

MEDENUS



Gas Pressure Regulation



Gas Pressure Regulator R 100 / R 100U

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 R 100 / R 100 U

List of abbreviations and formula symbols

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

*) K_G value for natural gas

Application, Characteristics, Technical Data

Application

Gas pressure regulator (GDR), direct-acting (operating without auxiliary power), for systems acc. to DVGW work sheets G 491 (A) and G 600 (A) (TRGI)

Particularly suitable for dynamic regulation sections (e.g. gas fireplaces, natural gas supply systems, burner circuits, gas motor operation)

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 work sheet G 260 / G 262 and neutral non-aggressive gases. (other gases on request)

Characteristics

- Integral pressure-tight version (IS)
- Pilot pressure-compensated double-seat valve
- High flow rate capacity
- Open-air model

Types of models (options) (see page 11)

- With throttle valve (RSD2) for the impulse line on the diaphragm assembly
- Oxygen model
- With FKM gaskets + stainless steel seat (e.g. for biogas applications)
- Coating with epoxy resin in RAL colors

Accuracy class AC and closing pressure group SG at the outlet pressure range p_d , minimum pressure differential 100 mbar	AC	SG
8 mbar to 22 mbar	10	50
> 22 mbar to 1200 mbar	10	20

Technical data

Type	R 100 / R 100 U
Model	Integral pressure-tight (IS)
Max. allowable pressure PS	8 bar
Max. inlet pressure $p_{u,max}$	R 100: 8 bar / R 100 U: 1.2 bar
Nominal width	R 100: DN 50, DN 80, DN 100, 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 DIN EN 1706-AC-42100 ST6
Corrosivity category	DIN EN ISO 12944-2
C1 to C5-I	without additional coatings
C5-M	an epoxy resin coating is recommended
Temperature range, Class 2 (operating/ambient temperature)	-20°C to +60°C
Closing pressure zone group	SZ 10
Function, strength and tightness	DIN EN 334
CE mark acc. to PED/ PIN number	CE-0085-AQ0410
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 R100 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.



Installation upside down 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 R 100

CE EAC

Application, Characteristics, Technical Data

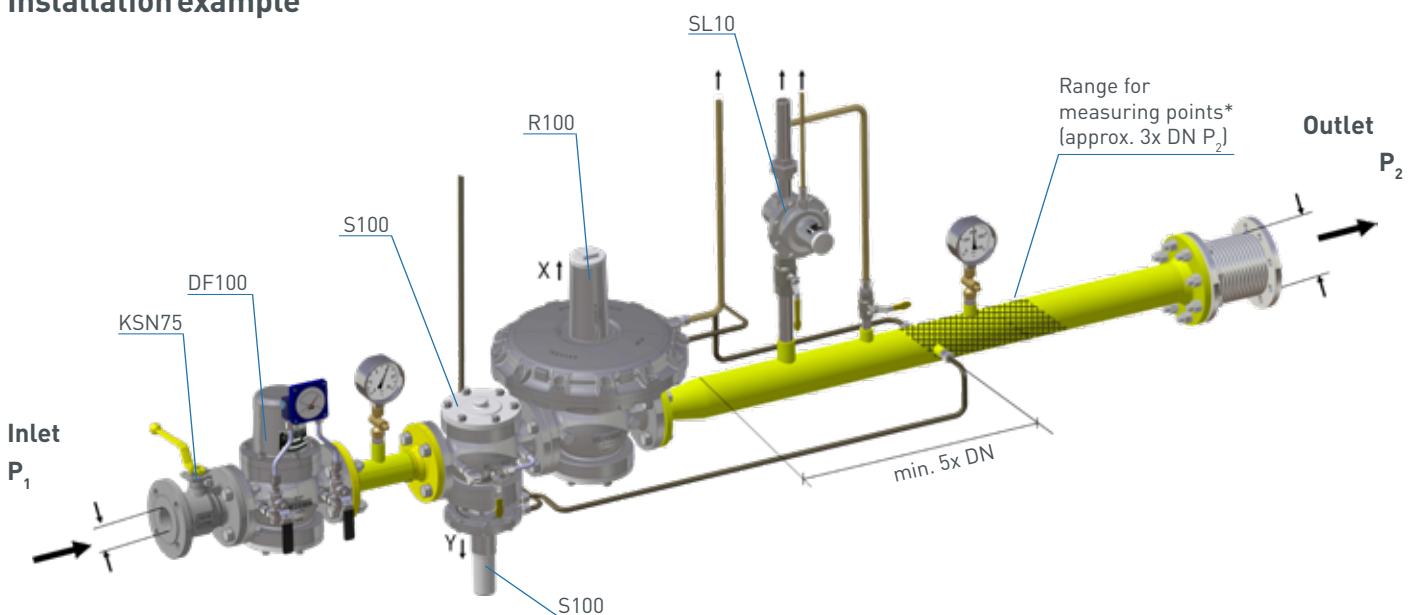
Design and function R 100

The spring-loaded gas pressure regulator R100 has the function of keeping the outlet pressure of a gaseous medium constant within allowable limit values, independently of the effect of interferences, such as changes in the inlet pressure and/or in the gas tap, in the connected regulation section on the outlet side. The gas pressure regulator is composed of the actuator housing and the "diaphragm assembly plus actuator" functional unit. The double-seat valve seat model is pre-pressure-compensated. The gas flows through the actuator housing in the direction of the arrow. The external measurement line port is used to pass the outlet pressure to be regulated to the bottom of the main diaphragm of the diaphragm assembly. It compares the actual value with the command variable preset by the force of the setpoint spring. The setpoint required in each case is set via the setting screw. Any deviation from the setpoint is transmitted by the screw spindle to the actuator, which is adjusted such that the actual value is adjusted to the setpoint. In case of zero tap, the actuator will close tight, causing the closing pressure to be established.

Design and function R 100 U

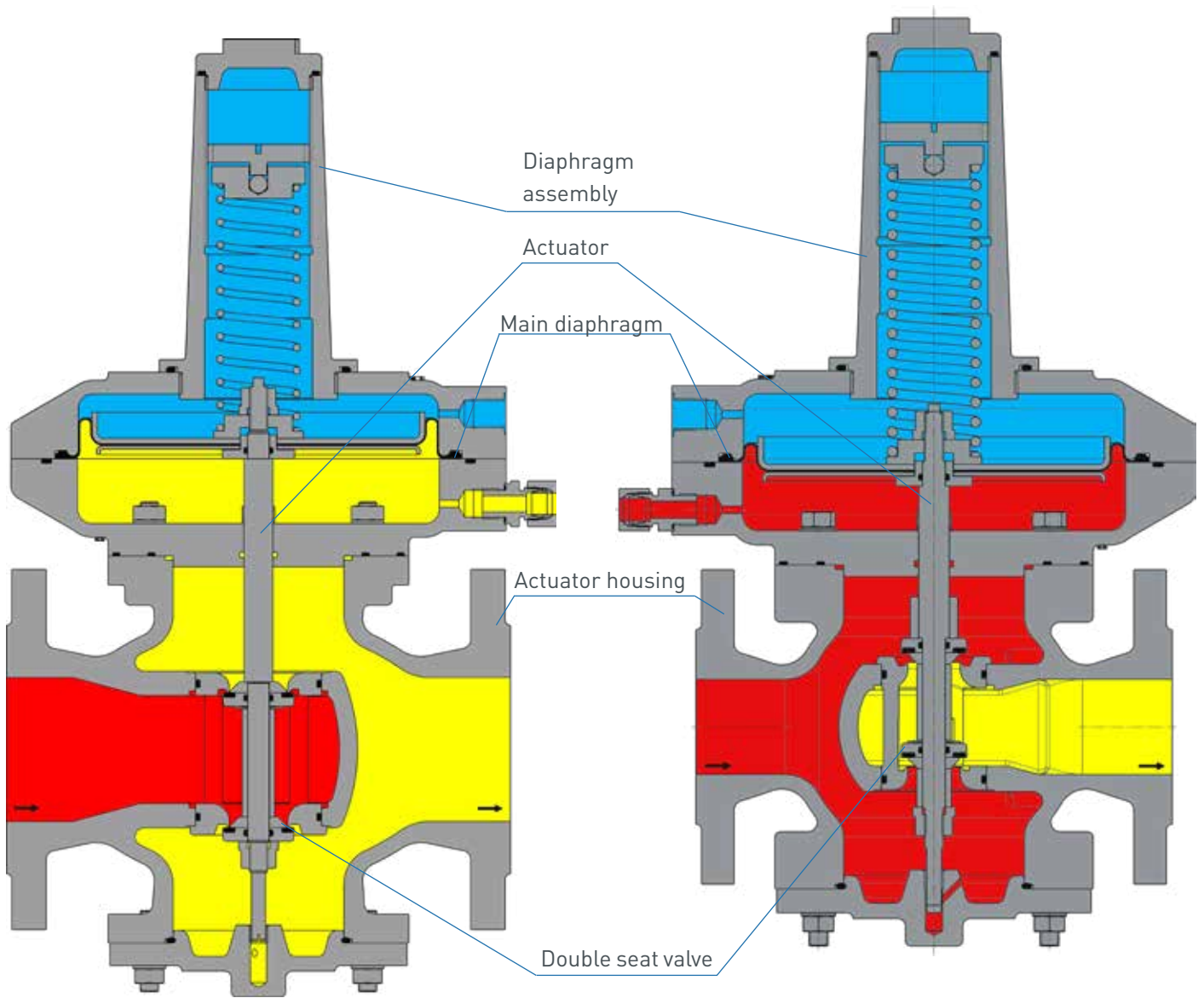
The spring-loaded gas pressure regulator R 100U has the function of keeping the inlet pressure of a gaseous medium constant within allowable limit values, independently of the effect of interferences, such as changes in the outlet pressure, in the connected regulation section on the inlet side. The gas pressure regulator is composed of the actuator housing and the "diaphragm assembly plus actuator" functional unit. The double-seat valve seat model is pre-pressure-compensated. The gas flows through the actuator housing in the direction of the arrow. The external measurement line port is used to pass the inlet pressure to be regulated to the bottom of the main diaphragm of the diaphragm assembly. It compares the actual value with the command variable preset by the force of the setpoint spring. The setpoint required in each case is set via the setting screw. Any deviation from the setpoint is transmitted by the screw spindle to the actuator, which is adjusted such that the actual value is adjusted to the setpoint.

Installation example



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

Sectional view



shown R 100

shown R 100 U

K_G value and diaphragm assemblies

(K_G value for natural gas: d = 0.64 (ρ_n = 0.83 kg/m³), t_v = 15° C)

Nominal width	R 100					R 100 U				
	DN 50	DN 80	DN 100	DN 150	DN 200	DN 50	DN 80	DN 100	DN 150	DN 200
Diaphragm assembly Ø	160	160	160	275-2	275-2	160	160	160	275-2	275-2
Valve seat Ø	275	275	275	385	385	275	275	275	385	385
27.5 - 27.5 mm	800					1100				
32.5 - 32.5 mm		1500					1700			
42.5 - 42.5 mm			2400					3200		
45.0 - 50.0 mm		2500					3400			
60.0 - 65.0 mm			4700					6000		
65.0 - 65.0 mm				5200					7000	
90.0 - 90.0 mm					10000					11000
95.0 - 100.0 mm				12000					13500	
125.0 - 130.0 mm					20200					25000
Connection	DIN EN 1092 - PN16									

RE - Diaphragm assembly

Regulator type Nominal width	Nominal width	Diaphragm assembly	Outlet pressure ranges [mbar]	Recommended use of the high-pressure screw spindle in the pressure range [mbar] (illustration with HDS on p. 11)
R100 / R100U	DN 50	RE 390	8 - 130	130 - 450
	DN 80	RE 275	130 - 450	450 - 1,100
	DN 100	RE 160	450 - 1,200	
	DN 150	RE 385	8 - 350	350 - 850
	DN 200	RE 275-2	350 - 850	850 - 1,200

Diaphragm assembly setpoint spring table R 100 / R100 U

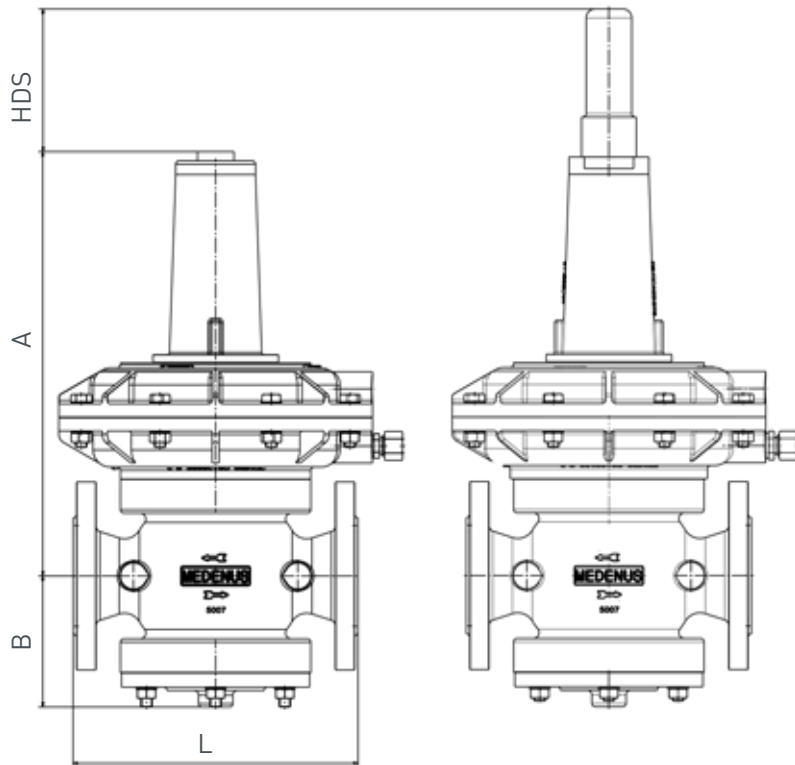
Spring data		Specific command range W_{ds} [mbar]		
Spring no.	Color [RAL]	RE 160	RE 275	RE 390
FA 01	blank		-	8 - 10
FA 02	9006	-	-	9 - 12
FA 03	5015	-	-	11 - 13
FA 04	4002	-	-	12 - 15
FA 05	7037	-	-	14 - 19
FA 06	9005	-	-	18 - 24
FA 07	3020	-	-	23 - 32
FA 08	9010	-	-	31 - 45
FA 09	7016	450 - 600	130 - 156	42 - 64
FA 10	6010	510 - 800	141 - 225	59 - 94
FA 11	2002	760 - 1200	208 - 339	88 - 142
FA 12*	7035	-	293 - 484	124 - 203
FA 13*	5010	-	436 - 726	185 - 305
FA 14*	1028	-	607 - 1017	258 - 428
FA 15*	6018	-	699 - 1100	297 - 450

Spring data		Specific command range W_{ds} [mbar]	
Spring no.	Color [RAL]	RE 275-2	RE 385
FB 701	6018	-	8 - 35
FB 702	9006	-	34 - 41
FB 703	5015	-	40 - 51
FB 704	4002	-	50 - 61
FB 705	7037	-	60 - 77
FB 706	9005	-	76 - 100
FB 707	3020	-	98 - 127
FB 708	9010	-	125 - 167
FB 709	7016	350 - 450	165 - 215
FB 710	6010	397 - 596	212 - 285
FB 711	2002	542 - 814	280 - 390
FB 712	7035	742 - 1078	385 - 520
FB 713*	5010	977 - 1200	515 - 671
FB 714*	1028	-	661 - 850

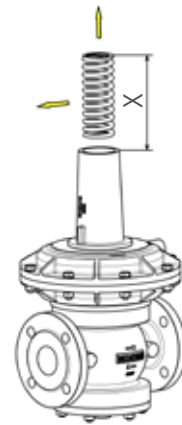
* High-pressure spindle HDS required (illustration p. 11)

Dimensions, Connection, and Weight

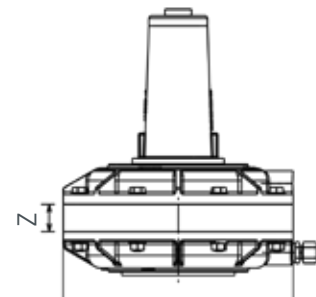
Dimensional drawing



Dismounting dimensions for springs / HDS



Safety diaphragm



Dimensions and weight

		R100 / R100 U					
		RE	DN 50	DN 80	DN 100	DN 150	DN 200
Dimensions	Nominal width						
	A [mm]	160 275 385/390	398 372 372	421 395 395	433 407 407	- 694 647	- 724 677
	HDS [mm]		125	125	125	205	205
	B [mm]		115	138	150	195	245
	L [mm]		250	280	300	380	420
	X [mm]		260	260	260	410	410
	Z [mm]		32.5	32.5	32.5	32.5	32.5
Weight [kg]		160	14	16	19	-	-
		275	17	19	22	62	60
		385/390	19	22	25	65	64
SM safety diaphragm weight [kg]		275	3	3	3	3.3	3.3
		385/390	5	5	5	6	6
	HDS weight [kg]		0.6	0.6	0.6	1.6	1.6
Connection		DIN EN 1092 - PN16					

Example: R100/050/390 with HDS and safety diaphragm

Weight (regulator + HDS + SM): 19 kg + 0.6 kg + 5 kg = 24.6 kg

Dimensions [A + HDS + SM]: 372 mm + 125 mm + 32.5 mm = 529.5 mm

Types of Models / Options

Safety diaphragm

In the model with safety diaphragm, the safety diaphragm is located above the main diaphragm. When the main diaphragm is damaged, the safety diaphragm makes contact with the top cover of the diaphragm assembly and limits any inadmissible escape of gas into the surrounding atmosphere to a maximum of 30l/h (air).

(Option not available for hydrogen version H₂)



RSD2 throttle valve

The RSD2 is a throttle valve which regulates the volume flow in the sensing/impulse line by means of a continuously adjustable cross-sectional reduction. The setting is made tool-free by means of a rotary knob and can be adjusted using a screw to be fixed. The throttle valve cannot be completely shut off, therefore a guaranteed minimum flow is ensured.



High-pressure spindle HDS

The high pressure spindle (HDS) is used to adjust the control spring at high pressure. (See spring tables p. 9)



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 version O₂

Hydrogen version H₂ (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)



Design

Note All calculated pressures are absolute pressures for natural gas. ($p+1$ bar) The required K_G value for a gas pressure regulator is determined with the smallest inlet pressure or lowest pressure drop.

p_u Inlet pressure (bar)
 p_d Outlet pressure (bar)
 Q_n Standard volumetric flow rate m^3/h

Calculation of the required K_G value

$p_d / p_u > 0.5$
 Value flow rate coefficient K_G at a subcritical pressure ratio
 $K_G = Q_n / \sqrt{p_d \cdot (p_u - p_d)}$

$p_d / p_u \leq 0.5$
 Value flow rate coefficient K_G at a supercritical pressure ratio
 $K_G = 2 \cdot Q_n / p_u$

Note For spring-loaded devices, a capacity reserve of 10-20% is recommended in order to comply with the accuracies given.

The device is selected on the basis of its K_G value from the table of flow rate coefficients (page 8)

Device selection

Note Closing pressure zone group: SZ 2.5

For the small load Q_{min} with SZ this yields 2.5: $Q_{min} = 0.025 \cdot K_G \cdot p_{u\ max}$

Small load Q_{min} - When burner is started or at Q_{min} a K_G utilization level of at least 1% should be reached. Selection of the diaphragm assembly from the diaphragm assembly setpoint spring table (page 9)

Selection of the closing pressure group from the closing pressure group table (page 4)

$$P_{f\ max} = p_{ds} \cdot (1 + SG/100)$$

Selection of the SSVs from the SSV control device table (page 10)
 Recommended upper SSV response pressure $p_{dso} < 500\ mbar + p_{ds}$

Example: Overpressure Absolute pressure

$p_{u\ min}$ 5.0 bar 6.0 bar
 $p_{d\ min}$ 0.5 bar 1.5 bar
 $Q_{n\ min}$ 2500 m^3/h

$1.5\ bar / 6\ bar = 0.25 < 0.5$
 \rightarrow Supercritical pressure ratio
 $K_G = 2 \cdot 2500 / 6 = 833\ [m^3/(h \cdot bar)]$

Selected device

Type R 100
 DN - Nominal width 080
 D - Nozzle V 32.5 - 32.5
 K_G value 1500 $m^3/(h \cdot bar)$

$$Q_{min} = 0.025 \cdot 833 \cdot 6 = 124.95\ m^3/h$$

Selected diaphragm assembly

RE - Diaphragm assembly 275
 Setpoint spring FA11
 (W_{ds} 208 - 339)

AC 5/SG 10 (for RE 275 D - Nozzle 27.5)

Selected SSV

MD-R with FD 913 (285 - 460 mbar) AG_u 10
 set to $P_{dso} = 375\ mbar$
 and FE 901 (50 - 80 mbar) AG_u 5

Note Standard setpoint springs SSV

(small ball lock)

MD FE 902 (12 - 24 mbar)
 MD-R FE 901 (50 - 80 mbar)

(large ball lock)

MD FM 402 (35 - 115 mbar)
 MD-R FM 400 (10 - 180 mbar)

Nominal width of input and output of pipeline according to the selected device: 80 mm
 Selected widening of outlet pipeline: 200 mm

$$w_u = 380 \cdot 3000 / (80^2 \cdot 14) = 13\ m/s$$

$$w_d = 380 \cdot 3000 / (80^2 \cdot 1.25) = 143\ m/s$$

$$w_{impulse} = 380 \cdot 3000 / (200^2 \cdot 1.25) = 23\ m/s$$

Determining the upper response pressure

Outlet pressure P_d (mbar)	Upper response pressure W_{dso} *
≤ 200	$P_d + 100\ mbar$
$> 200 - \leq 800$	$P_d \cdot 1.5$
$> 800 - \leq 1600$	$P_d \cdot 1.3$
> 1600	$P_d + 500\ mbar$

Checking the gas velocities

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

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:
 $w_{corr} = w \cdot (t_{gas} + 273.15) / 290$

Recommended max. gas velocity at the inlet flange:

50 - 70 m/s lower value for redirections upstream of the control valve, 20 m/s for upstream filters

Recommended max. gas velocity at the outlet flange:

100 - 200 m/s lower value to reduce noise emissions

Recommended max. gas velocity on impulse tap: 15 - 25 m/s

15 m/s max. value for outlet pressures below 100 mbar

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

*) The upper response pressure is rounded up to full tens (e.g. 251 mbar \rightarrow 260 mbar)

Properties of gases

- for natural gas ($\rho_n = 0.83 \text{ kg/m}^3$; $t = 15^\circ\text{C}$)
- Δp = pressure difference from inlet pressure to outlet pressure
- Q_n = max. possible volume flow (determined using K_g values with a safety margin of 10%)
- f - natural gas conversion factor- L

Gas	f	Hs,n [kWh/m ³]	Gas	f	Hs,n [kWh/m ³]
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% CH ₄)		0.86	Hydrogen	3.04	13.43
Helium	2.15	-			

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Notes

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Order Data

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

Example:

Gas pressure regulator: R100/050/275/27.5-27.5/HDS/left/SM/RSD2/WAZ/So

Order selection	Designation	Order code:													
		R100	050	-	205	27.5-27.5	HDS	left	SM	RSD2	WAZ	So			
Type															
R 100	R 100	R100													
R 100 U	R 100 U														
DN - Nominal width	Table p. 8		050												
Flange model															
PN 16	-			-											
Class 150	C														
RE - Diaphragm assembly	Table p. 8				275										
D - Nozzle (valve seat diameter)	Table p. 8					27.5-27.5									
High-pressure spindle	Fig. p. 11														
without high-pressure spindle	-														
with high-pressure spindle	HDS							HDS							
Direction of flow															
Right (from left to right)	-														
Left (from right to left)	left								left						
Additional unit, diaphragm assembly	Fig. p. 11														
without additional unit, diaphragm assembly	-														
Safety diaphragm	SM									SM					
Throttle valve	Fig. p. 11														
without throttle valve	-														
with throttle valve	RSD2											RSD2			
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
- Hydrogen model
- FKM gaskets + stainless steel seat

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Trade representation worldwide
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