	30	30	–	✓	SSC61	SSC61.5	
PN 16		1...110 °C					DN	G [inch]	k_{vs} [m³/h]	Δp_s [kPa]	Δp_{max} [kPa]
Data sheet		N4845		N4845							
		VVP45.20-4				VXP45.20-4	20	G 1B	4	350	350
		VVP45.25-6.3				VXP45.25-6.3	25	G 1¼B	6,3	300	300
		VVP45.25-10				VXP45.25-10	25	G 1½B	10	300	300
		VVP45.32-16				VXP45.32-16	32	G 2B	16	175	175
		VVP45.40-25				VXP45.40-25	40	G 2¼B	25	75	75

Threaded 2-port and 3-port valves with 20 mm actuators

Typical applications		Actuators		Data sheet					Spring return function	20 mm			
– Heating plants – Ventilation and air conditioning plants – Heat generation – Heat distribution – District heating		SAX..		N4501						800 N	1000 N	2800 N	
		SKD..		N4561									
		SKB..		N4564									
		Operating voltage		Positioning signal	Positioning time [s]		Spring return function						
		AC 230 V		3-position	120	120	120	–	SAX31.00	SKD32.50	SKB32.50		
				3-position	–	120	120	✓	–	SKD32.51	SKB32.51		
				3-position	30	–	–	–	SAX31.03	–	–		
				3-position	–	30	–	✓	–	SKD32.21	–		
		AC 24 V ¹⁾		3-position	120	120	120	–	SAX81.00	SKD82.50	SKB82.50		
				3-position	–	120	120	✓	–	SKD82.51	SKB82.51		
				3-position	30	–	–	–	SAX81.03	–	–		
				0...10 V, 4...20 mA	–	30	120	–	–	SKD60	SKB60		
				0...10 V, 4...20 mA	–	30	120	✓	–	SKD62	SKB62		
		AC/DC 24 V		0...10 V, 4...20 mA	30	–	–	–	SAX61.03	–	–		

PN 16		-25...150 °C		N4463					DN	G [inch]	k_{vs} [m³/h]	Δp_s [kPa]	Δp_{max} [kPa]	Δp_s [kPa]	Δp_{max} [kPa]
Data sheet	N4363														
	VVG41.11..12		–	–	15	G 1B	0.63 / 1	1600	800	1600	800	1600	800		
	VVG41.13		–	VXG41.1301	15	G 1B	1.6	1600	800	1600	800	1600	800		
	VVG41.14		–	VXG41.1401	15	G 1B	2.5	1600	800	1600	800	1600	800		
	VVG41.15		VXG41.1501	15	G 1B	4	1600	800	1600	800	1600	800			
	VVG41.20		VXG41.2001	20	G 1¼B	6.3	1600	800	1600	800	1600	800			
	VVG41.25		VXG41.2501	25	G 1½B	10	1550	800	1600	800	1600	800			
	VVG41.32		VXG41.3201	32	G 2B	16	875	800	1275	800	1600	800			
	VVG41.40		VXG41.4001	40	G 2¼B	25	525	525	775	775	1600	800			
	VVG41.50		VXG41.5001	50	G 2¾B	40	300	300	450	450	1225	800			

2-port and 3-port valves fitted with magnetic actuator

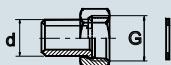
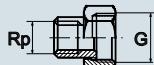
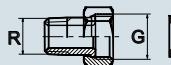
Typical applications		Valve type	Operating voltage		Positioning signal		Type suffix		
– Supply air control with/without cascade		MXF461..	AC 24 V		0...10 V, 2...10 V, 4...20 mA		P ¹⁾		
– Fast-acting heat exchanger control		M3P..FY..	AC 24 V		0...10 V, 4...20 mA		P ¹⁾		
– Domestic hot water mixing control		MVF461H..	AC/DC 24 V		0...10 V, 2...10 V, 0...20 mA, 4...20 mA		–		
– High-precision process control		MXG461..	AC 24 V		0...10 V, 2...10 V, 4...20 mA		P ¹⁾		
		MXG461B..	AC/DC 24 V		0...10 V, 2...10 V, 0...20 mA, 4...20 mA		–		
		MXG461S..	AC 24 V		0...10 V, 2...10 V, 4...20 mA		–		
		MXG462S..	AC/DC 24 V		0...10 V, 2...10 V, 0...20 mA, 4...20 mA		–		
PN 16		1...130 °C			DN	k_{vs} [m³/h]	Δp_s [kPa]	Δp_{max} [kPa]	
Data sheet		N4455							
		MXF461.15-..	15	0.6 / 1.5 / 3	300	300	To be used as 2-port or mixing valves, not as diverting valves. Selectable valve characteristic: equal-percentage or linear.		
		MXF461.20-5.0	20	5	300	300			
		MXF461.25-8.0	25	8	300	300			
		MXF461.32-12	32	12	300	300			
		MXF461.40-20	40	20	300	300			
		MXF461.50-30	50	30	300	300			
		MXF461.65-50	65	50	300	300			
1...120 °C		N4454							
		M3P80FY	80	80	300	300			
		M3P100FY	100	130	200	200			
PN 16		1...180 °C			DN	k_{vs} [m³/h]	Δp_s [kPa]	Δp_{max} [kPa]	
Data sheet		N4361							
		MVF461H15-..	15	0.6 / 1.5 / 3	1000	1000	To be used as 2-port or mixing valves, not as diverting valves. Selectable valve characteristic: equal-percentage or linear.		
		MVF461H20-5	20	5	1000	1000			
		MVF461H25-8	25	8	1000	1000			
		MVF461H32-12	32	12	1000	1000			
		MVF461H40-20	40	20	1000	1000			
		MVF461H50-30	50	30	1000	1000			
PN 16		1...130 °C			DN	G [inch]	k_{vs} [m³/h]	Δp_s [kPa]	Δp_{max} [kPa]
Data sheet		N4455							
		MXG461.15-..	15	G 1B	0.6 / 1.5 / 3	300	300	To be used as 2-port or mixing valves, not as diverting valves. Selectable valve characteristic: equal-percentage or linear.	
		MXG461.20-5.0	20	G 1½B	5	300	300		
		MXG461.25-8.0	25	G 1½B	8	300	300		
		MXG461.32-12	32	G 2B	12	300	300		
		MXG461.40-20	40	G 2¼B	20	300	300		
		MXG461.50-30	50	G 2¾B	30	300	300		
PN 16		-20...130 °C			DN	G [inch]	k_{vs} [m³/h]	Δp_s [kPa]	Δp_{max} [kPa]
Data sheet		N4461							
		MXG461B15-..	15	G 1B	0.6 / 1.5 / 3	1000	1000	To be used as 2-port or mixing valves, not as diverting valves. Selectable valve characteristic: equal-percentage or linear. ²⁾	
		MXG461B20-5	20	G 1½B	5	800	800		
		MXG461B25-8	25	G 1½B	8	700	700		
		MXG461B32-12	32	G 2B	12	600	600		
		MXG461B40-20	40	G 2¼B	20	600	600		
		MXG461B50-30	50	G 2¾B	30	600	600		
PN 16		1...130 °C			DN	G [inch]	k_{vs} [m³/h]	Δp_s [kPa]	Δp_{max} [kPa]
Data sheet		N4465							
		MXG461S15-1.5	-	15	G 1B	1.5	300	300	To be used as 2-port or mixing valves, not as diverting valves. Selectable valve characteristic: equal-percentage or linear. ²⁾
		MXG461S20-5.0	-	20	G 1½B	5	300	300	
		MXG461S25-8.0	-	25	G 1½B	8	300	300	
		MXG461S32-12	-	32	G 2B	12	300	300	
		MXG462S50-30	50	G 2¾B	30	600	600		
Note									

¹⁾ P = media containing mineral oil

²⁾ Parts that are in contact with medium in stainless steel

Union nuts for threaded valves¹⁾

Type	G [inch]	R, Rp [inch]	Material
Set of 2	Set of 3		
ALG132	ALG133	G 1/2B	R 5/8 (externally threaded) Brass
ALG142	ALG143	G 3/4B	R 1/2 (externally threaded) Brass
ALG122	ALG123	G 3/8B	Malleable cast iron
ALG152	ALG153	G 1B	Malleable cast iron
ALG152B	ALG153B	G 1B	Brass
ALG202	ALG203	G 1 1/4B	Malleable cast iron
ALG202B	ALG203B	G 1 1/4B	Brass
ALG252	ALG253	G 1 1/2B	Malleable cast iron
ALG252B	ALG253B	G 1 1/2B	Brass
ALG322	ALG323	G 2B	Malleable cast iron
ALG322B	ALG323B	G 2B	Brass
ALG402	ALG403	G 2 1/4B	Malleable cast iron
ALG402B	ALG403B	G 2 1/4B	Brass
ALG502	ALG503	G 2 3/8B	Malleable cast iron
ALG502B	ALG503B	G 2 3/4B	Brass
Type	G [inch]	$\varnothing d$ [mm]	Material
Set of 2			
ALS152	G 3/4B	21.3	Steel, weldable
ALS202	G 1B	26.8	Steel, weldable
ALS252	G 1 1/4B	33.7	Steel, weldable



¹⁾ Valve side: cylindrical thread G according to ISO 228-1, pipe side: ALG.. with cylindrical Rp- or tapered R-thread according to ISO 7-1
Pipe side: ALS.. with welded connection

2-port and 3-port control ball valves with rotary actuators

Typical applications	Actuators	Data sheet					Spring return function	2 Nm	5 Nm	7 Nm	10 Nm
		Operating voltage	Positioning signal	Positioning time [s]							
– Heating plants – Ventilation and air conditioning plants – Heat and cooling generation – Heat and cooling distribution	GQD..9A	N4659	AC 230 V	3-position	–	150	–	150	–	–	GDB331.9E
	GDB..9E	N4657		3-position	–	150	–	150	–	–	GDB131.9E
	GMA..9E	N4658		0...10 V	–	150	–	150	–	–	GDB161.9E
	GLB..9E	N4657		AC 24 V	3-position	30 / 15	–	90 / 15	–	✓	GQD131.9A
			AC/DC 24 V	3-position	30 / 15	–	90 / 15	–	✓	GQD161.9A	–
				0...10 V	30 / 15	–	90 / 15	–	✓	GQD161.9A	–
											GMA161.9E
											–

PN 40	1...120 °C										
Data sheet	N4211		N4211	DN	Rp [inch]	k_{vs} [m³/h]		Δp_s [kPa]	Δp_{max} [kPa]	Δp_s [kPa]	Δp_{max} [kPa]
	VAI61.15..		VBI61.15..	15	Rp ½	1.6 / 2.5 / 4 / 6.3		1400	350	1400	350
	VAI61.15..		–	15	Rp ½	1 / 10		1400	350	1400	350
	VAI61.20..		VBI61.20..	20	Rp ¾	4 / 6.3		1400	350	1400	350
	VAI61.20..		–	20	Rp ¾	10		1400	350	1400	350
	VAI61.25..		VBI61.25..	25	Rp 1	10		–	–	1400	350
	VAI61.25..		–	25	Rp 1	6.3 / 16		–	–	1400	350
	VAI61.32..		VBI61.32..	32	Rp 1¼	10		–	–	–	1000
	VAI61.32..		–	32	Rp 1¼	16		–	–	–	1000
	VAI61.32..		VBI61.32..	32	Rp 1¼	25		–	–	–	240
	VAI61.40..		–	40	Rp 1½	16		–	–	–	800
	VAI61.40..		VBI61.40..	40	Rp 1½	25		–	–	–	240
	VAI61.40..		–	40	Rp 1½	40		–	–	–	800
	VAI61.50..		–	50	Rp 2	25		–	–	–	600
	VAI61.50..		VBI61.50..	50	Rp 2	40		–	–	–	600
	VAI61.50..		–	50	Rp 2	63		–	–	–	240

Changeover and open/close ball valves with rotary actuators

Typical applications	Actuators	Data sheet					Spring return function	2 Nm	7 Nm	10 Nm
		Operating voltage	Positioning signal	Positioning time [s]						
– Heating plants – Ventilation and air conditioning plants – Heat and cooling generation – Heat and cooling distribution	GSD..9A	N4655	AC/DC 24 V	2-position	30	–	–	–	GSD141.9A	–
	GQD..9A	N4659		2-position	30	–	–	–	GSD341.9A	–
	GMA..9E	N4658		(2)/3-position	–	150	–	–	–	–
	GLB..9E	N4657		(2)/3-position	–	150	–	–	–	GLB131.9E
			AC 230 V	2-position	–	30 (15)	–	✓	GQD121.9A	–
				2-position	–	30 (15)	–	✓	GQD321.9A	–
			AC 24 V	2-position	–	–	90 (15)	✓	–	GMA121.9E
				2-position	–	–	90 (15)	✓	–	GMA321.9E
			AC 230 V	2-position	–	–	90 (15)	✓	–	–
				2-position	–	–	90 (15)	✓	–	–

PN 40	-10...120 °C									
Data sheet	N4213		DN	Rp [inch]	k_{vs} [m³/h]		Δp_{max} [kPa]	Δp_{max} [kPa]	Δp_{max} [kPa]	
	VBI60.15-12T		15	Rp ½	12		350	350	350	
	VBI60.20-16T		20	Rp ¾	16		350	350	350	
	VBI60.25-16T		25	Rp 1	16		350	350	350	
	VBI60.32-25T		32	Rp 1¼	25		–	350	350	
	VBI60.40-49T		40	Rp 1½	49		–	350	350	
	VBI60.50-73T		50	Rp 2	73		–	350	350	
PN 40	-10...120 °C						Δp_{max} [kPa]	Δp_{max} [kPa]	Δp_{max} [kPa]	
Data sheet	N4213		DN	Rp [inch]	k_{vs} [m³/h]		Δp_{max} [kPa]	Δp_{max} [kPa]	Δp_{max} [kPa]	
	VBI60.15-5L		15	Rp ½	5		350	350	350	
	VBI60.20-9L		20	Rp ¾	9		350	350	350	
	VBI60.25-9L		25	Rp 1	9		350	350	350	
	VBI60.32-13L		32	Rp 1¼	13		–	350	350	
	VBI60.40-25L		40	Rp 1½	25		–	350	350	
	VBI60.50-37L		50	Rp 2	37		–	350	350	
PN 40	-10...120 °C						Δp_s [kPa]	Δp_{max} [kPa]	Δp_s [kPa]	Δp_{max} [kPa]
Data sheet	N4213		DN	Rp [inch]	k_{vs} [m³/h]		Δp_s [kPa]	Δp_{max} [kPa]	Δp_s [kPa]	Δp_{max} [kPa]
	VAI60.15-15		15	Rp ½	15		1400	350	1400	350
	VAI60.20-22		20	Rp ¾	22		1400	350	1400	350
	VAI60.25-22		25	Rp 1	22		1400	350	1400	350
	VAI60.32-35		32	Rp 1¼	35		–	1000	350	1000
	VAI60.40-68		40	Rp 1½	68		–	800	350	800
	VAI60.50-96		50	Rp 2	96		–	600	350	600

VBI61...: For noiseless operation, the Δp_{max} value of 200 kPa should not be exceeded

3-port and 4-port slipper valves with rotary actuators

Typical applications	Actuators	Data sheet				5 Nm	5 Nm	10 Nm
– Small to medium-sized heating plants	SQK34../84.. SQK33.. SAL..	N4508 N4506 N4502						
	Operating voltage	Positioning signal		Positioning time [s]				
	AC 230 V	3-position 3-position		135	125	120	SQK34.00	SQK33.00
	AC 24 V	3-position		135	–	30	–	SAL31.00T10 SAL31.03T10
	AC/DC 24 V	3-position 3-position 0...10 V, 4...20 mA 0...10 V, 4...20 mA		–	–	120	SQK84.00	–
				–	–	30	–	SAL81.00T10 SAL81.03T10
				–	–	120	–	SAL61.00T10
				–	–	30	–	SAL61.03T10
	Mounting set ¹⁾					direct	ASK32	ASK31N
PN 6	1...120 °C			DN	k_{vs} [m³/h]	Δp_{max} [kPa]	Δp_{max} [kPa]	Δp_{max} [kPa]
Data sheet	N4241							
 	VBF21.40 VBF21.50 VBF21.65 VBF21.80 VBF21.100 VBF21.125 VBF21.150	40 50 65 80 100 125 150	G 1/2B G 1 1/2B G 2B G 2 1/4B	25 40 63 100 160 550 820	30 30 – – – – –	30 30 – – – – –	– – 30 30 30 30 30	– – 30 30 30 30 30
PN 10	1...120 °C	DN	G [inch]	k_{vs} [m³/h]	Δp_{max} [kPa]	Δp_{max} [kPa]	Δp_{max} [kPa]	Δp_{max} [kPa]
Data sheet	N4233							
 	VBG31.20 VBG31.25 VBG31.32 VBG31.40	20 25 32 40	G 1 1/4B G 1 1/2B G 2B G 2 1/4B	6.3 10 16 25	30 30 30 30	30 30 30 30	– – – –	– – – –
PN 10	1...120 °C	DN	Rp [inch]	k_{vs} [m³/h]	Δp_{max} [kPa]	Δp_{max} [kPa]	Δp_{max} [kPa]	Δp_{max} [kPa]
Data sheet	N4232							
 	VBI31.20 VBI31.25 VBI31.32 VBI31.40	20 25 32 40	Rp 3/4 Rp 1 Rp 1 1/4 Rp 1 1/2	6.3 10 16 25	30 30 30 30	30 30 30 30	– – – –	– – – –
PN 10	1...120 °C	DN	Rp [inch]	k_{vs} [m³/h]	Δp_{max} [kPa]	Δp_{max} [kPa]	Δp_{max} [kPa]	Δp_{max} [kPa]
Data sheet	N4252							
 	VCI31.20 VCI31.25 VCI31.32 VCI31.40	20 25 32 40	Rp 3/4 Rp 1 Rp 1 1/4 Rp 1 1/2	6.3 10 16 25	30 30 30 30	30 30 30 30	– – – –	– – – –

¹⁾ Mounting sets ASK40, ASK41 for products of other manufacturers: mounting sets for SQK33.. for 3-port and 4-port slipper valves from AXA, BUDERUS, CENTRA, ESBE/SHUNT AB, LOELL, MUEHLENBERG, ONDAMIX and VIESSMANN. For additional details, see data sheet N4291.

Butterfly valves with rotary actuators

Typical applications	Actuators	Data sheet	Rotation angle		90°				
			Torque		5 Nm		10 Nm		
– Shutoff or control – For closed or open circuits	SQK.. SAL..	N4506 N4502							
	Operating voltage	AC 230 V	Positioning signal	Positioning time [s]					
			3-position	120		–		SQL31.00T10	
			3-position	125		SQL33.00		–	
		AC/DC 24 V	3-position	30		–		SAL31.03T10	
			3-position	120		–		SAL81.00T10	
			3-position	30		–		SAL81.03T10	
			0...10 V, 4...20 mA	120		–		SAL61.00T10	
			0...10 V, 4...20 mA	30		–		SAL61.03T10	
		Mounting set			ASK33		ASK33N		
PN 16	-10...120 °C		DN	k_{vs} [m³/h]		Δp_s [kPa]		Δp_s [kPa]	
Data sheet	N4131								
		VKF41.40	40	50	200		500		
		VKF41.50	50	80	–		500		
		VKF41.65	65	200	–		500		
		VKF41.80	80	400	–		500		
		VKF41.100	100	760	–		500		
		VKF41.125	125	1000	–		300		
		VKF41.150	150	2100	–		250		
		VKF41.200	200	4000	–		125		
Typical applications	Actuators	Data sheet	90°		20 Nm	40 Nm	100 Nm	400 Nm	1200 Nm
– Shutoff or control – For closed or open circuits	SAL.. SQL35../85.. SQL36..	N4502 N4505 N4505							
	Operating voltage	AC 230 V	Positioning signal	time [s]					
			3-position	6 ¹⁾	–	–	–	SQL36E65	–
			3-position	12 ¹⁾	–	–	–	SQL36E110	–
			3-position	24 ¹⁾	–	–	–	–	SQL36E160
			3-position	25	–	SQL36E50F04	SQL36E50F05	–	–
			3-position	120	SAL31.00T20	–	–	–	–
			3-position	125	–	SQL35.00	–	–	–
		AC 24 V	3-position	125	–	SQL85.00	–	–	–
			3-position	120	SAL81.00T20	–	–	–	–
		AC/DC 24 V	3-position	120	SAL61.00T20	–	–	–	–
		Mounting set		–	ASK35.2	–	–	–	–
PN 16	-10...120 °C	DN	k_{vs} [m³/h]	Δp_s [kPa]	Δp_s [kPa]	Δp_s [kPa]	Δp_s [kPa]	Δp_s [kPa]	Δp_s [kPa]
Data sheet	N4136								
		VKF46.40	40	50	1600	–	1600	–	–
		VKF46.50	50	85	1600	–	1600	–	–
		VKF46.65	65	215	1600	–	1600	–	–
		VKF46.80	80	420	–	1600	–	1600	–
		VKF46.100	100	800	–	1600	–	1600	–
		VKF46.125	125	1010	–	1000	–	1000	–
		VKF46.150	150	2100	–	–	–	1600	–
		VKF46.200	200	4000	–	–	–	1000	–
		VKF46.250	250	6400	–	–	–	–	1000
		VKF46.300	300	8500	–	–	–	–	1000
		VKF46.350	350	11500	–	–	–	–	600
		VKF46.400	400	14500	–	–	–	–	300
		VKF46.450	450	20500	–	–	–	–	300
		VKF46.500	500	21000	–	–	–	–	300
		VKF46.600	600	29300	–	–	–	–	300
PN 16	-10...120 °C	DN	k_{vs} [m³/h]	Δp_s [kPa]	Δp_s [kPa]	Δp_s [kPa]	Δp_s [kPa]	Δp_s [kPa]	Δp_s [kPa]
Data sheet	N4136								
		VKF46.350TS	350	11500	–	–	–	–	1000
		VKF46.400TS	400	14500	–	–	–	–	1000
		VKF46.450TS	450	20500	–	–	–	–	1000
		VKF46.500TS	500	21000	–	–	–	–	1000
		VKF46.600TS	600	29300	–	–	–	–	1000

¹⁾ With auxiliary module SEZ31.1 variable positioning time: SQL36E65: 30...180 s, SQL36E110: 60...360 s, SQL36E160: 120...720 s

Recommended maximum flow velocity:

VKF41..: < 4 m/s for water, see data sheet for details

VKF46..: 4.5 m/s for water, 60 m/s for gas

Refrigerant valves								
Typical applications		Valve	Operating voltage	Positioning signal			Auxiliary functions	
– Expansion, direct/indirect hot gas and hot gas distribution applications – Suction gas applications – Condensate mixing – Brine plants	M2FP03GX	AC 24 V	0...10 V, 4...20 mA, 0...20 Phs				–	
	MVL661..	AC/DC 24 V	0...10 V, 2...10 V, 0...20 mA, 4...20 mA				Minimum stroke setting	
	MVS661..N	AC/DC 24 V	0...10 V, 2...10 V, 0...20 mA, 4...20 mA				Minimum stroke setting	
	M3FB..LX..	AC 24 V	0...10 V, 4...20 mA, 0...20 Phs				–	
	M3FK..LX..	AC 24 V	0...10 V, 4...20 mA, 0...20 Phs				–	
PN 32	-40...100 °C			k_{vs} [m³/h]			Δp_{max} [kPa]	
Data sheet	N4731							
	M2FP03GX	Pilot valve		0.3			1800	
PS 45	-40...120 °C	DN	Connection	Inner Ø [inch]	k_{vs} [m³/h]	k_{vs} reduced [m³/h]	Δp_{max} [kPa]	
Data sheet	N4714							
	MVL661.15-0.4	15	Sleeve	5/8	0.4	0.25	2500	
	MVL661.15-1.0	15	Sleeve	5/8	1	0.63	2500	
	MVL661.20-2.5	20	Sleeve	7/8	2.5	1.6	2500	
	MVL661.25-6.3	25	Sleeve	1 1/8	6.3	4	2500	
	MVL661.32-12	32	Sleeve	1 3/8	12	7.6	200	
PS 53	-40...120 °C	DN	Connection	Inner Ø [mm]	Outer Ø [mm]	k_{vs} [m³/h]	k_{vs} reduced [m³/h]	Δp_{max} [kPa]
Data sheet	N4717							
	MVS661.25-016N	25	Weldable	22.4	33.7	0.16	0.1	2500
	MVS661.25-0.4N	25	Weldable	22.4	33.7	0.4	0.25	2500
	MVS661.25-1.0N	25	Weldable	22.4	33.7	1	0.63	2500
	MVS661.25-2.5N	25	Weldable	22.4	33.7	2.5	1.6	2500
	MVS661.25-6.3N	25	Weldable	22.4	33.7	6.3	4	2500
PN 32	-40...120 °C	DN	Connection	Inner Ø [inch]	k_{vs} [m³/h]		Liquid Δp_{max} [kPa]	Gas Δp_{max} [kPa]
Data sheet	N4722							
	M3FK15LX06	15	Sleeve	5/8	0.6		200	800
	M3FK15LX15	15	Sleeve	5/8	1.5		200	800
	M3FK15LX	15	Sleeve	5/8	3		200	800
	M3FK20LX	20	Sleeve	7/8	5		200	800
	M3FK25LX	25	Sleeve	1 1/8	8		200	800
	M3FK32LX	32	Sleeve	1 3/8	12		200	800
	M3FK40LX	40	Sleeve	1 5/8	20		200	800
	M3FK50LX	50	Sleeve	2 1/8	30		200	800
PS 43	-40...120 °C	DN	Connection	Inner Ø [inch]	k_{vs} [m³/h]		Δp_{max} [kPa]	
Data sheet	N4721							
	M3FB15LX06/A	15	Sleeve	5/8	0.6		2200	
	M3FB15LX15/A	15	Sleeve	5/8	1.5		2200	
	M3FB15LX/A	15	Sleeve	5/8	3		2200	
	M3FB20LX/A	20	Sleeve	7/8	5		1800	
	M3FB25LX/A	25	Sleeve	1 1/8	8		1200	
	M3FB32LX	32	Sleeve	1 3/8	12		800	

Definitions

Abbr.	Term	Unit	Definition
Δp	Differential pressure	kPa	Pressure differential between plant sections.
Δp_{\max}	Maximum differential pressure	kPa	Maximum permissible differential pressure across the valve's control path (when mixing), valid for the entire actuating range of the motorized valve.
$\Delta p_{\max V}$	Maximum differential pressure	kPa	Maximum permissible differential pressure across the valve's control path (when distributing), valid for the entire actuating range of the motorized valve.
Δp_{\min}	Minimum differential pressure	kPa	Minimum differential pressure required, so that the differential pressure regulator works reliably with combi valves. Δp_{\min} depends on presetting position, see data sheet for details.
Δp_{v0}		kPa	Maximum differential pressure across the valve's closed control path.
Δp_{V100}	Differential pressure at nominal flow rate	kPa	Differential pressure across the fully open valve and the valve's control path by a volumetric flow V_{100} .
Δp_s	Closing pressure	kPa	For 2-port valves, maximum permissible differential pressure at which the motorized valve will close securely against the pressure (close off pressure). Only valid for 2-port valves.
Δp_{MV}		kPa	Differential pressure across the variable flow path. Often Δp_{MV} is not known, in which case typical values can be used.
Δp_{VR}		kPa	Differential pressure between flow and return.
ΔT	Temperature spread	K	Temperature differential between flow and return.
DN	Nominal size		Characteristic for matching parts of the piping system.
H_0	Shutoff head	m	The head generated by a pump at closed value, at a given speed and a given pump medium.
kPa	Unit of pressure	kPa	100 kPa = 1 bar = 10 mWC
mWC	Meter water column	m	
k_v	Nominal flow	m^3/h	Amount of cold water (5...30 °C) passing through the valve at the respective stroke and at a differential pressure of 100 kPa (1 bar).
k_{vs}	Nominal flow rate	m^3/h	Nominal flow rate of cold water (5...30 °C) through the fully open valve (H_{100}) at a differential pressure of 100 kPa (1 bar).
	Spring return function		Shutoff in the event of a power failure.
PN	PN class		Characteristic relating to the combination of mechanical and dimensional properties of a component in the piping system.
Phs	Phase cut control signal	V	DC 0...20 V Phs
P_v	Valve authority		Ratio of differential pressure across fully open valve (H_{100}) and differential pressure across valve and variable flow path. To ensure correct control, a minimum valve authority of 0.25 is required.
Q_{100}	Rated capacity	kW	Plant's design capacity.
V_{100}	Volumetric flow	m^3/h	Volumetric flow with valve fully open (H_{100}).
V_{\min}	Minimum volumetric flow	m^3/h	Smallest presetable volumetric flow through the fully open combi valve (H_{100}).
ν	Kinematic viscosity	mm^2/s	In the case of kinematic viscosities ν up to 10 mm^2/s , no corrections are required. For the selection of actuating devices for kinematic viscosities ν above 10 mm^2/s , please contact your local Siemens branch office.
c	Specific heat capacity	kJ/kgK	
ρ	Specific density	kg/m^3	

Symbols

	3-port valve, control path with equal-percentage valve characteristic, bypass with linear valve characteristic.
	3-port valve, control path with equal-percentage valve characteristic, bypass with linear valve characteristic with 70% of the k_{vs} value. This compensates for the flow resistance of the heat exchanger, so that the total volumetric flow V_{100} remains as constant as possible.
	2-port valve, control path with equal-percentage valve characteristic.
	2-port valve, control path with linear valve characteristic.
	3-port, control path and bypass with linear valve characteristic. Bypass with 70% of the k_{vs} value. This compensates for the flow resistance of the heat exchanger, so that the total flow amount V_{100} remains as constant as possible.
	3-port valve, control path and bypass with linear valve characteristic.
	3-port valve, control path and bypass with equal-percentage valve characteristic.

Valve sizing and actuator selection

Basic hydraulic circuit

1	Determine the type of hydraulic circuit	Throttling circuit	Injection circuit with 2-port valve	Diverting circuit	Injection circuit with 3-port valve	Mixing circuit	Mixing circuit with fixed premixing
	For valve sizing relevant variable flow path					Primary pump ✓ Primary pump ✗	Primary pump ✓ Primary pump ✗

HVAC plants and consumers

Heating

Surface/floor heating	-	■	-	outdated	-	-	■	■
Heating plant (primary)	-	■	■	outdated	■	■	■	■
Zone control, heating	-	■	-	outdated	-	-	-	-
Heating group	-	■	-	-	■	■	■	■
Generation of heat energy	-	-	-	-	■	-	-	■
Heat exchanger water-water	■	uncommon	uncommon	uncommon	uncommon	-	-	-

Ventilation and air conditioning plants

Air handling unit (AHU)	■	■	■	outdated	■	■	-	-
Fan coil unit	■	-	■	outdated	-	-	-	-
Cooling coil	dehumidifying	-	dehumidifying	uncommon	-	-	-	-
Reheating coil	■	■	outdated	outdated	uncommon	uncommon	uncommon	uncommon
Preheating coil	-	■	-	outdated	uncommon	uncommon	uncommon	uncommon
VAV	■	-	■	outdated	-	-	-	-
Zone control	■	-	■	outdated	-	-	-	-

Chiller plants

Surface/floor cooling	-	■	-	outdated	-	-	-	-
Generation of cooling energy	-	-	-	-	-	■	-	■
Cooling towers	■	-	■	uncommon	-	-	-	-
Zone control, cooling	-	■	-	outdated	-	-	-	-

District heating and cooling

District heating, primary	■	uncommon	-	-	-	uncommon	-	uncommon
District heating, secondary	■	■	-	-	-	uncommon	-	uncommon
District cooling, primary	■	uncommon	-	-	-	uncommon	-	uncommon
District cooling, secondary	■	■	-	-	-	uncommon	-	uncommon

Domestic hot water (DHW)

DHW	-	■	-	-	-	■	-	-
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Header

Differential pressure header	pressurized				pressureless			
Volumetric flow	variable		constant		variable			

Determination of k_{vs} value

2	Δp_{VR} or Δp_{MV}	Δp_{VR}	Δp_{MV}					
	typical range	10...200 kPa	10...200 kPa	10...50 kPa	2...5 kPa	2...5 kPa	5...15 kPa	2...5 kPa
	typical value	Use effective Δp_{VR} value						8 kPa
3	Determine Δp_{V100}	$\Delta p_{V100} \geq \frac{\Delta p_{VR}}{2}$	$\Delta p_{V100} > \Delta p_{MV}$					
4	Calculate V_{100}	Water without anti-freeze $V_{100} = \frac{Q_{100}}{1.163 \cdot \Delta T}$	Water with anti-freeze $V_{100} = \frac{Q_{100} \cdot 3600}{c \cdot \rho \cdot \Delta T}$					
5	Determine k_{vs} value	$k_v = \frac{V_{100}}{\sqrt{\frac{\Delta p_{V100}}{100}}} \Rightarrow k_{vs} \geq 0.85 \cdot k_v$ value						
6	Check resulting Δp_{V100}	$\Delta p_{V100} = 100 \cdot \left(\frac{V_{100}}{k_{vs}} \right)^2$						

Selection of valve and actuator

7	Select suitable valve series	a) Type of valve (2-port, 3-port, 3-port with bypass) b) Connections (flanged, threaded, soldered)	c) PN class d) Nominal size DN	e) Max./min. medium temperature f) Medium
8	Check valve authority P_v (control stability)	$P_v = \frac{\Delta p_{V100}}{\Delta p_{VR}} \geq 0.25...0.8$	$P_v = \frac{\Delta p_{V100}}{\Delta p_{V100} + \Delta p_{MV}} \geq 0.25...0.8$	
9	Select actuator	a) Operating voltage b) Positioning signal	c) Positioning time d) Spring return function	e) Auxiliary functions
10	Check working range	a) Differential pressure $\Delta p_{max} > \Delta p_{vo}$	b) Closing pressure $\Delta p_s > H_0$	
11	Selection	Valve and suitable actuator		

Size and select combi valves

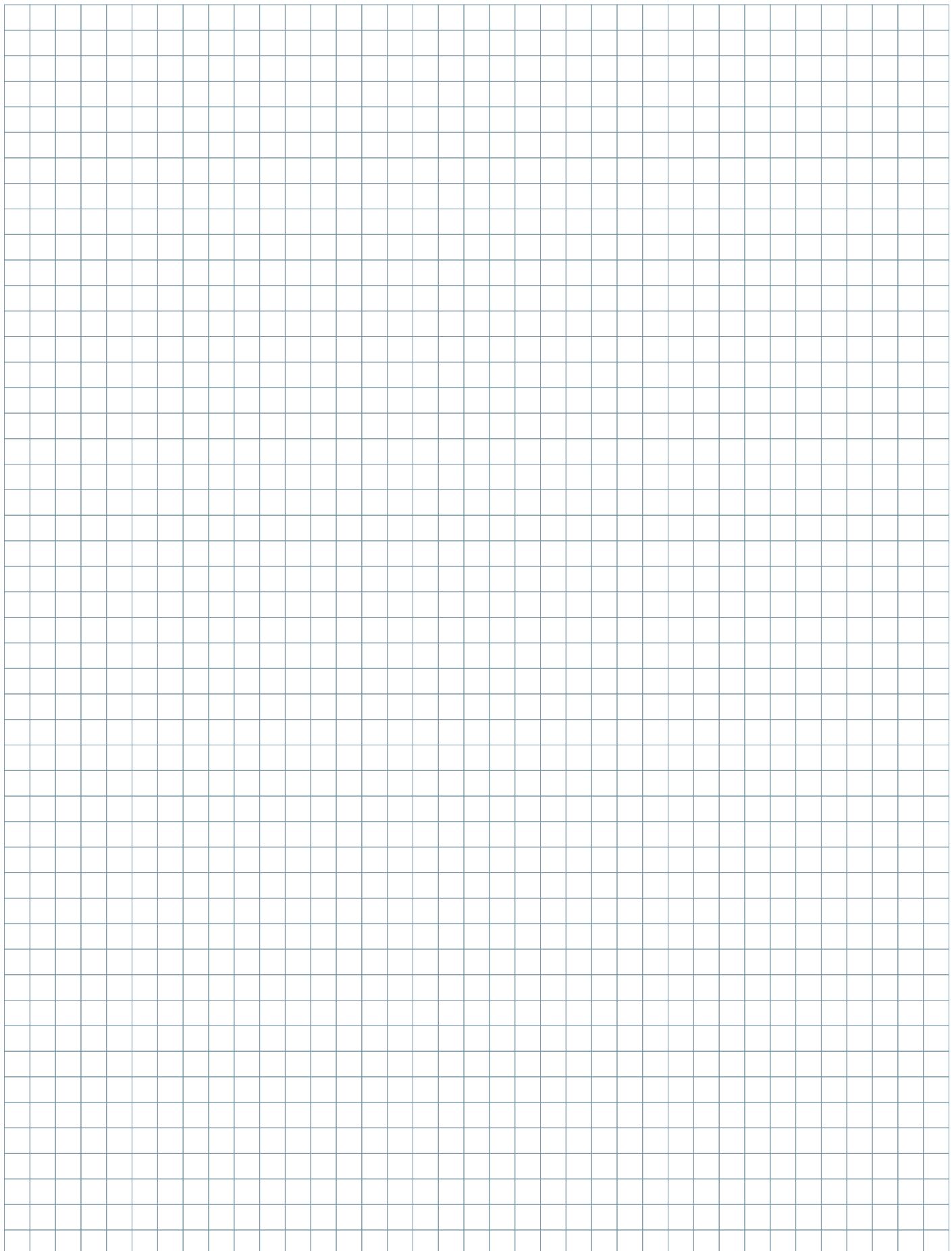
Determine volumetric flow V

1	Determine Q_{100}	Q_{100}
2	Determine ΔT	ΔT
3	Calculate V	Water without anti-freeze $V_{100} = \frac{Q_{100}}{1.163 \cdot \Delta T}$ Water with anti-freeze $V_{100} = \frac{Q_{100} \cdot 3600}{c \cdot \rho \cdot \Delta T}$

Select combi valve and actuator

4	Select suitable combi valve	a) Type of valve (with/without P/T plugs) ¹⁾ d) Connection (flanged, threaded)	b) PN class e) Nominal size DN	c) Max./min. medium temperature f) Medium	
5	Determine presetting	Determine presetting using the volumetric flow/dial table in data sheet of the respective combi valve			
6	Select actuator	a) Operating voltage b) Positioning signal c) Positioning time d) Auxiliary functions			
7	Check working range	a) $\Delta p < \Delta p_{max}$ – maximum permissible differential pressure across the valve's control path, valid for the entire actuating range of the motorized valve b) $\Delta p > \Delta p_{min}$ – minimum differential pressure required across the valve's control path, so that the differential pressure regulator works reliably			
8	Select actuator	Combi valve and suitable actuator			

Notes



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The information in this document contains general descriptions of technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.

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