FRM

Medium Pressure Regulator

DUNGS®
Combustion Controls

Medium pressure regulator Type FRM

Direct acting pressure regulator with adjustable setpoint springs and modular mounted safety shutoff valve (SAV)

In compliance with EN 334 and EN 14382

- Inlet pressures up to 25 bar (2500 kPa)
- High flow rate
- Stable, accurate and sensitive regulation of the outlet pressure
- Admission pressure compensation diaphragm for a high regulation accuracy
- External impulse
- Maintenance-friendly
- Flange connection according to DN 65 – DN 80

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FRM

Spring-loaded, pressure compensating regulator with adjustable setpoint springs for regulation of the regulator outlet pressure. External impulse of the regulator outlet pressure.

Application

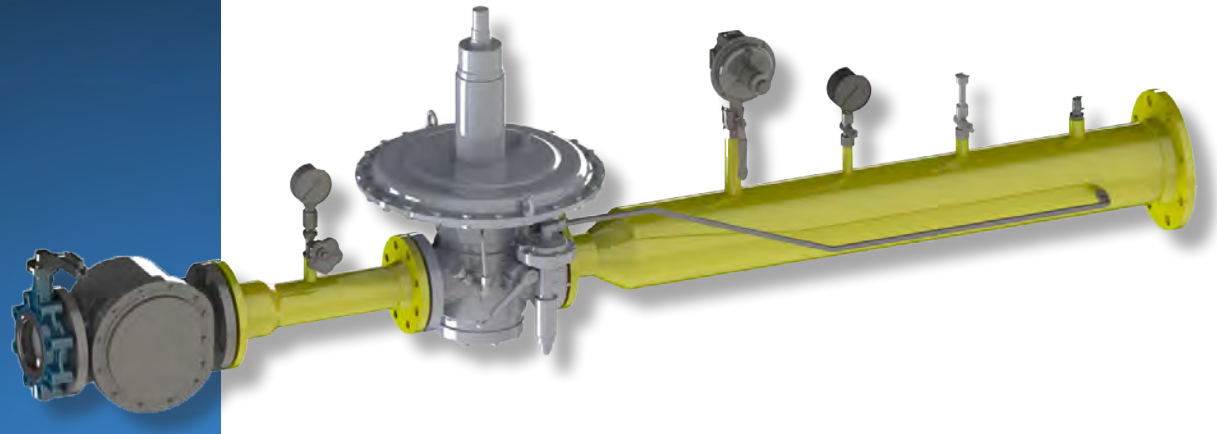
Pressure regulation of industrial gas burners and gas heating appliances. Also for installation in the municipal and commercial gas supply.

Suitable for gases of gas families 1, 2, 3 and other neutral gases.

Approval

EC type testing certificate as per:

- EC-Pressure Equipment Directive



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Spring-loaded medium pressure regulator in compliance with EN334

Type	FRM 100... IS (integral strength range) / FRM 250... DS (differential strength range)
Type of gas	Family 1+2+3
Nominal diameters Flanges	Connecting flange PN 25 according to EN1092-1or ANSI 150 lbs (B16.5) DN 65 80
Max. inlet pressure	FRM 100... 10 bar (1000 kPa) / FRM 250... 25 bar (2500 kPa)
Outlet pressure range	90 mbar a 4000 mbar (9-400 kPa)
Minimum differential pressure (MD)	350 mbar (35 kPa)
Minimum differential pressure (HD/UHD)	500 mbar (50 kPa)
Accuracy class	up to AC 5 (see adjustment range, page 8)
Lock-up pressure class	up to SG 10 (see adjustment range, page 8)
Failure mode (diaphram rupture)	fail-open
Materials	Main body housing: cast iron GGG 50 Diaphragm housing: steel Diaphragms: NBR
Ambient temperature	-20 °C to +60 °C

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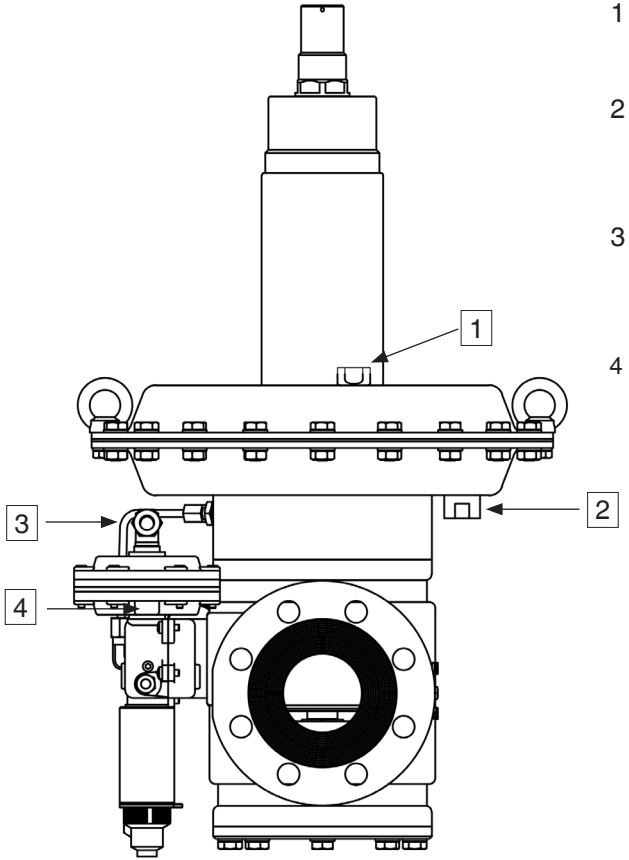
Safety shut-off valve in compliance with EN14382, class A

Type	FRM 100... IS (integral strength range) / FRM 250... DS (differential strength range)
Response time	< 2 s
Lower adjustment range W_{du}	35 mbar up to 3000 mbar (3,5-300 kPa)
Upper adjustment range W_{do}	180 mbar up to 5000 mbar (18-500 kPa)
Materials	Main body housing: cast iron GGG 50 Diaphragm housing: aluminium Diaphragms: NBR



1 Vent line connection of the regulator, G ½ ISO 228

2 External impulse line connection of the regulator, Ermeto screw connection GE 12- ½ for tubes 12 x 1.5

3 External impulse line connection of the SAV, Ermeto screw connection GE 12- ¼ for tubes 12 x 1.5

4 Vent line connection SAV, G ¼ ISO 228

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Example FRM 100080 MD/ SAV MD	FRM	100	080	MD	SAV	MD
Type	Spring-loaded medium pressure regulator					
MOP	**100 …** **10 000 mbar**					
	250 … **25 000 mbar**					
Nominal diameter	065 DN 65					
	080 DN 80					
Pressure range, outlet pressure	MD Medium pressure					
	HD High pressure					
	UHD Ultra high pressure					
Safety device	SAV Integrated shut-off valve					
Pressure range, trip pressure	MD Medium pressure					
	HD High pressure					
	UHD Ultra high pressure					
Flange type	with standard PN-25					
	ANSI with ANSI 150 lbs					

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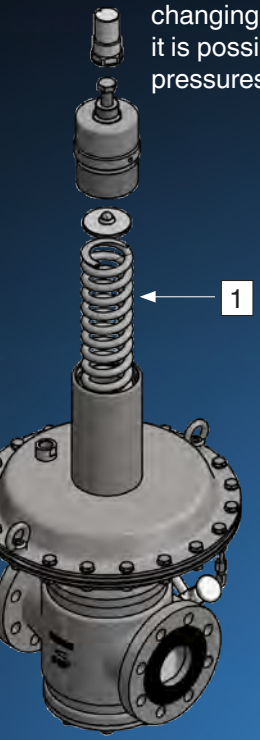
Type	Connec-tion	Ver-sion	Accuracy class* [AC]	Lock-up pressure class* [SG]	Outlet pressure range W_d	Under pressure monitoring SAV		Over pressure monitoring SAV	
						W_{du}	AG	W_{do}	AG
FRM 100065 MD	DN 65	MD	AC 5/10**	SG 10/20**	90-420 mbar				
FRM 100065 HD	DN 65	HD	AC 5	SG 10	400-1500 mbar				
FRM 250065 UHD	DN 65	UHD	AC 5	SG 10	1000-4000 mbar				
FRM 100065 MD / SAV MD	DN 65	MD	AC 5/10**	SG 10/20**	90-420 mbar	35-400 mbar	AG 10	180-800 mbar	AG 10
FRM 100065 HD / SAV HD	DN 65	HD	AC 5	SG 10	400-1500 mbar	150-1400 mbar	AG 5	500-3500 mbar	AG 5
FRM 250065 UHD / SAV UHD	DN 65	UHD	AC 5	SG 10	1000-4000 mbar	150-3000 mbar	AG 5	1300-5000 mbar	AG 5
FRM 100080 MD	DN 80	MD	AC 5/10**	SG 10/20**	90-420 mbar				
FRM 100080 HD	DN 80	HD	AC 5	SG 10	400-1500 mbar				
FRM 250080 UHD	DN 80	UHD	AC 5	SG 10	1000-4000 mbar				
FRM 100080 MD / SAV MD	DN 80	MD	AC 5/10**	SG 10/20**	90-420 mbar	35-400 mbar	AG 10	180-800 mbar	AG 10
FRM 100080 HD / SAV HD	DN 80	HD	AC 5	SG 10	400-1500 mbar	150-1400 mbar	AG 5	500-3500 mbar	AG 5
FRM 250080 UHD / SAV UHD	DN 80	UHD	AC 5	SG 10	1000-4000 mbar	150-3000 mbar	Ag 5	1300-5000 mbar	AG 5

*Accuracy class / Lock-up pressure class to EN 334

**p_d = 90-180 mbar: AC 10, SG 20; p_d= 180-420 mbar: AC 5, SG 10

Selection of regulator springs

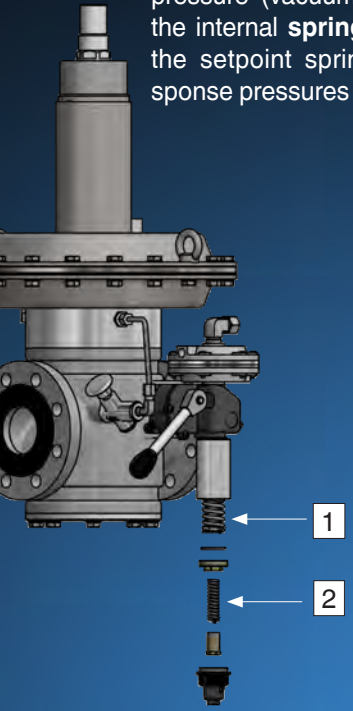
The response pressure results from the force of the installed adjusting spring and the weight force of the movable parts. By changing the setpoint **spring 1**, it is possible to set different outlet pressures.



Specific set range, outlet pressure W_{ds}							
Spring colour	Order number	Wire diameter [mm]	Length [mm]	Diameter [mm]	Setpoint range [mbar]		
					MD	HD	UHD
Blue	270347	8.0	300	65	90-140		
Black	270348	9.0	300	68	120-185	400-550	
Purple	270349	10.0	300	69	180-280	540-850	1000-1300
Orange	270350	11.0	300	71	250-420	800-1150	1100-1800
Pink	270352	12.0	300	73		1100-1500	1600-2500
Red	271132	14.0	300	77			2400-4000

Selection of SAV springs

The response pressure results from the force of the installed adjusting spring. The upper response pressure (overpressure) is set on the external **spring 1** of the measurement device. The lower response pressure (vacuum) can be set on the internal **spring 2**. By changing the setpoint springs, different response pressures can be set.

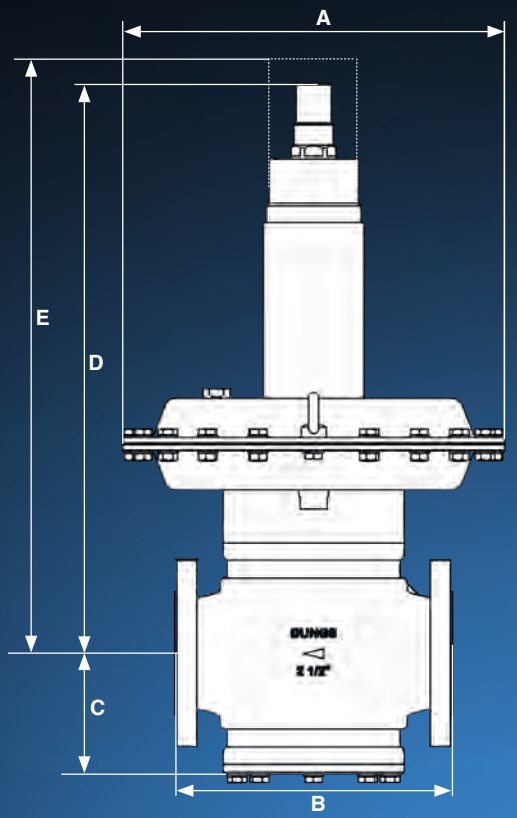


Specific set range, underpressure W_{dsu}

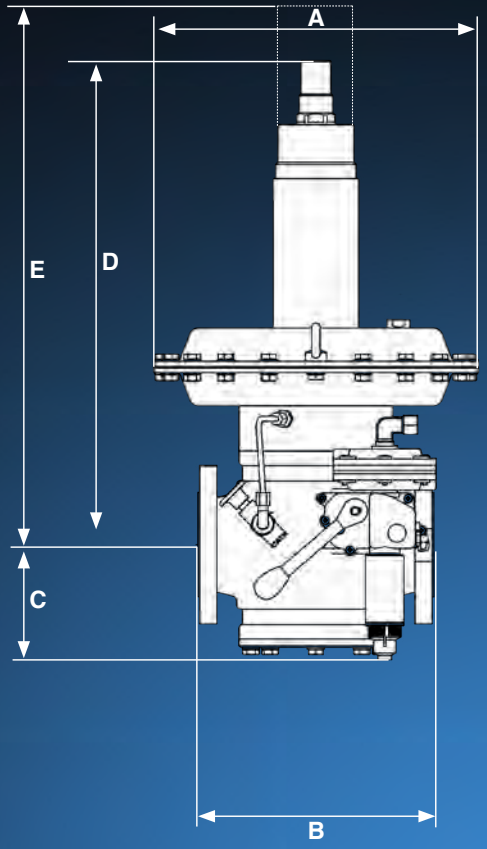
Spring colour	Order number	Wire diameter [mm]	Length [mm]	Diameter [mm]	Setpoint range [mbar]		
					MD	HD	UHD
Blue	270356	2.0	55	12.3	35-110		
Black	270357	2.3	55	12.3	50-250		
Purple	270358	2.5	55	12.3	80-400	150-500	150-500
Orange	270359	2.8	55	12.3		300-1000	300-1000
Silver	270360	3.0	60	15.0		800-1400	800-1400
Pink	276126	3.5	60	15.0			1200-3000

Specific set range, overpressure W_{dso}

Spring colour	Order number	Wire diameter [mm]	Length [mm]	Diameter [mm]	Setpoint range [mbar]		
					MD	HD	UHD
Green	270366	2.5	60	30.0	180-270		
Red	270367	2.7	60	30.0	230-370		
Yellow	270368	3.2	60	30.0	300-500		
Blue	270369	3.5	60	30.0	400-800	500-1000	
Black	270370	3.7	60	30.0		700-1300	
Purple	270371	4.0	60	30.0		1000-1800	
Orange	270372	4.5	60	30.0		1300-2500	1300-2500
Pink	270373	4.8	60	30.0		1800-3500	1800-3500
White	271115	5.0	60	30.0			2500-5000



Type	Order number	p max. [bar / kPa]	DN	Dimensions [mm]					Weight [kg]
				A	B	C	D	E	
FRM 100065 MD	277241	10 / 1000	65	500	276	120	567	892	56
FRM 100065 HD	277242	10 / 1000	65	380	276	120	567	892	50
FRM 250065 UHD	277243	25 / 2500	65	380	276	120	567	892	52
FRM 100080 MD	277244	10 / 1000	80	500	298	120	567	892	58
FRM 100080 HD	277245	10 / 1000	80	380	298	120	567	892	53
FRM 250080 UHD	277246	25 / 2500	80	380	298	120	567	892	55



Type	Order number	p max. [bar / kPa]	DN	Dimensions [mm]					Weight [kg]
				A	B	C	D	E	
FRM 100065 MD/SAV MD	273061	10 / 1000	65	500	276	135	567	892	71
FRM 100065 HD/SAV HD	276113	10 / 1000	65	380	276	135	567	892	65
FRM 250065 UHD/SAV UHD	276114	25 / 2500	65	380	276	135	567	892	67
FRM 100080 MD/SAV MD	276115	10 / 1000	80	500	298	135	567	892	73
FRM 100080 HD/SAV HD	276116	10 / 1000	80	380	298	135	567	892	68
FRM 250080 UHD/SAV UHD	276117	25 / 2500	80	380	298	135	567	892	70

Function

Mode of operation according to the force comparison principle between the force:

- of the adjustable setpoint spring,
- coming from the differential pressure on the working diaphragm and
- of the weight of the movable parts.

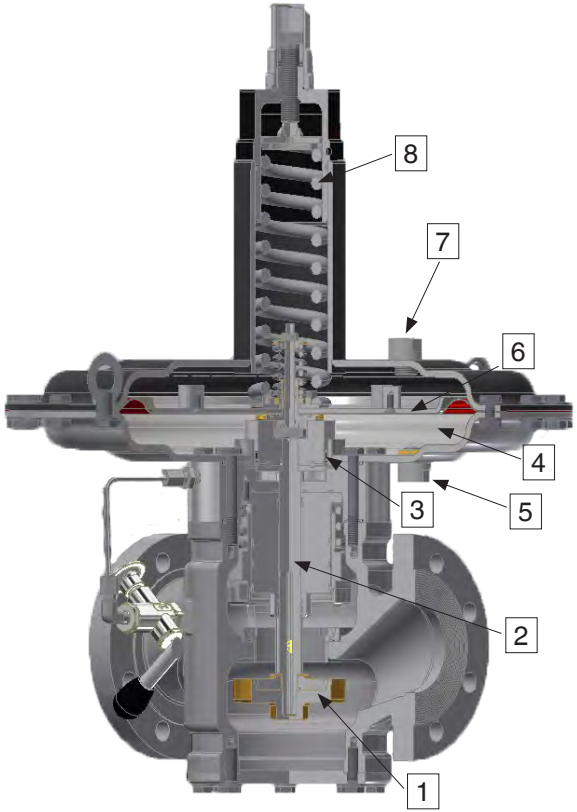
The setting spring acts independently of the weight of the movable parts. The outlet pressure is set depending on the preload of the setting spring.

Information
gas carrying and impulse lines and connecting lines must be resistant to thermal, chemical and mechanical stresses. They must also be durable and resistant to deformation and cracks.

Any condensate from impulse lines must not flow into the pressure regulator.

Combustible gas and gas/air mixtures must not enter the installation space of the adjusting spring.

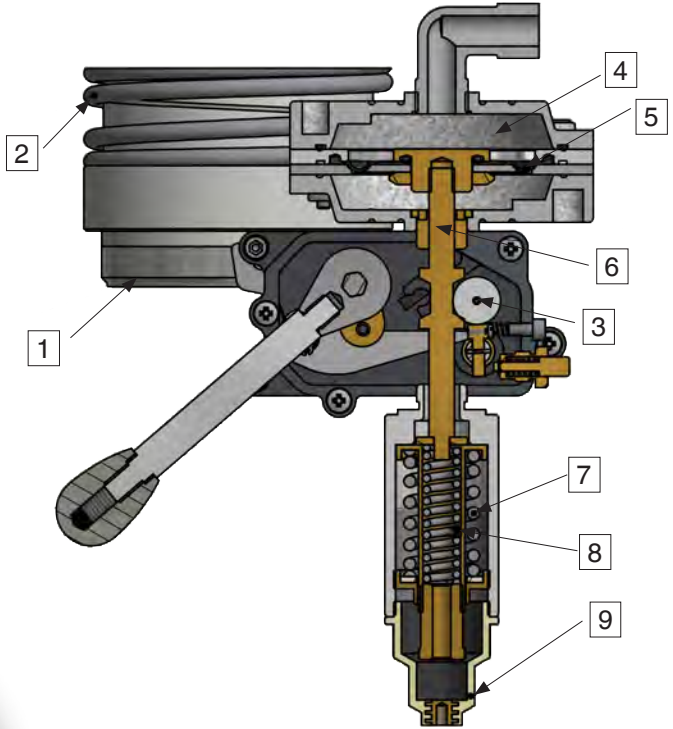
Sectional drawing FRM
Pressure regulator in open position



As the output pressure increases, the force in the lower diaphragm shell **4** increases to the working diaphragm **6**.
The working diaphram **6** is pushed upwards, until the force of the setpoint spring **8** is equal to that of the outlet pressure. The upward movement of the working diaphragm **6** causes the working plate shaft **2** to be pulled upwards. In this way, the control plate **1** is then pushed upwards and the valve gap is reduced.
The flow volume decreased in this way reduces the outlet pressure until the set nominal value (outlet pressure) is reached and a balance of forces at the working diaphragm **6** is established.

1	Control plate
2	Control plate shaft
3	Inlet pressure compensation diaphragm
4	Lower diaphragm shell
5	Impulse connection for the outlet pressure
6	Working diaphragm
7	Vent connection
8	Setpoint spring

Sectional drawing SAV
Device in the closed position



Chamber **4** is connected to the outlet pressure via an impulse line. The pressure being monitored acts on the working diaphragm **5**. The force of the setpoint springs **7 and 8** acts as counterforce. In case of an unbalance of forces (overpressure or underpressure), the SAV is actuated and the gas supply is blocked.

1	Valve disc
2	Closing spring
3	Ball catch / trigger mechanism
4	Chamber with the pressure to be monitored
5	Working diaphragm
6	Push rod
7	Setpoint spring for pd_o
8	Setpoint spring for pd_u
9	Protective cap

The following flow rate tables can be used to select the device. The maximum indicated volume flow refers to the natural gas with a standard density of 0,81 kg / m^3 at a temperature of 15 °C. In case of different types of gases, a conversion of the volume flow according to the equation on page 18 is carried out. It is possible to determine the maximum flow volume of the corresponding regulator at the operating point defined using p_d and p_u.

Design a straight stabilisation section with the equal diameter.

Impulse connection at a distance of > 5 x DN.

Maximum flow velocity in the stabilisation section of </= 30 m/s.

FRM 100065... DN 65 - max. flow volume [Nm^3/h] natural gas of density 0,81 kg/m^3 (K_G)

FRM ...	MD							HD					
p_d [bar] / p_u [bar]	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,4	0,5	0,75	1	1,25	1,5
0,5	1493	1427	1350	1257	1146	1012	841	605					
0,75	1903	1869	1827	1778	1720	1652	1573	1482	1376				
1	2239	2224	2204	2177	2145	2106	2060	2007	1946	1485			
1,5	2811	2811	2811	2811	2811	2801	2789	2773	2752	2572	2244	1683	
2	3370	3370	3370	3370	3370	3370	3370	3370	3370	3321	3174	2914	2508
2,5	3929	3929	3929	3929	3929	3929	3929	3929	3929	3929	3887	3763	3546
3	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4452	4343
3,5	5048	5048	5048	5048	5048	5048	5048	5048	5048	5048	5048	5048	5015
4	5607	5607	5607	5607	5607	5607	5607	5607	5607	5607	5607	5607	5607
4,5	6167	6167	6167	6167	6167	6167	6167	6167	6167	6167	6167	6167	6167
5	6726	6726	6726	6726	6726	6726	6726	6726	6726	6726	6726	6726	6726
6	7844	7844	7844	7844	7844	7844	7844	7844	7844	7844	7844	7844	7844
7	8963	8963	8963	8963	8963	8963	8963	8963	8963	8963	8963	8963	8963
8	10082	10082	10082	10082	10082	10082	10082	10082	10082	10082	10082	10082	10082
9	11200	11200	11200	11200	11200	11200	11200	11200	11200	11200	11200	11200	11200
10	12319	12319	12319	12319	12319	12319	12319	12319	12319	12319	12319	12319	12319

FRM 100080... DN 80 - max. flow volume [Nm³/h] natural gas of density 0,81 kg/m³ (K_G)

FRM ...	MD							HD					
p_d [bar] / p_u [bar]	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,4	0,5	0,75	1	1,25	1,5
0,5	1837	1757	1661	1547	1411	1245	1035	745					
0,75	2342	2300	2249	2188	2116	2033	1936	1824	1693				
1	2756	2738	2712	2680	2640	2592	2535	2470	2395	1828			
1,5	3460	3460	3460	3460	3460	3447	3433	3413	3387	3166	2762	2071	
2	4148	4148	4148	4148	4148	4148	4148	4148	4148	4087	3906	3587	3086
2,5	4836	4836	4836	4836	4836	4836	4836	4836	4836	4836	4784	4631	4365
3	5525	5525	5525	5525	5525	5525	5525	5525	5525	5525	5525	5479	5346
3,5	6213	6213	6213	6213	6213	6213	6213	6213	6213	6213	6213	6213	6173
4	6901	6901	6901	6901	6901	6901	6901	6901	6901	6901	6901	6901	6901
4,5	7590	7590	7590	7590	7590	7590	7590	7590	7590	7590	7590	7590	7590
5	8278	8278	8278	8278	8278	8278	8278	8278	8278	8278	8278	8278	8278
6	9655	9655	9655	9655	9655	9655	9655	9655	9655	9655	9655	9655	9655
7	11031	11031	11031	11031	11031	11031	11031	11031	11031	11031	11031	11031	11031
8	12408	12408	12408	12408	12408	12408	12408	12408	12408	12408	12408	12408	12408
9	13785	13785	13785	13785	13785	13785	13785	13785	13785	13785	13785	13785	13785
10	15161	15161	15161	15161	15161	15161	15161	15161	15161	15161	15161	15161	15161

FRM 250065 UHD... DN 65 - max. flow volume [Nm³/h] natural gas of density 0,81 kg/m³ (K_G)

FRM ...	UHD						
p_d [bar] / p_u [bar]	1	1,5	2	2,5	3	3,5	4
1,5	2244						
2	3174	2508					
2,5	3887	3546	2746				
3	4489	4343	3883	2965			
3,5	5048	5015	4756	4193	3169		
4	5607	5607	5492	5135	4481	3361	
6	7844	7844	7844	7844	7762	7514	7084
8	10082	10082	10082	10082	10082	10082	10018
10	12319	12319	12319	12319	12319	12319	12319
12	14556	14556	14556	14556	14556	14556	14556
14	16793	16793	16793	16793	16793	16793	16793
16	19030	19030	19030	19030	19030	19030	19030
18	21267	21267	21267	21267	21267	21267	21267
20	23504	23504	23504	23504	23504	23504	23504
22	25741	25741	25741	25741	25741	25741	25741
25	29097	29097	29097	29097	29097	29097	29097

FRM 250080 UHD... DN 80 - max. flow volume [Nm³/h] natural gas of density 0,81 kg/m³ (K_G)

FRM ...	UHD						
p_d [bar] / p_u [bar]	1	1,5	2	2,5	3	3,5	4
1,5	2762						
2	3906	3086					
2,5	4784	4365	3379				
3	5525	5346	4779	3649			
3,5	6213	6173	5853	5161	3900		
4	6901	6901	6759	6320	5516	4136	
6	9655	9655	9655	9655	9553	9248	8718
8	12408	12408	12408	12408	12408	12408	12329
10	15161	15161	15161	15161	15161	15161	15161
12	17915	17915	17915	17915	17915	17915	17915
14	20668	20668	20668	20668	20668	20668	20668
16	23422	23422	23422	23422	23422	23422	23422
18	26175	26175	26175	26175	26175	26175	26175
20	28928	28928	28928	28928	28928	28928	28928
22	31682	31682	31682	31682	31682	31682	31682
25	35812	35812	35812	35812	35812	35812	35812

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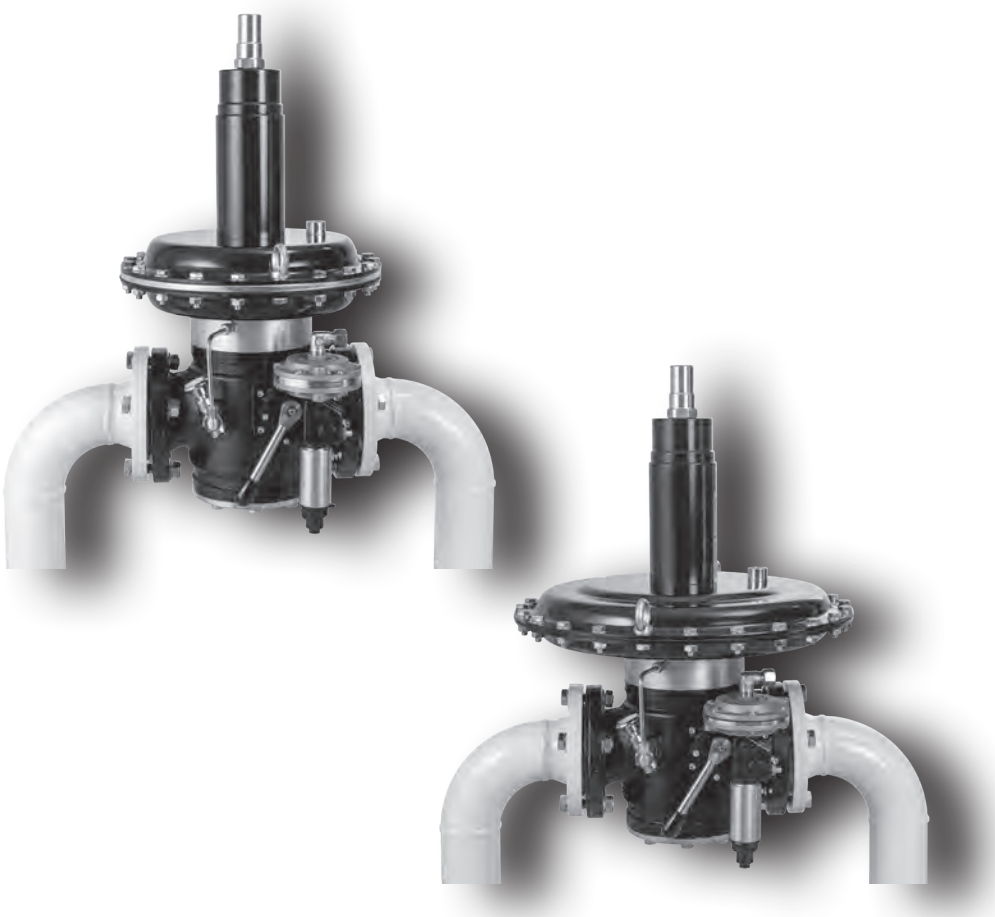
$$\dot{V}_{used\ gas} = \dot{V}_{air} \times f$$

$$f = \sqrt{\frac{\text{air density}}{\text{spec. weight of the gas used}}}$$

Type of gas	Spec. Wgt. [kg/m³]	dv	f
Natural gas	0.81	0.65	1.24
City gas	0.58	0.47	1.46
LPG	2.08	1.67	0.77
Air	1.24	1.00	1.00



Subject to technical modification in the interest of technical progress.

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