MEDENUS

Gas Pressure Regulation

MADE IN GERMANY

100% Wasserstoff geeignet

H_2

100% Hydrogen ready

Safety Shut-Off Valve S 104

Product information

EN

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ATTENTION Observe the following publications in relation to installation, start-up and maintenance:
DVGW - work sheets G 491 and G 600
Operating and Maintenance Instructions S104

List of abbreviations and formula symbols

AC	Accuracy class
AG_o	Upper response pressure group
AG_u	Lower response pressure group
BV	Breather valve
GPR	Gas pressure regulator
HDS	High-pressure spindle
K_G	Valve flow rate coefficient
p	Pressure
p_d	Outlet pressure
p_{df}	SRV closing pressure
p_{do}	SRV opening pressure
p_{ds}	Setpoint of the response pressure
$p_{ds\,o}$	Upper SSV response pressure
$p_{ds\,u}$	Lower SSV response pressure
$p_{f,max}$	Maximum closing pressure
PS	Maximum allowable pressure
p_u	Inlet pressure
Q_n	Standard volumetric flow rate
RE	Diaphragm assembly
RSD2	Throttle valve
SSV	Safety shut-off valve
SRV	Safety relief valve
SG	Closing pressure group
t_{Gas}	Gas inlet temperature
VS	Valve seat
w_d	Outlet gas velocity
w_u	Inlet gas velocity
$W_{ds\,o}$	Upper spring adjustment range (SSV)
$W_{ds\,u}$	Lower spring adjustment range (SSV)
Δp	Pressure difference from inlet pressure to outlet pressure
Δp_{wo}	Min. re-engagement difference between upper response pressure and normal operating pressure
Δp_{wu}	Min. re-engagement difference between lower response pressure and normal operating pressure
ρ_n	Gas density

*) KG value for natural gas

Application, characteristics, technical data

Application

Safety shut-off valve (SSV), direct-acting (operating without auxiliary power), for systems acc. to DVGW Code of Practice G 491 (A) and G 600 (A) (TRGI)
Can be used as an equipment component on gas consumption facilities as defined in Regulation (EU) 2016/426.
Can be used for the gases defined in DVGW Code of Practice G 260 / G 262 and neutral non-aggressive gases. (other gases on request)

Characteristics

- Integral pressure-tight version (IS)
- High flow rate capacity
- Open-air model

Type of models / Options (see page 13)

- With AV breather valve
- With electric position indicator SSV "Closed" via Reed contact
- With SSV electromagnetic remote release when power is applied or in case of power failure
- With SSV manual release
- Oxygen model
- Hydrogen version
- Coating with epoxy resin in RAL colors

Response pressure groups

Upper response pressure group AG_o in command area w_{dso}	AG_o
50 mbar to 100 mbar	10
> 100 mbar to 500 mbar	5
> 500 mbar	2.5

Lower response pressure AG_u in command area w_{dsu}	AG_U
10 mbar to 30 mbar	20
> 30 mbar to 50 mbar	10
> 50 mbar	5

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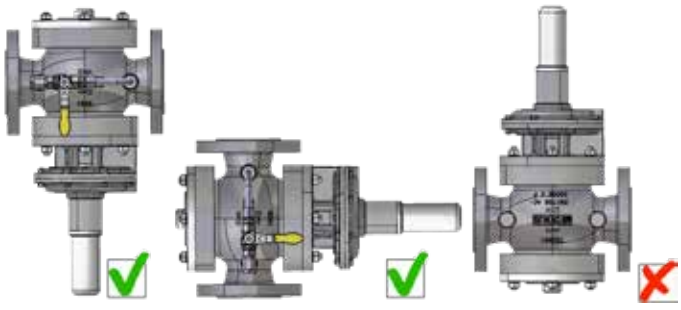
Technical data

Type	S 104
Model	Integral pressure-tight (IS)
Max. allowable pressure PS	16 bar
Max. inlet pressure $p_{u,max}$	16 bar
Nominal width	DN 25, DN 40, DN 50, DN 65, DN 80, DN 100, DN 125, DN 150, DN 200
Connection type	DIN EN 1092 PN 16 flanges ASME - B16.5 flanges Class 150 RF
Material Housing / actuator housing/ control device housing	 Al cast alloy
Corrosivity category C1 to C5-I C5-M	DIN EN ISO 12944-2 without additional coatings an epoxy resin coating is recommended (see page13)
Temperature range, Class 2 (operating/ambient temperature)	-20°C to +60°C
Function, strength, and tightness to CE mark acc. to PED/ PIN number	DIN EN 14382 CE-0085-AQ0880
Ex protection	The mechanical parts of the device do not have any potential ignition sources of their own and therefore do not fall within the scope of ATEX 95 (94/9/EC). Electrical components fitted to the device comply with the ATEX requirements.

Preferred installation position

The gas pressure regulators S104 shall be installed in the pipeline preferably in horizontal position.
For all nominal widths, the direction of flow is indicated by an arrow on the housing.



Overhead installation position
only after consultation
with Medenus GmbH

Note: Observe the following documents in relation to installation, start-up, and maintenance:

- DVGW - work sheets G 491 and G 600
- Operating and Maintenance Instructions S104

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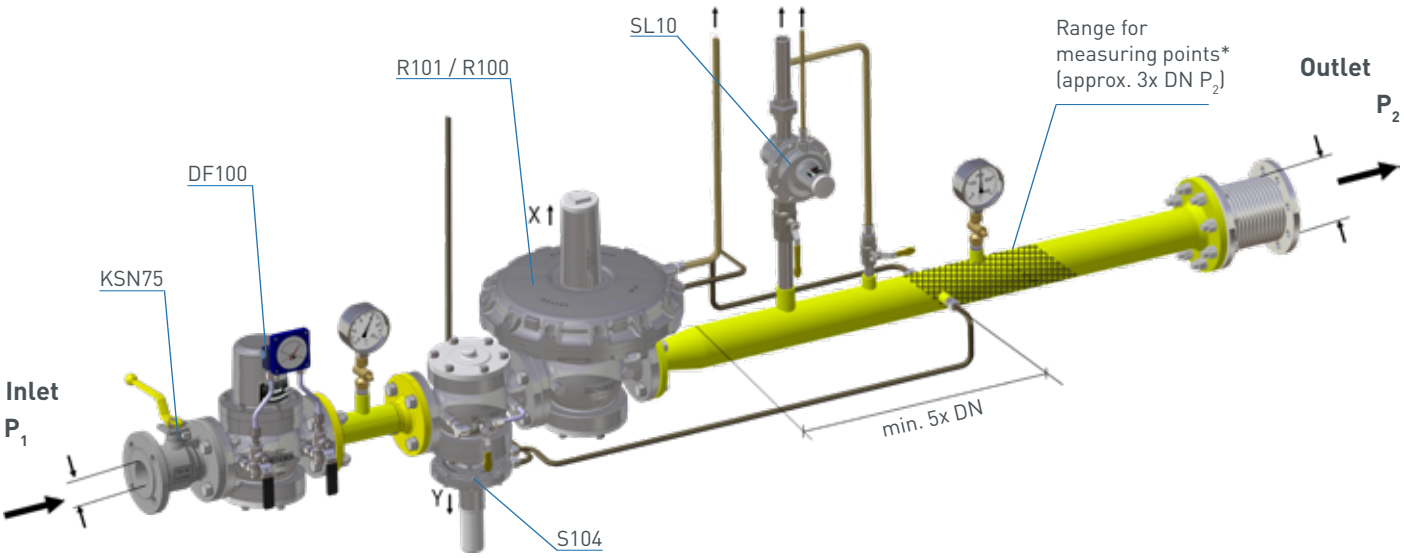
Application, characteristics, technical data

Structure and function

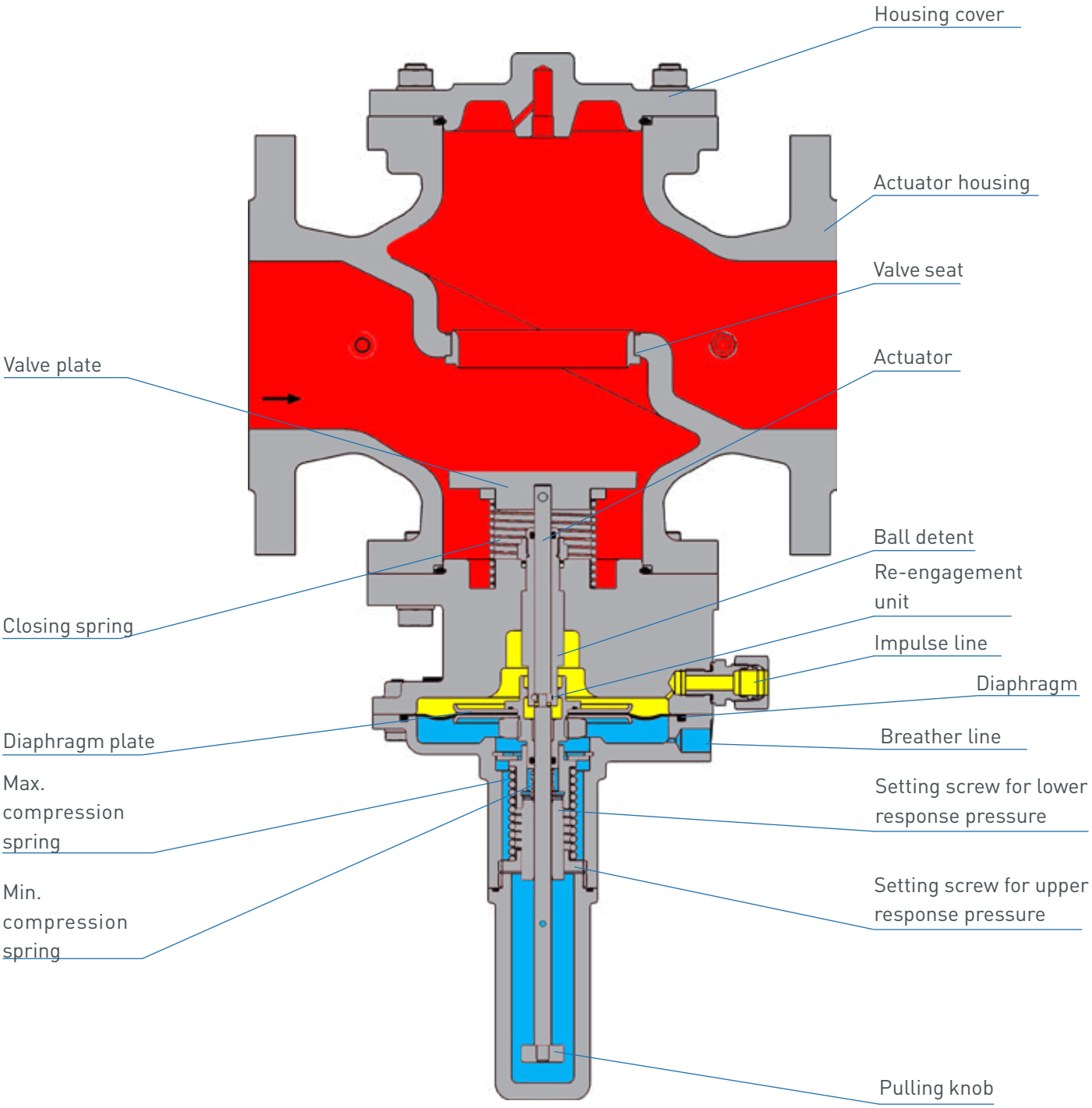
The safety shut-off valve S 104 shuts off the gas flow when the outlet pressure in the regulating section exceeds or falls below a certain response pressure. To this end, the outlet pressure to be monitored is passed on to the SSV control device via a separate measurement line.
As a function of the change in pressure, the diaphragm in the control device is raised or lowered. When the outlet pressure in the regulating section falls below the lower switch-off point or exceeds the upper switch-off point, the switch socket connected to the SSV diaphragm will move to the corresponding disengaging position, the balls of the engaging mechanism will release the SSV screw spindle, and the closing spring will press the SSV valve plate against the valve seat. The SSV actuator shuts off the gas flow gas-tight.
The SSV can only be opened by hand and engaged in the open position. To do so, the outlet pressure at the measuring point must be lowered below the upper response pressure or raised above the lower response pressure by at least the re-engaging differential amount (Δp).
The SSV can, except where otherwise stipulated in specific national legislation, be used in either functional class A (with diaphragm rupture protection) or B (without diaphragm rupture protection).
There is also the option of using a remote display for the SSV position "CLOSED" and a manual and remote release when power is applied or in case of power failure.

Installation example



*) Recommended max. velocity at the measurement line port 25 m/s

Sectional view



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K_G value

(KG value for natural gas: (ρ_n = 0.83 kg/m³), t_u = 15°C)

Nominal width / Valve seat Ø	DN 25	DN 40	DN 50	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200
32.5 mm	450	550							
52.5 mm			1350	1650					
80.0 mm					3300	3900	4500		
125.0 mm								8000	
160.0 mm									14,000
Connection type	DIN EN 1092 - PN16								

SSV setpoint spring table - control device

		S104: DN 25 - 125 small ball lock							
		ND				MD			
		to $W_{ds\,o}$ 200mbar				to $W_{ds\,o}$ 300mbar			
Spring data		Lower response pressure		Upper response pressure		Lower response pressure		Upper response pressure	
Feder Nr.	Farbe [RAL]	$W_{ds\,u}$ [mbar]	Δp_{wu} [mbar]	$W_{ds\,o}$ [mbar]	Δp_{wo} ** [mbar]	$W_{ds\,u}$ [mbar]	Δp_{wu} [mbar]	$W_{ds\,o}$ [mbar]	Δp_{wo} ** [mbar]
FE 900	1028								
FE 901 VA	2002								
FE 902 VA	6010	3 - 7	15			0 - 12*	40		
FE 903	5015	5 - 9	15			4 - 14	40		
FE 904 VA	9005	7 - 13	15			8 - 18	40		
FE 905 VA	9010	13 - 25	15			18 - 42	40		
FE 906	4002					48 - 70	40		
FD 910	1028							35 - 45	40
FD 911	2002			25 - 33	15			45 - 80	40
FD 912	6010			33 - 56	15			70 - 120	40
FD 913	5015			54 - 85	15			100 - 170	40
FD 914	9005			85 - 119	15			140 - 230	40
FD 915	9010			100 - 176	15			210 - 300	40
FD 916	3020			152 - 200	15				
FD 917	5010								
FD 918	9006								
FD 919	4002								

		S104: DN 25 - 125 small ball lock							
		MD-R				HD			
		to $W_{ds\,o}$ 3500mbar				to $W_{ds\,o}$ 16000mbar			
Spring data		Lower response pressure		Upper response pressure		Lower response pressure		Upper response pressure	
Feder Nr.	Farbe [RAL]	$W_{ds\,u}$ [mbar]	Δp_{wu} [mbar]	$W_{ds\,o}$ [mbar]	Δp_{wo} ** [mbar]	$W_{ds\,u}$ [mbar]	Δp_{wu} [mbar]	$W_{ds\,o}$ [mbar]	Δp_{wo} ** [mbar]
FE 900	1028								
FE 901 VA	2002					20 - 120*	500		
FE 902 VA	6010	24 - 74	90			120 - 310*	500		
FE 903	5015	36 - 78	90			160 - 316	500		
FE 904 VA	9005	58 - 110	90			200 - 400	500		
FE 905 VA	9010	110 - 160	90			416 - 650	500		
FE 906	4002	162 - 250	90			560 - 940	500		
FD 910	1028			100 - 135	50				
FD 911	2002			130 - 250	50				
FD 912	6010			220 - 360	50				
FD 913	5015			320 - 510	50				
FD 914	9005			440 - 700	50				
FD 915	9010			630 - 1130	50			2200 - 4000	300
FD 916	3020			1060 - 1750	50			3400 - 4750	300
FD 917	5010			1420 - 2520	50			4700 - 7400	300
FD 918	9006			1850 - 3200	50			7200 - 12100	300
FD 919	4002			2800 - 3500	50			11700 - 16000	300

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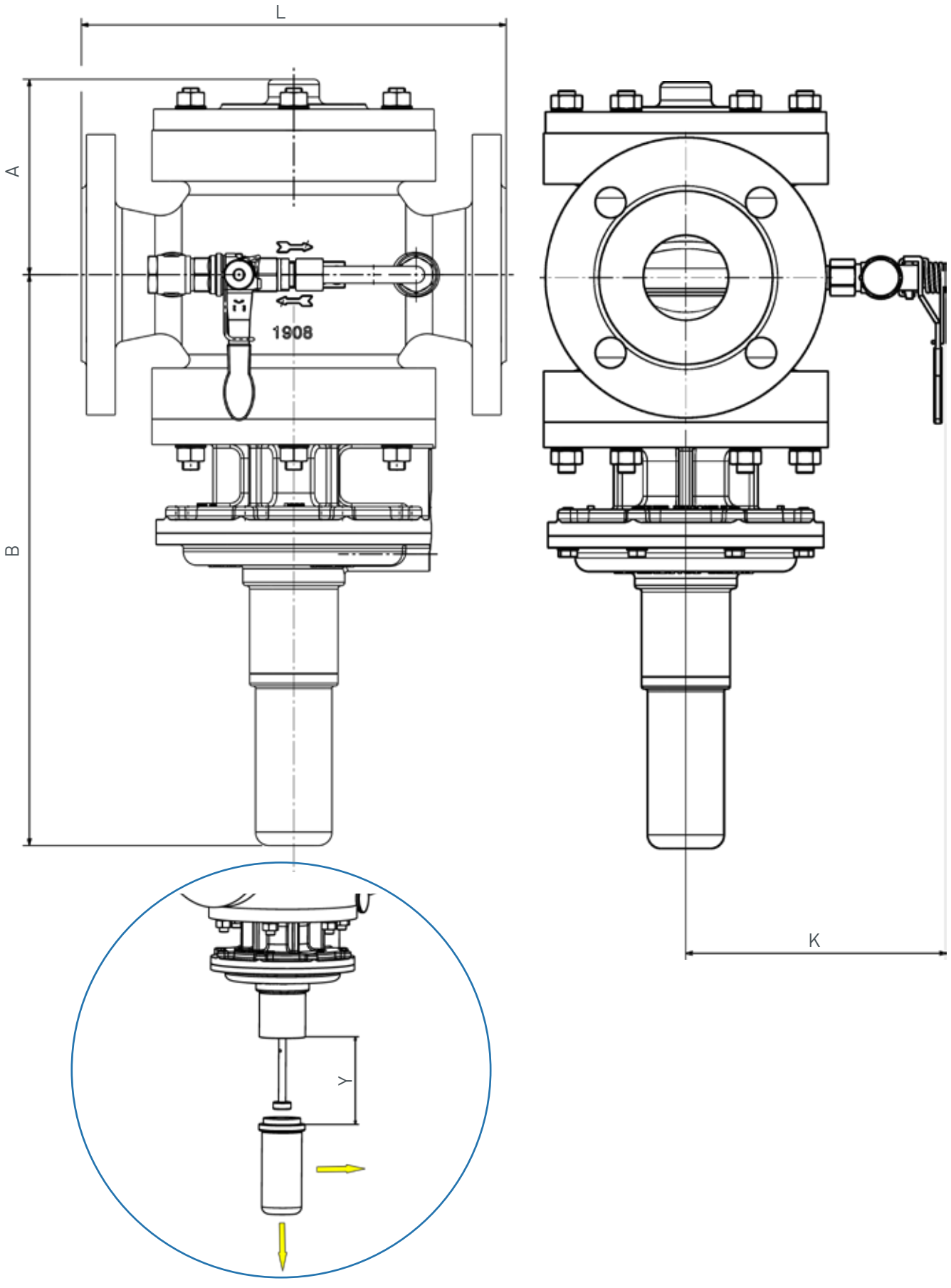
		S104: DN 150 - 200 large ball lock							
		ND				MD			
		to $W_{ds\,o}$ 200mbar				to $W_{ds\,o}$ 300mbar			
Spring data		Lower response pressure		Upper response pressure		Lower response pressure		Upper response pressure	
Feder Nr.	Farbe [RAL]	$W_{ds\,u}$ [mbar]	Δp_{wu} [mbar]	$W_{ds\,o}$ [mbar]	Δp_{wo} [mbar]	$W_{ds\,u}$ [mbar]	Δp_{wu} [mbar]	$W_{ds\,o}$ [mbar]	Δp_{wo} [mbar]
FM 400	1028	3 - 25	20			10 - 40*	30		
FM 402	6010					35 - 115	30		
FM 404	9005					60 - 245	30		
FL 411	2002			45 - 81	20				
FL 412	6010			62 -111	20			40 - 180	50
FL 413	5015			100 - 200	20			70 - 300	50
FL 415	9010								
FL 417	4010								

		S104: DN 150 - 200 large ball lock							
		MD-R				HD			
		bis $W_{ds\,o}$ 3500mbar				bis $W_{ds\,o}$ 16000mbar			
Spring data		Lower response pressure		Upper response pressure		Lower response pressure		Upper response pressure	
Feder Nr.	Farbe [RAL]	$W_{ds\,u}$ [mbar]	Δp_{wu} [mbar]	$W_{ds\,o}$ [mbar]	Δp_{wo} [mbar]	$W_{ds\,u}$ [mbar]	Δp_{wu} [mbar]	$W_{ds\,o}$ [mbar]	Δp_{wo} [mbar]
FM 400	1028	20 - 180*	60			0 - 250	500		
FM 402	6010	155 - 380	60			150 - 1000*	500		
FM 404	9005	200 - 950	90			650 - 2050	500		
FL 411	2002								
FL 412	6010			145 - 670	180			380 - 1400	500
FL 413	5015			270 - 1230	180			800 - 2800	500
FL 415	9010			1200 - 3500	180			3200 - 5500	500
FL 417	4010							4500 - 16000	500

Dimensions, connection, and weight

Dimensional drawing



Reactivation of SSV

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Dimensions and weight

Nominal width / Dimensions	DN 25	DN 40	DN 50	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200
A [mm]	105	98	115	116	139	150	150	195	225
B [mm]	286	314	336	342	360	360	371	371	475
B [mm] model with HD SSV [mm]	+10	+10	+10	+10	+10	+10	+10	+23	+23
L [mm]	160	160	250	220	280	300	260	380	420
K [mm]	157.5	175	153	160	165	177.5	190	209	233
Y [mm]	100	100	100	100	100	100	100	150	150
Weight [kg]	3.5	5.0	8.5	7.0	13.0	15.0	32.0	32.0	49.0
Connection	DIN EN 1092 - PN16								

Connection of the measuring lines and breather lines

Nominal width	Version	Bore Ø			
		Measurement line	Breather line	Measurement line	Breather line
DN 025 DN 040	MD	2	2	Connection* for: tube 12 x 1.5 (thread G 1/4)	
	MD-R	2	3		
	HD	2	2		
DN 050	MD	2	2		
	MD-R	2	3		
	HD	2	2		
DN 065	MD	3,5	2		
	MD-R	3,5	3		
	HD	3,5	2		
DN 080 DN 100 DN 125	MD	2	2		
	MD-R	2	3		
	HD	2	2		
DN 150	MD	4	2	Connection* for: tube 12 x 1.5 (thread G 3/8)	
	MD-R	4	2		
	HD	4	2		
DN 200	MD	4	2		
	MD-R	4	2		
	HD	4	2		

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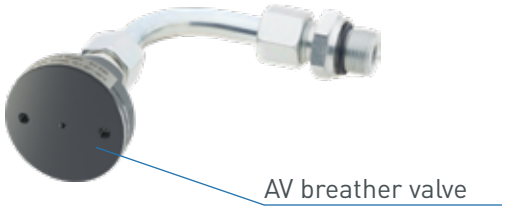
Types of models / Options

AV breather valve

The AV breather valve is used as for securing the installation room against inadmissible escape of gas from diaphragm comparator compartments of safety shut-off valves. In case of a defect, the impermissible escape of gas into the surrounding atmosphere is limited to a maximum of 30l/h (air).

It also serves as a substitute for an expensive and complex installation of breather lines.



(Option not available for hydrogen version H_2)

Reed contact

Reed contacts are used to monitor the position (closed or open position) of the safety shut-off valve via remote display.

SSV manual and remote release

The direct-acting safety solenoid valve is used as electromagnetic remote release for closing the safety shut-off valve when power is applied or in case of power failure.

Epoxy resin coating in RAL colors

To protect the gas pressure regulator from external influences, starting from a corrosivity category C5-M we recommend an epoxy resin coating.

Types of models

Oxygen model O_2 ($p_u \leq 10$ bar)

Hydrogen version H_2 (with helium leak test)

The Medenus gas pressure regulators are suitable for use with hydrogen as a medium up to a proportion of 100%. Further information can be found in the special edition (10/2019) of gwf Gas+Energie and on our homepage at

(www.medenus.de)

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Design

Device selection

Selection of the SSVs from the SSV control device table (page 8)
Note: Recommended upper SSV response pressure $p_{ds\,o}$ < 500 mbar + p_{ds}

Note: When selecting springs, AG_o and AG_u must be observed. The possible minimum and maximum response pressures are calculated as follows:
$p_{dso\ min/max} = p_{ds\,o} \bullet (1 \pm AG_o / 100)$

$p_{dsu\ min/max} \bullet (1 \pm AG_u / 100)$

Checking the gas velocities

$w = 380 \bullet Q_n / (DN^2 \bullet p_{abs})$

Note: The factor 380 refers to an operating gas temperature from approx. 15°C to 20°C. For other temperatures, the velocity must be corrected as follows: $w_{corr} = w \bullet (t_{gas} + 273.15) / 290$

Recommended max. gas velocity at the inlet flange:
50 - 70 m/s Lower value for redirections upstream of the SSV

Example:

MDR with FD 914 (440-770 mbar) AG_o10
set to $p_{ds\,o}$ = 700 mbar
and FE 904 (110-150 mbar) AG_u5
set to $p_{ds\,u}$= 130 mbar

$p_{dso\ max} = 700 \bullet (1 + 10 / 100) = 770$ mbar
$p_{dso\ min} = 700 \bullet (1 - 10 / 100) = 630$ mbar
$p_{dsu\ max} = 130 \bullet (1 + 5 / 100) = 136.5$ mbar
$p_{dsu\ min} = 130 \bullet (1 - 5 / 100) = 123.5$ mbar

Inlet and outlet nominal width of the pipeline according to the selected device: 80 mm
Selected widening of outlet pipeline: 200 mm

$w_u = 380 \bullet 2500 / (80^2 \bullet 6) = 24.7$ m/s

The device selected in the example of nominal width DN 80 can be operated under these conditions.

Determining the upper response pressure

Outlet pressure P_d (mbar)	Upper response pressure W_{dso}
⩽200	P_d +100 mbar
>200 - ⩽800	P_d x 1.5
>800 - ⩽1600	P_d x 1.3
>1600	P_d +500 mbar

Pressure loss formula

Calculation pressure absolute (p_u +1 bar)

$$\Delta p = \left(\frac{Q_n}{K_G}\right)^2 \times \frac{1000}{p_u}$$

Properties of gases

Gas	f	Hs,n [kWh/m³]	Gas	f	Hs,n [kWh/m³]
Acetylene	0.84	16.25	Sewage gas	0.84	
Ammonia	1.04	4.83	Carbon monoxide	0.81	3.51
Butane	0.55	37.23	Carbon dioxide	0.65	-
Chlorine	0.51	-	Air	0.80	-
Landfill gas	approx. 0.80		Methane	1.08	11.06
Natural gas L	1.00	9.77	Propane	0.64	28.03
Natural gas H	1.03	11.45	Oxygen	0.76	-
Ethane	0.78	19.55	Sulphur dioxide	0.53	-
Ethylene	0.97	16.516	Nitrogen	0.81	-
Mine gas	(30% CH4)	0.86	Hydrogen	3.04	13.43
Helium	2.15	-			

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Order data

Example:

Safety shut-off valve: S104/050/MD-R/left/BV/N/H/WAZ/So

Order selection	**Designation**	**Order code:**	S104	050	-	MD-R	-	left	BV	N	H	WAZ	So
Type													
S104	S104		S104										
DN - Nominal width	Table p. 8			050									
Flange model													
PN 16	-				-								
Class 150	C												
SSV													
with control device MD	MD												
with control device MD-R	MD-R					MD-R							
SSV functional class													
A	-						-						
B	B												
Direction of flow													
Right (from left to right)	-												
Left (from right to left)	left							left					
SSV valve accessories	page 13												
without SSV valve accessories	-												
Breather valve	BV								BV				
Electrical position indicator, SSV "Closed"	page 13												
without electrical position indicator	-												
with ... , via proximity switch	N									N			
with ... , via Reed contact	R												
SSV release	page 13												
without release	-												
with manual release	H										H		
with electromagnetic remote release, when power is supplied	SG												
with electromagnetic remote release, in case of power failure	SA												
Acceptance test certificate to EN 10204/3.1													
without acceptance test certificate	-												
with acceptance test certificate	WAZ											WAZ	
Special model	So*												So

- Coating with epoxy resin in RAL colors
- Oxygen model

In every selection group, only one option can be selected in each case.

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THE MEDENUS PLUS

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3. „DÜSE“ design programme: leave nothing to chance!
4. Shortest delivery times and spare parts: we won't leave you out in the rain!
5. Certified according to ISO 9001, quality standard products: with us you can be sure!
6. Special tools? You can service our appliances without them!
7. Modular design of the devices: be flexible for the most diverse requirements!
8. 100% Made in Germany, 100% hydrogen-ready!
9. Online service 24/7: documents, maintenance videos, ... around the clock!
10. Expertise: benefit from our in-house trainings at your premises or trainings at our location!

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Notes

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