

## Application

Solenoid valve for controlling pneumatic linear actuators with NAMUR rib according to IEC 60534 or pneumatic rotary actuators with NAMUR interface according to VDI/VDE 3845

Ex certified 

Intrinsically safe, low-power binary signals issued by automation equipment or fieldbus systems can be used for controlling purposes. Different nominal signals and connection types allow the solenoid valve to be optimally adapted for the specific task.

## Special features

- High level of operational reliability due to the flapper/nozzle assembly and booster valve with a seat and plug
- Standard version for nominal signals 6, 12, 24 V DC
- Type of protection: intrinsic safety Ex ia and non-sparking Ex nA
- Certification according to ATEX, IECEx, and EAC (GOST)
- Power consumption: 6 to 27 mW
- Electrical connection using M16 x 1.5 cable gland
- Corrosion-resistant enclosure with degree of protection IP 65
- Supply air 1.4 to 10 bar
- Ambient temperature  $-45$  to  $+80$  °C, depending on type of protection, temperature class and seals
- Use with safety shut-off valves, certification for safety-instrumented systems according to IEC 61508 (SIL, optional)

## Version

- 3/2-way solenoid valve with  $K_{VS}$  0.32 and NAMUR interface according to VDI/VDE 3845 and VDI/VDE 3847
- Attachment to linear actuators with NAMUR rib or to rotary actuators with NAMUR interface
- Restrictor plate with exhaust air or supply restrictor (optional)
- 3/2-way booster valve with  $K_{VS}$  2.0 and 4.3 and NAMUR interface according to VDI/VDE 3845 (optional)
- Aluminum or stainless steel

## Versions



Version with  $K_{VS}$  0.32



Version with  $K_{VS}$  2.0



Version with  $K_{VS}$  4.3

Fig. 1: Type 3967 Solenoid Valve

## Solenoid valve version

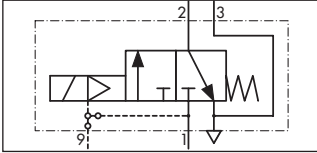
K<sub>VS</sub> 0.32



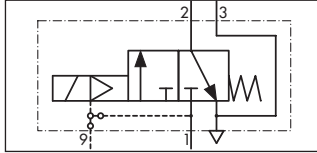
K<sub>VS</sub> 2.0



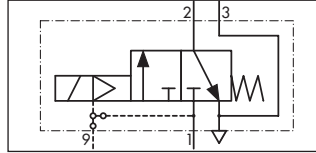
K<sub>VS</sub> 4.3



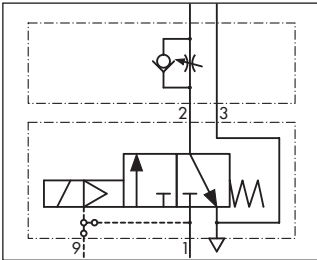
- 3/2-way function
- NAMUR interface 1/4



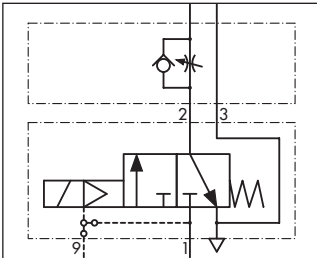
- 3/2-way function
- NAMUR interface 1/4



- 3/2-way function
- NAMUR interface 1/2



- 3/2-way function
- NAMUR interface 1/4
- Exhaust air restrictor plate



- 3/2-way function
- NAMUR interface 1/4
- Supply air restrictor plate

## Function

The solenoid valve consists of an electropneumatic binary converter with manual override and integrated booster valve actuated on one side with return spring.

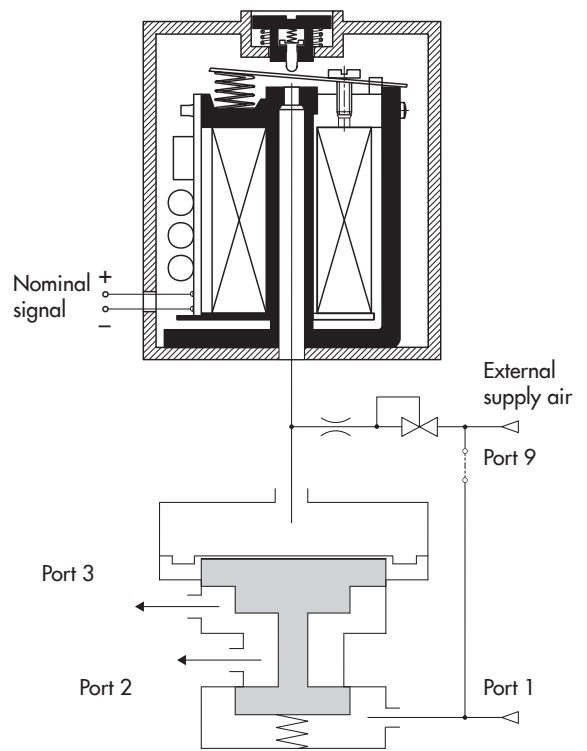
The air supply for the electropneumatic binary converter is routed internally over port 1 or externally over port 9. By turning a gasket, the supply air routing is changed (see Mounting and Operating Instructions ► EB 3967).

The pressure reducer reduces the supply air pressure to 1.4 bar.

In the idle position, the flapper is lifted off the outlet nozzle by the spring. As a result, a pressure lower than the deactivation pressure of the integrated booster valve builds up in the pressure divider, which consists of the restrictor and outlet nozzle. When the solenoid coil is energized by an electric binary signal, the outlet nozzle is closed by the flapper against the force of the spring. This causes the pressure in the pressure divider to rise above the activation pressure of the integrated booster valve and switches it to the operating position. After the solenoid coil is de-energized, the integrated booster valve is switched to the idle position again by a return spring.

Optionally, the solenoid valve can be upgraded to become a pneumatic booster valve actuated on one side. This results in higher  $K_{VS}$  coefficients (see Data Sheet ► T 3756).

## Functional diagram



**Fig. 2:** Solenoid valve with seat/plug switching element as a booster valve ( $K_{VS}$  0.32)

## Technical data

General data		
Design	Solenoid with flapper/nozzle assembly and plug/seat valve with return spring	
Degree of protection	IP 65 with filter check valve	
Compliance	<b>CE ENEC</b>	
Material	Enclosure	Polyamide PA 6-3-T-GF35, black
	Connecting plate	AlMgSiPb, powder coated, black, or stainless steel 1.4404
	Adapter plate	AlMgSiPb, powder coated, gray beige RAL 1019, or stainless steel 1.4404
	Screws	Stainless steel A2-70
	Springs	Stainless steel 1.4310
	Seals	Silicone rubber
Ambient temperature	See Electric data	
Mounting position	Any desired position	

Electric data					
Nominal signal	$U_N$	6 V DC	12 V DC	24 V DC	
	$U_{max}$	27 V	40 V	60 V	
Switching point	ON	$U_{80\text{ }^\circ\text{C}}$	$\geq 4.8\text{ V}$	$\geq 9.6\text{ V}$	$\geq 18\text{ V}$
		$I_{20\text{ }^\circ\text{C}}$	$\geq 1.41\text{ mA}$	$\geq 1.52\text{ mA}$	$\geq 1.57\text{ mA}$
		$P_{20\text{ }^\circ\text{C}}$	$\geq 5.47\text{ mW}$	$\geq 13.05\text{ mW}$	$\geq 26.71\text{ mW}$
	OFF	$U_{-25\text{ }^\circ\text{C}}$	$\leq 1.0\text{ V}$	$\leq 2.3\text{ V}$	$\leq 4.6\text{ V}$
		Input impedance $R_{20\text{ }^\circ\text{C}}$	2.6 k $\Omega$	5.3 k $\Omega$	10.5 k $\Omega$
		Temperature influence	0.4 %/ $^\circ\text{C}$	0.2 %/ $^\circ\text{C}$	0.1 %/ $^\circ\text{C}$
Type of protection <sup>1)</sup>	Intrinsic safety: II 2G Ex ia IIC T6 / II 2D Ex tD A21 IP65 T80 $^\circ\text{C}$				
	Non-sparking: II 3G Ex nA IIC T6 / II 3D Ex tD A21 IP65 T80 $^\circ\text{C}$				
Output voltage <sup>2)</sup>	$U_i$ (V)	25 · 27 · 28 · 30 · 32			
Output current <sup>2)</sup>	$I_i$ (mA)	150 · 125 · 115 · 100 · 85			
Power dissipation <sup>2)</sup>	$P_i$ (mW)	250	No restrictions		
Outer inductance <sup>2)</sup>	$L_i$	Negligibly small			
Outer capacitance <sup>2)</sup>	$C_i$	Negligibly small			
Ambient temperature <sup>3)</sup>	-45 to +60 $^\circ\text{C}$ (temperature class T6)				
	-45 to +70 $^\circ\text{C}$ (temperature class T5)				
	-45 to +80 $^\circ\text{C}$ (temperature class T4)				
Connection	Screw terminal, 2-pole, with cable gland M16 x 1.5				

Pneumatic data for solenoid valve with $K_{VS}$ 0.32, actuated on one side		
Switching function	3/2-way function	
$K_{VS}$ <sup>4)</sup>	0.32	
Safety approval	SIL <sup>5)</sup>	
Compressed air quality according to ISO 8573-1	Max. particle size and density: Class 4 · Oil content: Class 3 · Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected	
Supply air	Medium	Instrument air, free from corrosive substances and nitrogen
	Pressure <sup>6)</sup>	1.4 to 10 bar
Operating medium	Instrument air, free from corrosive substances and nitrogen	
Operating pressure	Max. 10 bar	
Air consumption	$\leq 80\text{ l}_n/\text{h}$ at 1.4 bar supply air in neutral position	
	$\leq 25\text{ l}_n/\text{h}$ at 1.4 bar supply air in operating position	
Switching time	$\leq 65\text{ ms}$	
Connection	G 1/4 or 1/4 NPT and NAMUR interface 1/4 <sup>7)</sup>	
Weight	0.45 kg,	
	1.9 kg (with adapter plate)	

<sup>1)</sup> According to EC type examination certificate and statement of conformity

<sup>2)</sup> Permissible maximum values when connected to a certified intrinsically safe circuit.

<sup>3)</sup> The maximum permissible ambient temperature depends on the permissible ambient temperature of the components, type of protection, and temperature class.

<sup>4)</sup> The air flow rate when  $p_1 = 2.4\text{ bar}$  and  $p_2 = 1.0\text{ bar}$  is calculated using the following formula:

$$Q = K_{VS} \times 36.22\text{ in m}^3/\text{h}.$$

<sup>5)</sup> SIL according to IEC 61508

<sup>6)</sup> When using the solenoid valve with an operating pressure of 10 bar, a minimum supply pressure of 1.9 bar is required.

<sup>7)</sup> NAMUR interface according to VDI/VDE 3845 and VDI/VDE 3847

## Technical data

Booster valve with NAMUR interface, $K_{VS}$ 2.0 or 4.3, actuated on one side		
Switching function	3/2-way function	
$K_{VS}$ <sup>1)</sup> (direction of flow)	1.1 (4»3) 2.0 (3»5)	1.9 (4»3) 4.3 (3»5)
Safety approval	SIL <sup>2)</sup>	
Type	Poppet valve with diaphragm actuator, soft seated, with return spring	
Material	Enclosure	Aluminum, powder coated, gray beige RAL 1019, or stainless steel 1.4404
	Diaphragms	Chloroprene rubber (-20 to +80 °C) or silicone rubber (-45 to +80 °C)
	Seals	Chloroprene rubber (-20 to +80 °C) or silicone rubber (-45 to +80 °C)
	Screws	Stainless steel 1.4571
	Springs	Stainless steel 1.4310
Operating medium	Instrument air (free from corrosive substances) or nitrogen, air containing oil or non-corrosive gases	
Compressed air quality according to ISO 8573-1	Max. particle size and density: Class 4 · Oil content: Class 3 · Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected	
Control	Type 3967 Solenoid Valve	
Supply air	1.4 to 6 bar	
Max. operating pressure	10.0 bar	
Ambient temperature <sup>3)</sup>	-20 to +80 °C -45 to +80 °C	
Connec- tion	Supply air	G ¼ or ¼ NPT and NAMUR interface ¼ <sup>4)</sup> with G ¾ / ¾ NPT
	Exhaust air	G ½ or ½ NPT and NAMUR interface ½ <sup>4)</sup> with G ¾ / ¾ NPT
Approx. weight	1.38 kg	
	1.5 kg	

<sup>1)</sup> The air flow rate when  $p_1 = 2.4$  bar and  $p_2 = 1.0$  bar is calculated using the following formula:

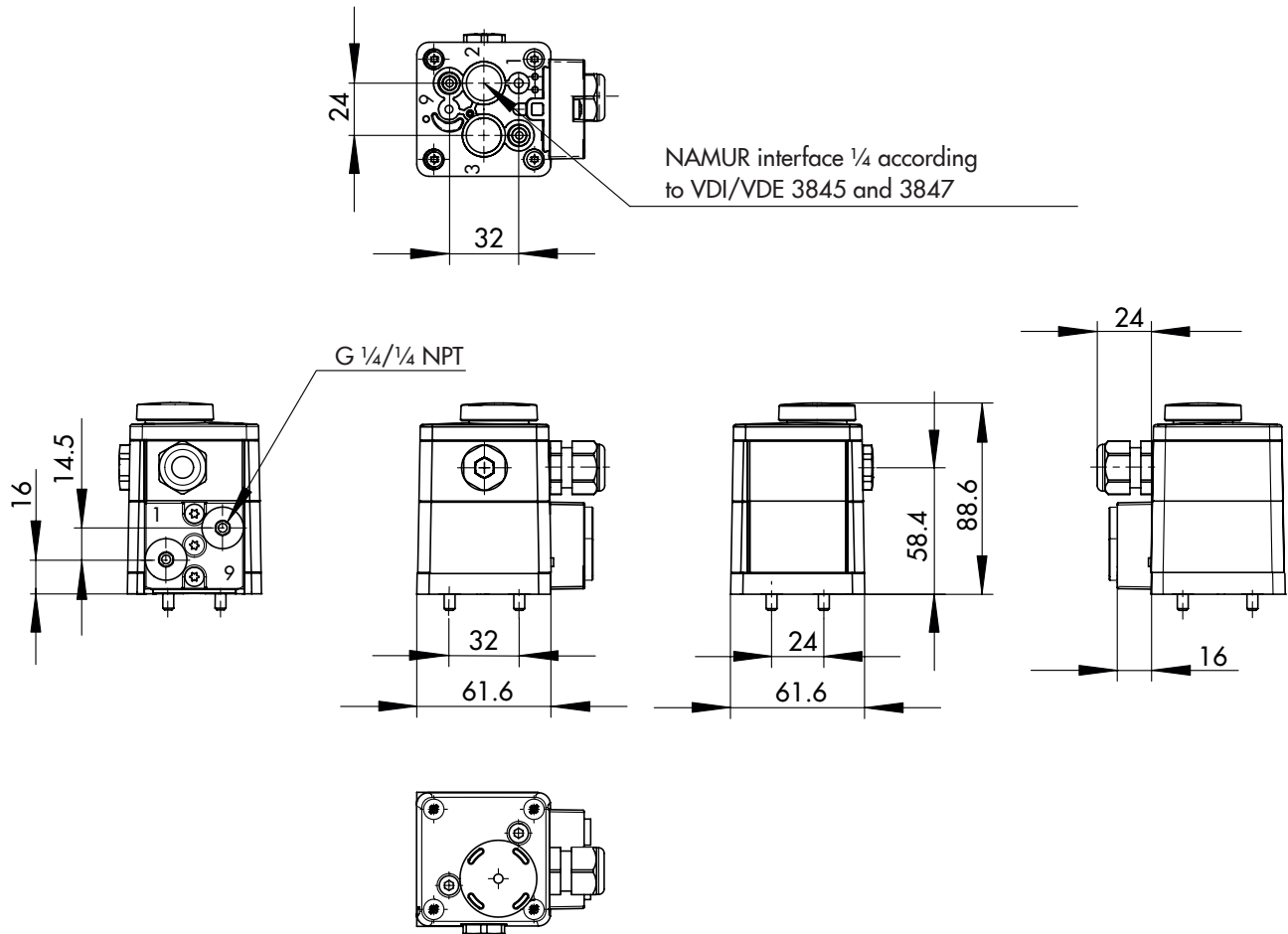
$$Q = K_{VS} \times 36.22 \text{ in m}^3/\text{h.}$$

<sup>2)</sup> SIL according to IEC 61508

<sup>3)</sup> The maximum permissible ambient temperature depends on the permissible ambient temperature of the components, type of protection, and temperature class.

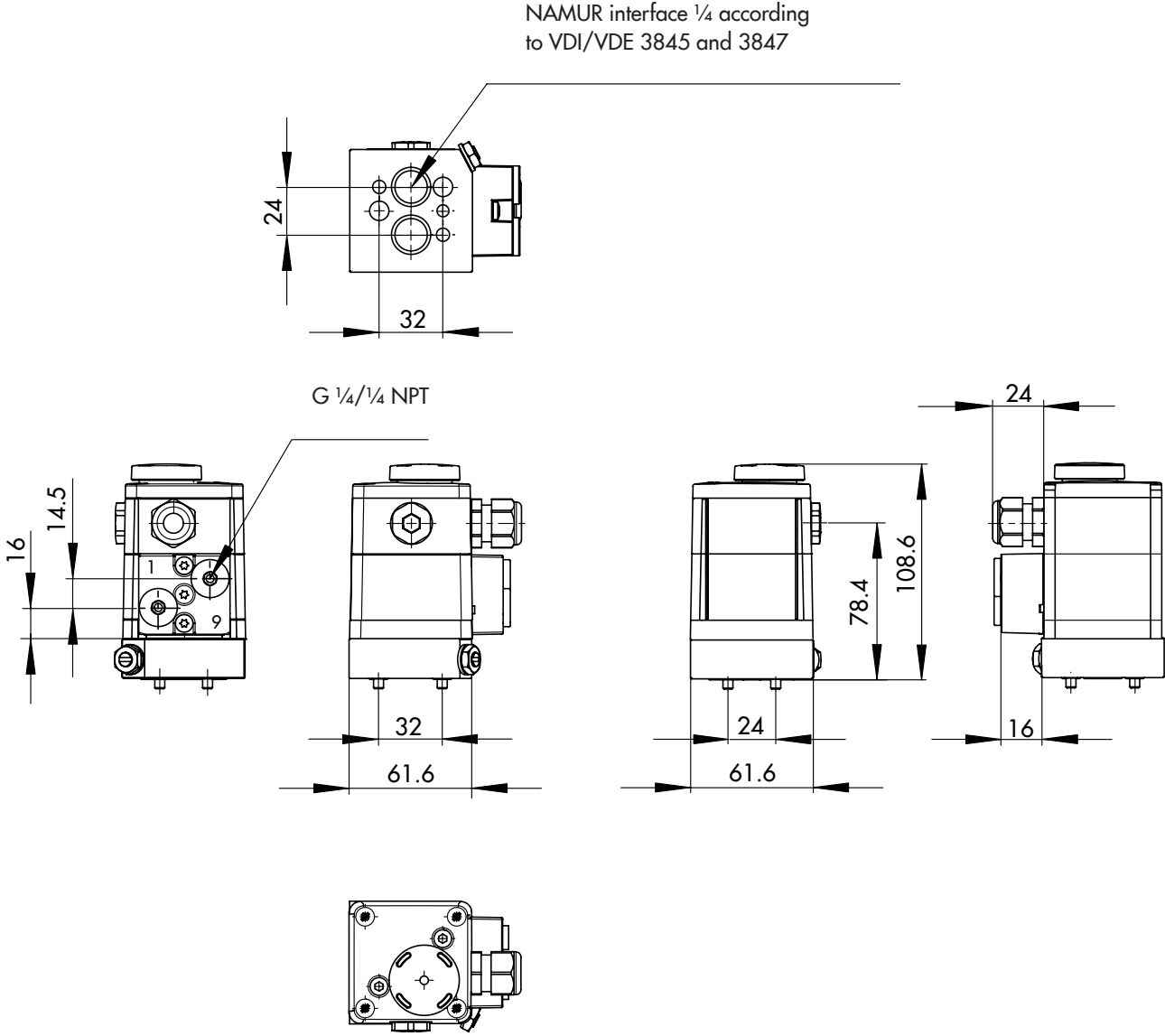
<sup>4)</sup> NAMUR interface according to VDI/VDE 3845

Version with NAMUR interface  $\frac{1}{4}$  according to VDI/VDE 3845 and direct attachment according to VDI/VDE 3847

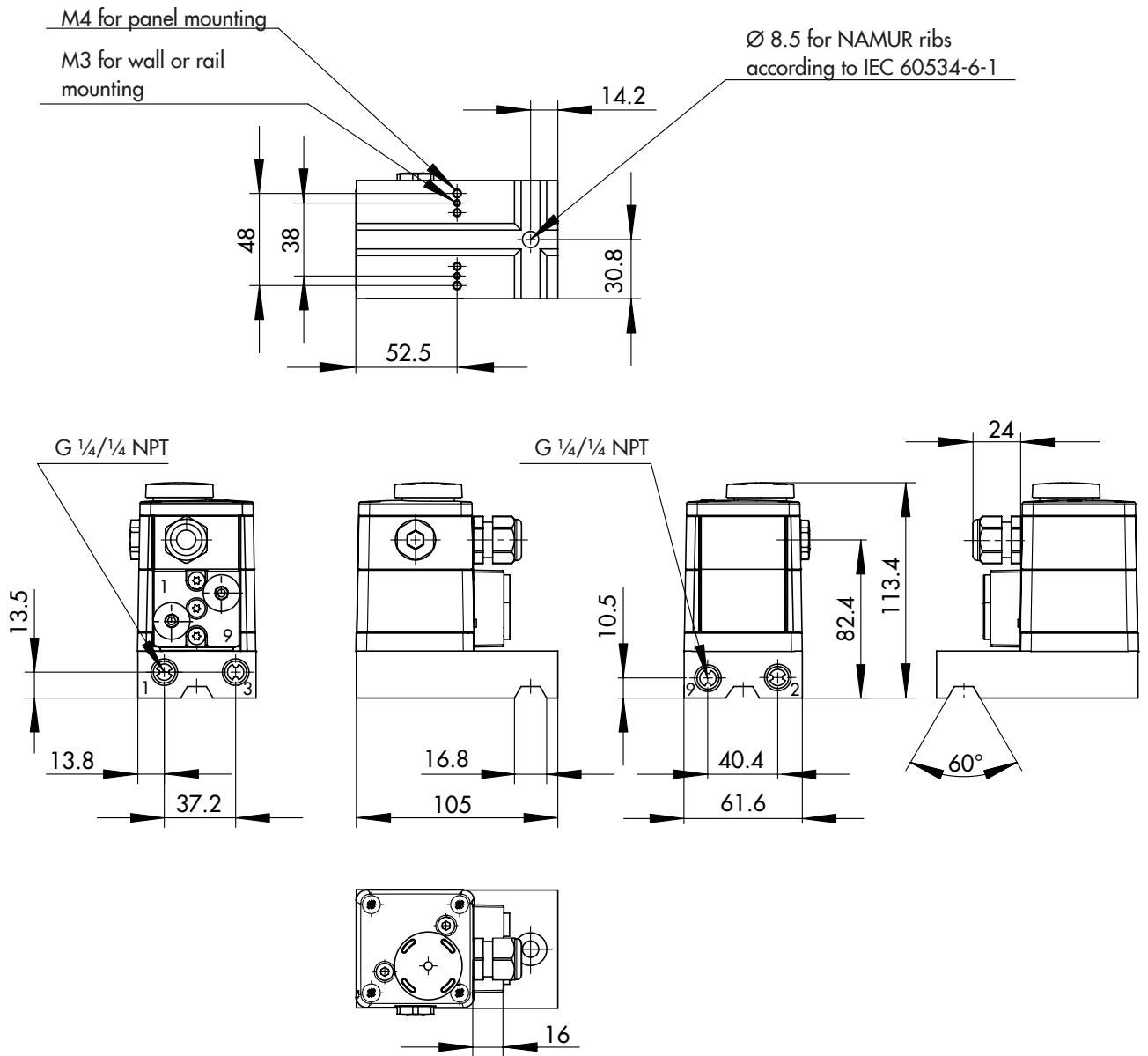


Dimensions (in mm)

Version with NAMUR interface 1/4 according to VDI/VDE 3845 and direct attachment according to VDI/VDE 3847 and restrictor plate



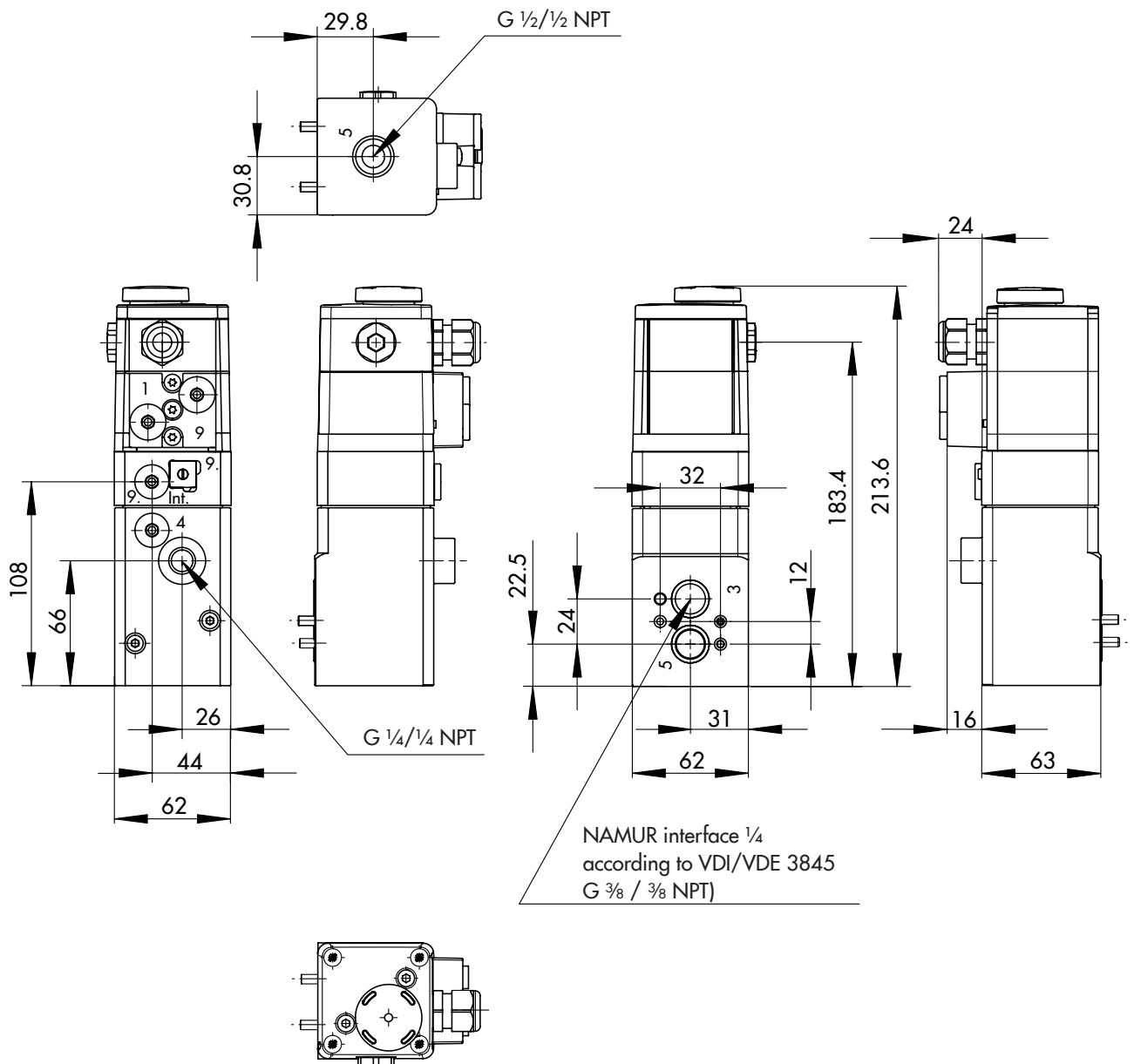
Version with adapter plate for linear actuators with NAMUR rib according to IEC 60531-6-1



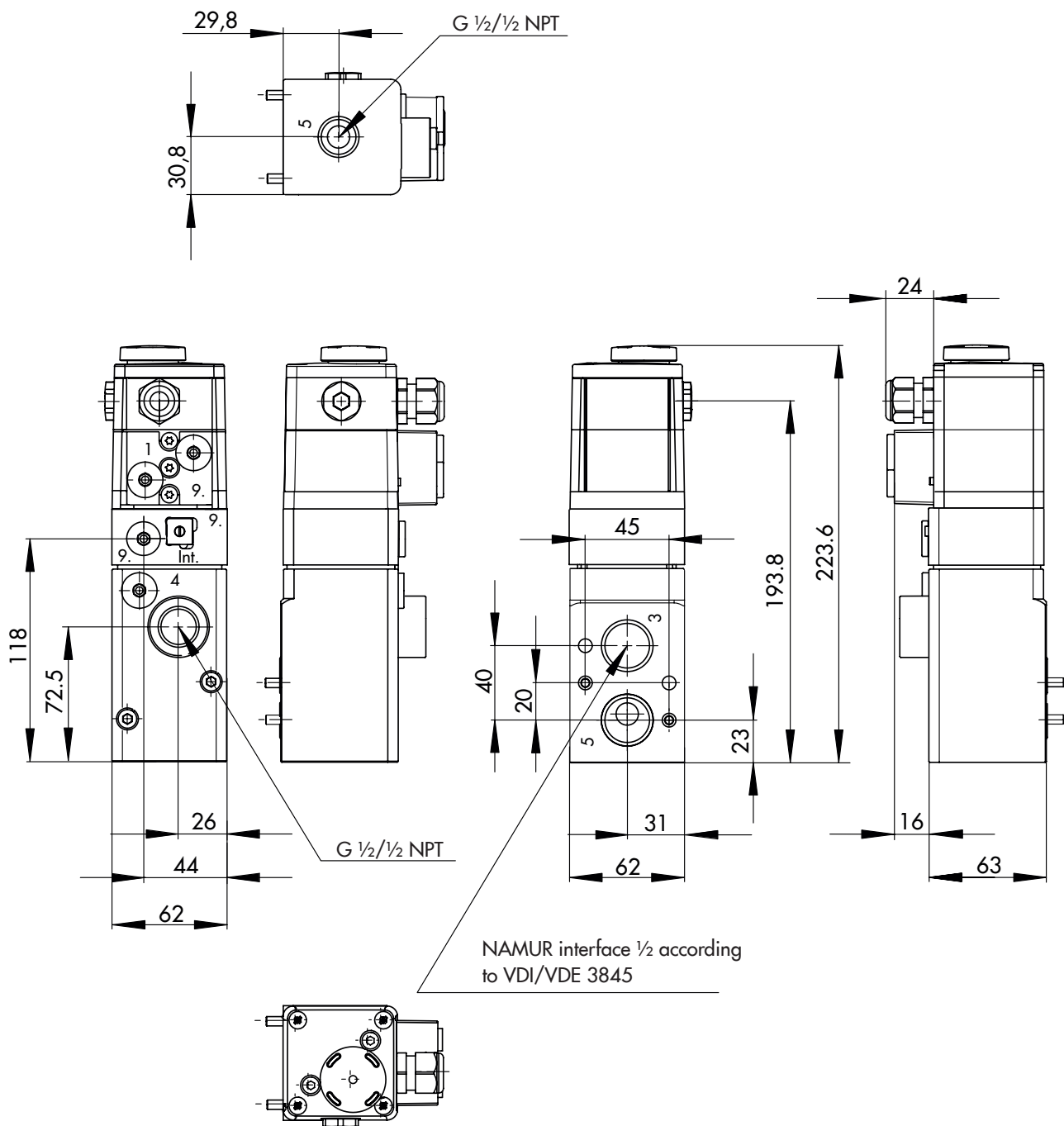


Dimensions (in mm)

Version with booster valve (K<sub>VS</sub> 2.0)



Version with booster valve (K<sub>vs</sub> 4.3)









Solenoid valve	Type 3967-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<b>Supply air</b>																						
Internal air supply for actuators for on/off service	0																					
External air supply for actuators for throttling service	1																					
<b>Electrical connection</b>																						
Without cable gland	0	0																				
Cable gland M16 x 1.5 made of black polyamide	0	1																				
M16 x 1.5 cable gland made of blue polyamide	1	1																				
Cable gland M16 x 1.5 made of black polyamide (Ex e, CEAG)	1	3																				
Cable gland M16 x 1.5, nickel-plated brass	1	4																				
Cable gland M16x1.5, brass, blue	1	5																				
<b>Degree of protection</b>																						
IP 65																						0
<b>Ambient temperature<sup>2)</sup></b>																						
-20 to +80 °C																						0
-45 to +80 °C																						1
<b>Fail-safe action</b>																						
Without																						0
SIL <sup>3)</sup>																						1
<b>Special version</b>																						
Without																						0 0 0
With exhaust air restrictor plate																						0 0 1
With supply air restrictor plate																						0 0 2
With exhaust air and supply air restrictor plates																						0 0 3

<sup>2)</sup> The maximum permissible ambient temperature depends on the permissible ambient temperature of the components, type of protection, and temperature class.

<sup>3)</sup> SIL according to IEC 61508

### Summary of explosion protection approvals

Type	Certification	No.	Date	Type of protection/comments
3967	SIL	No.	V 60.09/14 rev. 01	Certification for safety-instrumented systems according to IEC 61508
		Date	2015-02-10	
3967-1	 EC type examination certificate	No.	PTB 06 ATEX 2027	II 2G Ex ia IIC T6 II 2D Ex tb IIIC T80°C IP65
		Date	2007-11-16	
		No.	IECEX PTB 08.0036	Ex ia IIC T6 Ex tD A21 IP65 T80°C
		No.	RU C-DE08.B.00115	0Ex ia IIC T6/T5/T4 Ga Ex tb IIIC T80°C Db
		Date	2013-11-15	
3967-8	 EC type examination certificate	No.	PTB 06 ATEX 2028 X	II 3G Ex nA II T6 II 3G Ex ic IIC T6 II 3D Ex tc IIIC T80°C IP65
		Date	2008-01-09	
		No.	IECEX PTB 08.0038X	Ex nA II T6 Ex nL IIC T6 Ex tD A22 IP65 T80°
		No.	RU C-DE08.B.00115	2Ex nA IIC T6/T5/T4 Gc X 2Ex ic IIC T6/T5/T4 Gc X Ex tc IIIC T80°C Dc X
		Date	2013-11-15	

## Accessories and spare parts

Spare parts	
Order no.	Designation
1089-1527	Enclosure cover with pushbutton
1089-1528	Enclosure cover with switch
1099-6236	Enclosure cover
0430-1941	Gasket (for enclosure cover)
0070-0858	Blanking plug G ¼, stainless steel 1.4571 (for threaded connections)
0070-0862	Blanking plug ¼ NPT, stainless steel 1.4571 (for threaded connections)
8421-0070	O-ring 14 x 1.5 made of nitrile butadiene rubber (for blanking plug)
0430-1884	Turnable gasket (for connecting plate)
8336-1108	Screw DIN 7964, 5 x 20 (for connecting plate)
0550-0213	Filter ¼ (for connecting plate)
0430-1883	Formed seal (for NAMUR interface ¼, K <sub>VS</sub> 0.32)
8421-0364	O-ring 16 x 2, -20 to +80 °C (for booster valves with NAMUR interface ¼, K <sub>VS</sub> 2.0)
8421-0368	O-ring 16 x 2, -45 to +80 °C (for booster valves with NAMUR interface ¼, K <sub>VS</sub> 2.0)
8421-1077	O-ring 24 x 2, -20 to +80 °C (for booster valves with NAMUR interface ½, K <sub>VS</sub> 4.3)
8421-0425	O-ring 24 x 2, -45 to +80 °C (for booster valves with NAMUR interface ½, K <sub>VS</sub> 4.3)
8333-1303	Screw M5 x 60 A4 (for booster valves with NAMUR interface, K <sub>VS</sub> 2.0)
8392-0651	Spring washer A5-A4 (for booster valves with NAMUR interface, K <sub>VS</sub> 2.0)
8333-0538	Screw M5 x 60 A4 (for booster valves with NAMUR interface, K <sub>VS</sub> 4.3)
8392-0658	Spring washer A5-A4 (for booster valves with NAMUR interface, K <sub>VS</sub> 4.3)

Accessories	
Order no.	Designation
8808-1010	Cable gland M16 x 1.5 made of black polyamide, 5 to 10 mm cable diameter
8808-2007	Cable gland M16 x 1.5 made of black polyamide, 5.5 to 10 mm cable diameter (Ex e, CEAG)
8808-2008	Cable gland M16 x 1.5 made of blue polyamide, 4 to 8 mm cable diameter
8808-2009	Cable gland M16 x 1.5, nickel-plated brass, 4 to 8 mm cable diameter
1991-6471	Cable gland M16 x 1.5, brass, blue, 4 to 8 mm cable diameter
8808-2011	Extension cable gland M16 x 1.5 on M20, black polyamide, 5.5 to 13 mm cable diameter (-20 to +70 °C) (Ex e)
8808-1024	Blanking plug M16 x 1.5, black polyamide (for cable entry)
8421-0070	O-ring 14 x 1.5 made of nitrile butadiene rubber (for cable gland and blanking plug)
1402-1378	Cover for start-up

## Accessories and spare parts

Accessories for K <sub>VS</sub> 0.32	
Order no.	Designation
	Adapter plate for NAMUR rib according to IEC 60534-6-1, panel, wall or rail mounting, including fastening screw
1400-9598	Aluminum, powder coated, gray beige RAL 1019, G ¼ connection
1400-9599	Aluminum, powder coated, gray beige RAL 1019, ¼ NPT connection
1400-9600	Stainless steel 1.4404, G ¼ connection
1400-9601	Stainless steel 1.4404, ¼ NPT connection
	Mounting base according to EN 60715
1400-5930	G-profile rail 32 (2 pcs. required)
1400-5931	For 35 mm top-hat rail mounting (2 pcs. required)
1400-6726	Mounting plate for wall mounting including fastening screws
	Restrictor plate
1400-9602	With exhaust air restrictor, K <sub>VS</sub> 0.01 to 0.28, adjustable; made of aluminum, powder coated, gray beige RAL 1019
1402-0141	With exhaust air restrictor, K <sub>VS</sub> 0.01 to 0.28, adjustable; made of aluminum, powder coated, gray beige RAL 1019, <b>SIL</b>
1402-0137	With exhaust air restrictor, K <sub>VS</sub> 0.01 to 0.28, adjustable; made of stainless steel 1.4404
1402-0142	With exhaust air restrictor, K <sub>VS</sub> 0.01 to 0.28, adjustable; made of stainless steel 1.4404, <b>SIL</b>
1400-9603	With supply air restrictor, K <sub>VS</sub> 0.01 to 0.28, adjustable; made of aluminum, powder coated, gray beige RAL 1019
1402-0139	With supply air restrictor, K <sub>VS</sub> 0.01 to 0.28, adjustable; made of aluminum, powder coated, gray beige RAL 1019, <b>SIL</b>
1402-0136	With supply air restrictor, K <sub>VS</sub> 0.01 to 0.28, adjustable; made of stainless steel 1.4404
1402-0140	With supply air restrictor, K <sub>VS</sub> 0.01 to 0.28, adjustable; made of stainless steel 1.4404, <b>SIL</b>
	Adapter plate for NAMUR interface ¼ on NAMUR rib ¼ with external connections
1402-0695	Aluminum, powder coated, gray beige RAL 1019, G ¼ connection
1402-0697	Aluminum, powder coated, gray beige RAL 1019, ¼ NPT connection
1402-0696	Stainless steel 1.4404, G ¼ connection
1402-0698	Stainless steel 1.4404, ¼ NPT connection
	Double-axial adapter
1993-0089	90°, aluminum, powder coated, gray beige RAL 1019
1993-0220	270°, aluminum, powder coated, gray beige RAL 1019
1402-0280	180°, aluminum, powder coated, gray beige RAL 1019
	Adapter plate for NAMUR interface ¼ on NAMUR rib ½
1380-1652	Aluminum, powder coated, gray beige RAL 1019
1380-1797	Stainless steel 1.4404
	Adapter plate with NAMUR interface ¼
1402-0095	For SAMSON Type 3351
1409-3001	For SAMSON Type 3353 and Type 3354
8333-1237	Hexagon socket head screw M5 x 6 (required in addition to 1409-3001)
0790-6118	M5 seal (required in addition to 1409-3001)

## Accessories and spare parts

Accessories for K <sub>VS</sub> 0.32	
Order no.	Designation
1400-8817	Mounting block for SAMSON Type 3277 Pneumatic Actuator, G ¼ connection
1400-8818	¼ NPT connection
1400-6950	Pressure gauge mounting block, 1x Output and 1x Supply, made of stainless steel/brass (for mounting block)
1400-6444	Piping for actuator with fail-safe action "stem retracts" 240 cm² actuator area, zinc-coated steel
1400-6445	240 cm² actuator area, CrNiMo steel
1400-6446	350 cm² actuator area, zinc-coated steel
1400-6447	350 cm² actuator area, CrNiMo steel
1400-6448	700 cm² actuator area, zinc-coated steel
1400-6449	700 cm² actuator area, CrNiMo steel

Accessories for K <sub>VS</sub> 2.0	
Order no.	Designation
1400-6751	Adapter plate for NAMUR rib acc. to IEC 60531-6-1 Aluminum, powder coated, gray beige RAL 1019, G ¼ connection
1400-9924	Aluminum, powder coated, gray beige RAL 1019, ¼ NPT connection
1380-1652	Adapter plate for NAMUR interface ¼ on NAMUR rib ½ Aluminum, powder coated, gray beige RAL 1019
1380-1797	Stainless steel 1.4404

Accessories for K <sub>VS</sub> 4.3	
Order no.	Designation
0360-3945	Adapter plate for NAMUR interface ½ to thread ½ Aluminum, powder coated, gray beige RAL 1019, G ½ connection
0360-3946	Aluminum, powder coated, gray beige RAL 1019, ½ NPT connection
0360-3947	Stainless steel 1.4404, G ½ connection
0360-3948	Stainless steel 1.4404, ½ NPT connection
1380-1795	Adapter plate for NAMUR interface ½ on NAMUR rib ¼ Aluminum, powder coated, gray beige RAL 1019
1380-1796	Stainless steel 1.4404
1402-0827	Adapter plate for NAMUR rib acc. to IEC 60531-6-1 Aluminum, powder coated, gray beige RAL 1019, G ½ connection
1402-0829	Aluminum, powder coated, gray beige RAL 1019, ½ NPT connection
1402-0828	Stainless steel 1.4404, G ½ connection
1402-0830	Stainless steel 1.4404, ½ NPT connection
1402-0602	Double-axial adapter 90°, aluminum, powder coated, gray beige RAL 1019
1402-0603	90°, stainless steel 1.4404

Specifications subject to change without notice.



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**T 3967 EN**

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