

Pressure switches hex 27

Changeover with silver or gold contacts



- Switching point can be adjusted when fitted on site¹⁾
- Factory adjustable hysteresis (except types 0140 and 0141)
- High overpressure safety and long service life under harsh conditions
- Operating voltage up to 250 V
- Series 0140 / 0141 with protective insulation
- For ready-wired customized versions refer to chapter M.5, starting at page 62
- For pressure switches with integrated connectors refer to chapter M.2, starting at page 32

¹⁾ Pressure switches can also be supplied preset at factory.
Our preset switches are sealed with lacquer paint, set points are embossed on the housing.

Pressure switches hex 27

Technical details

M.4

hex 27



Temperature resistance of sealing materials	NBR (max. overpressure up to 100 bar)	-30 °C ... +100 °C
	NBR (max. overpressure up to 300/600 bar)	-40 °C ... +100 °C
	EPDM	-30 °C ... +120 °C
	EPDM-TW (in diaphragm pressure switch)	-20 °C ... +100 °C
	FKM (in diaphragm pressure switch)	-5 °C ... +120 °C
	FKM (in piston pressure switch)	-15 °C ... +120 °C
	FFKM	-20 °C ... +120 °C
	Silicone (in diaphragm pressure switch)	-40 °C ... +120 °C
	HNBR	-30 °C ... +120 °C
Switching frequency	200 / min	
Mechanical life expectancy	1,000,000 cycles (for diaphragm pressure switches, life expectancy value only applies for switching pressures to max. 50 bar)	
Pressure rise rate	≤ 1 bar/ms	
Hysteresis (only adjustable at factory)	Adjustable average value 10 ... 30 % depending on type Types 0140 and 0141 cannot be adjusted	
Vibration resistance	10 g; 5 ... 200 Hz sine wave; DIN EN 60068-2-6	
Shock resistance	294 m/s ² ; 14 ms half sine wave; DIN EN 60068-2-6, DIN EN 60068-2-29	
Protection class	IP65 with socket device, terminals IP00	
Weight	approx. 100 g	

Switching performance and materials overview

Type	0140	0141	0170	0171	0180	0181	0183	0186	0187	0190	0191	0196	0197
5 ... 24 V DC										●	●	●	●
10 ... 42 V AC/DC			●	●									
10 ... 250 V AC/DC	●	●			●	●	●	●	●				
3 ... 50 mA										●	●	●	●
10 mA ... 2 A	●	●											
10 mA ... 4 A			●	●	●	●	●	●	●				
Gold contacts										●	●	●	●
Silver contacts	●	●	●	●	●	●	●	●	●				
Adjustable hysteresis			●	●	●	●	●	●	●	●	●	●	●
Zinc-plated steel (CrVI-free)	●	●	●	●	●	●	●			●	●		
Stainless steel 1.4305								●	●			●	●

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Pressure switches hex 27

Electrical values

0140 / 0141		
Rated working voltage U_e :	Rated working current I_e	Usage category ¹⁾
250 VAC 50 / 60 Hz	2 A	AC12
24 VDC	2 / 1 A	DC12 / DC13
50 VDC	1 / 0.5 A	DC12 / DC13
75 VDC	0.5 / 0.25 A	DC12 / DC13
125 VDC	0.2 / 0.1 A	DC12 / DC13
250 VDC	0.15 / 0.1 A	DC12 / DC13
Rated insulation voltage U_i :	300 V	
Rated impulse withstand voltage U_{imp} :	4 kV	
Conventional thermal current I_{the} :	5 A	
Switching overvoltage:	< 2.5 kV	
Rated frequency:	DC and 50 / 60 Hz	
Nominal current of short-circuit mechanism:	to 3.5 A	
Rated short-circuit current:	< 350 A	
IP class of protection according to DIN EN 60529:1991+A1:1999:	IP65 with connector	
Tightening torque of terminal screws:	< 0.35 Nm	
Connector cross-section:	0.5 - 1.5 mm ²	

0170 / 0171 / 0180 / 0181 / 0183 / 0186 / 0187 / 0190 / 0191 / 0196 / 0197		
Rated working voltage U_e :	Rated working current I_e	Usage category ¹⁾
250 VAC 50 / 60 Hz	4 A	AC12
250 VAC 50 / 60 Hz	1 A	AC14
24 VDC	4 / 2 A	DC12 / DC13
50 VDC	2 / 1 A	DC12 / DC13
75 VDC	1 / 0.5 A	DC12 / DC13
125 VDC	0.3 / 0.2 A	DC12 / DC13
250 VDC	0.25 / 0.2 A	DC12 / DC13
Rated insulation voltage U_i :	300 V	
Rated impulse withstand voltage U_{imp} :	2.5 kV	
Conventional thermal current I_{the} :	5 A	
Switching overvoltage:	< 2.5 kV	
Rated frequency:	DC and 50 / 60 Hz	
Nominal current of short-circuit mechanism:	to 5 A	
Rated short-circuit current:	< 350 A	
IP class of protection according to DIN EN 60529:1991+A1:1999:	IP65 with socket device, terminals IP00	

0140 / 0141

Diaphragm / piston pressure switches 250 V

- Protection class 2, protective insulation
- Zinc-plated steel (CrVI-free)
- Changeover with silver contacts
- Overpressure safety up to 300 / 600 bar¹⁾
- Includes polyamide cap, protection class IP65

P_{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread	Order number
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0140 Diaphragm pressure switches with screw terminals

P_{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread	Order number
300 ¹⁾	0.3 - 1.5	± 0.2	G1/4	0140 - 457 03 - X - 003
			NPT1/8	0140 - 457 04 - X - 300
			NPT1/4	0140 - 457 09 - X - 305
			7/16-20 UNF	0140 - 457 20 - X - 310
			9/16-18 UNF	0140 - 457 21 - X - 315
	1 - 10	± 0.5	G1/4	0140 - 458 03 - X - 006
			NPT1/8	0140 - 458 04 - X - 301
			NPT1/4	0140 - 458 09 - X - 306
			7/16-20 UNF	0140 - 458 20 - X - 311
			9/16-18 UNF	0140 - 458 21 - X - 316
	10 - 20	± 1.0	G1/4	0140 - 459 03 - X - 009
			NPT1/8	0140 - 459 04 - X - 302
			NPT1/4	0140 - 459 09 - X - 307
			7/16-20 UNF	0140 - 459 20 - X - 312
			9/16-18 UNF	0140 - 459 21 - X - 317
	20 - 50	± 2.0	G1/4	0140 - 461 03 - X - 012
NPT1/8			0140 - 461 04 - X - 303	
NPT1/4			0140 - 461 09 - X - 308	
7/16-20 UNF			0140 - 461 20 - X - 313	
9/16-18 UNF			0140 - 461 21 - X - 318	

0141 Piston pressure switches with screw terminals

P_{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread	Order number
600 ¹⁾	50 - 150	± 5.0	G1/4	0141 - 460 03 - X - 003
			NPT1/8	0141 - 460 04 - X - 304
			NPT1/4	0141 - 460 09 - X - 309
			7/16-20 UNF	0141 - 460 20 - X - 314
			9/16-18 UNF	0141 - 460 21 - X - 319

Seal material – Application areas

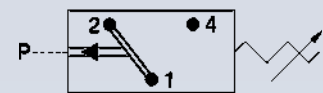
Seal material	Application areas	Order number
NBR	Hydraulic/machine oil, heating oil, air, nitrogen, etc.	1
EPDM	Brake fluid, hydrogen, oxygen, acetylene, etc.	2
FKM	Hydraulic fluids (HFA, HFB, HFD), petrol/gasoline, etc.	3
FFKM	Chemical acids, diluted alkalis, ketones, ester's, alcohols	6
HNBR	Hydraulic/machine oil, ester-based bio-oils	9

Refer to page 53 for the temperature range and application thresholds of sealing materials.



Your order number: **014X - XXX XX - X - XXX**

M.4
hex 27

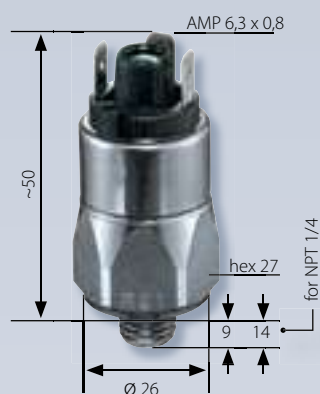


¹⁾ Static value. Dynamic value is 30-50 % lower. Values pertain to the hydraulic/pneumatic part of the pressure switch.

0170 / 0171

Diaphragm / piston pressure switches up to 42 V

- Zinc-plated steel (CrVI-free)
- Changeover with silver contacts
- Overpressure safety up to 100 / 300 / 600 bar¹⁾
- Hysteresis adjustable at factory



P_{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread	Order number
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0170 Diaphragm pressure switches with spade terminal

100 ¹⁾	0.3 - 1.5	± 0.2	G1/4	0170 - 457 03 - X - 003
			M10x1 con.	0170 - 457 01 - X - 001
			M12x1.5 cyl.	0170 - 457 02 - X - 002
			NPT1/8	0170 - 457 04 - X - 318
			NPT1/4	0170 - 457 09 - X - 314
			7/16-20 UNF	0170 - 457 20 - X - 301
			9/16-18 UNF	0170 - 457 21 - X - 302

	1 - 10	± 0.5	G1/4	0170 - 458 03 - X - 042
			M10x1 con.	0170 - 458 01 - X - 040
			M12x1.5 cyl.	0170 - 458 02 - X - 041
			NPT1/8	0170 - 458 04 - X - 343
			NPT1/4	0170 - 458 09 - X - 340
			7/16-20 UNF	0170 - 458 20 - X - 341
			9/16-18 UNF	0170 - 458 21 - X - 342

300 ¹⁾	10 - 50	± 3.0	G1/4	0170 - 459 03 - X - 009
			M10x1 con.	0170 - 459 01 - X - 007
			M12x1.5 cyl.	0170 - 459 02 - X - 008
			NPT1/8	0170 - 459 04 - X - 320
			NPT1/4	0170 - 459 09 - X - 316
			7/16-20 UNF	0170 - 459 20 - X - 305
			9/16-18 UNF	0170 - 459 21 - X - 306

	10 - 100	± 3.0 - 5.0	G1/4	0170 - 461 03 - X - 012
			M10x1 con.	0170 - 461 01 - X - 010
			M12x1.5 cyl.	0170 - 461 02 - X - 011
			NPT1/8	0170 - 461 04 - X - 321
			NPT1/4	0170 - 461 09 - X - 317
			7/16-20 UNF	0170 - 461 20 - X - 307
			9/16-18 UNF	0170 - 461 21 - X - 308

0171 Piston pressure switches with spade terminal

600 ¹⁾	50 - 200	± 5.0	G1/4	0171 - 460 03 - X - 003
			M10x1 con.	0171 - 460 01 - X - 001
			M12x1.5 cyl.	0171 - 460 02 - X - 002
			NPT1/8	0171 - 460 04 - X - 304
			NPT1/4	0171 - 460 09 - X - 303
			7/16-20 UNF	0171 - 460 20 - X - 301
			9/16-18 UNF	0171 - 460 21 - X - 302

Seal material – Application areas

NBR	Hydraulic/machine oil, heating oil, air, nitrogen, etc.	1
EPDM	Brake fluid, hydrogen, oxygen, acetylene, etc.	2
FKM	Hydraulic fluids (HFA, HFB, HFD), petrol/gasoline, etc.	3
FFKM	Chemical acids, diluted alkalis, ketones, ester's, alcohols	6
HNBR ²⁾	Hydraulic/machine oil, ester-based bio-oils	9

Refer to page 53 for the temperature range and application thresholds of sealing materials.



Your order number:

017X - XXX XX - X - XXX



¹⁾ Static value. Dynamic value is 30-50 % lower. Values pertain to the hydraulic/pneumatic part of the pressure switch.

²⁾ HNBR diaphragm not available for pressure ranges between 0.3 - 1.5 bar.

0180 / 0181

Diaphragm / piston pressure switches up to 250 V

- Zinc-plated steel (CrVI-free)
- Changeover with silver contacts
- Overpressure safety up to 100 / 300 / 600 bar¹⁾
- Hysteresis adjustable at factory

p_{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread	Order number
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0180 Diaphragm pressure switches with spade terminal

p_{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread	Order number	
100 ¹⁾	0.3 - 1.5	± 0.2	G1/4	0180 - 457 03 - X - 003	
			M10x1 con.	0180 - 457 01 - X - 001	
			M12x1.5 cyl.	0180 - 457 02 - X - 002	
			NPT1/8	0180 - 457 04 - X - 318	
			NPT1/4	0180 - 457 09 - X - 314	
			7/16-20 UNF	0180 - 457 20 - X - 301	
			9/16-18 UNF	0180 - 457 21 - X - 302	
300 ¹⁾	1 - 10	± 0.5	G1/4	0180 - 458 03 - X - 042	
			M10x1 con.	0180 - 458 01 - X - 040	
			M12x1.5 cyl.	0180 - 458 02 - X - 041	
			NPT1/8	0180 - 458 04 - X - 343	
			NPT1/4	0180 - 458 09 - X - 340	
			7/16-20 UNF	0180 - 458 20 - X - 341	
				9/16-18 UNF	0180 - 458 21 - X - 342
	10 - 50	± 3.0	G1/4	0180 - 459 03 - X - 009	
			M10x1 con.	0180 - 459 01 - X - 007	
			M12x1.5 cyl.	0180 - 459 02 - X - 008	
			NPT1/8	0180 - 459 04 - X - 320	
			NPT1/4	0180 - 459 09 - X - 311	
7/16-20 UNF			0180 - 459 20 - X - 305		
			9/16-18 UNF	0180 - 459 21 - X - 306	
10 - 100	± 3.0 - 5.0	G1/4	0180 - 461 03 - X - 012		
		M10x1 con.	0180 - 461 01 - X - 010		
		M12x1.5 cyl.	0180 - 461 02 - X - 011		
		NPT1/8	0180 - 461 04 - X - 321		
		NPT1/4	0180 - 461 09 - X - 312		
		7/16-20 UNF	0180 - 461 20 - X - 307		
			9/16-18 UNF	0180 - 461 21 - X - 308	

0181 Piston pressure switches with spade terminal

p_{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread	Order number
600 ¹⁾	50 - 200	± 5.0	G1/4	0181 - 460 03 - X - 003
			M10x1 con.	0181 - 460 01 - X - 001
			M12x1.5 cyl.	0181 - 460 02 - X - 002
			NPT1/8	0181 - 460 04 - X - 304
			NPT1/4	0181 - 460 09 - X - 303
			7/16-20 UNF	0181 - 460 20 - X - 301
			9/16-18 UNF	0181 - 460 21 - X - 302

Seal material – Application areas

NBR	Hydraulic/machine oil, heating oil, air, nitrogen, etc.	1
EPDM	Brake fluid, hydrogen, oxygen, acetylene, etc.	2
FKM	Hydraulic fluids (HFA, HFB, HFD), petrol/gasoline, etc.	3
FFKM	Chemical acids, diluted alkalis, ketones, ester's, alcohols	6
HNBR ²⁾	Hydraulic/machine oil, ester-based bio-oils	9

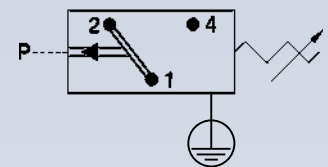
Refer to page 53 for the temperature range and application thresholds of sealing materials.

Your order number: **018X - XXX XX - X - XXX**

¹⁾ Static value. Dynamic value is 30-50 % lower. Values pertain to the hydraulic/pneumatic part of the pressure switch.

²⁾ HNBR diaphragm not available for pressure ranges between 0.3 - 1.5 bar.

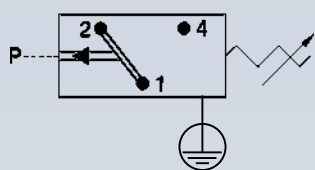
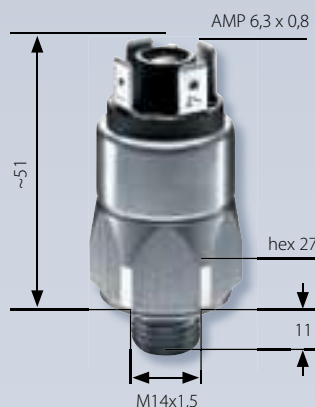
M.4
hex 27



M.4

hex 27

Thread similar to ISO 6149-3
(including O-ring for sealing)



0183

Piston pressure switches up to 250 V

- Zinc-plated steel (CrVI-free)
- Changeover with silver contacts
- Overpressure safety up to 600 bar¹⁾, Hysteresis adjustable at factory
- Adjustment range: 100 – 400 bar
- Height only 51 mm

P _{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread
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Order number

0183 Piston pressure switches with spade terminal

600 ¹⁾	100 - 300	± 10.0	M14x1.5
	200 - 400		DIN 6149-3

0183 - 462 45 - X - 051
0183 - 463 45 - X - 061

Seal material – Application areas

NBR	Hydraulic/machine oil, heating oil, air, nitrogen, etc.	1
EPDM	Brake fluid, hydrogen, oxygen, acetylene, etc.	2
FKM	Hydraulic fluids (HFA, HFB, HFD), petrol/gasoline, etc.	3
HNBR	Hydraulic/machine oil, ester-based bio-oils	9

Refer to page 53 for the temperature range and application thresholds of sealing materials.



Your order number: **0183 - 46X 45 - X - XXX**

¹⁾ Static value. Dynamic value is 30-50 % lower. Values pertain to the hydraulic/pneumatic part of the pressure switch.

Accessory ►

Not included in the delivery.
Please order separately.

Order number ►

Thread adapters

from M14 x 1.5		
to G1/4	to M12 x 1.5	to NPT1/8
1-1-83-420-006	1-1-83-420-007	1-1-83-420-008

0186 / 0187

Diaphragm / piston pressure switches up to 250 V
with stainless steel housing

- Stainless steel housing (1.4305 / AISI 303)
- Changeover with silver contacts
- Overpressure safety up to 300 / 600 bar¹⁾
(EPDM-TW and silicone diaphragm up to 35 bar²⁾)
- Hysteresis adjustable at factory

P_{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread	Order number
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0186 Diaphragm pressure switches with spade terminal

300 ¹⁾²⁾	0.5 - 5	± 0.3	G1/4	0186 - 457 03 - X - 003
	1 - 10	± 0.5		0186 - 458 03 - X - 006
	10 - 50	± 3.0		0186 - 459 03 - X - 009
	10 - 100	± 3.0 - 5.0		0186 - 461 03 - X - 012

0187 Piston pressure switches with spade terminal

600 ¹⁾	50 - 200	± 5.0	G1/4	0187 - 460 03 - X - 003
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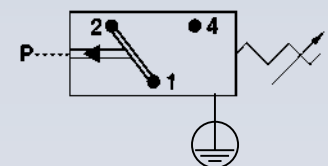
Seal material – Application areas

NBR	Hydraulic/machine oil, heating oil, air, nitrogen, etc.	1
EPDM	Brake fluid, water, hydrogen, oxygen, acetylene, etc.	2
EPDM-TW ³⁾	Drinking water ($p_{max} \leq 35$ bar)	5
FKM	Hydraulic fluids (HFA, HFB, HFD), petrol/gasoline, etc.	3
FFKM	Chemical acids, diluted alkalis, ketones, ester's, alcohols	6
Silicone	Water, food products, air, etc. ($p_{max} \leq 35$ bar)	8
HNBR	Hydraulic/machine oil, ester-based bio-oils	9

Refer to page 53 for the temperature range and application thresholds of sealing materials.

Your order number: **018X - XXX 03 - X - XXX**

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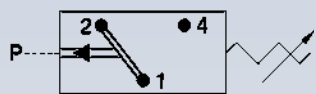
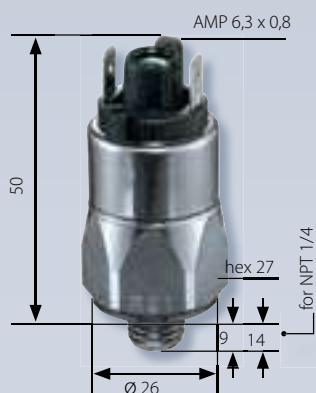
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¹⁾ Static value. Dynamic value is 30-50 % lower. Values pertain to the hydraulic/pneumatic part of the pressure switch.

²⁾ Overpressure safety of diaphragm pressure switch up to 600 bar. Functional reliability only up to 35 bar with diaphragm materials EPDM-TW and silicone.

³⁾ On demand





0190 / 0191

Diaphragm / piston pressure switches up to 24 V with gold contacts

- Zinc-plated steel (CrVI-free), with spade terminal
- Changeover with gold contacts
- Overpressure safety up to 100/300/600 bar¹⁾
- Hysteresis adjustable at factory

p_{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread	Order number
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0190 Diaphragm pressure switches with spade terminal

100 ¹⁾	0.3 - 1.5	± 0.2	G1/4	0190 - 457 03 - X - 003
			M10x1 con.	0190 - 457 01 - X - 001
			M12x1.5 cyl.	0190 - 457 02 - X - 002
			NPT1/8	0190 - 457 04 - X - 318
			NPT1/4	0190 - 457 09 - X - 314
			7/16-20 UNF	0190 - 457 20 - X - 301
			9/16-18 UNF	0190 - 457 21 - X - 302

1 - 10		± 0.5	G1/4	0190 - 458 03 - X - 042
			M10x1 con.	0190 - 458 01 - X - 040
			M12x1.5 cyl.	0190 - 458 02 - X - 041
			NPT1/8	0190 - 458 04 - X - 343
			NPT1/4	0190 - 458 09 - X - 340
			7/16-20 UNF	0190 - 458 20 - X - 341
			9/16-18 UNF	0190 - 458 21 - X - 342

300 ¹⁾	10 - 50	± 3.0	G1/4	0190 - 459 03 - X - 009
			M10x1 con.	0190 - 459 01 - X - 007
			M12x1.5 cyl.	0190 - 459 02 - X - 008
			NPT1/8	0190 - 459 04 - X - 320
			NPT1/4	0190 - 459 09 - X - 316
			7/16-20 UNF	0190 - 459 20 - X - 305
			9/16-18 UNF	0190 - 459 21 - X - 306

10 - 100		± 3.0 - 5.0	G1/4	0190 - 461 03 - X - 012
			M10x1 con.	0190 - 461 01 - X - 010
			M12x1.5 cyl.	0190 - 461 02 - X - 011
			NPT1/8	0190 - 461 04 - X - 321
			NPT1/4	0190 - 461 09 - X - 317
			7/16-20 UNF	0190 - 461 20 - X - 307
			9/16-18 UNF	0190 - 461 21 - X - 308

0191 Piston pressure switches with spade terminal

600 ¹⁾	50 - 200	± 5.0	G1/4	0191 - 460 03 - X - 003
			M10x1 con.	0191 - 460 01 - X - 001
			M12x1.5 cyl.	0191 - 460 02 - X - 002
			NPT1/8	0191 - 460 04 - X - 304
			NPT1/4	0191 - 460 09 - X - 303
			7/16-20 UNF	0191 - 460 20 - X - 301
			9/16-18 UNF	0191 - 460 21 - X - 302

Seal material – Application areas

NBR	Hydraulic/machine oil, heating oil, air, nitrogen, etc.	1
EPDM	Brake fluid, water, hydrogen, oxygen, acetylene, etc.	2
FKM	Hydraulic fluids (HFA, HFB, HFD), petrol/gasoline, etc.	3
FFKM	Chemical acids, diluted alkalis, ketones, ester's, alcohols	6
HNBR ²⁾	Hydraulic/machine oil, ester-based bio-oils	9

Refer to page 53 for the temperature range and application thresholds of sealing materials.



Your order number:

019X - XXX XX - X - XXX

¹⁾ Static value. Dynamic value is 30-50 % lower. Values pertain to the hydraulic/pneumatic part of the pressure switch.

²⁾ HNBR diaphragm not available for pressure ranges between 0.3 - 0.5 bar.

0196 / 0197

Diaphragm / piston pressure switches up to 24 V with stainless steel housing

- Stainless steel housing (1.4305 / AISI 303)
- Fitted with changeover contact and gold contacts
- Overpressure safety up to 300 / 600 bar¹⁾
(EPDM-TW and silicone diaphragm up to 35 bar²⁾)
- Hysteresis adjustable at factory

p_{max} in bar	Adjustment range in bar	Tolerance at room temperature in bar	Male thread	Order number
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0196 Diaphragm pressure switches with spade terminal

300 ¹⁾²⁾	0.5 - 5	± 0.3	G1/4	0196 - 457 03 - X - 003
	1 - 10	± 0.5		0196 - 458 03 - X - 006
	10 - 50	± 3.0		0196 - 459 03 - X - 009
	10 - 100	± 3.0 - 5.0		0196 - 461 03 - X - 012

0197 Piston pressure switches with spade terminal

600 ¹⁾	50 - 200	± 5.0	G1/4	0197 - 460 03 - X - 003
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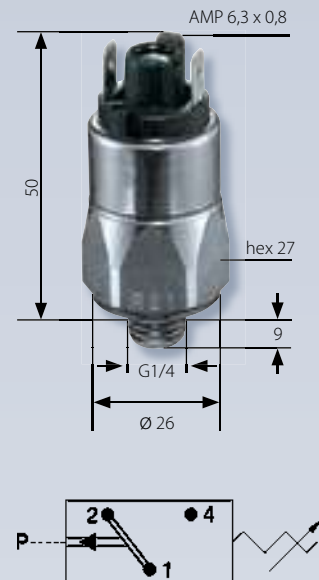
Seal material – Application areas

NBR	Hydraulic/machine oil, heating oil, air, nitrogen, etc.	1
EPDM	Water, Brake fluid, hydrogen, oxygen, acetylene, etc.	2
EPDM-TW ³⁾	Drinking water ($p_{max} \leq 35$ bar)	5
FKM	Hydraulic fluids (HFA, HFB, HFD), petrol/gasoline, etc.	3
FFKM	Chemical acids, diluted alkalis, ketones, ester's, alcohols	6
Silicone	Water, food products, air, etc. ($p_{max} \leq 35$ bar)	8
HNBR	Hydraulic/machine oil, ester-based bio-oils	9

Refer to page 53 for the temperature range and application thresholds of sealing materials.

Your order number: **019X - XXX 03 - X - XXX**

M.4
hex 27



¹⁾ Static value. Dynamic value is 30-50 % lower. Values pertain to the hydraulic/pneumatic part of the pressure switch.

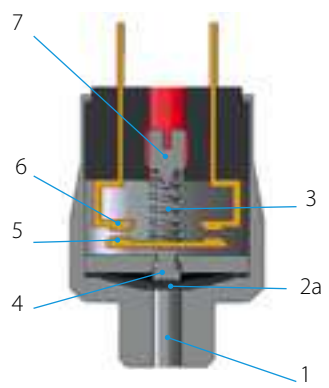
²⁾ Overpressure safety of diaphragm pressure switch up to 600 bar. Functional reliability only up to 35 bar with diaphragm materials EPDM-TW and silicone.

³⁾ On demand

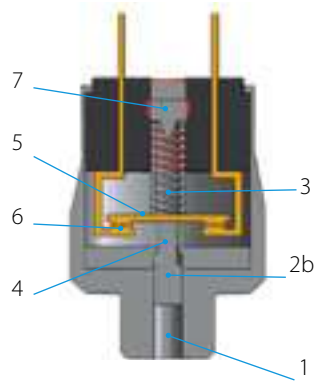


Technical explanations for mechanical pressure switches

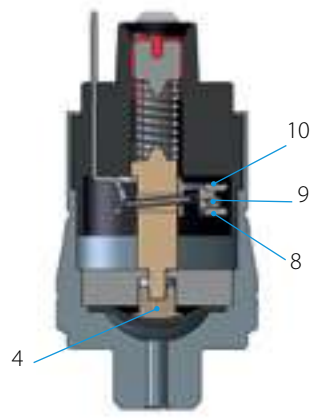
Diaphragm pressure switch
NO



Piston pressure switch
NC



Change-over



What is a mechanical pressure switch?

Mechanical pressure switches from SUCO monitor the pressure of liquid or gaseous media, and close or open an electrical circuit on reaching a set threshold.

Diaphragm pressure switches

SUCO diaphragm pressure switches are used in pressure ranges from 0.1 bar to 100 bar, meaning overpressure safety of 35, 100, 300 and 600 bar, depending on the used diaphragm type.

Piston pressure switches

Pressure ranges from 10 bar to 400 bar can be monitored with SUCO piston pressure switches (dependent on size); overpressure safety of up to 600 bar can be attained.

Sizes of pressure switches

Mechanical pressure switches from SUCO can be divided into sizes hex 24, hex 27 and 30 A/F. Each particular size has specific hydraulic, pneumatic and electric properties (specified on the relevant catalogue page in the technical details).

How does a pressure switch work?

Function description for **normally open (NO)**: Pressure is applied to the diaphragm (2a) / pistons (2b) through the pressure connector (1).

If the generated pressure force is greater than the force of the pre-tensioned pressure spring (3), the plunger (4) moves towards the counter-contact (6), carrying along the contact disc (5), and closes the circuit.

The switch opens again when the pressure is reduced by the hysteresis value.

Function description for **normally closed (NC)**: Engaging happens in the reverse order.

The adjustment screw (7) enables the switching point to be changed within the adjustment range.

The micro switch of a **change-over contact system** (snap-action) offers both, a NC and a NO contact.

The swivel contact (9) is activated by the plunger (4). The circuit is closed by the NC (8) as long as no pressure is applied. When the applied pressure exceeds the set switching point, the swivel contact changes over and closes the circuit via the NO (10).

Utilisation category

The utilisation category specifies for example voltages and currents, and the type of load, our pressure switches are designed for (according to DIN EN 60947-5-1).

AC voltage

AC12: Control of ohmic loads and semiconductor loads in input circuits of optocouplers (such as PLC inputs).

AC14: Control of electromagnetic loads, 72 VA.

DC voltage

DC12: Control of ohmic loads and semiconductor loads in input circuits of optocouplers (such as PLC inputs).

DC13: Control of electromagnets.

B10d value

According to DIN EN ISO 13849-1, the B10d value specifies the anticipated service life (with a 10% probability of failure). The B10d value is therefore directly dependent on the respective application of the pressure switch. For ohmic loads and currents < 1 A, we specify the B10d value as 1 million cycles of electrical life.

The specification of a MTTF time (mean time to failure) is not possible without knowing the specific conditions in the application. However, the MTTF time can be determined easily from the B10d value:

$$MTTF_d = \frac{B_{10d}}{0,1 n_{op}}$$

n_{op} : number of cycles per year

B_{10d} : number of cycles until 10 % of components have failed.

Classification of electrical switch functions

			Contact form DIN EN- 60947-5-1	Symbol IEC 60617
NO	NO, normally open	SPST single pole, single throw	X	
NC	NC, normally closed	SPST single pole, single throw	Y	
Change-over contacts	CO, change over (snap action)	SPDT single pole, double throw	C	

Minimum current / minimum working voltage

The minimum working current and minimum working voltage depend greatly on operating and ambient conditions. Physically, the build-up of impurity layers on the contact rivets must be countered with mechanical friction and/or electrical erosion.

It has proven useful in many applications to deploy our pressure switches with silver contact rivets ensuring that they are fail safe to 10 mA and 10 V. Variants with gold contacts are available in our catalogue for even lower currents and voltages.

Potential-free – galvanically isolated

Mechanical pressure switches from SUCO are potential-free, i.e. no auxiliary energy is required. Also, there is no electrical contact between the individual, live parts and the housing.

Adjustment range of switching point

The pressure range, within which the switching point of a pressure switch can be set, is called adjustment range. The switching point corresponds to the pressure value at which the electric circuit is opened or closed by the pressure applied.

If no switching point is specified on order, the pressure switches are adjusted by approximately half the adjustment range at factory.

Switching point tolerances

The switching point tolerances specified by us pertain to room temperature (RT) and condition as new. The values can change as a result of temperature, ageing and deployment conditions.

It is not possible to specify generally applicable value for switching point tolerances over temperature as the medium has a significant influence on the sealing materials in the pressure switch.

Double the tolerance stated for RT and condition as new can be assumed as a typical magnitude for the tolerance over the entire temperature range.

Based on their design, piston switches may exhibit an increase in switching points due to storage (dry run, stick-slip effect). Following a short start phase, the switching points return to the value set at the factory.

Pressure change rates of > 1 bar/s may have an effect on the switching point for diaphragm pressure switches.

The switching point (for rising pressure) and hysteresis increase, whilst the switch-back point (for falling pressure) sinks. Also, the effect of the maximum (system) pressure on the switchback point (for falling pressure ramp) must be factored in for tolerance-critical applications. The higher the (system) pressure, the lower the resulting switch-back value.

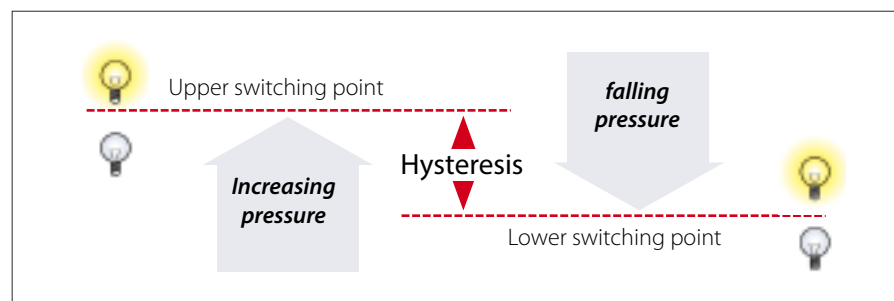
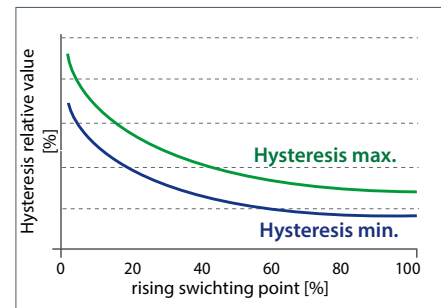
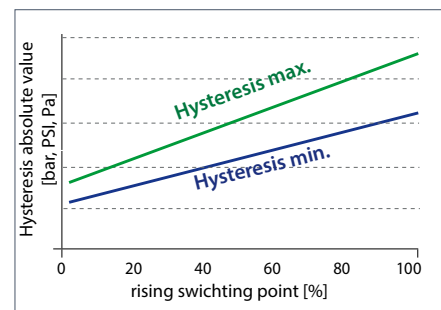
Hysteresis

Rising / falling switching point

The pressure difference between the rising (upper) and falling (lower) switching points (refer to the figure, e.g. NO) is known as hysteresis (switch-back difference).

Hysteresis has no constant value due to the structural layout of a mechanical pressure switch. In absolute values, the hysteresis is also the smallest with the smallest adjustment range. The hysteresis increases with increasing adjustment range.

Hysteresis over rising switching point



Technical explanations for mechanical pressure switches

Hysteresis can be set at SUCO in range from approx. 10 % (at end of adjustment range) to 30 % or higher (at start of adjustment range), related to the respective switching point for hex 27 and 30 A/F pressure switches with adjustable hysteresis.

The specifications in the catalogue only represent typical average values.

Please ask about the possible setting ranges you may require. Our electronic pressure switches are excellently suited to extremely low or high hysteresis.

The lowest possible hysteresis is set if nothing is specified in the order.

Switching frequency

The switching frequency provides information on the possible number of cycles in one minute. The value of 200/minute specified by us is a guideline value. Higher switching frequencies can be attained depending on switch type and conditions of use.

Sealing materials

The priority in sealing material selection is the chemical resistance. The temperature range only becomes a selection criterion when different sealing materials are suitable for the medium.

NBR (Buna-N)

This is the standard material most commonly used. It is a special SUCO material mix with high level of cold flexibility so that the sealing properties of the pressure switch are also retained at low temperatures.

NBR is denoted by number „1“ in our order number.

EPDM

This material is the solution of choice for applications with brake fluids. It is particularly suitable for applications with (process) water. Approval from the BAM (Federal Institute for Material Testing) is in place for oxygen applications. The safety regulations from country-specific authorities must be observed for oxygen applications.

EPDM may not come into contact with oil because this would entail swelling and softening of the material, and so failure of the pressure switch.

EPDM is denoted by number „2“ in our order number.

EPDM-TW with drinking water approval

This EPDM material is intended for drinking water applications according to Elastomer Guideline, WRAS (Water Regulation Advisory Scheme), ACS (Attestation de Conformité Sanitaire) and NSF 61 (National Sanitation Foundation) and for use in medical and pharmaceutical applications.

EPDM-TW may not come into contact with oil because this would entail swelling and softening of the material, and so failure of the pressure switch. Sealing is only available upon request, so please consult us before ordering.

EPDM-TW is denoted by number „5“ in our order number.

FKM / FPM (Viton®)

This is a diaphragm material suitable for high temperature exposure and exhibits special chemical resistance. It has been tested in the hydraulic sector and has been proven to work successfully with critical oils.

FKM / FPM is denoted by number „3“ in our order number.

FFKM

This diaphragm material is suitable for temperature exposure up to 120°C and can withstand very aggressive conditions such as chemical species including organic or inorganic acids, diluted alkalis, ketones, esters, alcohols, fuels and hot water.

FFKM is denoted by number „6“ in our order number.

TPE (Thermoplastic elastomers)

This sealing material is available only for our electrical products of the Performance Series.

TPE offers similar media compatibility like NBR, e.g. suitable for mineral oil and hydraulic fluids.

Additionally the material can be used with diluted acids and bases and cold water, too.

TPE is denoted by number „7“ in our order number.

ECO (epichlorhydrin)

ECO is only used in our vacuum switches. This material has similar properties to NBR in terms of chemical resistance, and can be used in gas applications as well as oil and fuel applications.

ECO is denoted by number „4“ in our order number.

Silicone

Silicone is suitable for use within a wide temperature range. The SUCO silicone diaphragm is FDA-approved (Food & Drug Administration) for the food sector.

Silicone is a soft material reserved for sensitive applications in the low pressure range (below 10 bar) with maximum overpressure safety to 35 bar. Piston switches are therefore not offered with silicone seals. Silicone is also not suitable for oil applications.

Silicone is denoted by number „8“ in our order number.

H-NBR

This is a special SUCO material mixture optimised for ester-based bio-oils. The multitude of bio-oils on the market means suitability of the material for the respective oil must be determined. This diaphragm material can also be used for a number of mineral and synthetic oils.

H-NBR is denoted by number „9“ in our order number.

Medium compatibility

The specifications on medium compatibility in this catalogue cannot be generalised as they pertain to the sealing materials used in our pressure switches.

Saturated and superheated steam applications

The sealing materials mentioned are not suitable for saturated or superheated steam applications.

Conversion table for pressure units

Unit symbol	Unit name	Pa= N/m ²	bar	Torr	lbf/in ² , PSI
1 Pa = N/m ²	Pascal	1	0.00001	0.0075	0.00014
1 bar	Bar	100 000	1	750.062	14.5
1 Torr = 1 mmHg	Millimetres, mercury column	133.322	0.00133	1	0.01934
1 lbf/in ² = 1 PSI	Pound-force per square inch	6 894	0.06894	51.71	1

Conversion table for temperature units

	K	°C	F
K	1	K - 273.15	9/5 K - 459.67
°C	°C + 273.15	1	9/5 °C + 32
F	5/9 (F + 459.67)	5/9 (F - 32)	1

Water applications

Standard piston switches are not suitable for water applications.

Pressure switches in stainless steel with EPDM seal have a special sealing system and can therefore also be used for water with corrosion protection, water mixtures or emulsions. The use of other fluid mixtures should be clarified with SUCO (e.g. swelling of EPDM sealing could happen by water – oil mixture).

Pressure switches with stainless steel housings with EPDM-TW diaphragm, SUCO type „5“ are designed for the use of drinking water.

Gas applications

Our pressure switches are suitable for liquid and gaseous media. Gaseous media place particular demands on leak-tightness however. The leakage rate is dependent on the respective gaseous medium, the working pressure and the permeability of the seal material used in the pressure switch.

Their lower leakage rates mean diaphragm pressure switches are better suited for gas pressures than piston pressure switches. The latter can also be used however if certain measures are taken (such as venting of the housing).

For gaseous applications below 10 bar (145 PSI) in combination with pressure switches with high IP class, i.e. IP 67 and IP6K9K, in general we recommend to use ventilation. Please consult us; we are able to offer suitable solutions.

Oxygen applications

Our mechanical pressure switches are suitable for use with oxygen. We recommend the use of our EPDM diaphragm. The resistance to internal burnout of the diaphragm has been tested by the BAM (Federal Institute for Material Testing).

Pressure switches with steel housings with zinc-nickel coating are, in conjunction with oxygen, only approved to a maximum working pressure of 10 bar.

Pressure switches with brass housings are, in conjunction with oxygen, only approved to a maximum working pressure of 35 bar.

Pressure switches with stainless steel housings are, in conjunction with oxygen, only approved to a maximum working pressure of 50 bar.

DGUV accident prevention regulations (such as DGUV 500, Section 2.32 and BGI 617) must be observed for first operation.

Please specify when ordering „oil and grease-free, for use with oxygen“.

Underpressure safety of pressure switches

Our pressure switches are underpressure safe down to 300 mbar (relative).

Overpressure safety of vacuum switches

Our vacuum switches are overpressure safe up to 20 or 35 bar depending on type.

cCSAus approval

Almost all of our mechanical pressure switches (sizes hex 24 and hex 27), and vacuum switch 0151, have cCSAus approval. The CSA mark together with „c“ and „us“ combines the control stamps for introduction onto the Canadian and American markets. The cCSAus certificate also includes the test of the relevant UL standard.

Checked by an official institution and verified with regular company visits by CSA inspectors, this approval guarantees the highest levels of quality and operational reliability for our products.

You can download the current cCSAus certificate on the download area of our homepage: <http://www.suco.de/en/downloads>

Product information

The technical information in this catalogue is based upon fundamental testing during product development, as well as upon empirical values. The information cannot be used for all application scenarios.

Testing of the suitability of our products for a specific application (e.g. also the checking of material compatibilities) rests under the responsibility of the user. It may be the case that suitability can only be guaranteed with appropriate field testing.

Please consult us about gas, water and oxygen applications.

Subject to technical changes.



General technical explanations

User information

Our pressure monitoring products may only be installed and started up by authorised specialists. The safety regulations of country-specific authorities must be observed, especially when working with mains voltages and oxygen, and in potentially explosive areas.

Product information

The technical information in this catalogue is based upon fundamental testing during product development and empirical values. The information cannot be used for all application scenarios.

Testing of the suitability of our products for a specific application (such as the checking of material compatibilities) remains the responsibility of the user. It may be the case that suitability can only be verified by appropriate field testing.

Mounting position

For mechanical and electronic pressure switches as well as transmitters there is no limitation due to the mounting position with regard to the accuracy of the pressure measurement.

However, other boundary conditions of the application may require a certain mounting position, e. g. horizontal installation to avoid waterlogging on the electrical connection or vertical installation to prevent debris from accumulating in the bore of the pressure connection.

IP protection class

The IP protection class is a defined protection level code (sealing) of electrical equipment housings in line with IEC 60529 (formerly DIN 40050 – Part 2). Protection of a housing against the following is tested here:

- The penetration of solid extraneous particles, such as dust
- Access of hazardous parts
- Penetration of water

IP protection tests are performed as type tests.

The IP protection type code, made up of two digits, specifies the protection of a housing against the penetration of solid extraneous particles and water.

The numeric code therefore provides conclusions to be drawn on the level of personal safety as well as the functional protection / mid to longterm functional reliability of electrical equipment.

Protection types IP00, IP65, IP67 and IP6K9K

IP00:

No protection against penetration of solid particles or water, no protection against contact.

IP6X:

Protection against penetration of dust (dust proof). Full contact protection.

IPX5:

A jet of water from a nozzle, aimed at equipment (such as a pressure switch) from all directions, must not have any harmful effect.

IPX7:

Protection from water, when equipment (such as a pressure switch) is immersed in water under defined pressure and time conditions. Water must not penetrate into the equipment in harmful quantities.

IP6K9K:

Devices satisfying these requirements must be dust-proof and be able to withstand loads during the use of high-pressure cleaners and steam jets. The standard stipulates a water pressure from 80 to 100 bar at a temperature of 80 °C for testing.

IP6KX:

Dust must not penetrate. Letter K: Specific to the electrical equipment of road vehicles.

IPX9K:

Protection against penetration of water at high pressure / for steam jet cleaning. Water aimed at the housing from every direction at greatly increased pressure may not have any damaging effects.

We are able to offer IP67 / IP6K9K for many of our mechanical and electronic pressure switches (pre-wired or with integrated connector) and for our transmitters.

IP67 / IP6K9K is the recommended protection for mobile hydraulics and any equipment exposed to the outdoor environment.

Cylindrical threads

Cylindrical threads are either sealed on the front by underlaying an appropriate sealing ring (such as a copper sealing ring) or by already having integrated O-rings or gaskets.

If the corresponding thread types do not provide specifications regarding the roughness of the counter sealing surface, we recommend the following values:

- $R_{amax} 1,6$
- $R_{max} 6,3$
- $R_{min}(-0,10) > 5 \% C_{ref} 5 \%$

Conical threads (cone-shaped threads)

Conical threads guarantee tolerance compensation of the two threaded parts. The sealing function is realised with thread flanks which deform permanently and enter into a metallic frictional fit. Conical threads are not screwed in down to the screw-in depth, but fixed with the tightening torque required for the leak tightness.

Remember not to exceed the permitted tightening torque of the pressure switch or transmitter presented in the following table (to prevent damaging the threaded pin beforehand, causing it to become untight during operation or to snap off when tightened).

Tightening torques of steel threads

The specifications below are to be understood upper material thresholds for the housing of pressure switches or transmitters. Remember during installation that the type and material of the seal, the condition of mating surfaces (e.g. dry or oily) and the material of the counter-piece all have a bearing on the tightening torque.

Thread	Tightening torque
NPT 1/8; M 10 x 1 conical	max. 18 Nm
M 10 x 1 cyl.; G 1/8	max. 20 Nm
M 12 x 1.5; 7/16 – 20 UNF	max. 30 Nm
G 1/4; 9/16 – 18 UNF	max. 40 Nm
NPT 1/4; M 14 x 1.5	max. 40 Nm

Values 30% lower than in the table above must be used for brass housings.

Gaseous applications

In particular using additional sealant to attain the required leak tightness may be necessary for gas applications.

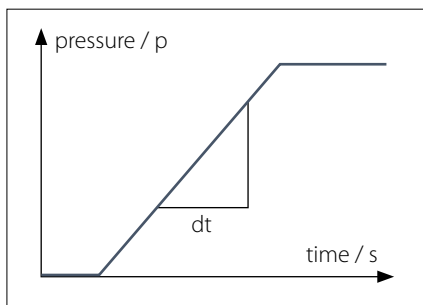
Vacuum

The values given in the technical details for the vacuum range are specified in millibars (mbar) below atmospheric pressure.

Pressure change rate (~rise / ~fall)

The pressure change rate denotes the pressure over time for the rising/falling pressure. The pressure change rate is specified in bar/s or bar/ms.

The maximum pressure change rate for SUICO mechanical pressure switches is 1 bar/ms (1,000 bar/s).



For SUICO electronic pressure monitoring products the maximum pressure change rate can be up to 5 bar/ms (5,000 bar/s).

Overpressure protection

The specified overpressure protection in the catalogue is based on a static pressure. The values refer to the hydraulic or pneumatic part of the switch. It is best practice to use 30 - 50% lower values for dynamic pressure compared to static pressure. These empirical values are based on the knowledge that, in pressure systems, unexpected pressure peaks which are higher than the working pressure are generated as a result of activation of valves, sudden falling or rising load or simply the change of cross-sections in the pipes. With conventional measurement techniques (such as manometers), these pressure peaks are hardly measurable. Faster measurement systems must therefore be used for this data acquisition. Attempts are being made to take this into account by using empirical or corrective factors.

If the pressure conditions are known and the pressure change rates are 0.1 bar/ms, our pressure switches and transmitters can be used up to the permitted overpressure protection as per data sheet / catalogue. Only 50 % of the specified overpressure protection is permitted when operating at the maximum permitted pressure change rate of ≤ 1 bar/ms for mechanical pressure switches, and at ≤ 5 bar/ms for transmitters.

RoHS-Compliance

RoHS

= Restriction of Hazardous Substances (EC Directive 2011/65/EU (RoHS II))



CE-Mark

= Communauté Européenne European Parliament and Council directives must be observed when products are launched onto the market. If a directive exists for a product, it must be applied. Only products for which a directive exists may bear the CE mark.

Only products which have been tested according to CE directive or corresponding standards may carry the CE mark.

Mechanical pressure switches with a supply voltage above 50 VAC or 75 VDC are covered by the 2014/35/EU Low Voltage Directive. Variants for potentially explosive areas are covered in addition by the 2014/34/EU ATEX Product Directive.

Our electronic products satisfy EMC (Electromagnetic Compatibility) Directive 2014/30/EC.

Mechanical pressure switches do not fall under the EMC Directive.

The Machinery Directive 2006/42/EC is not applicable, because our products are classed as components.

Our product designs are based upon „good engineering practise“ in line with Article 4, Paragraph 3 of the Pressure Equipment Directive (2014/68/EU), meaning neither a declaration of conformity may be issued nor a CE mark affixed.

The current product-specific CE declaration is available in the download area of our homepage:

www.suco.de/en/downloads



Subject to technical changes