

Instructions

FRM 100065 - 100080 - 250065 - 250080

1. Target group

The target group of this manual is qualified personnel of the gas safety and regulating technology. Due to their specialist training, knowledge and experience, they should be capable of evaluating the work assigned to them and recognising possible dangers. Only they are permitted to carry out assembly, commissioning, settings and maintenance on the devices in compliance with the recognised rules for occupational safety.



Hang this instruction manual in a readily visible place inside the installation room! Do not carry out any work until you have read the safety instructions of this instruction manual and are qualified to do so.

2. Warnings

2.1 General warnings



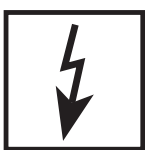
The recognised occupational safety rules and accident prevention regulations must be observed and, if necessary, personal protective measures must be taken.



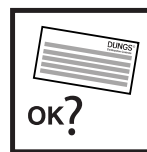
Protection from environmental impacts and weather conditions (corrosion, rain, snow, icing, humidity (e.g. by condensation), mould, UV radiation, harmful insects, poisonous, corrosive solutions/liquids (e.g. cutting and cooling fluids), must be guaranteed. Depending on the installation site, it may be necessary to take protective measures.



All adjustments and settings should only be performed in accordance with the instruction manuals of the connected machines.



Never carry out work as long as gas pressure or voltage is applied. Avoid open fire. Please observe public regulations.



The device may only be operated in compliance with the operating conditions stated on the type plate.



Prior to assembly, the device must be inspected for transport damage.



The device must be protected from vibrations and mechanical impacts.



The device must not be exposed to open fire. Protection against lightning strikes must be guaranteed.



The device must not be used in areas with increased seismic risk.



Connected line systems must be free from dirt and contamination.

Explanation of the symbols	
1, 2, 3,...	= Order of action
•	= Instruction

2.2 Designated use

The device is used in accordance with its designated use if the following instructions are observed:

- Use of the device in gas transport and gas distribution networks, commercial and industrial plants.
- Use in pressure regulator stations according to EN 12186 and EN 12279.
- Use with gases of the 1st and 2nd gas families according to EN 437 only.



- Use with dry and clean gases only, no aggressive media.
- Use only in compliance with the operating conditions stated on the type plate.
- Use in perfect condition only.
- Malfunctions and faults must be eliminated immediately.
- Use only in observance of the instructions given in this instruction manual and of national regulations.

2.3 Risks in case of misuse


- If used in accordance with their designated use, the devices are safe to operate.
- Non-observance of the regulations may result in personal injury or material damage, financial damage or environmental damage.

- Operator errors or misuse present risks to life and limb of the operators and also to the device and other material property.

3. Approval / EU declaration of conformity

EC type examination certificate
EG-Baumusterprüfbescheinigung




CE-0085CP0256
Product Identification No.
Produkt-Identifikationsnummer

Field of Application <i>Anwendungsbereich</i>	EC Pressure Equipment Directive (2014/68/EU) <i>EG-Druckgeräterichtlinie (2014/68/EU)</i>
Owner of Certificate <i>Zertifizierhalter</i>	Karl Dungs GmbH & Co. KG Karl-Dungs-Platz 1, D-73660 Urbach
Distributor <i>Vertreiber</i>	Karl Dungs GmbH & Co. KG Karl-Dungs-Platz 1, D-73660 Urbach
Product Category <i>Produktart</i>	gas fittings: Pressure regulator for natural gas and all-gas (4301)
Product Description <i>Produktbezeichnung</i>	spring operated regulator with optional safety-shut-off device
Model <i>Modell</i>	FRM 1000 ... D/ S; FRM 2500 ... D/ S
Test Reports <i>Prüfberichte</i>	supplement test: 19-00188-191 from 18.12.2019 (EBI)
Test Basis <i>Prüfgrundlagen</i>	2014/68/EU A III B Baumusterprüfung (15.04.2014) DIN EN 334 (01.11.2019) DIN EN 14382 (01.11.2019)
Date of Expiry / File No. <i>Ablaufdatum / Aktenzeichen</i>	12.09.2024 / 19-0747-GDA

25.02.2020 Kö A-1/2
Date, issued by, Sheet, Head of Certification Body
Datum, Bearbeiter, Blatt, Leiter der Zertifizierungsstelle

DVGW CERT GmbH is an accredited body by DAkkS according to DIN EN ISO/IEC 17055:2013 and notified by the government of the Federal Republic of Germany for certification of pressure equipment under EC Directive

DVGW CERT GmbH ist von der DAkkS nach DIN EN ISO/IEC 17055:2013 akkreditiert und von der Deutschen Bundesregierung benannte Stelle für die Zertifizierung von Druckgeräten und Baugruppen gemäß Richtlinie



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Type	Technical Data	Remarks
FRM 100025 ...	inlet pressure range: 0,3 bis 10 bar nominal diameter: DN 25	
FRM 100040 ...	max. allowable pressure PS: 10 bar inlet pressure range: 0,3 bis 10 bar nominal diameter: DN 40	
FRM 100050 ...	max. allowable pressure PS: 10 bar inlet pressure range: 0,3 bis 10 bar nominal diameter: DN 50	
FRM 100065 ...	max. allowable pressure PS: 10 bar inlet pressure range: 0,3 bis 10 bar nominal diameter: DN 65	
FRM 100080 ...	max. allowable pressure PS: 10 bar inlet pressure range: 0,3 bis 10 bar nominal diameter: DN 80	
FRM 250025 ...	max. allowable pressure PS: 10 bar inlet pressure range: 0,5 bis 25 bar nominal diameter: DN 25	
FRM 250040 ...	max. allowable pressure PS: 10/ 25 bar inlet pressure range: 0,5 bis 25 bar nominal diameter: DN 25	
FRM 250050 ...	max. allowable pressure PS: 10/ 25 bar inlet pressure range: 0,5 bis 25 bar nominal diameter: DN 50	
FRM 250065 ...	max. allowable pressure PS: 10/ 25 bar inlet pressure range: 0,5 bis 25 bar nominal diameter: DN 65	
FRM 250080 ...	max. allowable pressure PS: 10/ 25 bar inlet pressure range: 0,5 bis 25 bar nominal diameter: DN 80	

Type Variation	Explanations
Ausführungsvariante	Erläuterungen
FRM 1000... ND/ NDS	outlet pressure range: 0,02 up to 0,10 bar (type: PN 10)
FRM 1000... MD/ MDS	outlet pressure range: 0,08 up to 0,42 bar (type: PN 10)
FRM 1000... HD/ HDS	outlet pressure range: 0,40 up to 1,50 bar (type: PN 10)
FRM 2500... MD/ MDS	outlet pressure range: 0,08 up to 0,42 bar (type: PN 25)
FRM 2500... HD/ HDS	outlet pressure range: 0,30 up to 1,50 bar (type: PN 25)
FRM 2500... UHd/ UHDS	outlet pressure range: 1,00 up to 4,00 bar (type: PN 25)
FRM ... S	for maritime use
FRM ... D	for none maritime use
FRM ... INT	internal impulse configuration
... ND	low pressure
... MD	medium pressure
... HD	high pressure
... UHD	ultra high pressure

Hints of Utilization / Remarks
Verwendungshinweise / Bemerkungen

medium: fuel gas of the 1., 2. and 3. family and none aggressive gases
connection: flange
ambient temperature range: -20 °C ... +60 °C
regulator:
accuracy class AC 5: outlet pressure: 1,0 bar ... 4,0 bar (PN 25)
accuracy class AC 5: outlet pressure: 0,18 bar ... 1,5 bar (PN 10, PN 25)
accuracy class AC 10: outlet pressure: 0,018 bar ... 0,18 bar (PN 10)
lock up pressure class SG 10: outlet pressure: 1,0 bar ... 4,0 bar (PN 25)
lock up pressure class SG 10: outlet pressure: 0,18 bar ... 1,5 bar (PN 10, PN 25)
lock up pressure class SG 20: outlet pressure: 0,018 bar ... 0,18 bar (PN 10)
safety shut-off devices:
variation: range under pressure (UPSO); range upper pressure (OPSO)
... ND (PN 10; DN 25-50); 0,01 ... 0,115 bar/ 0,04 ... 0,24 bar
... MD (PN 10, PN 25; DN 25-80); 0,035 ... 0,4 bar/ 0,18 ... 0,8 bar
... HD (PN 10, PN 25; DN 25-80); 0,15 ... 1,4 bar/ 0,5 ... 4,0 bar
... UHD (PN 10, PN 25; DN 25-80); 0,15 ... 3,0 bar/ 1,3 ... 5,0 bar
body material: ductile cast iron EN GJS 400-18 LT or EN GJS 500-7 (PN 10), cast iron GGG50 (PN 25); type ... S only EN GJS 400-18, GGG40

EU Declaration of conformity

Produkt / Product Produit / Prodotto	FRM 100065 - 100080 FRM 250065 - 250080	Medium Pressure Regulator 10 bar / 25 bar	
Hersteller / Manufacturer Fabricant / Produttore	Karl Dungs GmbH & Co. KG Karl-Dungs-Platz 1 73660 Urbach, Germany		
bescheinigt hiermit, dass die in dieser Übersicht genannten Produkte einer EU-Baumusterprüfung unterzogen wurden und die wesentlichen Sicherheitsanforderungen der:	certifies herewith that the products named in this overview were subjected to an EU type-examination and meet the essential safety requirements:	certifie par la présente que le produit mentionné dans cette vue d'ensemble a été soumis à un examen de type de l'UE et qu'il est conforme aux exigences en matières de sécurité des dernières versions en vigueur de :	Con la presente si certifica che i prodotti citati in questa panoramica sono stati sottoposti a una prova di omologazione UE e che i requisiti di sicurezza essenziali:
EU-Druckgeräterichtlinie 2014/68	EU Pressure Equipment Directive 2014/68	à la directive UE « Équipements sous pression » 2014/68	direttiva UE sulle attrezzature a pressione 2014/68
in der gültigen Fassung erfüllen.	as amended.		sono soddisfatti nella versione valida.
Bei einer von uns nicht freigegebenen Änderung des Gerätes verliert diese Erklärung ihre Gültigkeit.	In the event of an alteration of the equipment not approved by us this declaration loses its validity.	Ce communiqué n'est plus valable si nous effectuons une modification libre de l'appareil.	In caso di modifica dell'apparecchio non ammessa, questa dichiarazione perde di validità.
Prüfgrundlage der EU-Baumusterprüfung Specified requirements of the EU type-examination Base d'essai de l'examen de type de l'UE Criteri di prova dell'omologazione UE	DIN EN 334 (01.11.2019) DIN EN 14382 (01.11.2019)		
Gültigkeitsdauer/Bescheinigung Term of validity/attestation Validité/certificat Durata della validità/Attestazione	2024-09-12 CE-0085CP0256		
Notifizierte Stelle (EU Baumusterprüfung: Modul B) Notified Body (EU type-examination: Module B) Organisme notifié (Examen de type de l'UE: module B) Organismo notificato (Esame UE del tipo: modulo B)	DVGW CERT GmbH Josef-Wirmer-Straße 1-3 D-53123 Bonn, Germany Notified Body number: 0085		
Überwachung des QM-Systems (Modul D) Monitoring of the QM system (module D) Contrôle de la gestion de l'assurance qualité (module D) Monitoraggio del sistema QM (modulo D)	DVGW CERT GmbH Josef-Wirmer-Straße 1-3 D-53123 Bonn, Germany Notified Body number: 0085		



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5. List of abbreviations

Abbreviation	Description
AG_o	Response pressure group of the upper response pressure
AG_u	Response pressure group of the lower response pressure
AC	Accuracy class
ASE	Safety shutoff valve (without housing)
K_G	Flow volume coefficient
DN	Nominal diameter
Fail-open	The firing valve moves automatically to the open position, if the main diaphragm or the auxiliary power required for the actuation of the firing valve fails
IS/DS	Type: integral strength range (IS) or differential strength (DS)
Class A	Functional class: the SAV closes if the comparison diaphragm is damaged or the auxiliary power supply has failed
MOP	Maximum admissible operating pressure
p_d	Outlet pressure
$p_{d, abs.}$	Output pressure as absolute pressure
p_u	Inlet pressure
$p_{u, abs.}$	Inlet pressure as absolute pressure
p_{do}	Upper response pressure
p_{du}	Lower response pressure
p_{max}	Maximum operating pressure
$p_{zul.}$	System-specific operating pressure according to the regulator
PN	Nominal pressure of the flange
PS	Maximum admissible pressure
SAV	Safety shutoff valve
SBV	Safety relief valve
SG	Lock-up pressure class
SN	Serial number
SZ	Closing pressure zone group
Tp.	Operating temperature -20 °C ... +60 °C
W_{ds}	Specific guide range
W_{do}	Adjustment range for the upper response pressure through regulation of the available adjusting springs
W_{du}	Adjustment range for the lower response pressure through regulation of the available adjusting springs
W_{dso}	Specific adjustment range of the adjusting spring installed for the upper response pressure
W_{dsu}	Specific adjustment range of the adjusting spring installed for the lower response pressure

6. Features

6.1. Technical data

Technical data	FRM ...						
Device	Spring-loaded medium pressure regulator according to EN 334						
Type	IS (FRM 100...) / DS (FRM 250...)						
Type of gas	Family 1+2+3						
Nominal diameters Flange	Connecting flanges PN 25 according to EN 1092-1 or ANSI 150 lbs (B16.5) <table border="1" style="margin-left: 20px;"> <tr> <td>DN</td> <td>65</td> <td>80</td> </tr> <tr> <td>ANSI</td> <td>2.5"</td> <td>3"</td> </tr> </table>	DN	65	80	ANSI	2.5"	3"
DN	65	80					
ANSI	2.5"	3"					
Admissible pressure load	FRM 250... 25 bar (2 500 kPa) / FRM 100... 10 bar (1 000 kPa)						
Max. inlet pressure	FRM 250... 25 bar (2 500 kPa) / FRM 100... 10 bar (1 000 kPa)						
Outlet pressure range	90-4000 mbar (9 - 400 kPa)						
Minimum differential pressure (MD)	350 mbar (35 kPa)						
Minimum differential pressure (HD/UHD)	500 mbar (50 kPa)						
Materials	Main body housing: cast iron GGG 50 Diaphragm housing: steel Diaphragms: NBR						
Ambient temperature	-20 °C to + 60 °C						

Technical data	SAV ...
Device	Safety shutoff valve in compliance with EN14382, class A
Type	IS (FRM 100...) / DS (FRM 250...)
Response time	≤ 2s
Adjustment range below W_{du}	35 - 3000 mbar (3,5 - 3 00kPa)
Adjustment range above W_{do}	180 - 5000 mbar (18 - 500 kPa)
Materials	Main body housing: cast iron GGG 50 Diaphragm housing: Aluminium Diaphragms: NBR

6.2 Nomenclature

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	ANSI	with standard PN-25 with ANSI 150 lbs				

6.3 Adjustment range

Type	Conne- ction	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

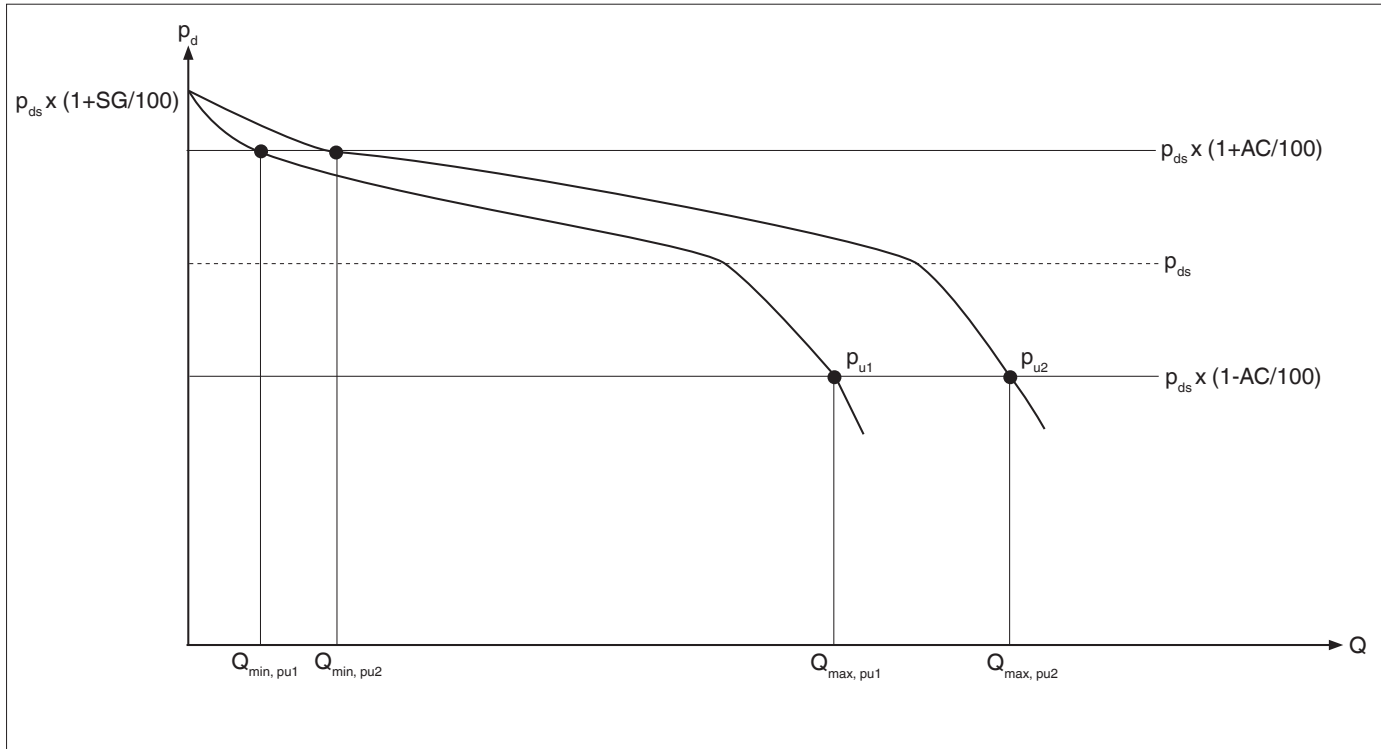
*Accuracy class / Lock-up pressure class to EN 334

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

6.4 Accuracy class / lock-up pressure class

The AC and SG data, in compliance with EN 334, do not make any statement about the modulation range. Knowledge of the minimum and maximum volume flow is essential for the application in the field. Therefore, the accuracy values 'control quality' and 'lock-up pressure class' that can be guaranteed at a volume flow of 1:10 were determined. The

AC values of the table mentioned above refer to the maximum admissible percentage deviation of the outlet pressure from the set nominal value, at which $Q_{\max} \leq 10$ is observed.



Abbreviation	Description
AC	Accuracy class
p_d	Outlet pressure
$p_{u1/2}$	Inlet pressure
p_{ds}	Set nominal value of the outlet pressure
SG	Lock-up pressure class
$Q_{\min / pu1/2}$	AC minimum flow volume at a specific inlet pressure p_u (lower limit of the volume flow at which the stable operating conditions for a given nominal value within the given operating temperature range).
$Q_{\max / pu1/2}$	AC maximum flow volume at a specific inlet pressure p_u (upper limit of the volume flow at which a given accuracy class for a given nominal value within the given operating temperature range).

6.5 Selection of regulator springs

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

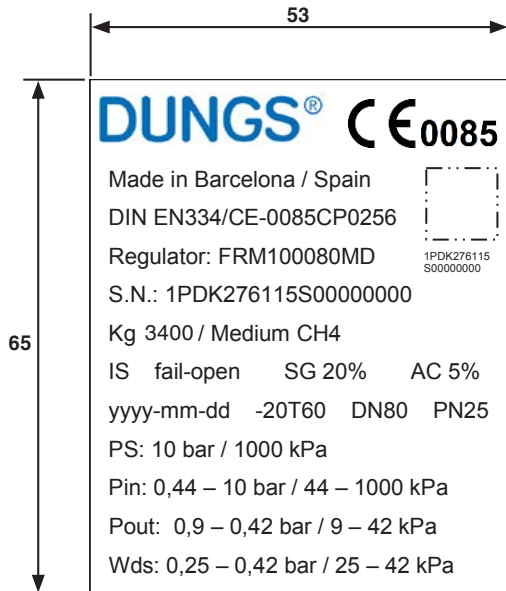
6.6 Selection of SAV springs

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

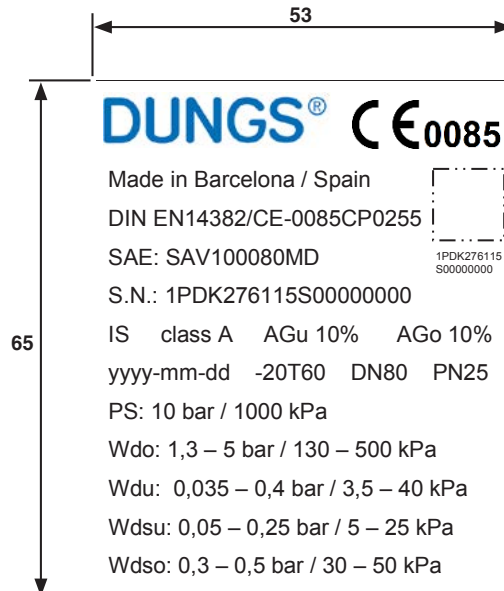
Specific set range, overpressure W_{dso}							
Spring colour	Order number	Wire diameter [mm]	Length [mm]	Diameter [mm]	Setpoint range [mbar]		
					MD	HD	UHD
Green	270366	2.5	60	30.0	180-270		
Red	270367	2.7	60	30.0	230-370		
Yellow	270368	3.2	60	30.0	300-500		
Blue	270369	3.5	60	30.0	400-800	500-1000	
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

6.7 Type plate

Regulator



SAV



Abbreviation	Description
AG_o	Response pressure group of the upper response pressure
AG_u	Response pressure group of the lower response pressure
AC	Accuracy class
K_G	Flow volume coefficient for natural gas
DN	Nominal diameter
Fail-open	The mainvalve moves automatically to the open position, if the main diaphragm or the auxiliary pressure required for the actuation of the main valve fails
IS/DS	FRM 100... IS (integral strength range) / FRM 250... DS (differential strength)
Class A	Functional class: in case the membrane is damaged or in the event of a breakdown of the impulse line pressure the SAV closes
p_d	Outlet pressure
p_u	Inlet pressure
PN	Nominal pressure of the flange
PS	Maximum admissible pressure
SAV	Safety shutoff valve
SG	Lock-up pressure class
-20T60	Operating temperature -20 °C ... +60 °C
SN	Serial number
W_{ds}	Specific guide range
W_{do}	Adjustment range for the upper response pressure through regulation of the available adjusting springs
W_{du}	Adjustment range for the lower response pressure through regulation of the available adjusting springs
W_{dso}	Specific adjustment range of the adjusting spring installed for the upper response pressure
W_{dsu}	Specific adjustment range of the adjusting spring installed for the lower response pressure

7. Function

The pressure regulator's function is to keep the outlet pressure largely constant, independent of changes in the inlet pressure and/or in the flow volume. In the depressurised state the regulator is open. The pressure regulator complies with the requirements of EN 334 as direct acting gas pressure regulator.

Main components

- A** Control plate
- B** Control plate shaft
- C** Inlet pressure compensation diaphragm
- D** Lower diaphragm shell
- E** Impulse connection for the outlet pressure
- F** Working diaphragm
- G** Vent connection
- H** Setpoint spring

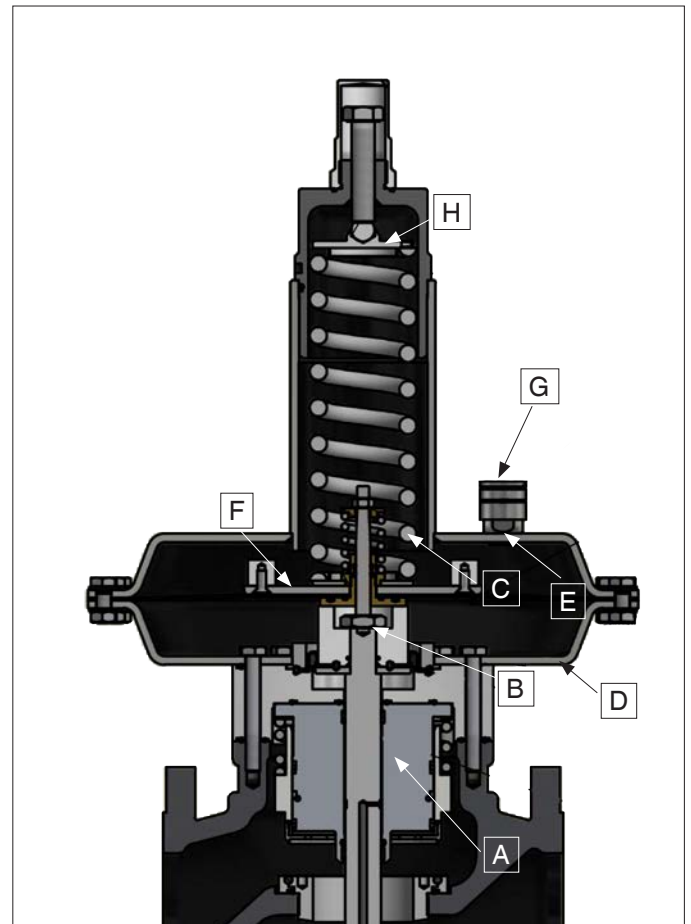
Depressurised state

The force of the setpoint spring **H** acts on the working diaphragm **F**. In depressurised state there is no counterforce acting in the lower diaphragm shell **D**, since no overpressure is applied in the outlet range. The resulting downward movement of the working diaphragm causes the control plate shaft **B** to be pushed downwards. In this way, the control plate **A** is also moved downwards and separated from the seat. The regulator is open.

Steady state

In case of increasing outlet pressure, the force on the working diaphragm **F** in the diaphragm shell **D** increases also. The working diaphragm **F** is thus pushed upwards until the force of the setpoint spring **H** is equal to that of the outlet pressure. The upward movement of the working diaphragm **F** causes the control plate shaft **B** to be pulled upwards. In this way, the control plate **A** is also 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 again and a balance of forces at the working diaphragm **F** is established.

If the outlet pressure drops, the force on the working diaphragm **F** in the lower diaphragm shell **D** decreases also. The working diaphragm **F** is, thus, pushed downwards until the force of the setpoint spring **H** is equal to that of the outlet pressure. The downward movement of the working diaphragm **F** causes the control plate shaft **B** to be pushed downwards. In this way, the control plate **A** is also moved downwards and the valve gap is increased. The increased flow volume increases the outlet pressure until the set nominal value (outlet pressure) is reached again and a balance of forces at the working diaphragm **F** is established.

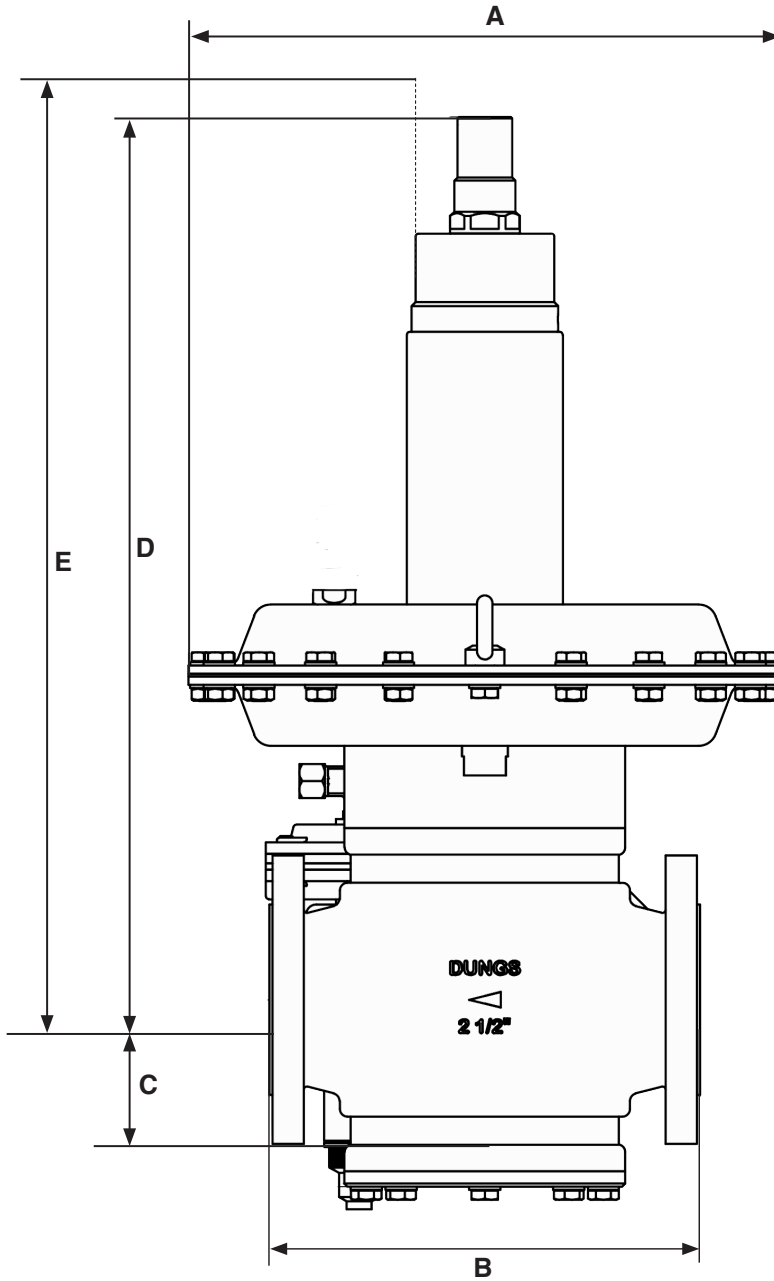


Inlet pressure compensation

Changes in the inlet pressure have no influence on the balance of forces. The inlet pressure is compensated by the inlet pressure compensation diaphragm **C**. The inlet pressure is then transferred in the chamber below the inlet pressure compensation diaphragm **C** through an opening at the control plate **A**. At the control plate **A**, the inlet pressure acts in the opening direction. At the inlet pressure compensation diaphragm **C**, opposite to the control plate, the inlet pressure acts in the closing direction. The surface of the control plate, on which the inlet pressure acts from top, has the same size as the admission pressure compensation diaphragm **C**, on which the inlet pressure acts from below. Therefore, both forces cancel each other. The inlet pressure balance at the regulator is ensured.

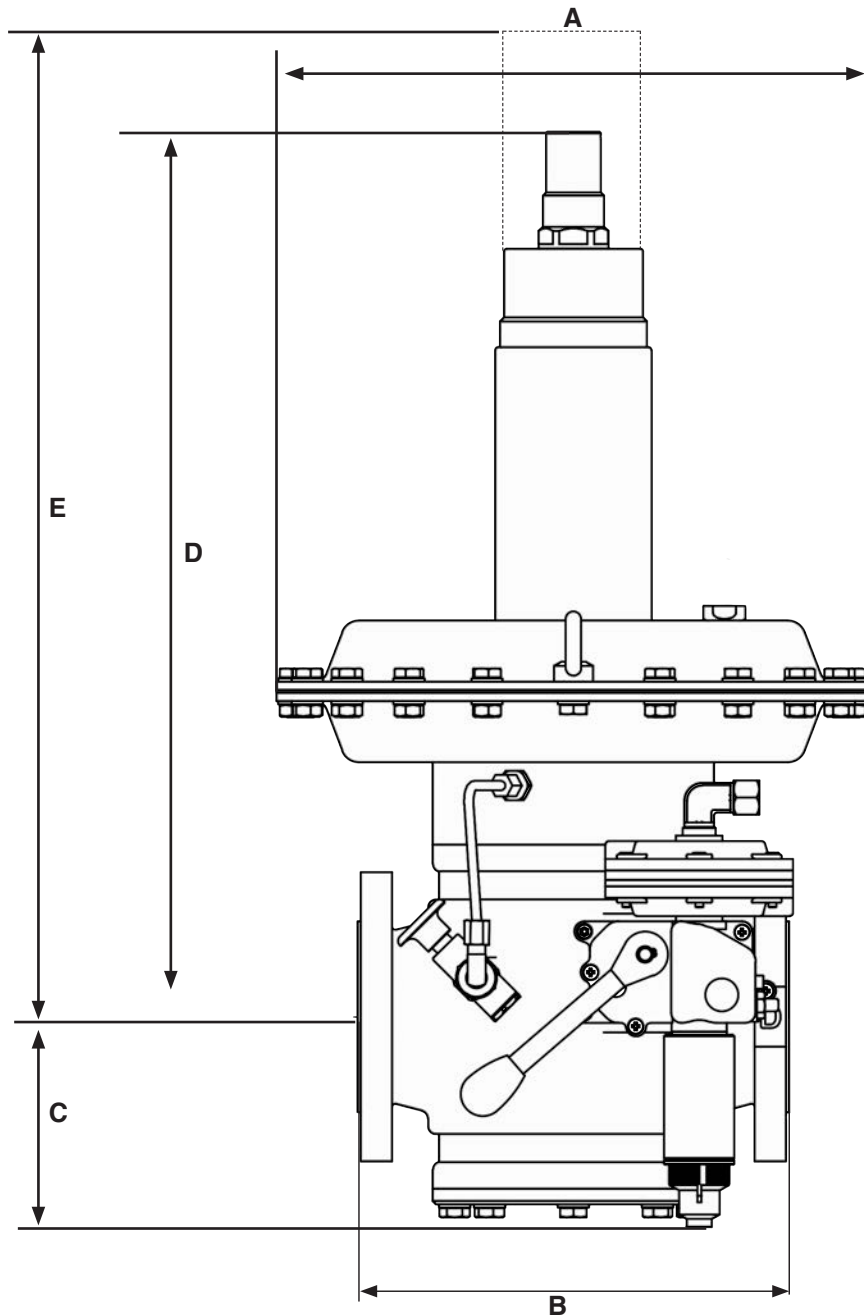
8. Dimensions

FRM...



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

FRM... / SAV



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

9. Installation

9.1 General information



- **This device can only be installed in compliance with the rules and standards applicable and in accordance with the local regulations and authorisations.**
- **Install the device in a building or housing, do not install it outdoors without suitable protective measures!**
- **The lifting devices used must be suitable for the load to be lifted.**
- **Enough installation space for operation and maintenance has to be provided.**
- **It is recommended to install a filter with a pore size $\leq 50 \mu\text{m}$ upstream of the regulator.**
- **The installation must not impair the functioning of other components.**

Check prior to installation!

- Shut-off valves both on the inlet and outlet side are closed.
- Lines are free from combustible gas.
- Prevent explosive gas-air mixture: the room atmosphere must be monitored for gas leakages.
- Ensure electrical continuity with use of suitable bonding straps. Prevent contact voltage and ignitable flashover.
- The performance data on the type plate corresponds to the purchase ordering data.

- Flanges on the inlet side and outlet side of the connecting line are parallel.
- The sealing surfaces of the flange are undamaged and clean.
- The maximum inlet pressure of the system is lower than the maximum admissible pressure of the regulator.
- Protective caps at the connection flange, if any, must be removed.
- The minimum distances for the setting must be observed.
- The pipeline on the inlet side must be free of water and dirt.

Note during installation!

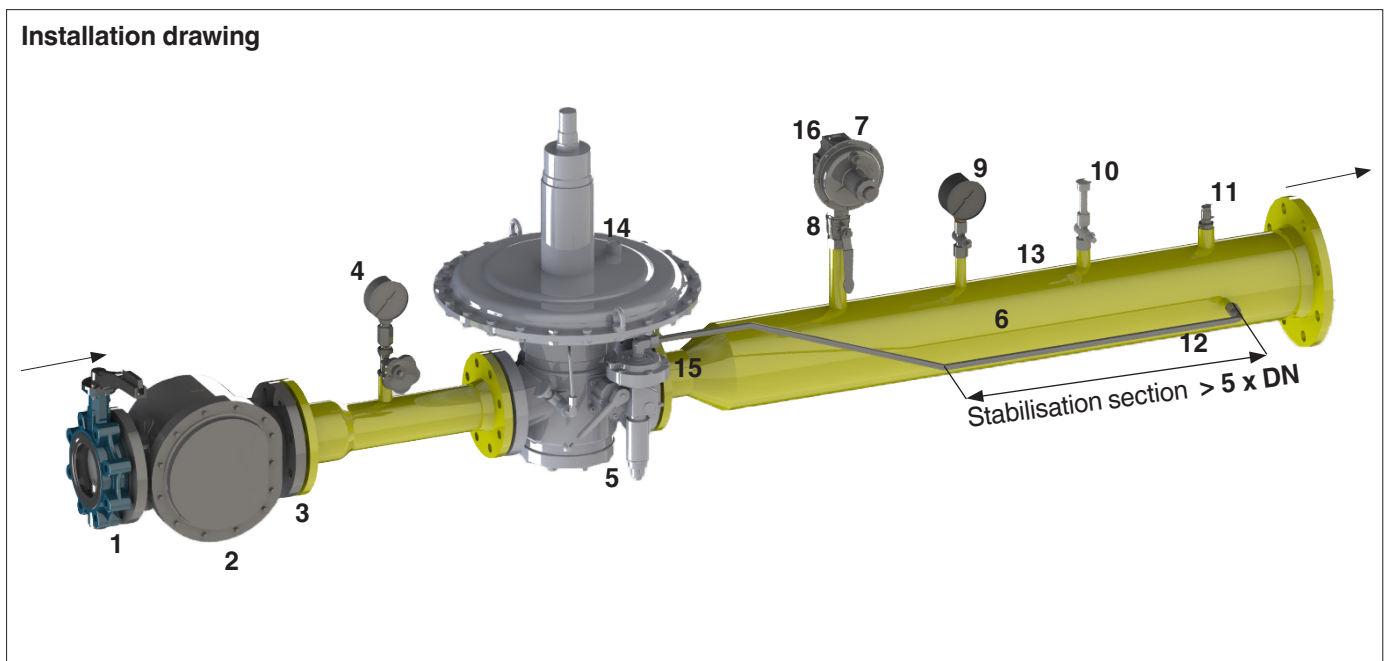
- Mounting must be carried out in a tension-free state.
- Tighten the screws crosswise.
- Tightening torques must be observed.
- Vent lines and blow-off lines have to be positioned separately.
- Vent lines and blow-off lines must lead outdoors: gases must be able to escape to a non-hazardous environment.
- The impulse lines may not be shut off.
- The specified distance between the measuring points of the impulse lines must be observed.
- The flow direction (arrow) on the housing must be followed.



9.2 Installation instructions

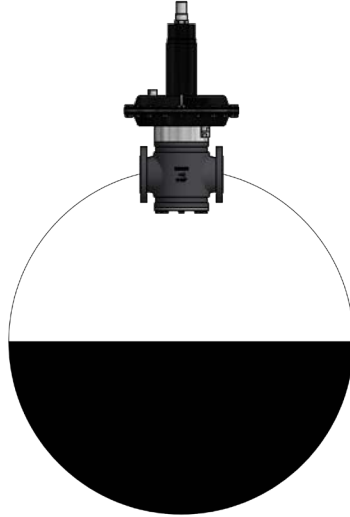
- The installation must be carried according to the installation scheme specified below.
- Install the safety shutoff valve in the flow direction (arrow/housing).
- Design a straight stabilisation section with the equal diameter.
- Make sure that the impulse tapping at the stabilisation section is clean and free from burrs. Distance $> 5 \times DN$
- Maximum flow velocity in the stabilisation section: $\leq 30 \text{ m/s}$.
- Use steel pipe impulse lines $D= 12 \times 1.5$
- Avoid accumulation of condensate: install the impulse lines with a gradient

Installation drawing



Pos.	Designation
1	Shutoff valve, inlet side (e.g. ball valve or butterfly valve)
2	Filter
3	Welded part
4	Pressure gauge, inlet side
5	Regulator with integrated SAV
6	Calming section
7	SBV
8	Ball valve
9	Pressure gauge, outlet side
10	Test burner
11	Venting ball valve
12	Impulse line, SAV
13	Impulse line, regulator
14	Vent line connection regulator
15	Vent line connection SAV
16	Relief line connection SBV

Mounting position

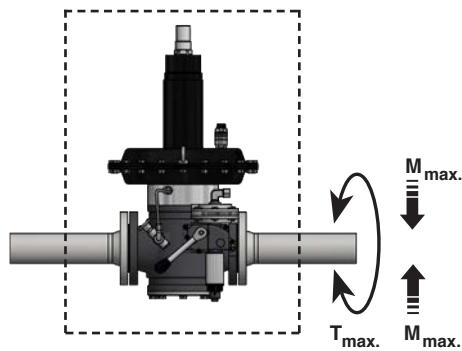


9.3 Torque

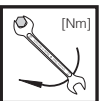


Use adequate tools!
Tighten the screws crosswise!

The device must not be used as lever.

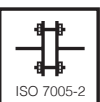


DN	--	--	--	25	40	50	65	80	100	125	150
Rp	3/8	1/2	3/4	1	1 1/2	2	2 1/2	--	--	--	--
M _{max.} [Nm] t 10 s	70	105	225	340	610	110	1600	2400	5000	6000	7600
T _{max.} [Nm] t 10 s	35	50	85	125	200	250	325	400	--	--	--



Max. torque system accessories

M ... / G ...	M 4	M 5	M 6	M 8	G 1/8	G 1/4	G 1/2	G 3/4
M _{max.} [Nm] t 10 s	2.5 Nm	5 Nm	7 Nm	15 Nm	5 Nm	7 Nm	10 Nm	15 Nm



Max. torque flanged joint

Stud	M 12 x 55 (EN 13611)	M 16 x 65 (DIN 939)
M _{max.} [Nm] t 10 s	30 Nm	60 Nm

10. Function integrated SAV

SAV protects downstream fittings or lines against pressures that are too high or too low. As soon as the pre-set trip pressure falls below or exceeds a limit due to a fault, the SAV automatically interrupts the gas flow. Under normal operating condition the SAV is open.

If the equipment downstream of the regulator, including any pipework, cannot safely operate or contain a pressure equal to the highest supply pressure (inlet to regulator), a SAV must be installed. The SAV is designed to shut down the gas supply in the event of a fault condition.

The SAV complies with the requirements of EN 14382 as safety shutoff valve.

Main components

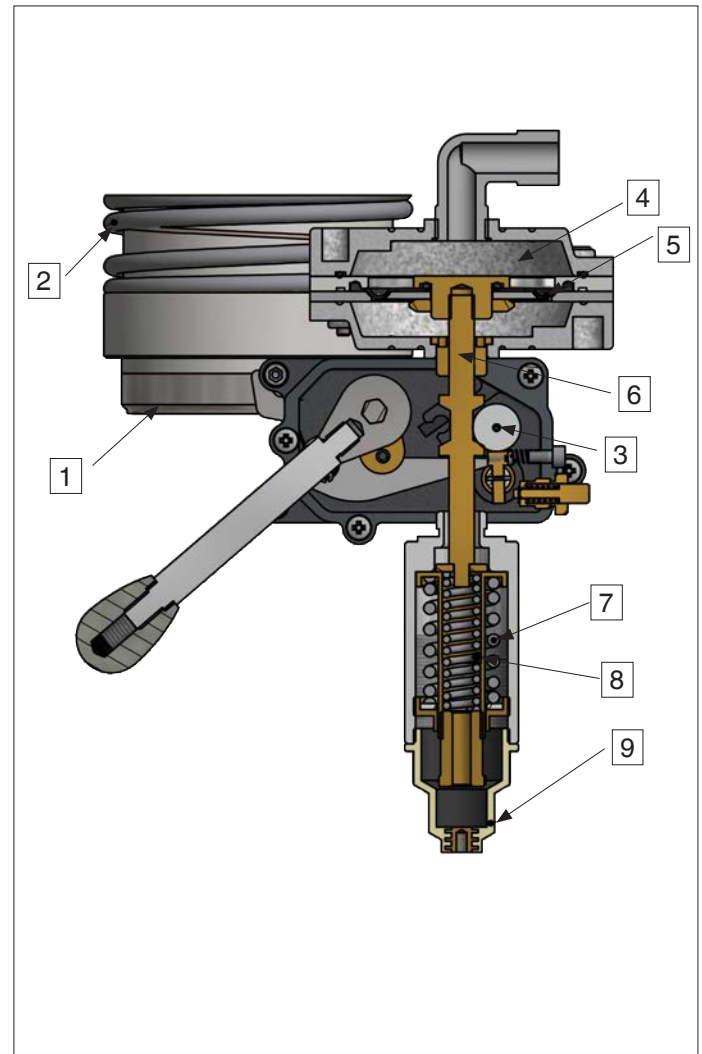
- 1 Shutter case
- 2 Closing spring
- 3 Trigger mechanism
- 4 Chamber with the pressure to be monitored
- 5 Working diaphragm
- 6 Push rod
- 7 Setpoint spring for p_{do}
- 8 Setpoint spring for p_{du}
- 9 Protective cap

Function

Chamber 4 is connected to the outlet pressure via a pulse line.

The pressure to be checked 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.



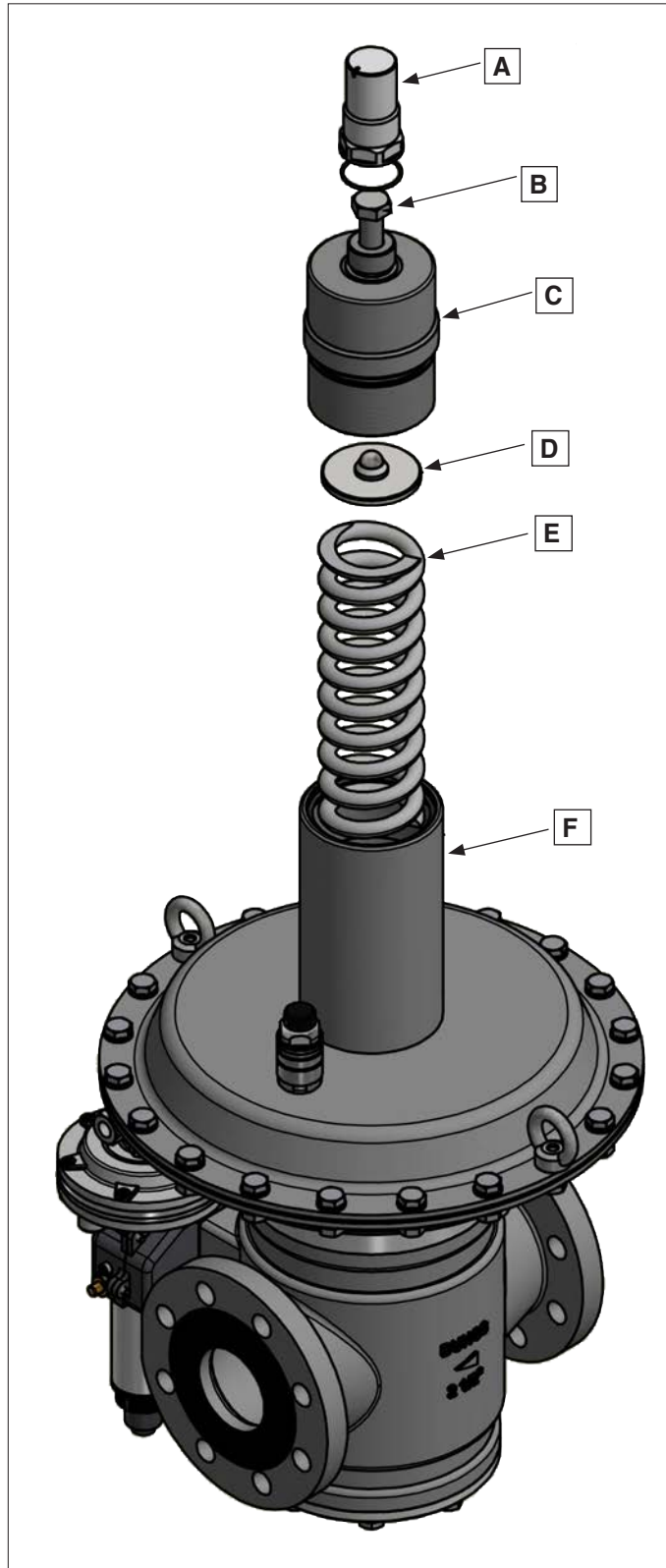
11. Setting

11.1 Regulator setting

Setting of the outlet pressure

The regulator is set using the adjusting screw **B**.

1. Remove the protective cap **A**.
2. Turn the adjusting screw **B** using an open-ended wrench **SW 24**.
3. Turning clockwise: the preload of the setpoint spring is increased and the outlet pressure p_{ds} is increased (+).
4. Turning counter-clockwise: the setpoint spring is released and the outlet pressure p_{ds} reduced (-).
5. After the setting: screw on the protective cap **A** again.



11.2 SAV setting

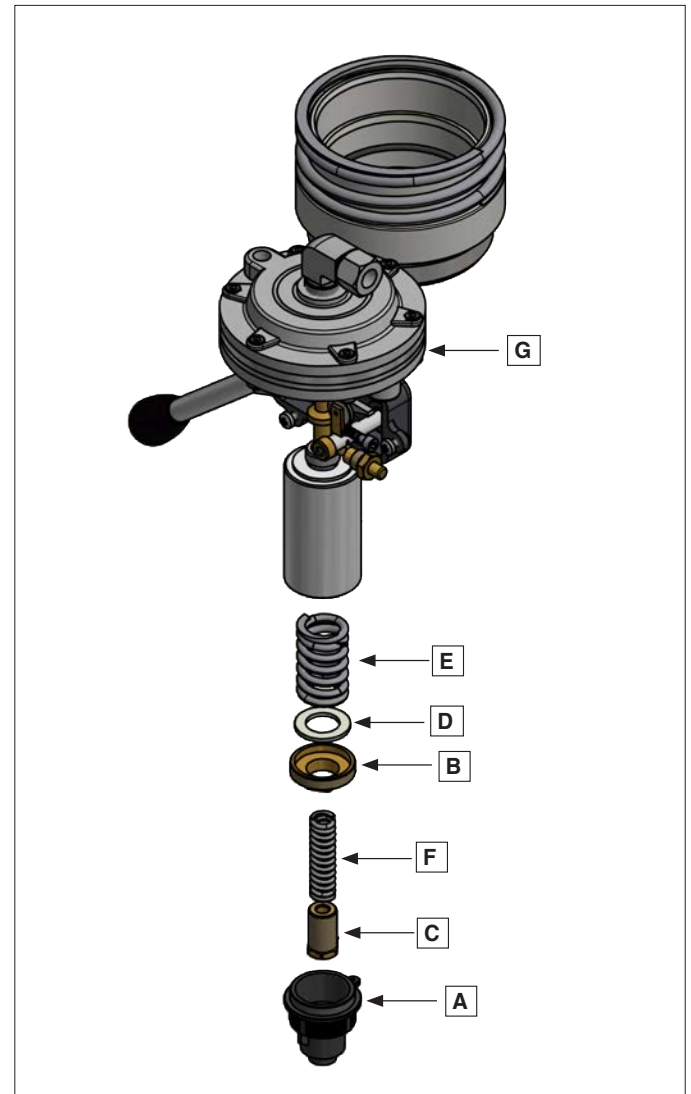
Switch-off setting in case of overpressure p_{do}

1. Remove the protective cap **A**.
2. Turn the external adjusting screw **B** using a socket wrench **SW 22**.
3. Turning clockwise: increase (+) in the upper shut down pressure p_{do} .
4. Turning counter-clockwise: reduction (-) in the upper shut down pressure p_{do} .
5. After the setting: screw on the protective cap **A** again.

Triggering setting in case of underpressure p_{du}

1. Remove the protective cap **A**.
2. Turn the internal adjusting screw **C** using a socket wrench **SW 17**.
3. Turning clockwise: increase (+) in the lower shut down pressure p_{do} .
4. Turning counter-clockwise: reduction (-) in the lower shut down pressure p_{do} .
5. After the setting: screw on the protective cap **A** again.

Attention: The setting for lower triggering affects the set value for upper triggering. Please set the vacuum triggering, first.



A mutual influence of the pressure regulator and the safety shutoff valve must be excluded.

Calculation of the recommended set values according to the outlet pressure p_d of the regulator

$$p_d \leq 100 \text{ mbar}$$

$$p_{do} = p_d + 50 \text{ mbar}$$

$$100 \text{ mbar} < p_d \leq 200 \text{ mbar}$$

$$p_{do} > p_d + 100 \text{ mbar}$$

$$p_d > 200 \text{ mbar}$$

$$p_{do} > p_d \times 1.5$$

- The SAV must lock as soon as it reaches the 1.1 times max. operating pressure according to the system specifications.
- The set values of the SAV must be defined taking into account the set values and tolerances of the pressure regulator.
- The tolerances and set values of additional safety devices must also be considered when setting of the SAV.
- In case of a fault or regular shut-down of the downstream shutoff valve the SAV may not be actuated. The upper shut down pressure should be determined to avoid nuisance shut down (e.g. shut down of downstream equipment)

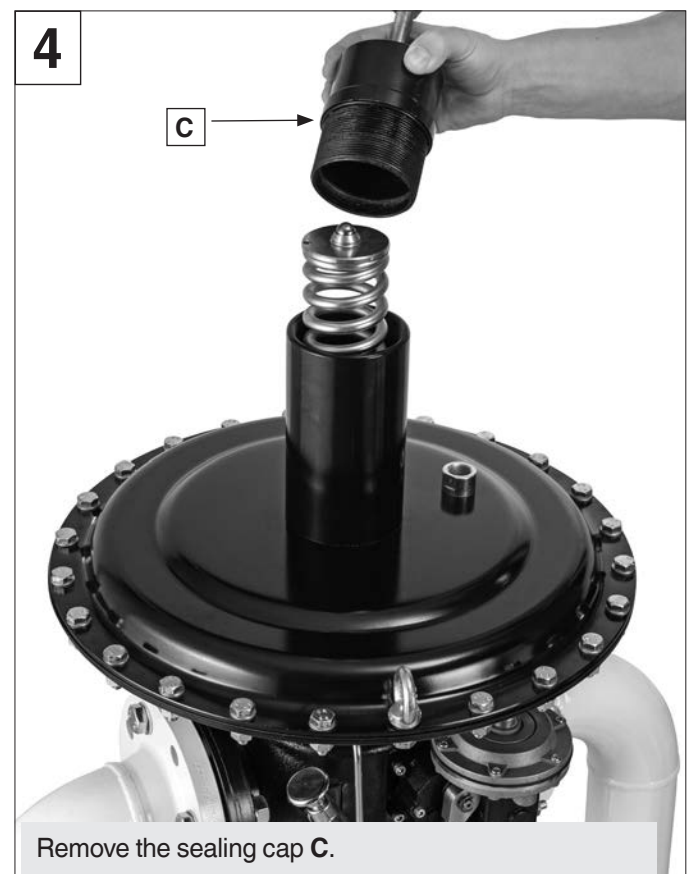
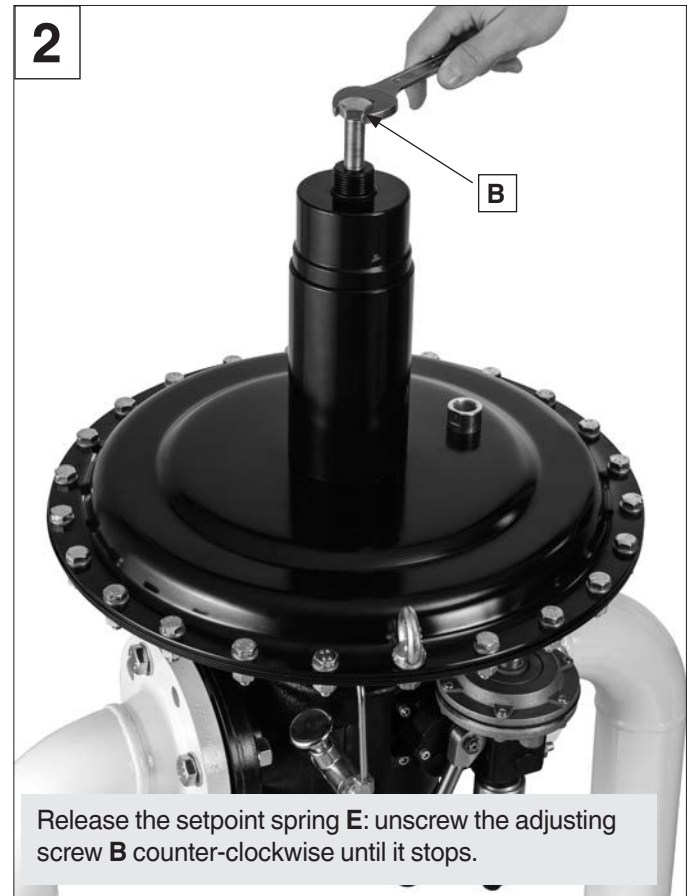
11.3 Calculation example of set values

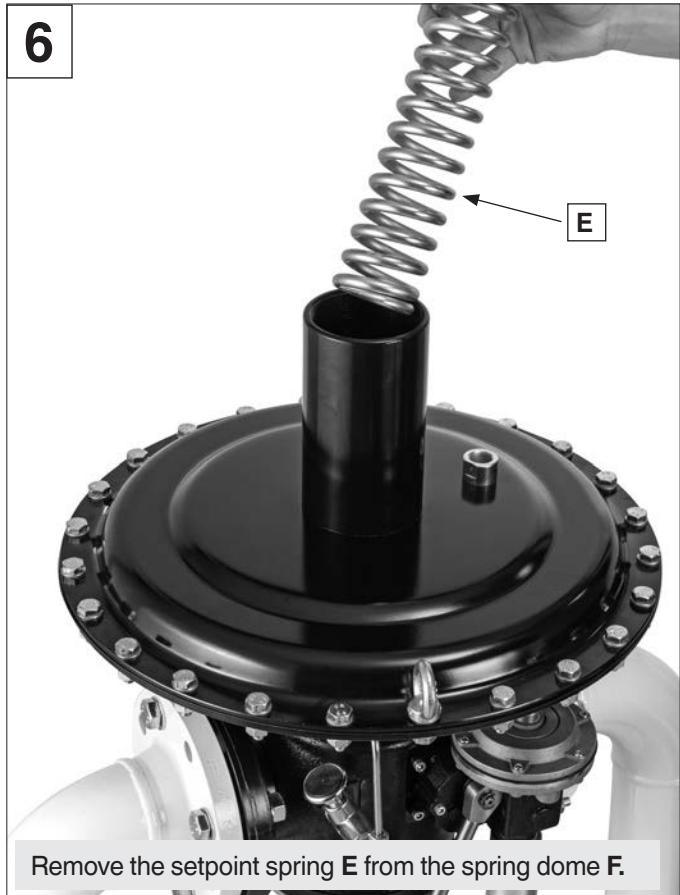
Determination of the set values by means of a pressure graduation chart

Selected regulator	FRM 100065 MD / SAV MD
Outlet pressure of the regulator p_d	200 mbar
System-specific operating pressure downstream of the regulator $p_{zul.}$	500 mbar
Limiting pressure in case of fault	550 mbar
Accuracy class	AC 5
Response pressure group of the upper shut down pressure SAV	AG _o 10
Response pressure group of the lower shut down pressure SAV	AG _u 10
Response group of the SBV	AG 5

Result		
Device group	Device data	Pressure graduation
Safety devices against excessive pressure	Limiting pressure in case of fault: $1.1 \cdot p_{perm.}$	550 mbar
	AG _o 10	440 mbar
	SAV	$p_{do} =$ 400 mbar
	AG _o 10	360 mbar
Safety devices against insufficient pressure	AG 5	315 mbar
	SBV	$p_d =$ 300 mbar
	AG 5	285 mbar
Gas pressure regulator	SG 20	240 mbar
	AC 5	210 mbar
	FRM	$p_d =$ 200 mbar
	AC 5	190 mbar
Safety device against insufficient pressure	AG _u 20	60 mbar
	SAV	$p_{du} =$ 50 mbar
	AG _u 20	40 mbar

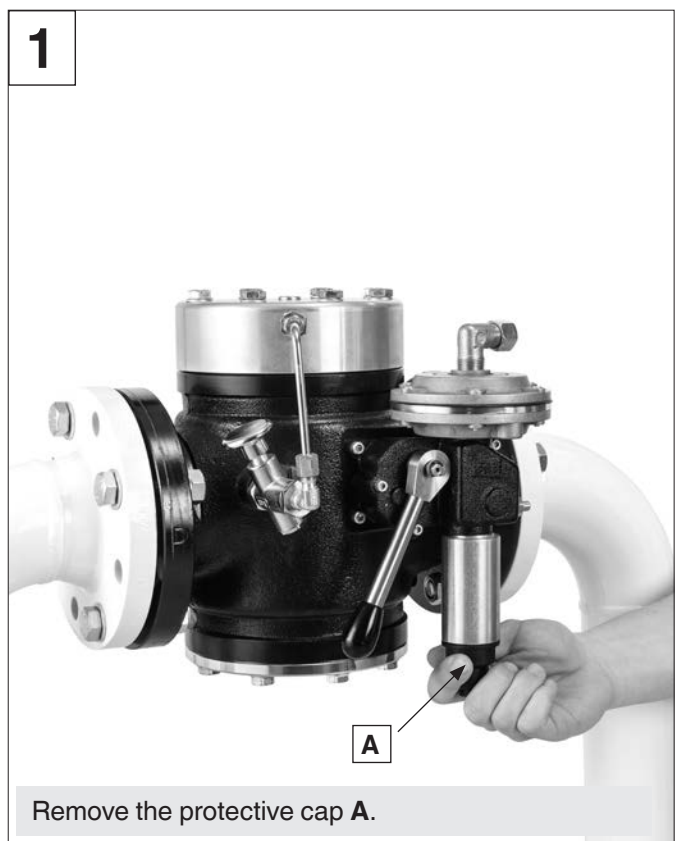
11.4 Replacement of regulator springs





7. Insert a new spring with a suitable adjustment range
8. Reattach the spring washer **D** incl. ball on the spring.
9. Reinsert the sealing cap **C** in the spring dome **F**. Tighten the adjusting screw **B** until the required spring preload is reached. Reinsert the protective cap **A**.

11.5 Replacement of SAV springs



11.5.1 Spring replacement W_{dso}

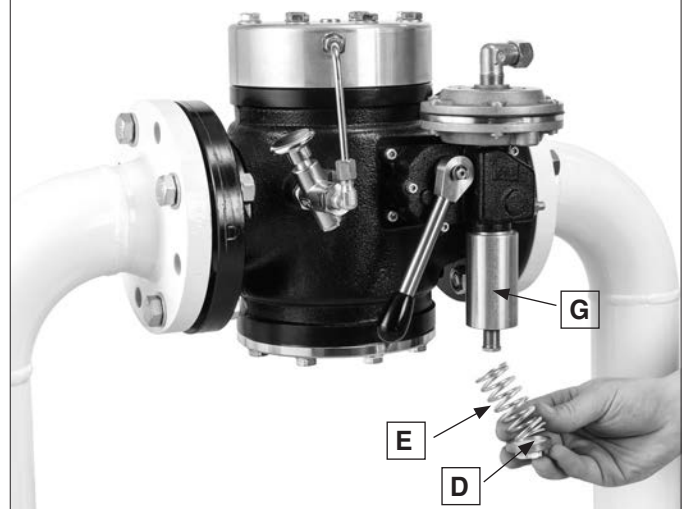
1

Unscrew the adjusting spring **B** from the spring dome **G** using a tube/socket wrench **SW 22**.



2

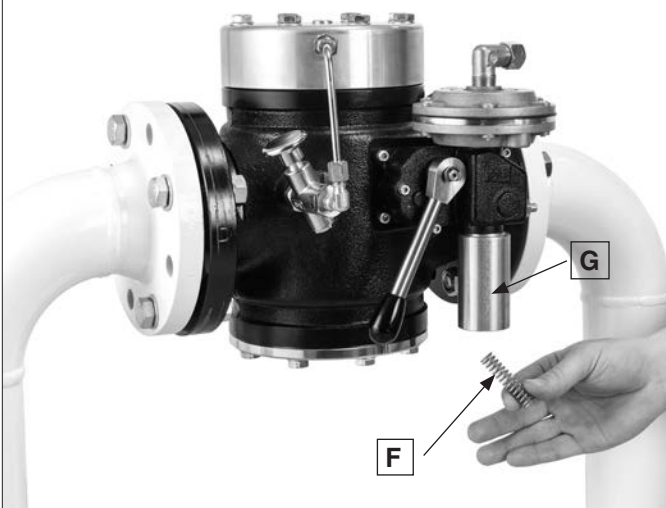
1. Remove the spring **E** from the spring dome **G**.
2. Install the new spring.
3. Tighten the adjusting screw **B** and plastic washer **D** in the spring dome **G** using a tube/socket wrench **SW 22** until the desired spring preload is reached.
4. Reinsert the protective cap **A**.



11.5.2 Spring replacement W_{dsu}

1

1. Remove the spring **F** from the spring dome **G**.
2. Install the new spring.
3. Tighten the adjusting screw **C** in the spring dome **G** using a tube/socket wrench **SW 17** until the desired spring preload is reached.
4. Reinsert the protective cap **A**.



12. Commissioning and decommissioning

12.1 General information



Prior to commissioning

- The performance data on the type plate correspond to the ordering data.
- Prevent explosive gas-air mixture: the room atmosphere must be monitored through gas concentration measuring devices for the detection of gas leakages.
- Only operate the device if all safety devices are fully functional.
- Only qualified personnel are allowed to carry out the commissioning.

12.2 Leakage test

Before commissioning the device, a test for internal and external leakages must be carried out.

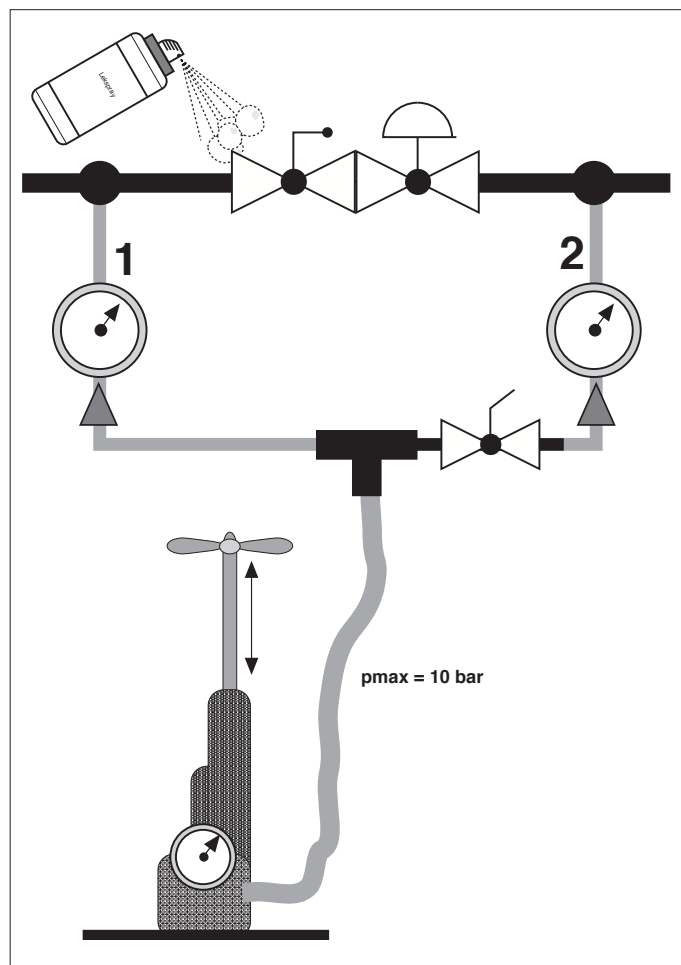
1. Test gases of the leakage test: air or inert gases.
2. Upstream and downstream shutoff valves must be closed.
3. Release the test section. Check the presence of gas and safely release to the atmosphere.
4. Test pressure > blow-off pressure SBV: block the line upstream of the SBV.
5. Connect the test section to the test device and apply pressure.
6. Test pressure: 1.1 x system-specific operating pressure Maximum PS of the device. Different pressure ratings of the system must be taken into account.
7. Observe the waiting time necessary for the pressure compensation according to the system-specific volumes.

External leakage

8. Use a suitable leak detection spray on the device.
9. Monitor the foam formation.

Internal tightness

10. Release the pressure in the test section downstream of the device.
11. Monitor the increase in pressure on the outlet side: pressure gauge accuracy 0.1 mbar
12. Once the leakage test has been carried out, open the shutoff valve upstream of the SBV.
13. Release pressure in the test section.



12.3 Commissioning / unlocking/ control of the set values

1. Slowly open the shutoff valve on the inlet side. The ball valve on the outlet side remains closed.
2. Monitor the pressure rise on the pressure gauge on the inlet side upstream of the device.

3. SAV unlocking:

3.1



3.2



4.0 Venting

- 4.1 Vent the test section in the atmosphere by using a suitable hose. Do not use a test burner for venting.
- 4.2 The test section must be completely filled with gas: make sure that the test section is free from air by using a test burner. Close the stop-cock on the venting hose.

5.0 Check of the outlet pressure

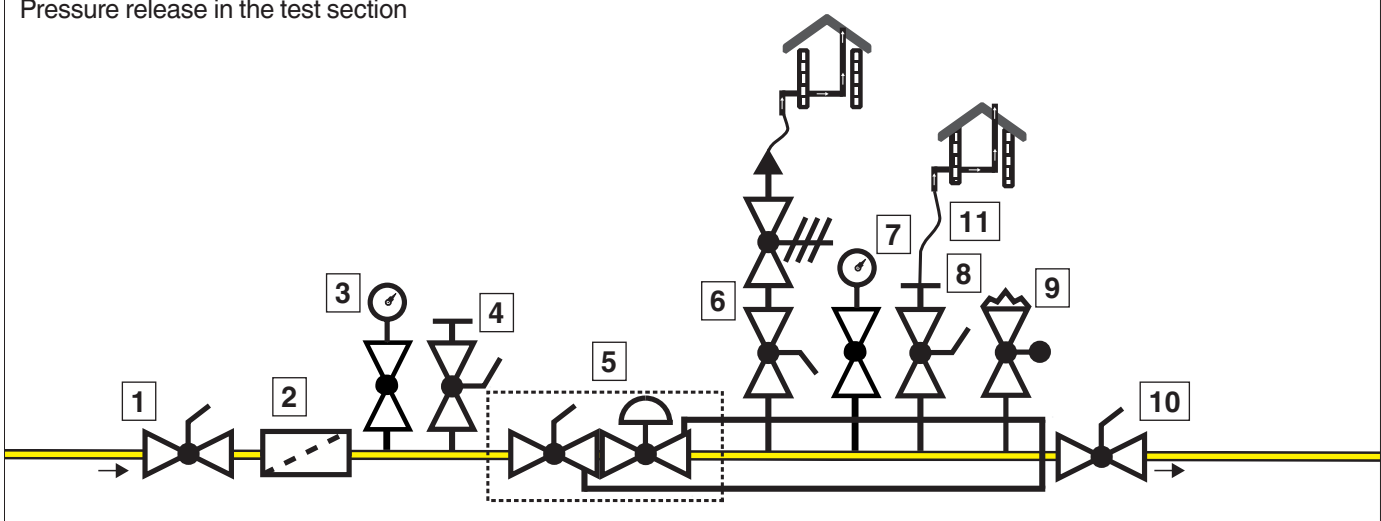
- 5.1 Check the closing pressure of the regulator.
- 5.2 Open the vent valve and check the set value (outlet pressure) on the pressure gauge and, if necessary, correct it according to section 11.1
- 5.3 Close the vent valve, remove the hose.

6.0 Check of the upper shut-down pressure p_{do}

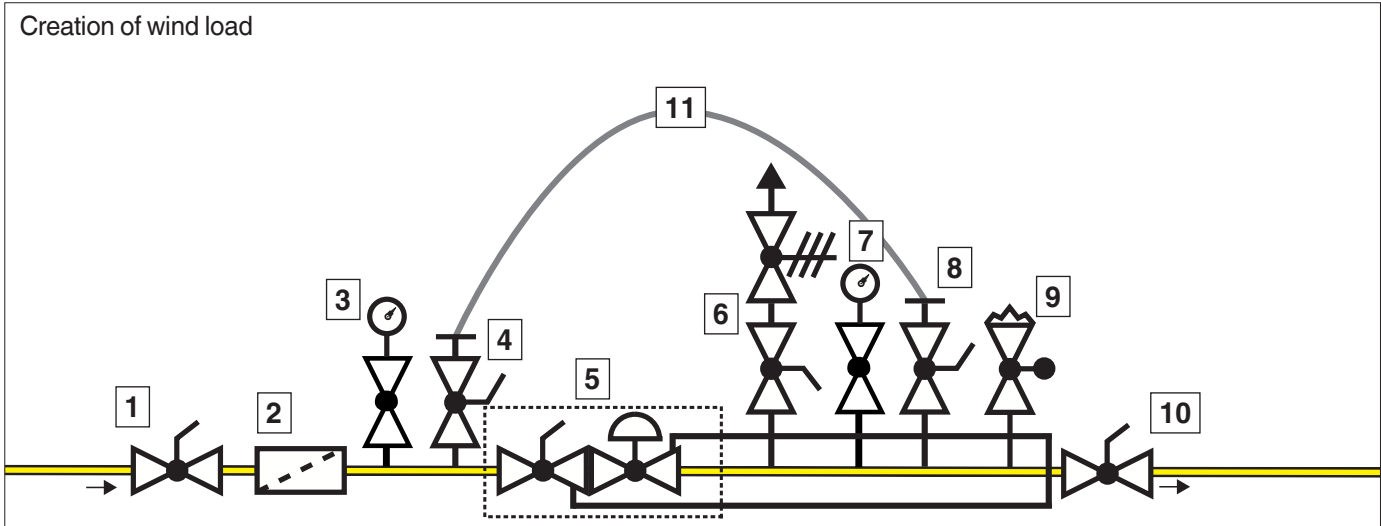
- 6.1 SBV installation on the outlet side: block the line upstream of the SBV.
- 6.2 Check the upper trip pressure of the SAV: create wind load on the outlet side (reduction in pressure pulse)
- 6.3 Create a lockable connection between the inlet and outlet side.
- 6.4 Conduct the inlet pressure in the bypass on the outlet side through the long opening of the stop-cock.
- 6.5 Monitor the increase in pressure on the outlet side on the pressure gauge.
- 6.6 Avoid inadmissible high pressure on the outlet side. Stop applying pressure immediately after the SAV has tripped.

- 6.7 Read the upper response pressure on the pressure gauge on the outlet side and compare it with the nominal value.
- 6.8 The determined triggering pressure must be within the response tolerance (AG_o) of the nominal value.
- 6.9 If necessary, correct the response pressure according to the specifications in section 11.2 and check it again.
- 7.0 Check of the lower shut down pressure p_{du}**
- 7.1 Release the pressure in the test section on the outlet side until the operating pressure is reached.
- 7.2 Check if gas is available and release it safely in the atmosphere.
- 7.3 Monitor pressure drop on the pressure gauge.
- 7.4 Unlock SAV.
- 7.5 Close the shut-off fitting on the input side.
- 7.6 Create the wind load: continue to safely release the gas in the line on the outlet side into the atmosphere.
- 7.7 After trip the SAV: 6.7 Read the lower response pressure on the pressure gauge on the outlet side and compare it with the nominal value.
- 7.8 The determined trip pressure must be within the response tolerance (AG_o) of the nominal value.
- 7.9 Close the vent valve, remove the hose, insert the sealing cap.
- 7.10 Slowly open the shut-off valve on the inlet side.

Pressure release in the test section



Creation of wind load



Pos.	Designation
1	Shut-off valve, inlet side
2	Filter
3	Pressure gauge with pushbutton
4	Venting ball valve
5	Regulator with integrated SAV
6	SBV with shutoff valve

Pos.	Designation
7	Pressure gauge with pushbutton
8	Venting ball valve
9	Test burner
10	Shut-off valve, outlet side
11	Hose

12.4 Recommissioning

1. Close the shutoff valve upstream of the bypass.
2. Remove the hose.
3. Open the ball valve upstream of SBV.
4. Slowly open SAV, see section 11.3.
5. Once SAV has been opened completely, open the shutoff valve on the outlet side.

12.5 Decommissioning

1. Slowly close the shutoff valve on the outlet side.
2. Slowly close the shutoff valve on the inlet side.
3. Check if gas is available in the test section and release it safely into the atmosphere.

13. Faults and related causes



- Repair work must only be performed by authorized and skilled personnel.
- Only use original spare parts.

Fault on SAV	Possible causes	Troubleshooting
It is not possible to open/activate the SAV.	The impulse line is not installed.	Install the impulse line.
	The impulse line is clogged.	Clean the impulse line.
	The impulse line is leaky.	Seal the impulse line.
	The impulse line is broken.	Replace the impulse line.
	The impulse pressure is outside the adjustment range.	Set the shut-down pressure of the SAV or the outlet pressure.
	The adjusting springs are not suitable for the application.	Replace the adjusting springs.
	The adjustment range of the SAV is outside the outlet pressure.	Replace the SAV or the ASE.
The SAV cannot be activated.	The impulse line is not installed.	Connect/install the pulse line.
	The impulse line is clogged.	Clean the impulse line.
	The impulse line is leaky.	Seal the impulse line.
	The impulse line is broken.	Replace the impulse line.
	The impulse pressure is outside the adjustment range.	Set the shut-down pressure of the SAV.
	The adjusting springs are not suitable for the application.	Replace the adjusting springs.
The SAV can be activated, but not sealed.	The valve disc is damaged or worn out.	Replace the ASE or have it repaired by DUNGS.
	The valve seat is damaged.	Replace the valve seat.
	The movable parts are contaminated with foreign particles.	Clean the movable parts or replace the ASE.
	The drive is damaged.	Replace the ASE.
	The O-ring is damaged.	Replace the O-ring or the ASE.
The SAV is leaking towards the atmosphere.	The working diaphragm is damaged.	Change the working diaphragm or replace the ASE.
	The sealing ring between the ASE and the housing of the SAV is damaged.	Replace the sealing ring or the ASE.
	The O-ring in the ASE is damaged.	Replace the O-ring or the ASE.

Fault on the regulator	Possible causes	Troubleshooting
There is no gas.	The regulator contains no gas.	Check the gas installation upstream of the regulator.
	The SAV is closed.	Unlock the SAV.
The regulator provides a wrong outlet pressure.	The false setpoint spring is installed in the regulator.	Replace the setpoint spring.
	The required outlet pressure is outside the possible range.	Change the model of the regulator.
	The inlet pressure is not sufficient.	Check the gas installation or dismount the regulator again.
With no flow volume the outlet pressure corresponds to the inlet pressure.	The impulse line is not installed.	Close the impulse line.
	The impulse line is blocked.	Check the impulse line.
	The impulse line is leaky.	Seal the impulse line.
	The control plate is damaged.	Replace the control plate.
	The control plate seat is damaged.	Replace the control plate seat.
	The working diaphragm is damaged.	Replace the working diaphragm.
	The admission pressure compensation diaphragm is damaged.	Replace the admission pressure compensation diaphragm.
	The O-rings in the regulator are damaged.	Replace the O-rings of the regulator.
The O-rings of the SAV are damaged.	Replace the O-rings of the SAV.	
During operation the outlet pressure corresponds to the inlet pressure.	The pulse impulse is not installed.	Close the impulse line.
	The pulse impulse is blocked.	Check the impulse line.
	The pulse impulse is leaky.	Seal the impulse line.
	The working diaphragm is damaged.	Replace the working diaphragm.
	The admission pressure compensation diaphragm is damaged.	Replace the admission pressure compensation diaphragm.
The outlet pressure drops if the flow rate of the outlet pressure is increased.	The desired volume flow exceeds the capacity of the regulator.	Start the regulator again and replace it.
	False dimensions of the gas installation.	Increase the nominal values of the pipeline.
	The gas filter upstream of the regulator is soiled.	Clean the gas filter, replace the filter mat.
	The pulse line is blocked.	Check the impulse line.
	The SAV is damaged.	Check the SAV.
Gas escapes at the vent connection.	The working diaphragm is damaged.	Replace the working diaphragm.
	The compensation unit is damaged.	Replace the compensation membrane.

14. Maintenance

14.1 General information



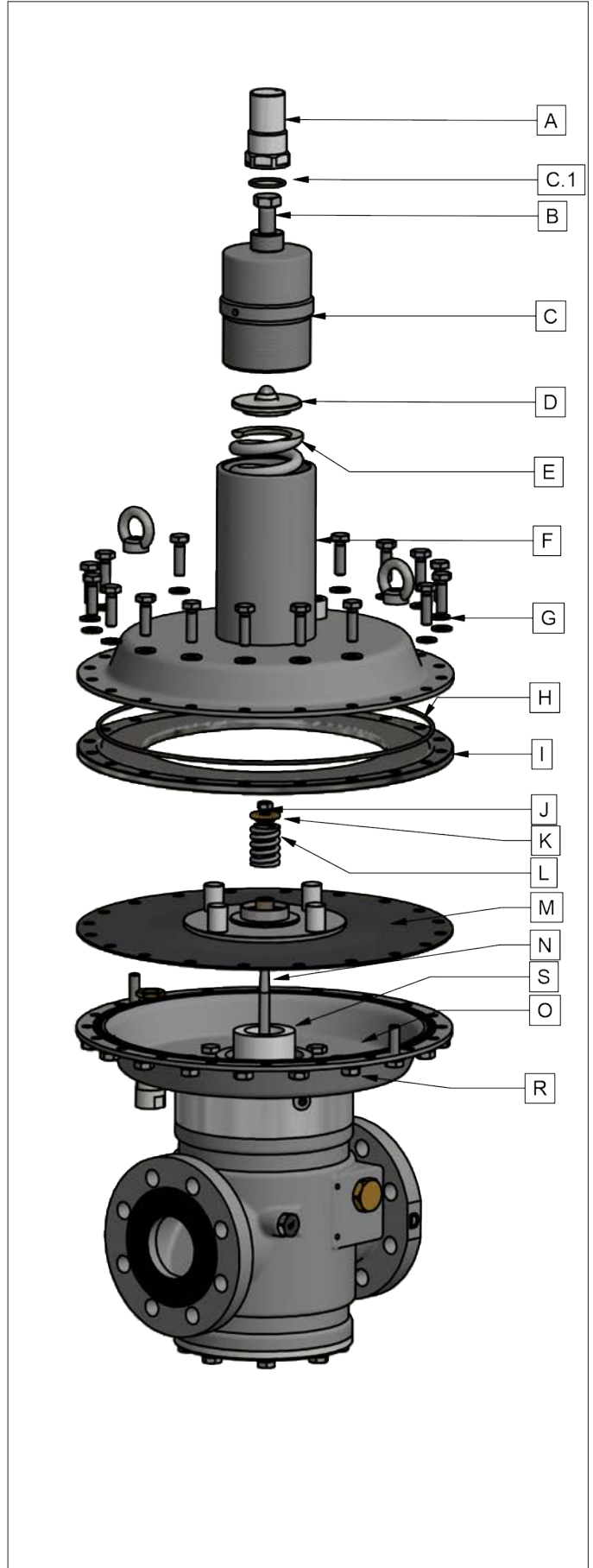
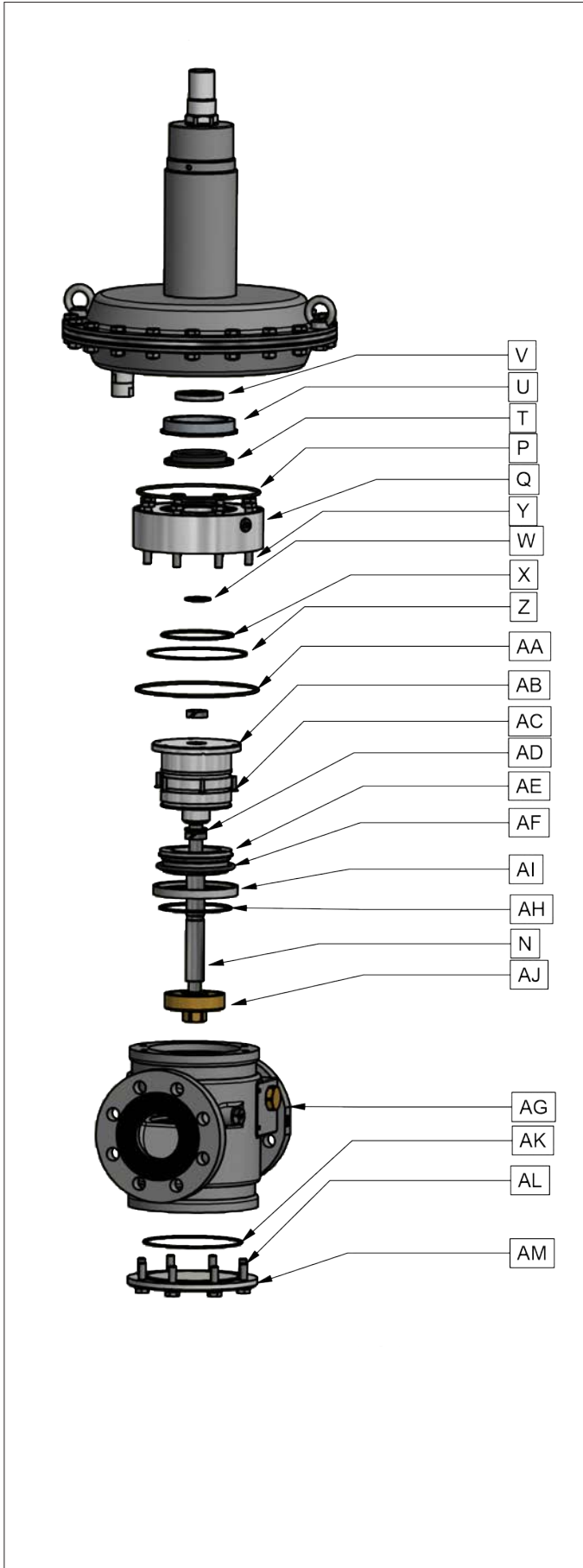
• The Pressure Equipment Directive (PED) requires the regulator to be checked at regular intervals to ensure: safety and correct functioning of the device, high long-term utilisation ratios, resulting in minimum environmental impact.

- The maintenance of the device can only be carried out in compliance with the rules and standards applicable and in accordance with current local regulations.
- Maintenance work must only be performed by authorised and skilled personnel.
- Adhere to the maintenance intervals indicated.
- The risks in case of an escape of flammable or noxious gases into the atmosphere have to be assessed.
- Always install new seals after replacement or modification of parts.
- Only use original spare parts.
- Do not use alcohol-based or solvent-containing cleaning solutions for cleaning the rubber parts.

Prior to maintenance

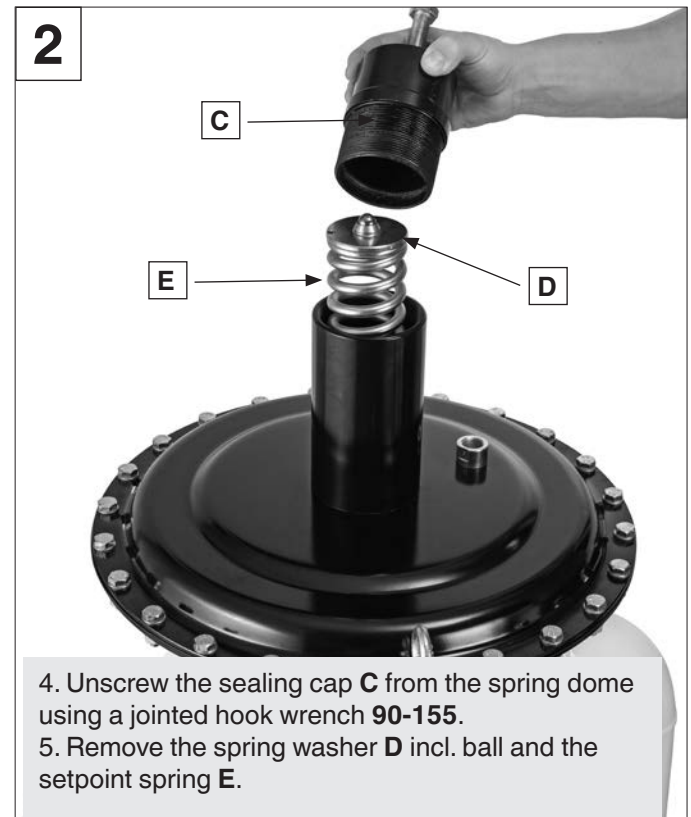
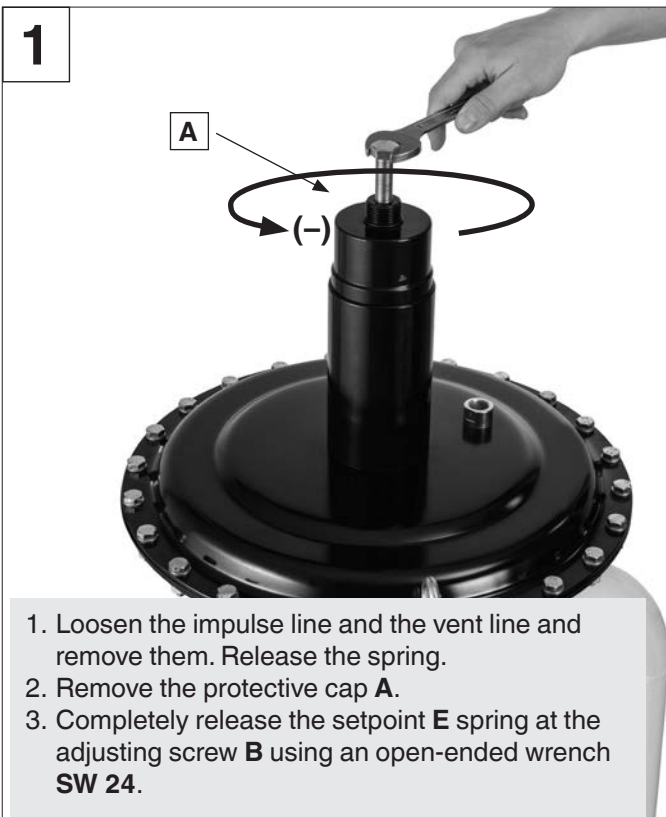
- Shut-off valves both on the inlet and outlet side are closed.
- Lines are unstressed and free from combustible gas.
- Prevent explosive gas-air mixture: the room atmosphere must constantly be monitored through gas concentration measuring devices for the detection of gas leakages.
- SAV is in the closing position.
- Original spare parts are available.

Pos.	Designation
A	Protective cap
A1	O-ring
B	Adjusting screw
C	Sealing cap
D	Spring washer with ball
E	Setpoint spring
F	Diaphragm hood
G	Hexagon screws + nut + washer
H	O-ring (UHD version)
I	Reducing washer (UHD version)
J	Locking nut
K	Spring washer
L	Locking spring
M	Working diaphragm
N	Guide rod
O	Lower diaphragm shell
P	Intermediate housing
Q	O-Ring
R	Hexagon nut
S	Compensation guide support
T	Compensation membrane
U	Upper Compensation membrane
V	Under Compensation fixing disc
W	O-ring
X	O-ring
Y	Hexagon screws
Z	O-ring
AA	O-ring
AB	Shaft guide
AC	Screws
AD	O-ring
AE	Valve seat orifice
AF	O-ring
AI	Housing
AH	O-ring
AJ	Valve sear disc
AG	Control plate
AK	O-ring
AL	Hexagon screws
AM	Bottom cover



14.2 Maintenance instructions of the regulator

14.2.1 Preparation



14.2.2 Replacement of the working diaphragm

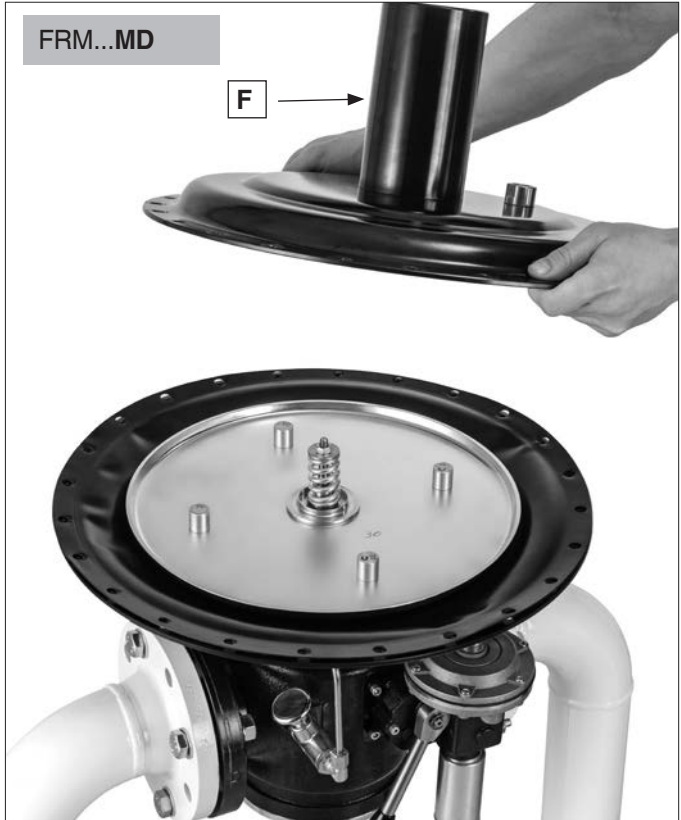


3 FRM...HD/UHD



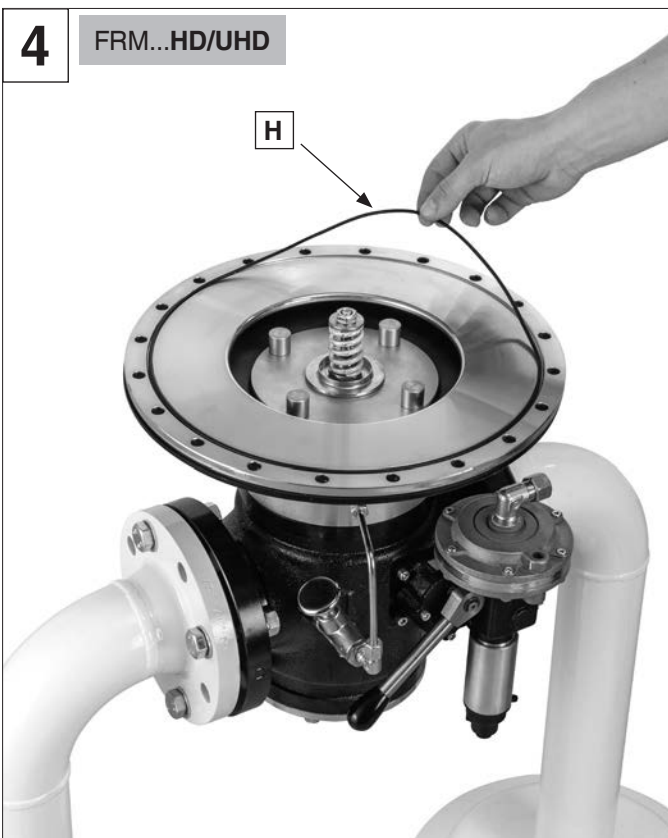
Remove the upper diaphragm shell F.

FRM...MD



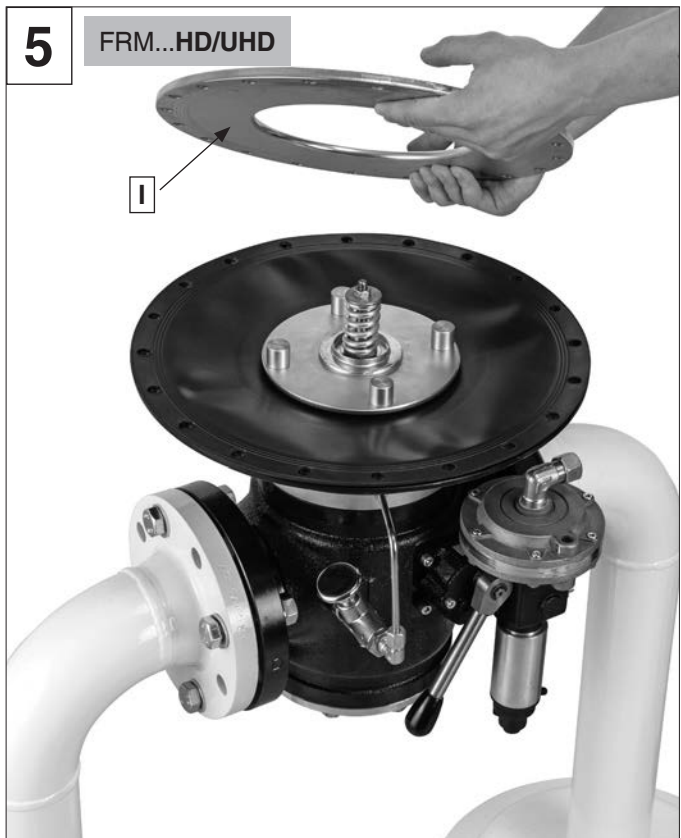
Remove the upper diaphragm shell F.

4 FRM...HD/UHD



Remove the O-ring H.

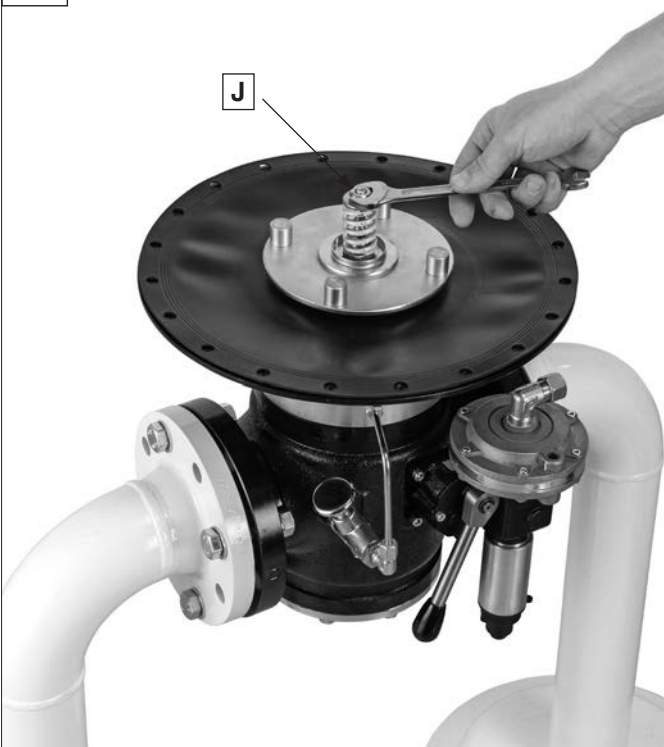
5 FRM...HD/UHD



Remove the reducing washer I.

6

FRM...HD/UHD



Loosen the nut J (M 8) using an open-ended wrench SW 13.

FRM...MD



Loosen the nut J (M 8) using an open-ended wrench SW 13.

7

FRM...HD/UHD



Remove the spring washer K.

FRM...MD



Remove the spring washer K.

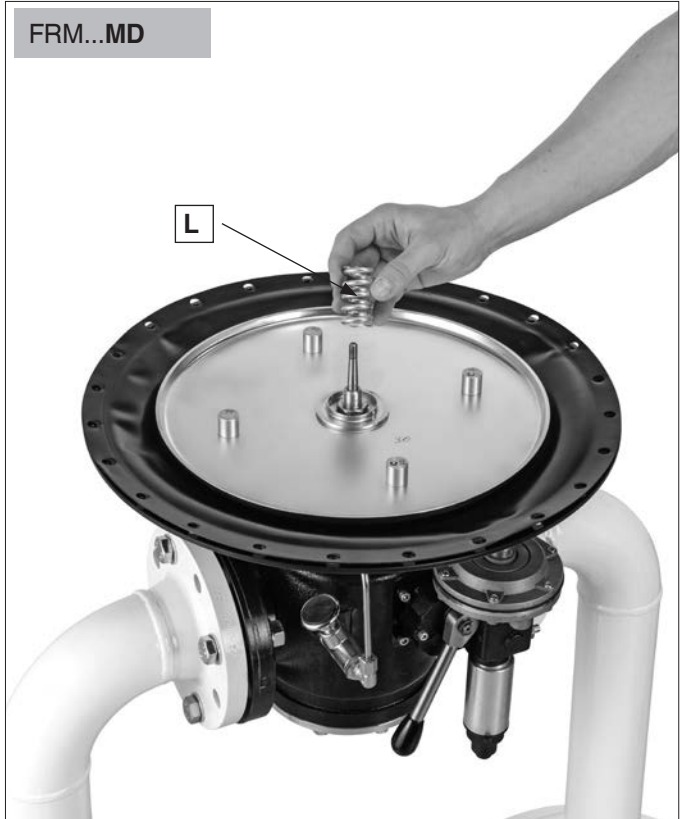
8

FRM...HD/UHD



Remove the safety spring **L**.

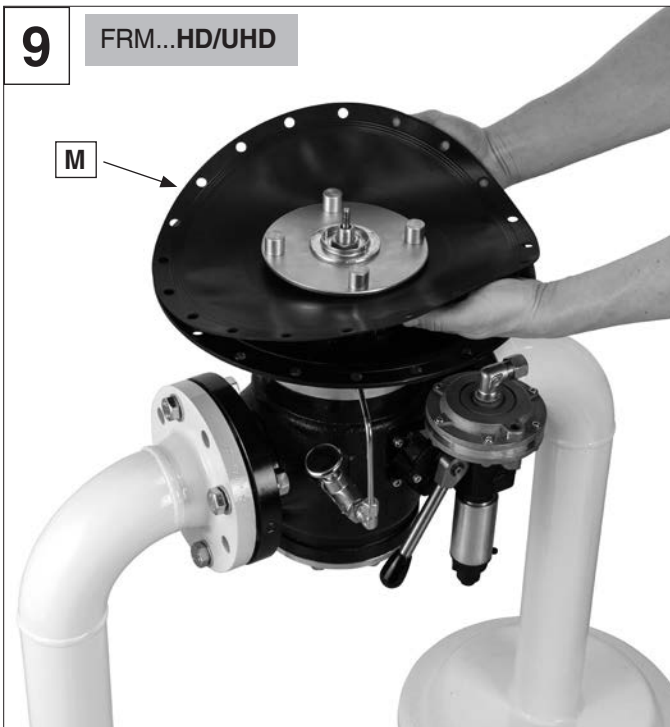
FRM...MD



Remove the safety spring **L**.

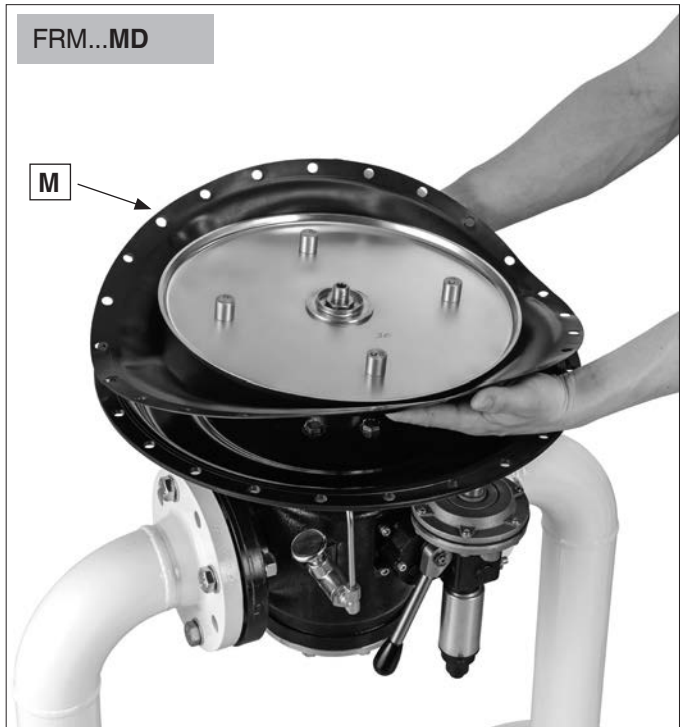
9

FRM...HD/UHD



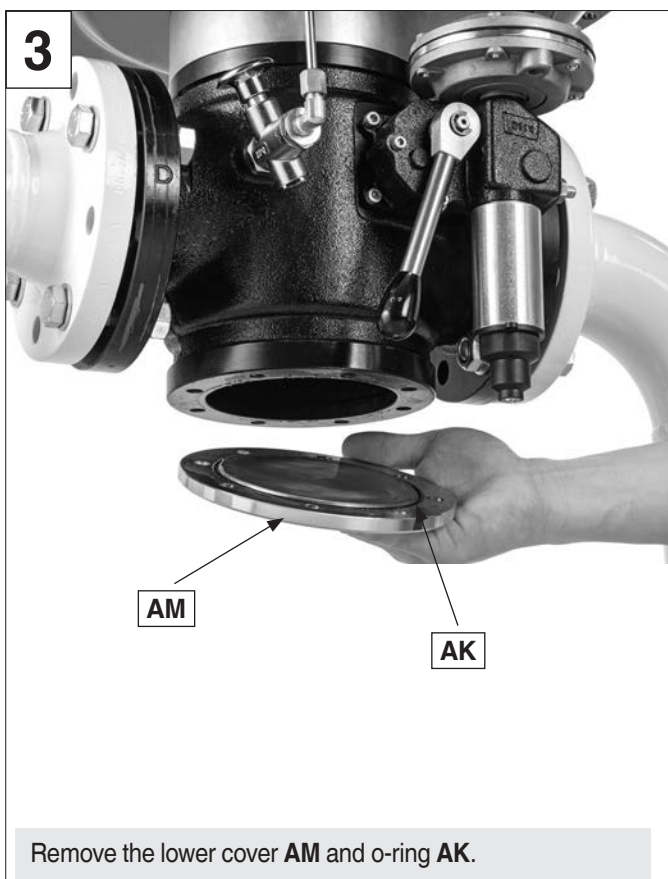
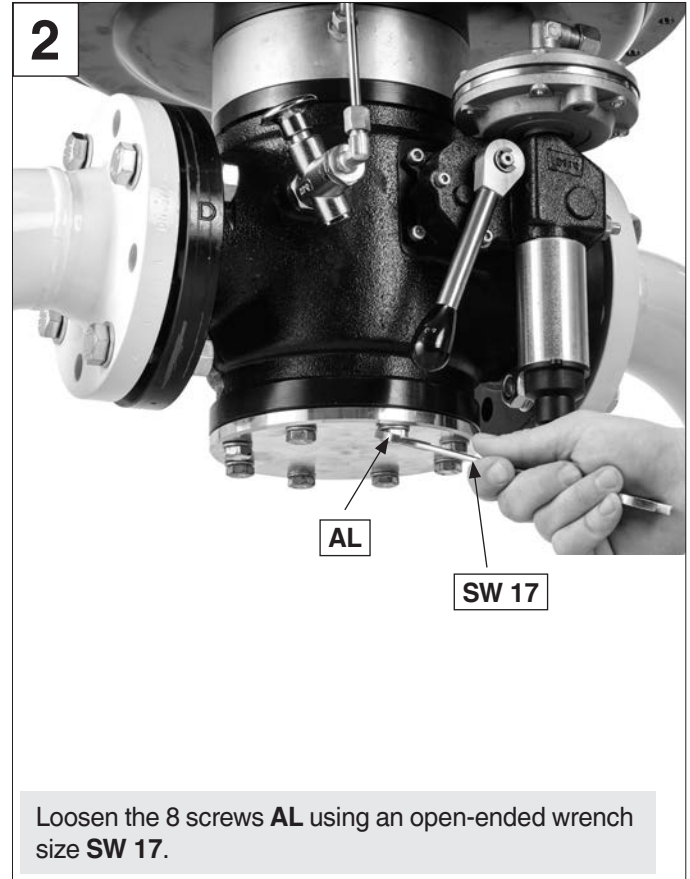
Remove the working diaphragm **M** from the guide rod **N** and check for signs of damage or wear. If necessary, reassemble a new working diaphragm **M** (maintenance kit 2).

FRM...MD



Remove the working diaphragm **M** from the guide rod **N** and check for signs of damage or wear. If necessary, reassemble a new working diaphragm **M** (maintenance kit 2).

14.2.3 Replacement of the control plate



5



6



Take out the guide rod **N** and the bottom control plate **AJ** with a hammer. For safety, hold the control plate from below with your hand so that it does not fall.

7



14.2.4 Replacement of the compensation membrane

1



Loosen screws **Y** using an open-ended wrench **SW 17**.

2



Remove lower cover of the working diaphragm **O**.

3



Remove compensation guide support **S**.

4



Remove upper compensation fixing disc **U**.

5

T



Replace compensation membrane T.

14.2.5 Replacement closing part SAV

1

V



Remove the under compensation fixing disc V under the compensating membrane T.

2



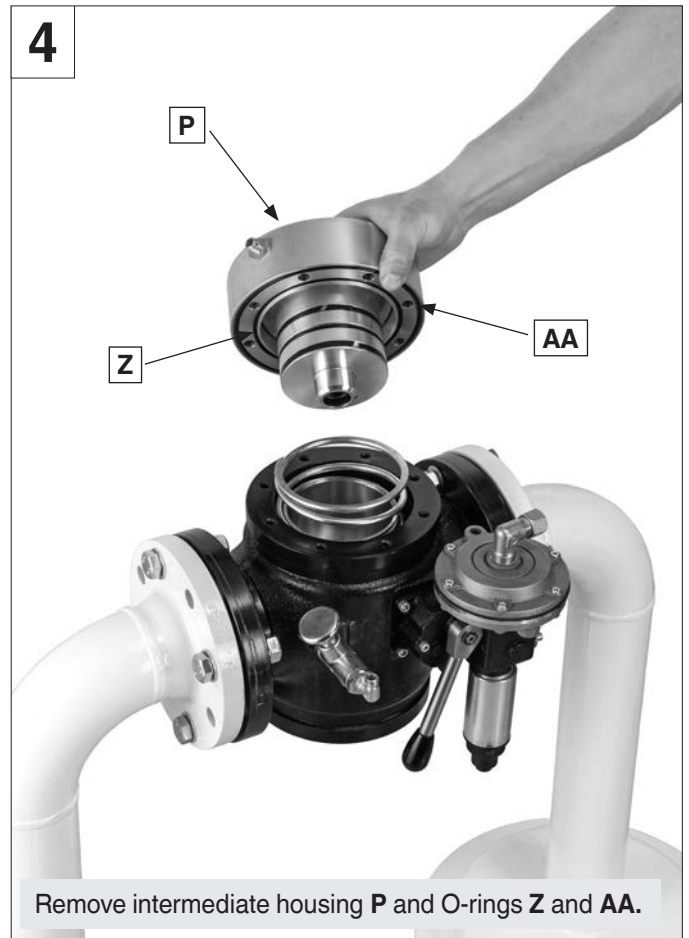
Remove bypass tubing using an open-ended wrench SW 14.

3



Remove o-ring **Q**.

4



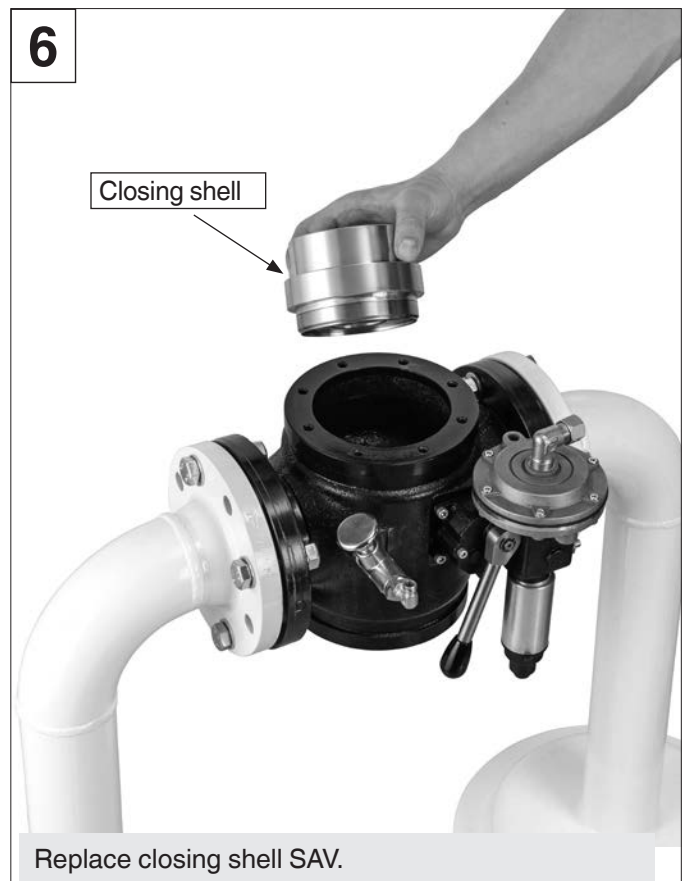
Remove intermediate housing **P** and O-rings **Z** and **AA**.

5



Remove closing spring **SAV**.

6



Replace closing shell **SAV**.

14.3 Maintenance instruction of the SAV

14.3.1 Preparation

1

Make sure that SAV is tripped by pressing triggering button..

2

1. Remove the impulse and vent lines.
2. Remove the protective cap **A**.
3. Release the setpoint springs at the adjusting screws **B** and **C** (page 19).



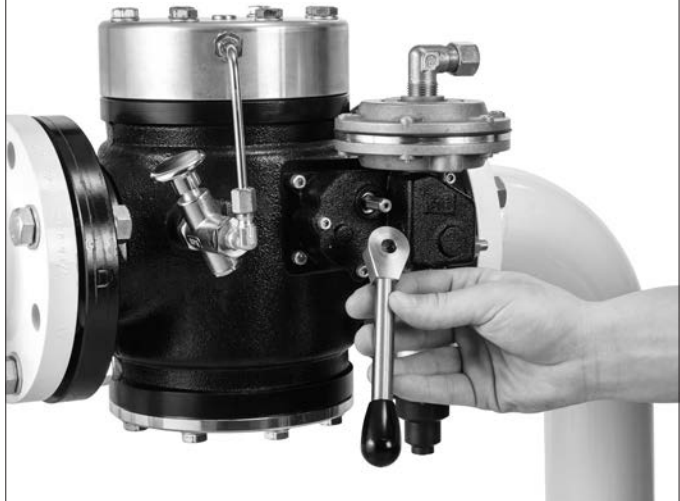
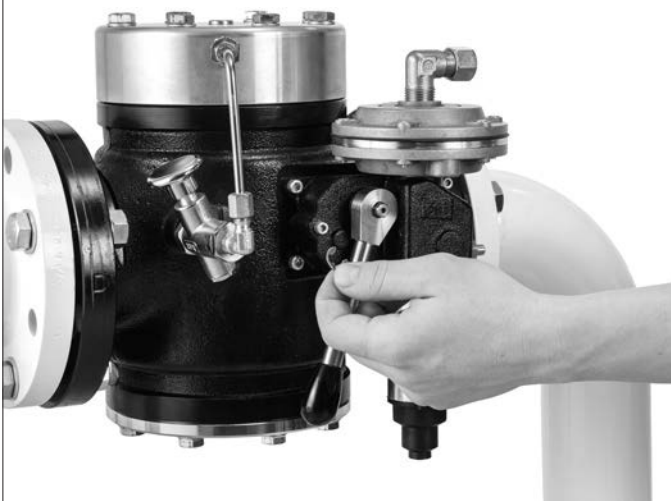
13.3.2 Removing the ASE from the housing

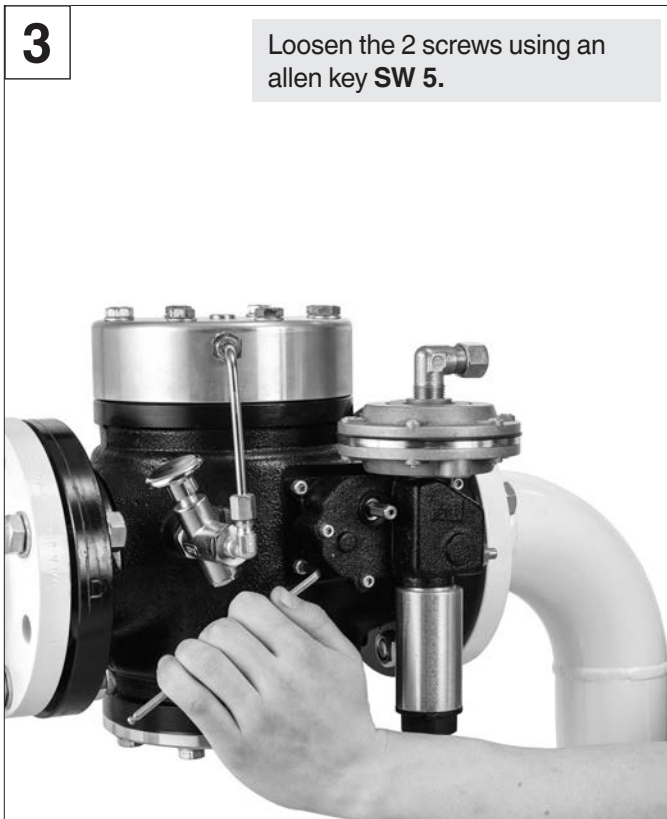
1

Remove circlip.

2

Remove resetting lever.





14.3.3 Mounting of the ASE on the housing

1	Install new ASE in its position and put back 2 bolts using an allen key SW 5 .
2	Install again resetting lever in his position and fix with circlip on the shaft.
3	Put back again setting spring for over and under pressure tripping value.

14.4 Required tools



SAV

Work step	Tool designation	Pressure rating	Wrench size		
			DN 65	DN 80	
1	Loosen the pulse lines.	Open-ended spanner (A)	MD/HD/UHD	SW 24	SW 24
2	Release the setpoint springs.	Tube/socket wrench (B)	MD/HD/UHD	SW 17	SW 17
		Tube/socket wrench (B)		SW 22	SW 22
3	Loosen ASE from the housing.	Internal hex key (C1)	MD/HD/UHD	SW 5	SW 5

Regulator

Work step		Tool designation	Pressure rating	Wrench size	
				DN 65	DN 80
1	Loosen the pulse lines.	Open-ended spanner (A)	MD/HD/UHD	SW 24	SW 24
2	Release the setpoint springs.	Open-ended spanner (A)	MD/HD/UHD	SW 24	SW 24
		Hinged hook wrench (D)		90-155	90-155
3	Replace the working diaphragm.	Open-ended spanner (A)	MD/HD/UHD	SW 17	SW 17
		Open-ended spanner (A)		SW 13	SW 13
4	Replace the control plate.	Tube socket wrench (B) / Hammer (E)	MD/HD/UHD	SW 30	SW 30
5	Loosen bypass pipe.	Open-ended spanner (A)	MD/HD/UHD	SW 14	SW 14
6	Replace closing shell SAV.	Open-ended spanner (A)	MD/HD/UHD	SW 17	SW 17

14.5 Leakage test

After maintenance or repair work, the device must be checked for internal and external leakages.

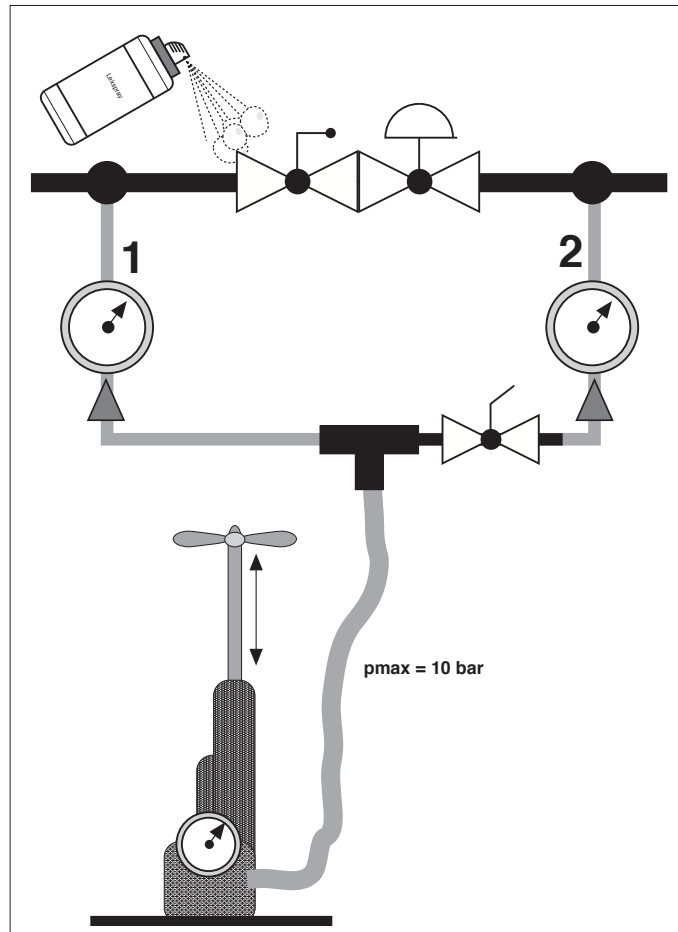
1. Test gases of the leakage test: air or inert gases.
2. Upstream and downstream shutoff valves must be closed.
3. Test pressure > blow-off pressure SBV: block the line upstream of the SBV.
4. Connect the test section to the test device and apply pressure.
5. Test pressure: 1.1 x system-specific operating pressure
Maximum PS of the device (SAV 100... 10 bar/SAV 60...6 bar). Different pressure ratings of the system must be taken into account.
6. Observe the waiting time necessary for the pressure compensation according to the system-specific volumes.

External leakage

7. Use a suitable leak detection spray on the device.
8. Monitor the foam formation.

Internal tightness

9. Remove the pressure in the test section downstream of the device.
10. Monitor the increase in pressure on the outlet side: pressure gauge accuracy 0.1 mbar
11. Once the leakage test has been carried out, open the shutoff valve upstream of the SBV.
12. Release pressure in the test section.
13. Check the correct functioning and set values (see section 11.3.).

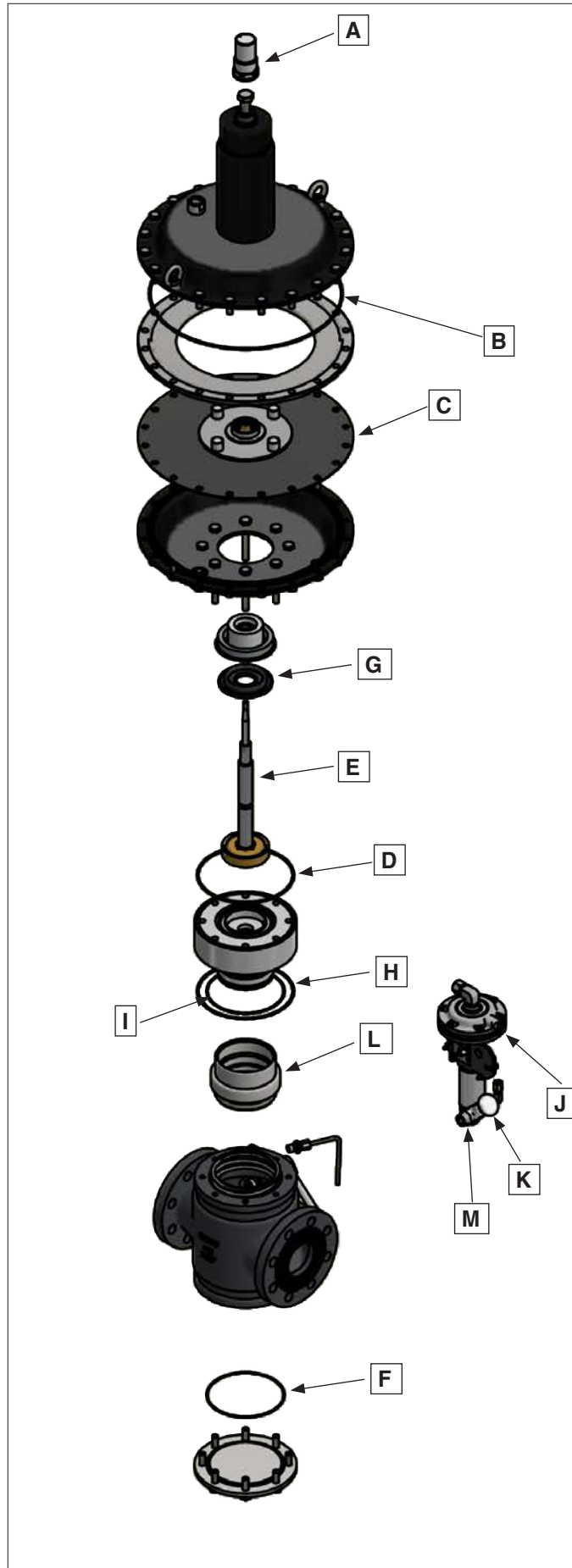


14.6 Recommended maintenance intervals



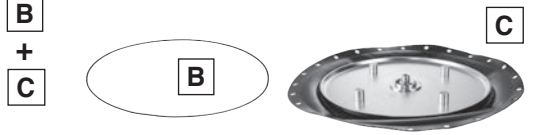
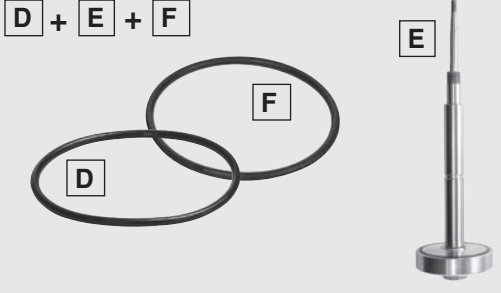
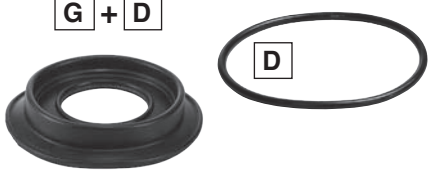
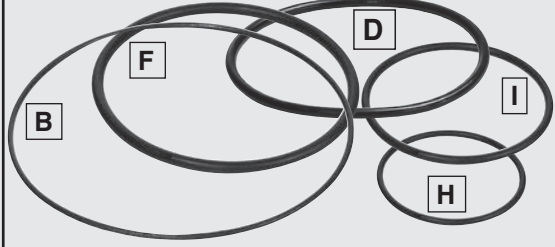

1. The maintenance intervals depend on the system-specific operating and environmental conditions, gas quality, state of the pipelines, etc.
2. The maintenance intervals have to be set by the system operator according to the system requirements.
3. It is recommended to perform a functional test on a monthly base and carry out maintenance works every year, in order to guarantee the system availability.
4. It is necessary to comply at least with the maintenance intervals specified in G 495.

Max. inlet pressure [bar]	Functional test	Maintenance
> 0.1 to 1	every 4 years	every 8 years
> 1 to 5	every 2 years	every 4 years
> 5	once a year	every 2 years





15. Spare parts



15.1 List of spare parts of the regulator

Kit	Spare part	Version	Order number	Spare part / image
1	Protective cap	FRM 100065-100080 FRM 250065-250080	270396	
2	Working diaphragm with O-ring	FRM 100065-100080 MD	277997	
		FRM 100065 - 100080 HD FRM 250065 - 250080 UHD	277998	
3	Control plate with shaft	FRM 100065 FRM 250065	277999	
		FRM 100080 FRM 250080	278000	
4	Compensating membrane	FRM 100065 FRM 250065	278001	
		FRM 100080 FRM 250080	278002	
5	Kit O-rings	FRM 100065 - 100080 FRM 250065 - 250080	278004	 B + D + F + H + I
6	Protective cap	SAV 100065 - 100080 SAV 250065 - 250080	278005	

15.2 List of spare parts of SAV

Kit	Spare part	Version	Order number	Spare part / image
7	Closing shell SAV	SAV 100065 - 100080 SAV 250065 - 250080	278003	
8	ASE with o-ring	SAV 100065 - 100080 MD	278006	
		SAV 100065 - 100080 HD SAV 250065 - 250080 UHD	278007	
9	Bypass push button valve	SAV 100065 - 100080 SAV 250065 - 250080	278008	
10	Nozzle Set	7pc Ø 1,5 - 3 mm	270712	

15.3 Storage conditions

Basically, DIN 7716 (standards for storage, maintenance and cleaning of rubber products) applies to the storage of diaphragms and O-rings.

The ageing process mostly depends on the following factors:

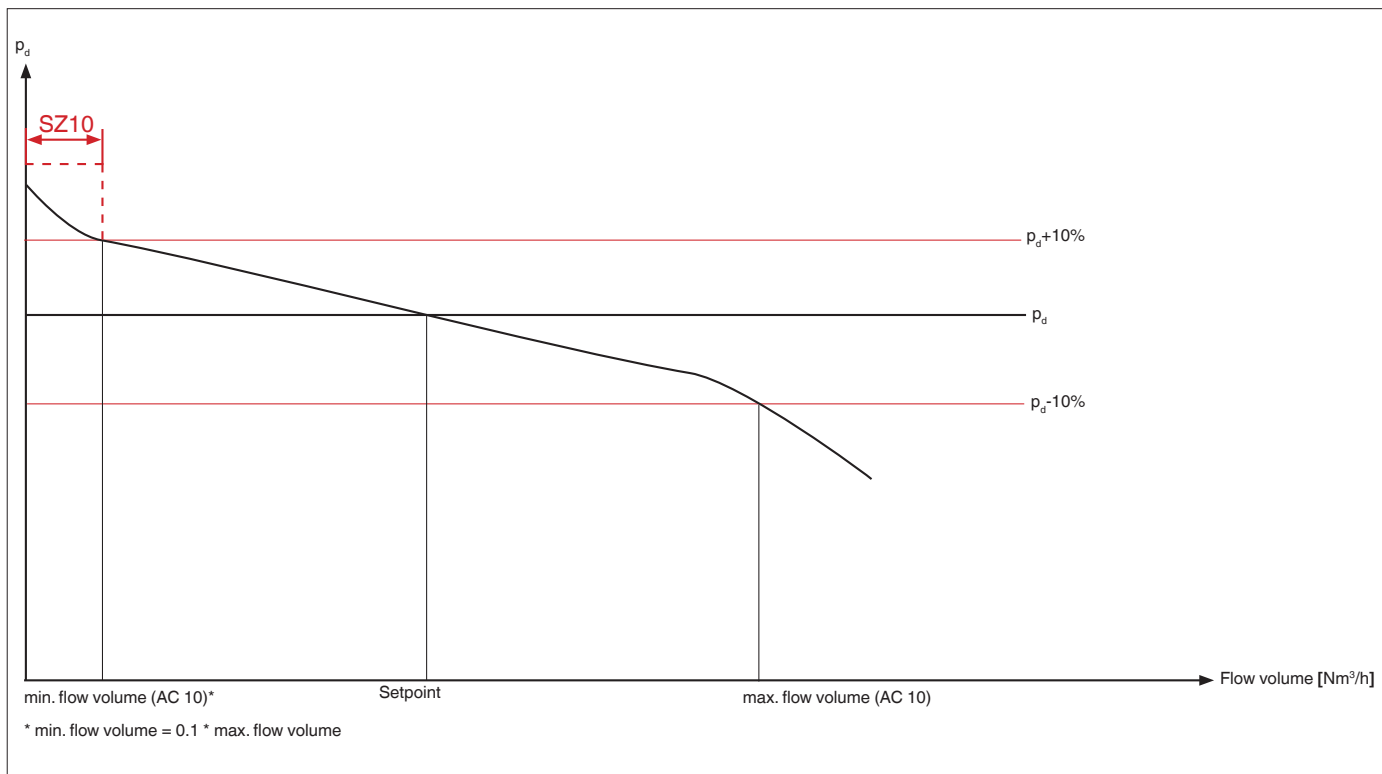
- Temperature
- Thermal radiation
- Solar radiation
- Humidity
- Relative humidity

- Ozone
- Stress conditions of the components

Proper storage

- Storage temperature between 5° C and 20° C
- No direct solar radiation
- No direct heat sources in the storage area
- No exposure to ozone
- Tension-free storage
- Storage in polyethylene bags
- Do not exceed the max. storage periods of 3 years

16. Flow volume tables



16.1 Natural gas flow volume tables

FRM 100065 ... DN 65 - max. flow volume [Nm³/h] natural gas of density 0.81 kg/m³ (K_G)

FRM ...	MD							HD					
p_g [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_g [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

16.2 Air flow volume tables

FRM 100065... DN 65 - max. air flow volume [Nm³/h] (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	1206	1154	1091	1016	927								
0,75	1538	1510	1477	1437	1390	1335	1272						
1	1810	1798	1781	1760	1733	1702	1665	1622	1573				
1,5	2272	2272	2272	2272	2272	2264	2254	2241	2224	2079	1814		
2	2724	2724	2724	2724	2724	2724	2724	2724	2724	2684	2565	2356	2027
2,5	3176	3176	3176	3176	3176	3176	3176	3176	3176	3176	3142	3041	2866
3	3628	3628	3628	3628	3628	3628	3628	3628	3628	3628	3628	3598	3510
3,5	4080	4080	4080	4080	4080	4080	4080	4080	4080	4080	4080	4080	4054
4	4532	4532	4532	4532	4532	4532	4532	4532	4532	4532	4532	4532	4532
4,5	4984	4984	4984	4984	4984	4984	4984	4984	4984	4984	4984	4984	4984
5	5436	5436	5436	5436	5436	5436	5436	5436	5436	5436	5436	5436	5436
6	6340	6340	6340	6340	6340	6340	6340	6340	6340	6340	6340	6340	6340
7	7244	7244	7244	7244	7244	7244	7244	7244	7244	7244	7244	7244	7244
8	8148	8148	8148	8148	8148	8148	8148	8148	8148	8148	8148	8148	8148
9	9052	9052	9052	9052	9052	9052	9052	9052	9052	9052	9052	9052	9052
10	9956	9956	9956	9956	9956	9956	9956	9956	9956	9956	9956	9956	9956

FRM 100080... DN 80 - max. air flow volume [Nm³/h] (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	1485	1420	1342	1250	1140								
0,75	1893	1859	1818	1768	1711	1643							
1	2227	2213	2192	2166	2133	2095	2049	1996	1936				
1,5	2796	2796	2796	2796	2796	2786	2774	2758	2737	2559	2233		
2	3352	3352	3352	3352	3352	3352	3352	3352	3352	3304	3157	2899	2494
2,5	3909	3909	3909	3909	3909	3909	3909	3909	3909	3909	3867	3743	3528
3	4465	4465	4465	4465	4465	4465	4465	4465	4465	4465	4465	4429	4321
3,5	5021	5021	5021	5021	5021	5021	5021	5021	5021	5021	5021	5021	4989
4	5578	5578	5578	5578	5578	5578	5578	5578	5578	5578	5578	5578	5578
4,5	6134	6134	6134	6134	6134	6134	6134	6134	6134	6134	6134	6134	6134
5	6690	6690	6690	6690	6690	6690	6690	6690	6690	6690	6690	6690	6690
6	7803	7803	7803	7803	7803	7803	7803	7803	7803	7803	7803	7803	7803
7	8916	8916	8916	8916	8916	8916	8916	8916	8916	8916	8916	8916	8916
8	10029	10029	10029	10029	10029	10029	10029	10029	10029	10029	10029	10029	10029
9	11141	11141	11141	11141	11141	11141	11141	11141	11141	11141	11141	11141	11141
10	12254	12254	12254	12254	12254	12254	12254	12254	12254	12254	12254	12254	12254

FRM 250065 UHD... DN 65 - max. air flow volume [Nm³/h] (K_G)

FRM ...	UHD							
p_d [bar] \ p_u [bar]	1	1,5	2	2,5	3	3,5	4	
1,5	1814							
2	2565	2027						
2,5	3142	2866	2219					
3	3628	3510	3138	2396				
3,5	4080	4054	3844	3389	2561			
4	4532	4532	4438	4151	3622	2716		
6	6340	6340	6340	6340	6274	6073	5725	
8	8148	8148	8148	8148	8148	8148	8097	
10	9956	9956	9956	9956	9956	9956	9956	
12	11764	11764	11764	11764	11764	11764	11764	
14	13572	13572	13572	13572	13572	13572	13572	
16	15381	15381	15381	15381	15381	15381	15381	
18	17189	17189	17189	17189	17189	17189	17189	
20	18997	18997	18997	18997	18997	18997	18997	
22	20805	20805	20805	20805	20805	20805	20805	
25	23517	23517	23517	23517	23517	23517	23517	

FRM 250080 UHD... DN 80 - max. air flow volume [Nm³/h] (K_G)

FRM ...	UHD							
p_d [bar] \ p_u [bar]	1	1,5	2	2,5	3	3,5	4	
1,5	2233							
2	3157	2494						
2,5	3867	3528	2731					
3	4465	4321	3863	2949				
3,5	5021	4989	4731	4171	3152			
4	5578	5578	5463	5108	4458	3343		
6	7803	7803	7803	7803	7721	7475	7046	
8	10029	10029	10029	10029	10029	10029	9965	
10	12254	12254	12254	12254	12254	12254	12254	
12	14479	14479	14479	14479	14479	14479	14479	
14	16705	16705	16705	16705	16705	16705	16705	
16	18930	18930	18930	18930	18930	18930	18930	
18	21155	21155	21155	21155	21155	21155	21155	
20	23381	23381	23381	23381	23381	23381	23381	
22	25606	25606	25606	25606	25606	25606	25606	
25	28944	28944	28944	28944	28944	28944	28944	

The maximum indicated volume flow refers to natural gas with a density 0.81 kg/m³ or to air with a density of 1.24 kg / m³ at 15 °C under standard conditions. In case of different types of gases, a conversion of the volume flow according to the equation below is carried out.

$\dot{V}_{\text{gas used}} = \dot{V}_{\text{air}} \times f$ $f = \frac{\text{Air density}}{\text{spec. weight of the gas used}}$	Type of gas	Density	dv	f
		[kg/m ³]		
	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

16.3 Valve flow volume coefficient K_G

Type	DN	K_G -value
FRM 100065...	65	2600
FRM 100080...	80	3200

The valve flow volume coefficient K_G of FRM is equal to the flow volume for a completely open firing valve with an absolute inlet pressure of $p_{u, \text{abs.}} = 2.01325$ bar and absolute outlet pressure of $p_{d, \text{abs.}} = 1.01325$ bar. The K_G -value value refers to natural gas with a density ratio of $d = 0.64$ according to a standard density of $p_n = 0.83$ kg/m³ and gas inlet temperature of $t = 15$ °C

The mass flow through a nozzle increases at constant upstream pressure with sinking pressure downstream of the nozzle, until it reaches its maximum at critical pressure ratio and remains constant from that moment on.

At constant outlet pressure, further increase of the upstream pressure causes a mass flow increase through the regulator. Therefore, to calculate the mass flow through a nozzle, a distinction is made between two ranges:

a) subcritical or critical pressure ratio

$$\frac{p_{d, \text{abs.}}}{p_{u, \text{abs.}}} \geq 0,53$$

$$K_G = \sqrt{\frac{Q_N}{(p_u + 1,013) \cdot (p_u - p_d)}}$$

Abbreviation	Description
p_d [bar]	Outlet pressure
$p_{d, \text{abs.}}$ [bar]	Outlet pressure as absolute pressure ($p_d + 1,013$)
p_u [bar]	Inlet pressure
$p_{u, \text{abs.}}$ [bar]	Inlet pressure as absolute pressure ($p_u + 1,013$)

b) supercritical pressure ratio

$$\frac{p_{d, \text{abs.}}}{p_{u, \text{abs.}}} < 0,53$$

$$K_G = \frac{Q_N \cdot 2}{(p_u + 1,013)}$$

with Q_N = power of the regulator under standard conditions



The Pressure Equipment Directive (PED) and the Energy Performance of Buildings Directive (EPBD) require a periodic inspection of heat generators in order to ensure a high degree of efficiency over a long term and, consequently, the least environmental pollution.

It is necessary to replace safety-relevant components after they have reached the end of their useful life:

Safety relevant component	Designed Lifetime		CEN-Standard
	Operating cycles	Time [years]	
Valve proving systems	250.000	10	EN 1643
Gaz Pressure switch	50.000	10	EN 1854
Air Pressure switch	250.000	10	EN 1854
Low gas pressure switch	N/A	10	EN 1854
Automatic burner control	250.000	10	EN 298 (Gaz) EN 230 (Oil)
Flame detector (UV probes) ¹	N/A	10.000 Operating hours	---
Gas pressure regulators ¹	N/A	15	EN 88-1 EN 88-2
Gas valve with valve testing system ²	after error detection		EN 1643
Gas valve without valve testing system ²	50.000 - 200.000 depends on diameter	10	EN 161
Gas-air ratio control system	N/A	10	EN 88-1 EN 12067-2
¹ Performance decrease due to ageing ² Gas families I, II, III N/A not applicable			

We reserve the right to make modifications in the course of technical development.

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