GB

DUNGS®
Combustion Controls

Instruction manual

FRM-NOC

1 Target group

This manual is intended for personnel qualified in gas safety and regulation technology, as well as personnel trained or instructed by them.
The former are in a position to judge the work assigned to the latter on the basis of their technical training, knowledge and experience, as well as knowledge of the relevant regulations, and are able to recognise potential 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.

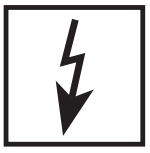
Hang this instruction manual in a clearly visible place inside the installation room! Do not carry out any work until you have read the safety instructions of this instruction manual and are qualified to do so.

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.

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 naked flames. Please observe public regulations.

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

The device must not be exposed to naked flames. Protection against lightning strikes must be guaranteed.

Connected line systems must be free from dirt and contamination.

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.

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

The device must be protected from vibrations and mechanical impacts.

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

Explanation of the symbols		
1, 2, 3,...	=	Act based on the sequence
•	=	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 in accordance with EN 12186 and EN 12279.
- Use with gases of the 1st, 2nd and 3rd gas families in accordance with 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 the 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. EU Approval/Statement of Conformity

CE 0085

DVGW CERT

EC type examination certificate

EG-Baumusterprüfbescheinigung

CE-0085CP0256
Product Identification No.
Produkt-Identnummer

Field of Application *Anwendungsbereich*	EC Pressure Equipment Directive (2014/68/EU) *EG-Druckgeräterichtlinie (2014/68/EU)*
Distributor *Vertreiber*	Karl Dungs GmbH & Co. KG Karl-Dungs-Platz 1, D-73660 Urbach
Product Category *Produktart*	gas fittings: Pressure regulator for natural gas and all-gas (4301)
Product Description *Produktbezeichnung*	spring operated regulator with optional safety-shut-off device
Model *Modell*	FRM-NOC 100 ... D
Test Reports *Prüfberichte*	supplement test: 15/052/4308/191 from 15.08.2018 (EBI) supplement test: 15/052/4308/191 v2 from 04.10.2018 (EBI)
Test Basis *Prüfgrundlagen*	2014/68/EU A III B Baumusterprüfung (15.04.2014) DIN EN 334 (01.07.2009) DIN EN 14382 (01.07.2009)
Date of Expiry / File No. *Ablaufdatum / Aktenzeichen*	12.09.2024 / 18-0642-GDR

17.10.2018 Kö B-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 17065:2013 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 17065:2013 akkreditierte und von der Deutschen Bundesregierung benannte Stelle für die Zertifizierung von Druckgeräten und Baugruppen gemäß Richtlinie

DAkkS
Deutsche Akkreditierungsstelle
D-ZE-16028-01-02

DVGW CERT GmbH
Zertifizierungsstelle
Josef-Wirmer-Str. 1-3
53123 Bonn
Tel. +49 228 91 88 - 888
Fax +49 228 91 88 - 993
www.dvgw-cert.com
info@dvgw-cert.com

B-2/2 CE-0085CP0256

Type *Typ*	Technical Data *Technische Daten*	Remarks *Bemerkungen*
FRM-NOC 10010...	inlet pressure range: 0,5 ... 10,0 bar nominal diameter: DN 25 (1") max. allowable pressure PS: 10 bar	
FRM-NOC 10015...	inlet pressure range: 0,5 ... 10,0 bar nominal diameter: DN 40 (1 1/2") max. allowable pressure PS: 10 bar	
FRM-NOC 10020...	inlet pressure range: 0,5 ... 10,0 bar nominal diameter: DN 50 (2") max. allowable pressure PS: 10 bar	
FRM-NOC 100025...	inlet pressure range: 0,5 ...10,0 bar nominal diameter: DN 25 max. allowable pressure PS: 10 bar	
FRM-NOC 100040...	inlet pressure range: 0,5 ...10,0 bar nominal diameter: DN 40 max. allowable pressure PS: 10 bar	
FRM-NOC 100050...	inlet pressure range: 0,5 ... 10,0 bar nominal diameter: DN 50 max. allowable pressure PS: 10 bar	

Type Variation *Ausführungsvariante*	Explanations *Erläuterungen*
FRM-NOC 100... ND	outlet pressure range: 0,02 up to 0,10 bar (type: PN 10)
FRM-NOC 100... MD	outlet pressure range: 0,08 up to 0,40 bar (type: PN 10)
FRM-NOC 100... HD	outlet pressure range: 0,30 up to 1,50 bar (type: PN 10)
FRM-NOC 100... UHD	outlet pressure range: 0,80 up to 4,00 bar (type: PN 10)
FRM-NOC ...	none input-pressure-compensated high-pressure regulator

Hints of Utilization / Remarks
Verwendungshinweise / Bemerkungen

medium: fuel gas of the 1., 2. and 3. family and none aggressive gases
connection: flanged an threaded (DN 25 ... DN 50)
ambient temperature range: -20 ... +60°C
safety shut-off device: Karl Dungs, SAV 1000..., CE-0085CP0255
body material: EN GJS 500-7, EN GJS 400-15 or EN AC 46500

DUNGS®
Combustion Controls

EU Statement of Conformity

Produkt / Product Produit / Prodotto	**FRM-NOC 100...**	**Medium Pressure Regulator 10 bar**	
Hersteller / Manufacturer Fabricant / Produttore	**Karl Dungs GmbH & Co. KG Karl-Dungs-Platz 1 D-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 (01.07.2009) DIN EN 14382 (01.07.2009)**	
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	

B. Sc., MBA, Simon P. Dungs
Geschäftsführer / Chief Operating Officer
Directeur / Amministratore
Urbach, 2020-05-11

4. Contents

5. Abbreviations

Abbreviation	Description
AG_o	Accuracy class of the upper response pressure
AG_u	Accuracy class of the lower response pressure
AC	Accuracy class
ASE	Safety Cutting Device (without casing)
K_G	Flow coefficient
DN	Nominal diameter
Fail-open	Actuator that automatically moves to the open position when the main membrane or auxiliary power required to drive it fails
DS	Type of construction: differential strength
Class A	Functional class: in case the comparison membrane is damaged or in the event of a breakdown of the auxiliary power supply, the SAV will close
MOP	Maximum permitted operating pressure
p_d	Outlet pressure
$p_{d, abs.}$	Outlet pressure as absolute pressure
p_u	Inlet pressure
$p_{u, abs.}$	Inlet pressure as absolute pressure
p_{do}	Upper release pressure (overpressure)
p_{du}	Lower release pressure (low pressure)
p_{max}	Maximum operating pressure
$p_{adm.}$	System-specific operating pressure according to regulator
PN	Nominal pressure of the flanges
PS	Maximum admissible pressure
SAV	Safety cut-off valve
SBV	Safety Relief Valve
SG	Closing pressure class
S.n.	Serial Nº
SZ	Closing pressure zone class
Tp.	Operating temperature -20 °C ... +60 °C
W_{ds}	Range of regulation determined
W_{do}	Adjustment range for overpressure by using the available adjusting springs
W_{du}	Adjustment range for low pressure by using the available adjusting springs
W_{dso}	Range of the adjustment spring installed for overpressure
W_{dsu}	Range of the adjustment spring installed for low pressure

6. Features

6.1 Technical data

Technical data	FRM-NOC
Device	**Medium pressure regulator with spring loading in accordance with EN 334**
Type of construction	DSDS
Type of gas	Family 1+2+3
Nominal diameters Flange	Connecting flanges PN 25 in accordance with EN 1092-1 or ANSI 150 lbs (B16.5) DN 25 40 50 ANSI 1" 1.5" 2"
Nominal diameters Thread	Connecting thread in accordance with BSP (ISO228/1) or NPT (B1.20.1) G 1" 1.5" 2" NPT 1" 1.5" 2"
Permissible pressure load	10 bar (1000 kPa)
Max. inlet pressure	10 bar (1000 kPa)
Outlet pressure range	20 - 4000 mbar (2-400 kPa)
Minimum differential pressure (ND)	20 mbar (2 kPa)
Minimum differential pressure (MD)	80 mbar (8 kPa)
Minimum differential pressure (HD/UHD)	250 mbar (25 kPa)
Materials	Body of the regulator: Cast iron GGG 50 Actuator housing: Steel sheet (UHD)/aluminium Membranes: NBR
Ambient temperature	-20 °C to +60 °C
Relief valve	Optional. Can be activated with limited capacity

Technical data	SAV …
Device	Safety shut-off valve according to EN 14382, class A
Type of construction	DSDS
Reaction time	≤ 2s
Adjustment range for shut-down W_{du}	10 - 3000 mbar (1-300 kPa)
Adjustment range for overpressure $W_{do:}$	40 - 5000 mbar (4-500 kPa)
Materials	Actuator body: Cast iron GGG 50 (GJS 400-18 on request) Actuator housing: Aluminium Diaphragms: NBR

6.2 Nomenclature

Example FRM 100025 ND / SAV ND	FRM-NOC		100	025	ND	SAV	ND
Type	**Medium pressure regulator spring-loaded**						
MOP	100 …	10 000 mbar					
Nominal diameter	10	1"					
	15	1 ½"					
	20	2"					
	025	DN 25					
	040	DN 40					
	050	DN 50					
Outlet pressure ranges	ND	Low pressure					
	MD	Medium pressure					
	HD	High pressure					
	UHD	Ultra high pressure					
Safety device	SAV	Integrated safety cut-off valve					
Cracking pressure ranges	ND	Low pressure					
	MD	Medium pressure					
	HD	High pressure					
	UHD	Ultra high pressure					
Type of thread/flange		with Standard Rp or PN-25					
	ANSI	with flanges ANSI 150 lbs					
	NPT	with threads NPT					

6.3 Adjustment ranges

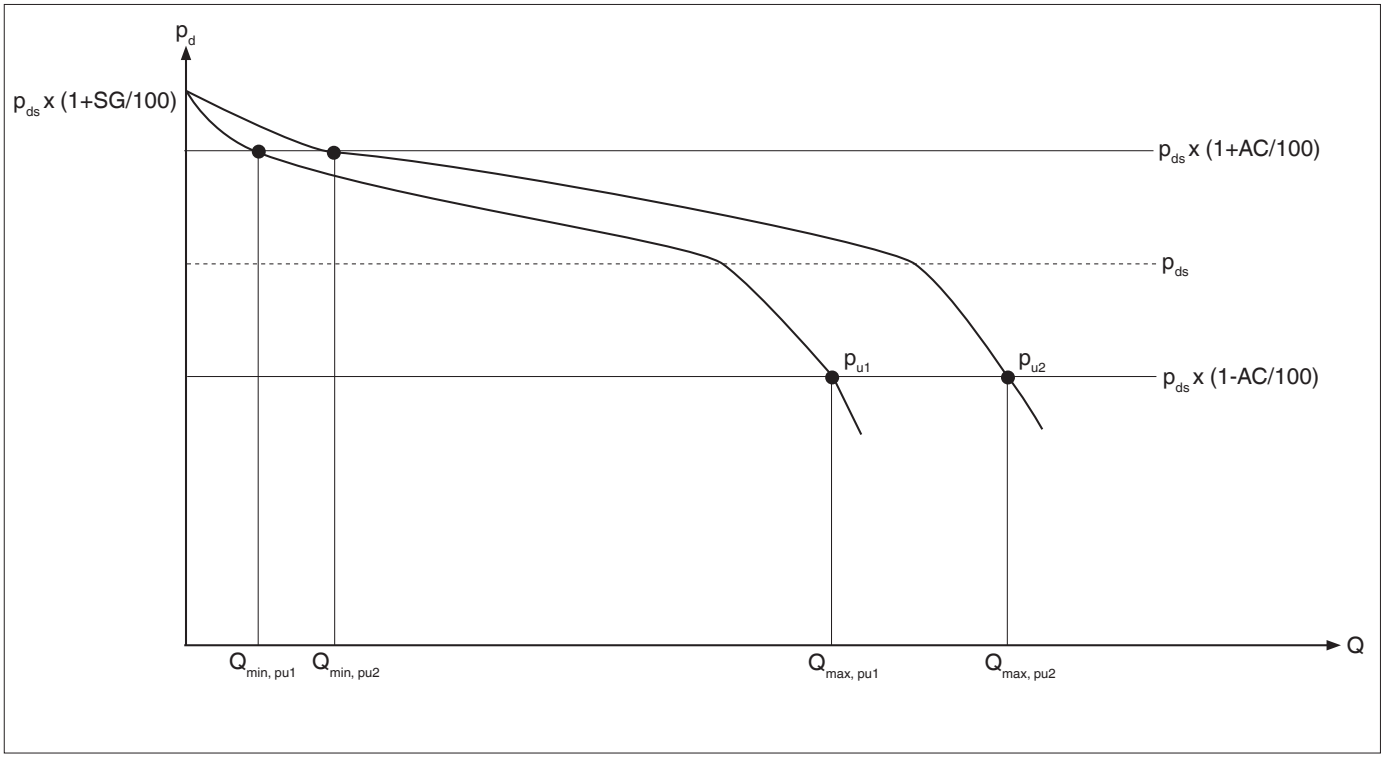
Type	Connection	Version	Accuracy class* [AC]	Closing pressure class* [SG]	Outlet pressure range W_d	Monitoring depression SAV		Monitoring overpressure SAV	
						W_{du}	AG	W_{do}	AG
FRM-NOC 10010 ND	G 1	ND	10 %	20 %	20-100 mbar		10 %		10 %
FRM-NOC 10010 MD	G 1	MD	10 %	20 %	80-400 mbar		10 %		10 %
FRM-NOC 10010 HD	G 1	HD	5 %	10 %	300-1500 mbar		5 %		5 %
FRM-NOC 10010 UHD	G 1	UHD	5 %	10 %	1000-4000 mbar		5 %		5 %
FRM-NOC 10010 ND / SAV ND	G 1	ND	10 %	20 %	20-100 mbar	10-115 mbar	10 %	40-240 mbar	10 %
FRM-NOC 10010 MD / SAV MD	G 1	MD	10 %	20 %	80-400 mbar	35-400 mbar	10 %	180-800 mbar	10 %
FRM-NOC 10010 HD / SAV HD	G 1	HD	5 %	10 %	300-1500 mbar	150-1400 mbar	5 %	500-3500 mbar	5 %
FRM-NOC 10010 UHD / SAV UHD	G 1	UHD	5%	10 %	1000-4000 mbar	150-3000 mbar	5 %	1300-5000 mbar	5 %
FRM-NOC 10015 ND	G 1 ½	ND	10 %	20 %	20-100 mbar		10 %		10 %
FRM-NOC 10015 MD	G 1 ½	MD	10 %	20 %	80-400 mbar		10 %		10 %
FRM-NOC 10015 HD	G 1 ½	HD	5 %	10 %	300-1500 mbar		5 %		5 %
FRM-NOC 10015 UHD	G 1 ½	UHD	5 %	10 %	1000-4000 mbar		5 %		5 %
FRM-NOC 10015 ND / SAV ND	G 1 ½	ND	10 %	20 %	20-100 mbar	10-115 mbar	10 %	40-240 mbar	10 %
FRM-NOC 10015 MD / SAV MD	G 1 ½	MD	10 %	20 %	80-400 mbar	35-400 mbar	10 %	180-800 mbar	10 %
FRM-NOC 10015 HD / SAV HD	G 1 ½	HD	5 %	10 %	300-1500 mbar	150-1400 mbar	5 %	500-3500 mbar	5 %
FRM-NOC 10015 UHD / SAV UHD	G 1 ½	UHD	5%	10 %	1000-4000 mbar	150-3000 mbar	5 %	1300-5000 mbar	5 %
FRM-NOC 10020 ND	G 2	ND	10 %	20 %	20-100 mbar		10 %		10 %
FRM-NOC 10020 MD	G 2	MD	10 %	20 %	80-400 mbar		10 %		10 %
FRM-NOC 10020 HD	G 2	HD	5 %	10 %	300-1500 mbar		5 %		5 %
FRM-NOC 10020 UHD	G 2	UHD	5 %	10 %	1000-4000 mbar		5 %		5 %
FRM-NOC 10020 ND / SAV ND	G 2	ND	10 %	20 %	20-100 mbar	10-115 mbar	10 %	40-240 mbar	10 %
FRM-NOC 10020 MD / SAV MD	G 2	MD	10 %	20 %	80-400 mbar	35-400 mbar	10 %	180-800 mbar	10 %
FRM-NOC 10020 HD / SAV HD	G 2	HD	5 %	10 %	300-1500 mbar	150-1400 mbar	5 %	500-3500 mbar	5 %
FRM-NOC 10020 UHD / SAV UHD	G 2	UHD	5%	10 %	1000-4000 mbar	1000-4000 mbar	5 %	1300-5000 mbar	5 %
FRM-NOC 100025 ND	DN 25	ND	10 %	20 %	20-100 mbar		10 %		10 %
FRM-NOC 100025 MD	DN 25	MD	10 %	20 %	80-400 mbar		10 %		10 %
FRM-NOC 100025 HD	DN 25	HD	5 %	10 %	300-1500 mbar		5 %		5 %
FRM-NOC 100025 UHD	DN 25	UHD	5 %	10 %	1000-4000 mbar		5 %		5 %
FRM-NOC 100025 ND / SAV ND	DN 25	ND	10 %	20 %	20-100 mbar	10-115 mbar	10 %	40-240 mbar	10 %
FRM-NOC 100025 MD / SAV MD	DN 25	MD	10 %	20 %	80-400 mbar	35-400 mbar	10 %	180-800 mbar	10 %
FRM-NOC 100025 HD / SAV HD	DN 25	HD	5 %	10 %	300-1500 mbar	150-1400 mbar	5 %	500-3500 mbar	5 %
FRM-NOC 100025 UHD / SAV UHD	DN 25	UHD	5%	10 %	1000-4000 mbar	150-3000 mbar	5 %	1300-5000 mbar	5 %
FRM-NOC 100040 ND	DN 40	ND	10 %	20 %	20-100 mbar		10 %		10 %
FRM-NOC 100040 MD	DN 40	MD	10 %	20 %	80-400 mbar		10 %		10 %
FRM-NOC 100040 HD	DN 40	HD	5 %	10 %	300-1500 mbar		5 %		5 %
FRM-NOC 100040 UHD	DN 40	UHD	5 %	10 %	1000-4000 mbar		5 %		5 %
FRM-NOC 100040 ND / SAV ND	DN 40	ND	10 %	20 %	20-100 mbar	10-115 mbar	10 %	40-240 mbar	10 %
FRM-NOC 100040 MD / SAV MD	DN 40	MD	10 %	20 %	80-400 mbar	35-400 mbar	10 %	180-800 mbar	10 %
FRM-NOC 100040 HD / SAV HD	DN 40	HD	5 %	10 %	300-1500 mbar	150-1400 mbar	5 %	500-3500 mbar	5 %
FRM-NOC 100040 UHD / SAV UHD	DN 40	UHD	5%	10 %	1000-4000 mbar	150-3000 mbar	5 %	1300-5000 mbar	5 %
FRM-NOC 100050 ND	DN 50	ND	10 %	20 %	20-100 mbar		10 %		10 %
FRM-NOC 100050 MD	DN 50	MD	10 %	20 %	80-400 mbar		10 %		10 %
FRM-NOC 100050 HD	DN 50	HD	5 %	10 %	300-1500 mbar		5 %		5 %
FRM-NOC 100050 UHD	DN 50	UHD	5 %	10 %	1000-4000 mbar		5 %		5 %
FRM-NOC 100050 ND / SAV ND	DN 50	ND	10 %	20 %	20-100 mbar	10-115 mbar	10 %	40-240 mbar	10 %
FRM-NOC 100050 MD / SAV MD	DN 50	MD	10 %	20 %	80-400 mbar	35-400 mbar	10 %	180-800 mbar	10 %
FRM-NOC 100050 HD / SAV HD	DN 50	HD	5 %	10 %	300-1500 mbar	150-1400 mbar	5 %	500-3500 mbar	5 %
FRM-NOC 100050 UHD / SAV UHD	DN 50	UHD	5%	10 %	1000-4000 mbar	150-3000 mbar	5 %	1300-5000 mbar	5 %

*Accuracy class de / closing pressure group in accordance with EN 334
**p_d = 80-180 mbar: AC 10 / p_d= 180-420 mbar: AC 5

6.4 Accuracy class / closing pressure class

AC and SG data according to EN 334 do not constitute a declaration with respect to the modulation range. For field use it is important to know the minimum and maximum flow rates. Therefore, the accuracy characteristics 'accuracy class and shut-off pressure class' were determined which can be guaranteed for a flow rate of 1:10.

The AC values of the above table refer to the maximum possible percentage deviation of the output pressure from the adjusted set-point, in which $Q_{max} / Q_{min} \geq 10$ is observed.



Abbreviation	Description
AC	Accuracy class
p_d	Outlet pressure
$p_{u1/2}$	Inlet pressure
p_{ds}	Nominal adjusted value of the outlet pressure
SG	Closing pressure class
$Q_{min\ /\ pu1/2}$	Minimum AC flow at a certain inlet pressure P_U (lower flow limit, from which stable operating conditions occur for a given set-point within the specified operating temperature range).
$Q_{max\ /\ pu1/2}$	Maximum AC flow at a certain inlet pressure P_U (upper flow limit, up to which a given accuracy class can be observed for a given set-point within the specified operating temperature range).

6.5 Selection of regulating spring

6.5.1 For FRM-NOC 10010 / 10015 / 100025

Outlet pressure adjustment range W_{ds}								
Spring colour	Item Nº	Wire diameter [mm]	Diameter [mm]	Length [mm]	Adjustment range [mbar]			
					ND	MD	HD	UHD
Red	287881	2.5	37	134	20-35			
White	287882	2.8	37	134	30-50			
Yellow	287883	3	37	134	50-75			
Blue	274969	3.2	37	130	60-100	80-150		
Black	274970	3.5	37	130		100-200		
Purple	274971	3.7	37	130		130-250		
Orange	274972	4	37	130		180-350		
Pink	274973	4.3	37	130		200-400		
White 2	287888	4.5	35	100			300-500	
Yellow 2	287889	5	35	100			450-700	
Blue 2	287890	5.5	35	100			550-900	
Black 2	287891	6	35	100			650-1150	
Purple 2	287892	6.5	35	100			1000-1500	
Purple 3	287893	10	70	155				1000-1600
Orange 2	287894	11	70	155				1500-2400
Pink 2	287895	12	73	155				2300-3600
Red 2	287896	13	74	160				3500-4000

6.5.2 For FRM-NOC 10020 / 100040 / 100050

Outlet pressure adjustment range W_{ds}								
Spring colour	Item Nº	Wire diameter [mm]	Diameter [mm]	Length [mm]	Adjustment range [mbar]			
					ND	MD	HD	UHD
Yellow	287884	3.5	50	220	20-25			
Blue	287885	4	50	220	25-45			
Black	287886	4.5	50	220	30-65			
Silver	287887	5	50	220	50-100			
Pink	274982	5.5	50	260		80-150		
Green	274983	6	50	260		130-250		
Blue 2	274985	7	50	240		200-350		
Black 2	274986	8	50	240		300-400		
White	287888	4.5	35	100			300-500	
Yellow 2	287889	5	35	100			450-700	
Blue 3	287890	5.5	35	100			550-900	
Black 2	287891	6	35	100			650-1150	
Purple 2	287892	6.5	35	100			1000-1500	
Purple 3	287893	10	70	155				1000-1600
Orange 2	287894	11	70	155				1500-2400
Pink 2	287895	12	73	155				2300-3600
Red 2	287896	13	74	160				3500-4000

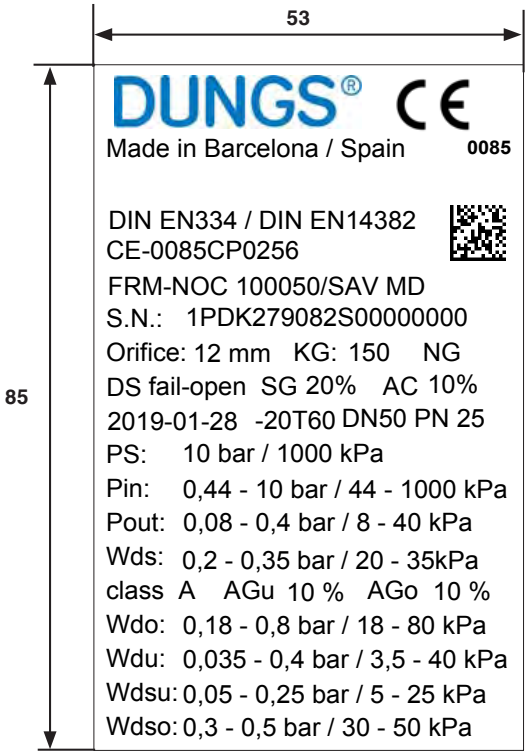
6.6 Selection of spring SAV

Specific adjustment range under pressure W_{dsu}								
Spring colour	Item Nº	Wire diameter [mm]	Length [mm]	Diameter [mm]	Adjustment range [mbar]			
					ND	MD	HD	UHD
White	270353	1.2	60	10.0	10-32			
Yellow	270355	1.5	55	12.3	24-40			
Blue	270356	2.0	55	12.3	30-115	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 adjustment range over pressure W_{dso}								
Spring colour	Item Nº	Wire diameter [mm]	Length [mm]	Diameter [mm]	Adjustment range [mbar]			
					ND	MD	HD	UHD
Silver	270361	2.2	60	30.0	40-130			
Green	270366	2.5	60	30.0	60-190	180-290		
Red	270367	2.7	60	30.0	90-240	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

FRM + SAV



Abbreviation	Description
AG_o	Accuracy class of the upper response pressure
AG_u	Accuracy class of the lower response pressure
AC	Accuracy class
K_G	Flow coefficient referred to natural gas
DN	Nominal diameter
Fail-open	Actuator that automatically moves to the open position when the main membrane fails or the auxiliary power required to drive it
DS	Type of construction of the SAV: of differential resistance
Class A	Functional class: in case the comparison membrane is damaged or in the event of a breakdown of the auxiliary power supply, the SAV will close
p_d	Outlet pressure
p_u	Inlet pressure
PN	Nominal pressure of the flanges
PS	Maximum admissible pressure
SG	Closing pressure class
-20T60	Operating temperature -20 °C ... +60 °C
S.n.	Serial Nº
W_{ds}	Range of regulation determined
W_{do}	Adjustment range for overpressure by using the available adjusting springs
W_{du}	Adjustment range for low pressure by using the available adjusting springs
W_{dso}	Range of the adjustment spring installed for overpressure
W_{dsu}	Range of the adjustment spring installed for low pressure

7. Function

The pressure regulator has the task of maintaining constant outlet pressure despite fluctuations in inlet pressure and/or flow. In the depressurised state, the regulator is open. The pressure regulator meets the requirements of EN 334 as a gas pressure regulator of the differential resistance type (DS) and zero flow rate.

Main components
A Seal
B Set point spring
C Bottom membrane enclosure
D Lever system
E Breathing connection
F Working membrane

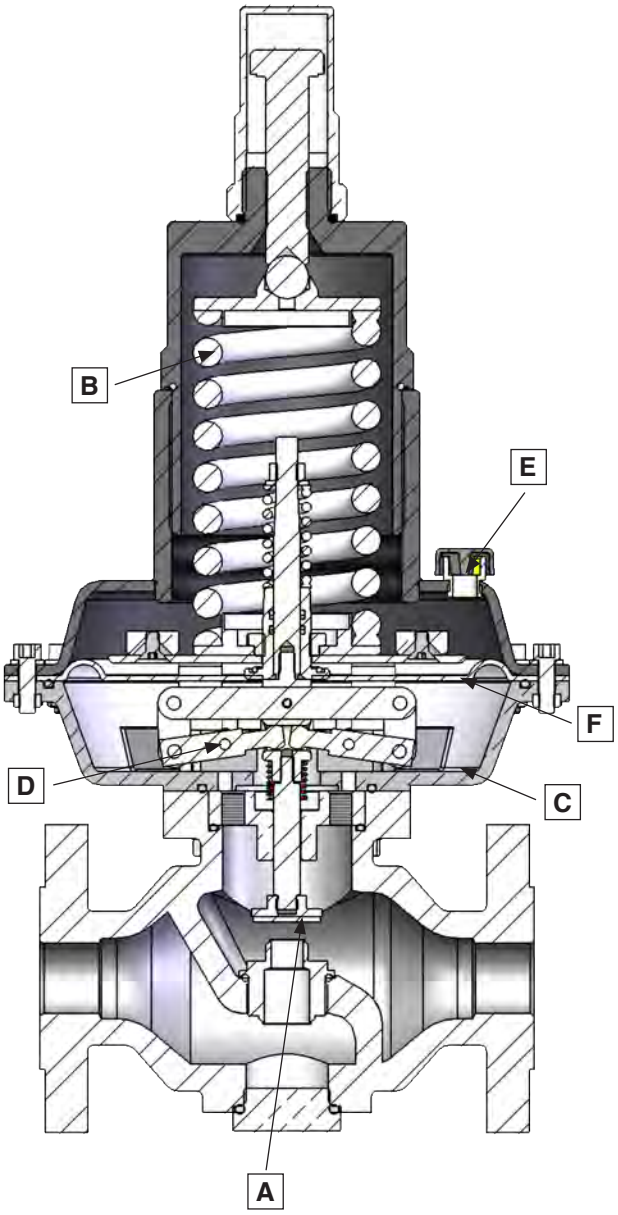
Depressurised state
The force of the set point spring **B** acts on the working diaphragm **F.** In the depressurised state, no force is acting on the underside of membrane **C** since there is no overpressure in the outlet zone. The downward movement of the working membrane presses down on the lever system **D**, which pulls up from the seal **A**,lifting it out of place. The regulator is open

Checked condition
As the outlet pressure increases, the force on the working diaphragm **F** increases on the underside of diaphragm **C**. As a result, the working membrane **F** is moved upwards until the equilibrium of forces is established between the force of the set point spring **B** and that of the outlet pressure. The upward movement of the working membrane **F** pulls the lever system **D** upwards, thus pressing the seal **A** downwards, reducing the valve clearance. The minimised flow reduces the output pressure until the set-point value (output pressure) is reached again and the equilibrium of forces in the working membrane is restored **F**.

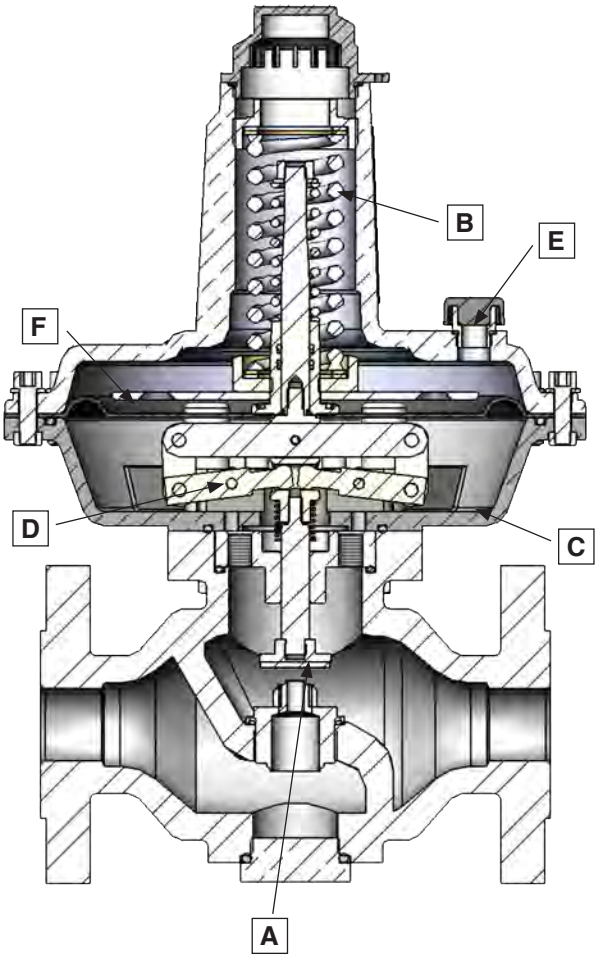
When the outlet pressure drops, the force on the working membrane **F** on the underside of the membrane **C** is reduced. As a result, the working membrane **F** is moved upwards until the equilibrium of forces is established between the force of the set-point spring **B** and that of the outlet pressure. The downward movement of the working membrane **F** pulls the lever system **D** downwards, thus pressing the seal **A** upwards, reducing the valve clearance. The increased flow increases the output pressure until the set-point value (output pressure) is reached again and the equilibrium of forces in the working membrane is restored **F**.

Influence of changes in inlet pressure on outlet pressure
Changes in the inlet pressure have a influence on the outlet pressure, as there is no balancing device. The ratio of changes depends on the size of the working membrane (fixed size) and the size of the shell (variable).

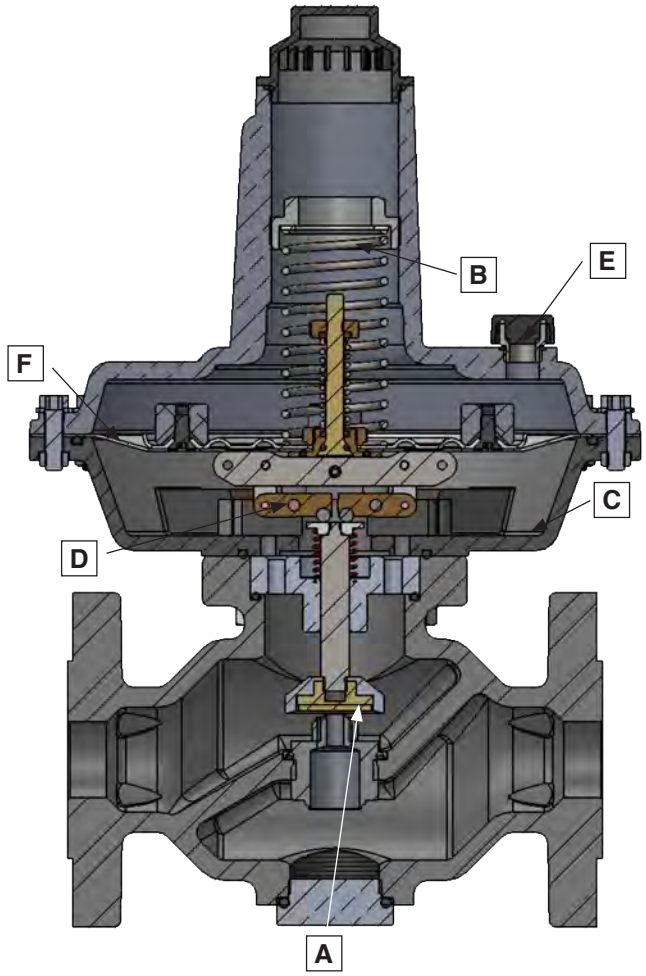
Type UHD



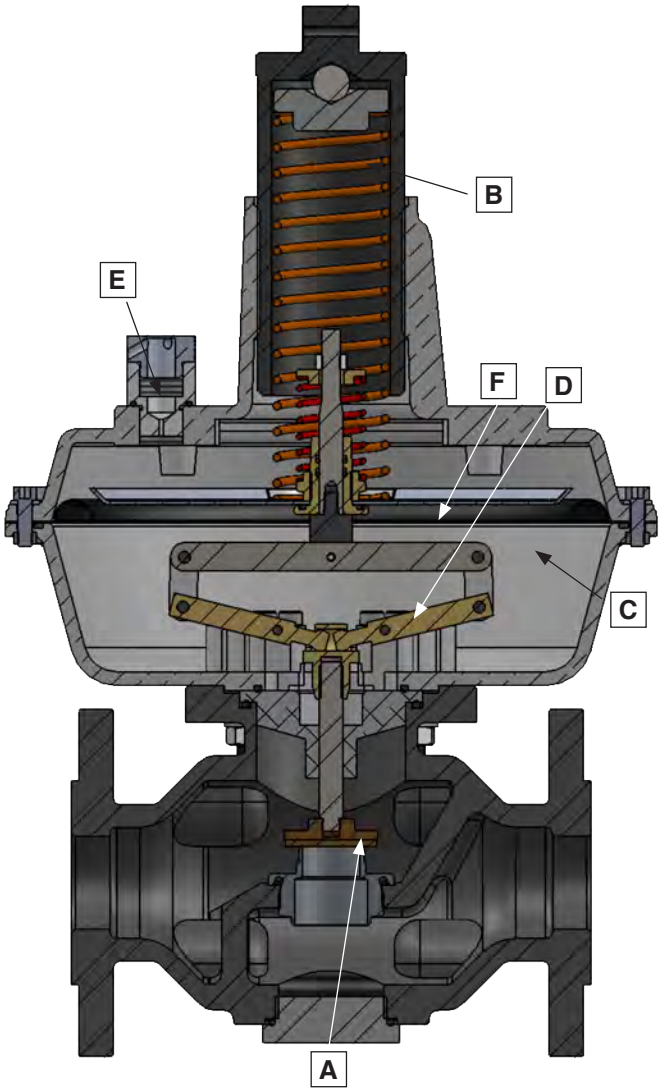
Type HD



ND for G1", G1,5" y DN25

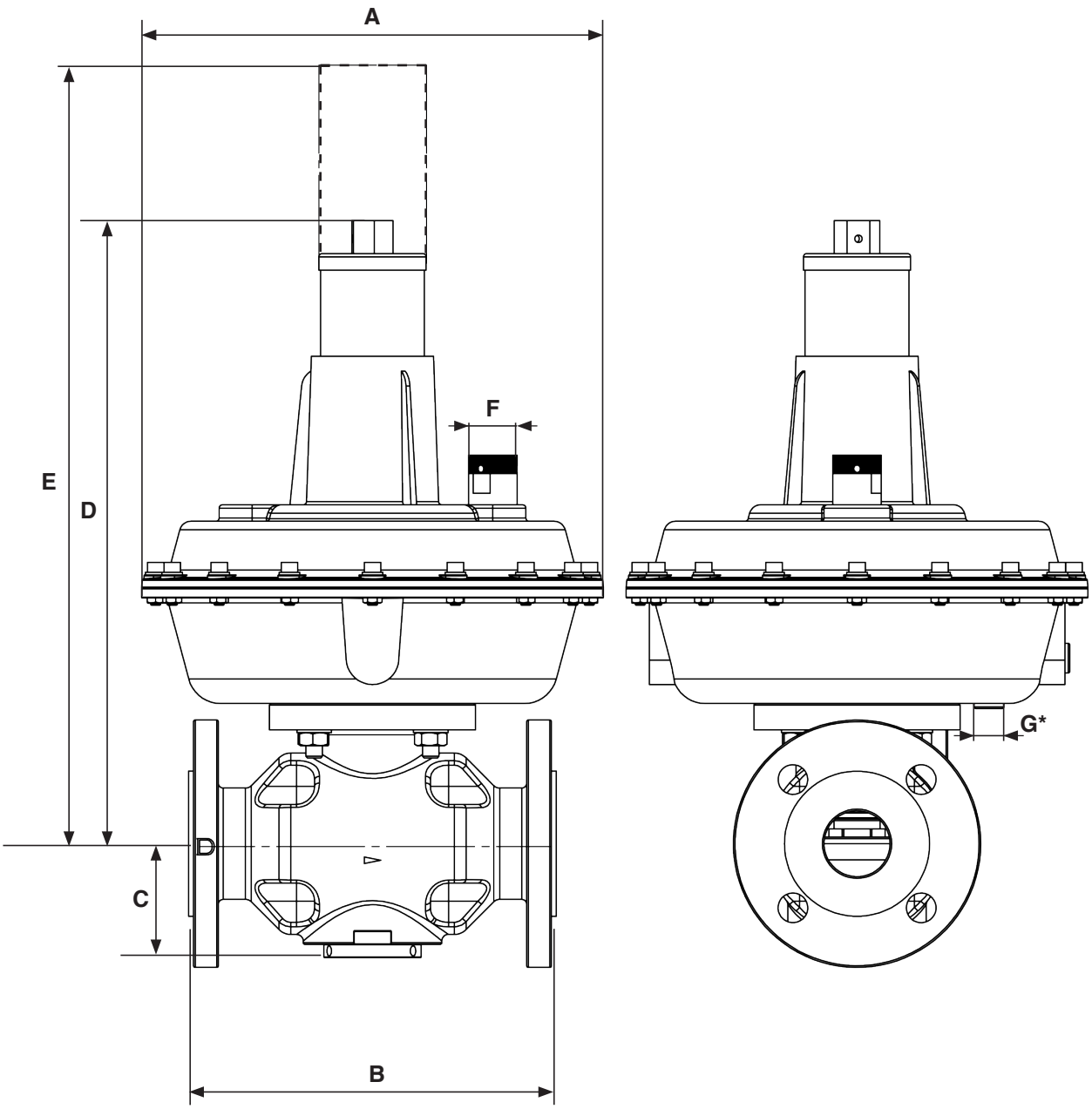


ND, MD for G2", DN40, DN50



8. Dimensions

FRM-NOC...

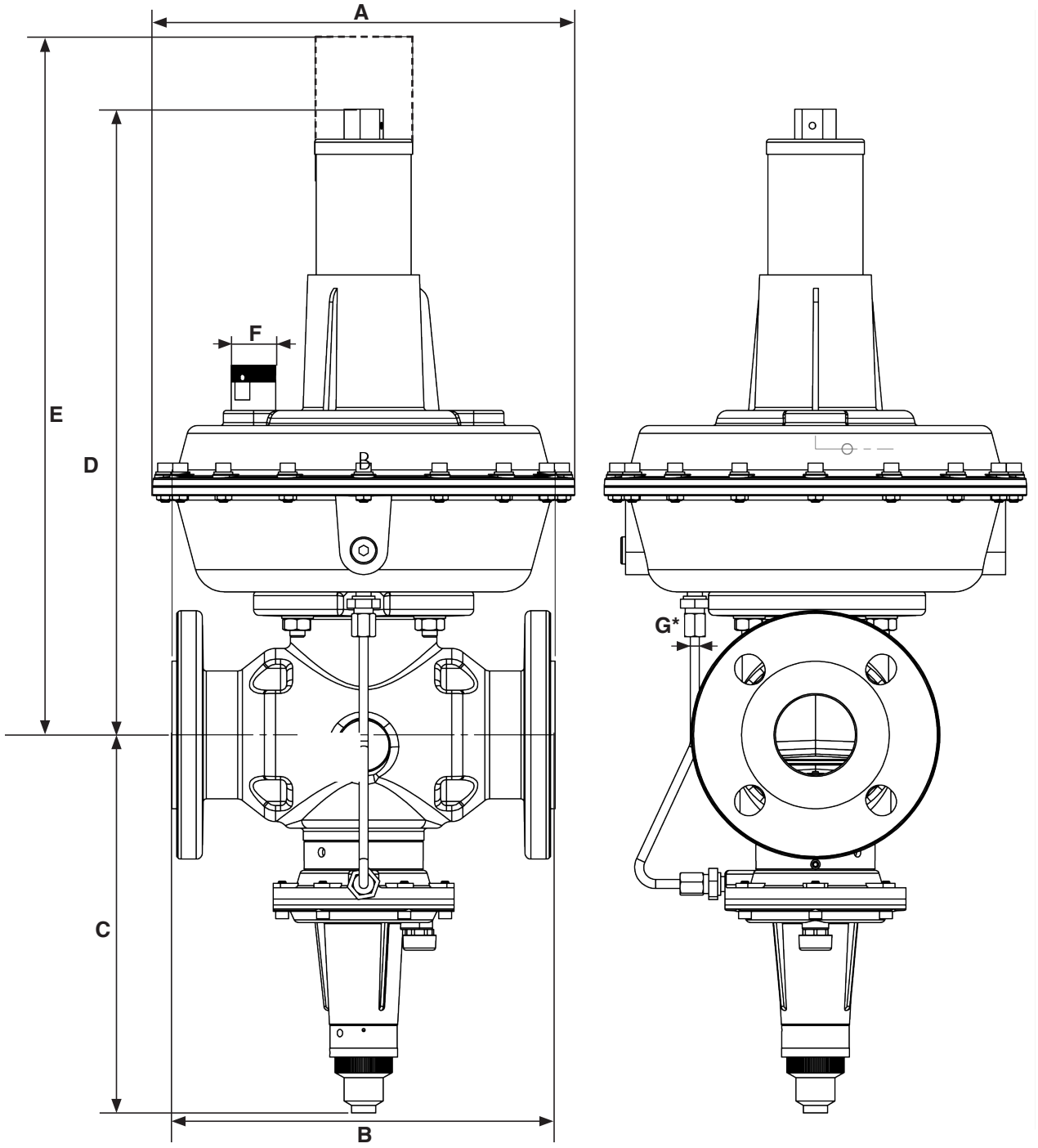


Option external line: Only on request.
* Ermeto screw connection 12L: GE 12 - 1/4 with screw connection M16 for pipes 12 x 1.5

Type	Item Nº		$p_{max.}$ [bar/kPa]	DN	Dimensions [mm]							Wgt. [kg]
	BSP	NPT			A	B	C	D	E	F	G	
FRM-NOC 10010 ND	279054	280236	10 / 1000	1"	210	104	-240	240	250	½" G	¼" G	5
FRM-NOC 10010 MD	279055	280237	10 / 1000	1"	210	104	-240	240	250	½" G	¼" G	5
FRM-NOC 10010 HD	279058	280238	10 / 1000	1"	210	104	-240	240	250	½" G	¼" G	5
FRM-NOC 10010 UHD	279059	280239	10 / 1000	1"	210	104	-342	342	667	½" G	¼" G	9
FRM-NOC 10015 ND	279060	280240	10 / 1000	1 ½"	210	132	-240	240	250	½" G	¼" G	6
FRM-NOC 10015 MD	279061	280241	10 / 1000	1 ½"	210	132	-240	240	250	½" G	¼" G	6
FRM-NOC 10015 HD	279062	280242	10 / 1000	1 ½"	210	132	-240	240	250	½" G	¼" G	6
FRM-NOC 10015 UHD	279063	280243	10 / 1000	1 ½"	210	132	-342	342	667	½" G	¼" G	10
FRM-NOC 10020 ND	279064	280244	10 / 1000	2"	280	156	61	345	495	½" G	¼" G	12
FRM-NOC 10020 MD	279065	280245	10 / 1000	2"	280	156	61	345	495	½" G	¼" G	12
FRM-NOC 10020 HD	279066	280246	10 / 1000	2"	210	156	61	245	255	½" G	¼" G	11
FRM-NOC 10020 UHD	279067	280247	10 / 1000	2"	210	156	61	345	670	½" G	¼" G	16

Type	Item Nº		$p_{max.}$ [bar/kPa]	DN	Dimensions [mm]							Wgt. [kg]
	DN	ANSI			A	B	C	D	E	F	G	
FRM-NOC 100025 ND	279085	280260	10 / 1000	25	210	184	50	260	270	½" G	¼" G	9
FRM-NOC 100025 MD	279086	280261	10 / 1000	25	210	184	50	260	270	½" G	¼" G	9
FRM-NOC 100025 HD	279087	280262	10 / 1000	25	210	184	50	260	270	½" G	¼" G	9
FRM-NOC 100025 UHD	279088	280263	10 / 1000	25	210	184	50	362	687	½" G	¼" G	13
FRM-NOC 100040 ND	279089	280264	10 / 1000	40	280	223	70	350	500	½" G	¼" G	17
FRM-NOC 100040 MD	279090	280265	10 / 1000	40	280	223	70	350	500	½" G	¼" G	17
FRM-NOC 100040 HD	279091	280266	10 / 1000	40	210	223	70	250	260	½" G	¼" G	16
FRM-NOC 100040 UHD	279092	280267	10 / 1000	40	210	223	70	350	675	½" G	¼" G	21
FRM-NOC 100050 ND	279093	280268	10 / 1000	50	280	254	80	400	550	½" G	¼" G	20
FRM-NOC 100050 MD	279094	280269	10 / 1000	50	280	254	80	400	550	½" G	¼" G	20
FRM-NOC 100050 HD	279095	280270	10 / 1000	50	210	254	80	300	310	½" G	¼" G	19
FRM-NOC 100050 UHD	279096	280271	10 / 1000	50	210	254	80	395	720	½" G	¼" G	24

FRM-NOC... / SAV



Option external line: Only on request.
* Ermeto screw connection 12L: GE 12 - 1/4 with screw connection M16 for pipes 12 x 1.5

Type	Item Nº		$p_{max.}$ [bar/kPa]	DN	Dimensions [mm]							Wgt. [kg]
	BSP	NPT			A	B	C	D	E	F	G	
FRM-NOC 10010 ND /SAV ND	279042	280224	10 / 1000	1"	210	104	245	240	250	½" G	¼" G	7
FRM-NOC 10010 MD /SAV MD	279043	280225	10 / 1000	1"	210	104	245	240	250	½" G	¼" G	7
FRM-NOC 10010 HD /SAV HD	279044	280226	10 / 1000	1"	210	104	245	240	250	½" G	¼" G	7
FRM-NOC 10010 UHD /SAV UHD	279045	280227	10 / 1000	1"	210	104	245	342	667	½" G	¼" G	11
FRM-NOC 10015 ND /SAV ND	279046	280228	10 / 1000	1 ½"	210	132	245	240	250	½" G	¼" G	8
FRM-NOC 10015 MD /SAV MD	279047	280229	10 / 1000	1 ½"	210	132	245	240	250	½" G	¼" G	8
FRM-NOC 10015 HD /SAV HD	279048	280230	10 / 1000	1 ½"	210	132	245	240	250	½" G	¼" G	8
FRM-NOC 10015 UHD /SAV UHD	279049	280231	10 / 1000	1 ½"	210	132	245	342	667	½" G	¼" G	12
FRM-NOC 10020 ND /SAV ND	279050	280232	10 / 1000	2"	280	156	245	345	495	½" G	¼" G	14
FRM-NOC 10020 MD /SAV MD	279051	280233	10 / 1000	2"	280	156	245	345	495	½" G	¼" G	14
FRM-NOC 10020 HD /SAV HD	279052	280234	10 / 1000	2"	210	156	245	245	255	½" G	¼" G	13
FRM-NOC 10020 UHD /SAV UHD	279053	280235	10 / 1000	2"	210	156	250	345	670	½" G	¼" G	18

Type	Item Nº		$p_{max.}$ [bar/kPa]	DN	Dimensions [mm]							Wgt. [kg]
	DN	ANSI			A	B	C	D	E	F	G	
FRM-NOC 100025 ND /SAV ND	279073	280248	10 / 1000	25	210	184	245	260	270	½" G	¼" G	11
FRM-NOC 100025 MD /SAV MD	279074	280249	10 / 1000	25	210	184	245	260	270	½" G	¼" G	11
FRM-NOC 100025 HD /SAV HD	279075	280250	10 / 1000	25	210	184	245	260	270	½" G	¼" G	11
FRM-NOC 100025 UHD /SAV UHD	279076	280251	10 / 1000	25	210	184	245	362	687	½" G	¼" G	15
FRM-NOC 100040 ND /SAV ND	279077	280252	10 / 1000	40	280	223	250	350	500	½" G	¼" G	19
FRM-NOC 100040 MD /SAV MD	279078	280253	10 / 1000	40	280	223	250	350	500	½" G	¼" G	19
FRM-NOC 100040 HD /SAV HD	279079	280254	10 / 1000	40	210	223	250	250	260	½" G	¼" G	18
FRM-NOC 100040 UHD /SAV UHD	279080	280255	10 / 1000	40	210	223	250	350	675	½" G	¼" G	23
FRM-NOC 100050 ND /SAV ND	279081	280256	10 / 1000	50	280	254	250	400	550	½" G	¼" G	22
FRM-NOC 100050 MD /SAV MD	279082	280257	10 / 1000	50	280	254	250	400	550	½" G	¼" G	22
FRM-NOC 100050 HD /SAV HD	279083	280258	10 / 1000	50	210	254	250	300	310	½" G	¼" G	21
FRM-NOC 100050 UHD /SAV UHD	279084	280259	10 / 1000	50	210	254	250	395	720	½" G	¼" G	26

9. Assembly/installation

9.1 General information

This device should only be installed in compliance with the applicable rules and standards and in accordance with the local regulations, if necessary apply for the required approvals.

- **Install the device in a building or under a cover; do not install it outdoors without appropriate protective measures!**
- **The work area must be provided with general safety devices.**
- **The lifting devices used must be suitable for the load to be lifted.**
- **Enough installation space for operation and maintenance has to be provided.**
- **We recommend installing a filter with a pore size ≤ 50 µm upstream of the regulator.**
- **The installation must not impair the functioning of other components.**

Check prior to installation!

- The 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 constantly be monitored using appropriate gas concentration measuring devices for the detection of gas leakages.
- Ensure electrically conductive bridging.
  Prevent contact voltage and ignitable flash-over.
- The performance data on the type plate correspond to the 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 connecting flange 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.

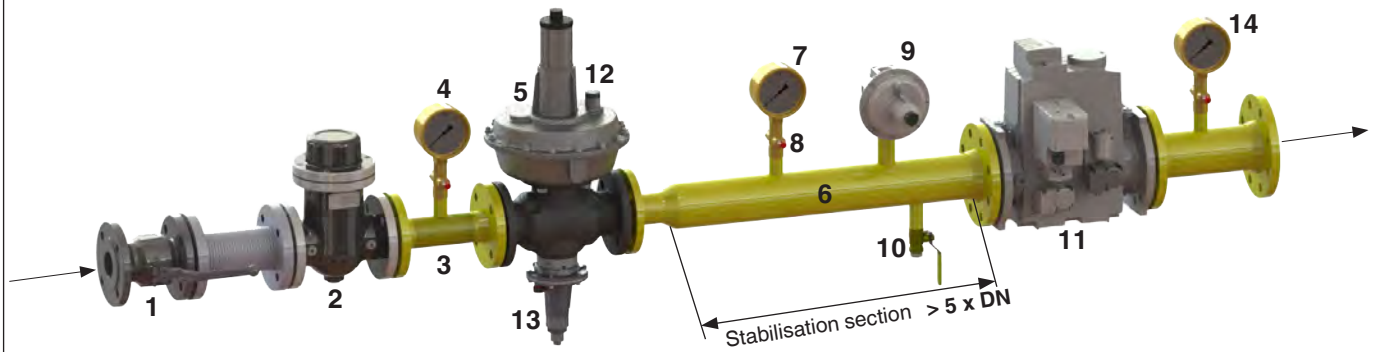
Make sure during installation!

- Tension-free assembly.
- Tighten the screws crosswise.
- Tightening torques must be observed.
- Vent lines and blow-off lines individually piped.
- Vent lines and blow-off lines must end in free space: gases must be exhausted to a safe place.
- The pulse lines may not be shut off.
- The specified distance between the measuring points of the pulse lines must be observed.
- The flow direction (arrow) on the housing must be followed.

9.2 Installation instructions

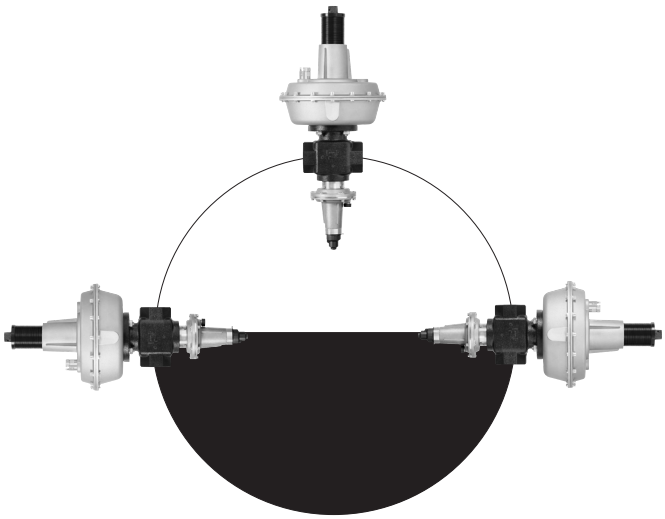
- The installation must be carried out according to the installation scheme specified below.
- Installation of the safety shut-off valve in the flow direction (arrow/housing).
- Design a straight stabilisation section with the same diameter.
- Run pulse line clean and burr-free. Distance > 5 x DN
- Maximum flow velocity in the stabilisation section: ≤ 30 m/s.
- (Version of the pulse lines: steel pipe D= 12 x 1.5, only with external pulse)
- (Avoid accumulation of condensate: install the pulse lines with a gradient, only with external pulse.)

Installation scheme



Pos.	Designation
1	Shut-off valve, inlet side (e.g. ball valve or butterfly valve)
2	Filter
3	Welded part
4	Pressure gauge, inlet side
5	Regulator with SAV integrated
6	Stabilisation section
7	Pressure gauge, outlet side
8	Pushbutton cock
9	SBV
10	Venting ball valve
11	Shut-off valve outlet side (e.g. DMV)
12	Breathing connection regulator
13	Breathing connection SAV
14	Relief connection SBV

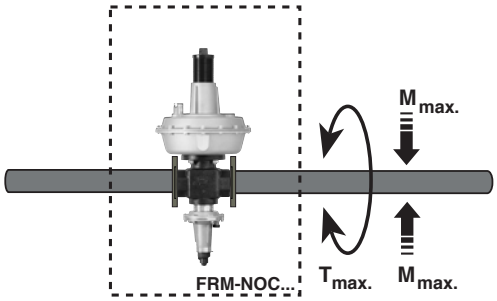
Mounting position



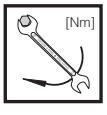
9.3 Torques

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	⅜	½	¾	1	1 ½	2	2 ½	--	--	--	--
$M_{max.}$ [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	--	--	--

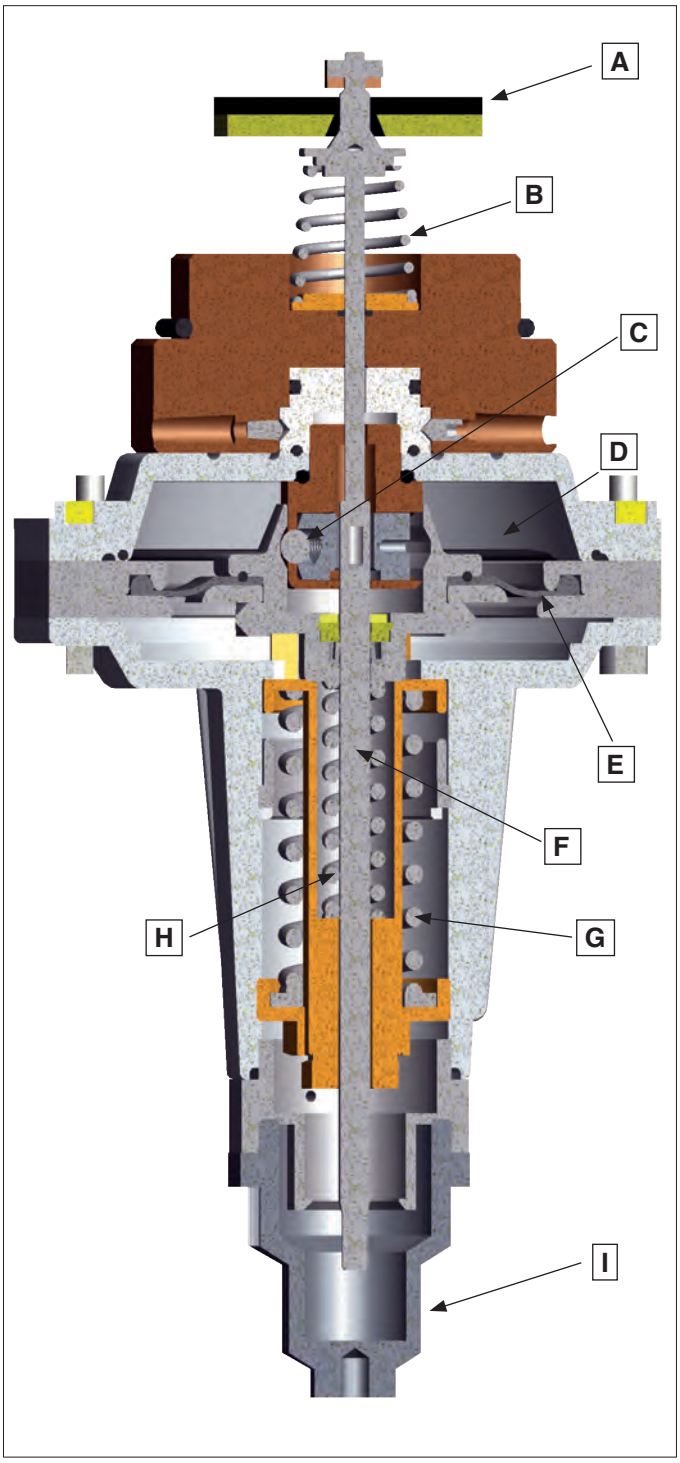


Max. torque of system accessories								
M … / G …	M 4	M 5	M 6	M8	G ⅛	G ¼	G ½	G ¾
$M_{max.}$ [Nm] t 10 s	2.5 Nm	5 Nm	7 Nm	15 Nm	5 Nm	7 Nm	10 Nm	15 Nm

Max. torque of 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 SAV

The SAV protects downstream components against pressures that are too high or too low. Automatically interrupts the flow of gas, as soon as the pre-set triggering pressure falls below or exceeds a limit due to a fault. Under normal operating conditions the SAV is open.
If the outlet side of the gas pressure regulator and/or the fittings and devices of the succeeding gas line section, inclusive its equipment until the gas-consuming device, are not designed for the highest supply pressure (inlet pressure to the gas pressure regulator in case of an error), a SAV must be installed to shut down the gas supply before the gas pressure becomes too high.
The SAV complies with the requirements of the standard. EN 14382 as an integral resistance type (IS) safety shut-off device.



Main components
A Valve disc
B Closing spring
C Ball catch / trigger mechanism
D Chamber with the pressure to be monitored
E Working diaphragm
F Push rod
G Setpoint spring for p_{do}
H Setpoint spring for p_{du}
I Protective cap

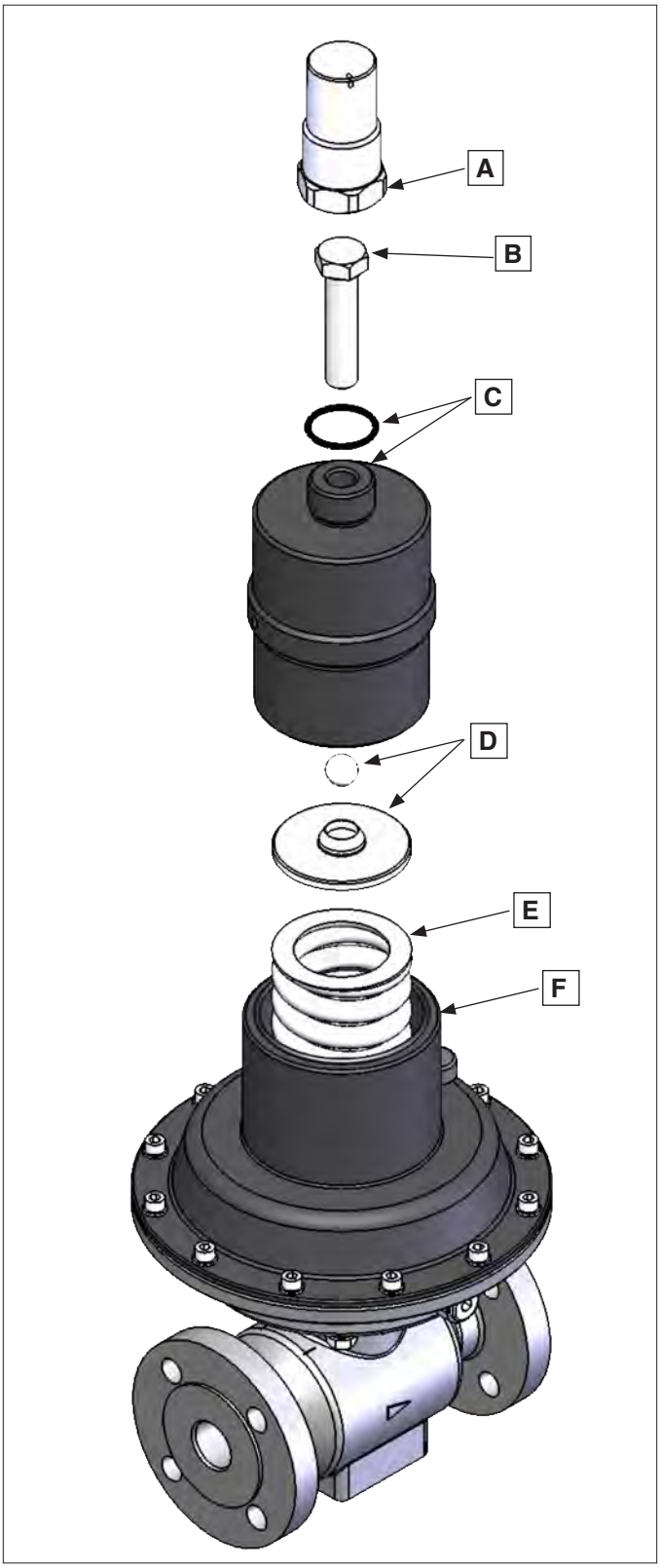
Function
Chamber **D** is connected to the outlet pressure via a pulse line.
The pressure to be controlled acts on the working membrane **E**. The force of the set point springs **G** and **H** acts as a counter force.
In case of an unbalance of forces (overpressure or underpressure), the SAV is actuated and the gas supply is blocked.

11. Adjustment

11.1 Adjusting the regulator

Adjusting the outlet pressure (type UHD)
The regulator is adjusted by turning the adjustment screw **B**.

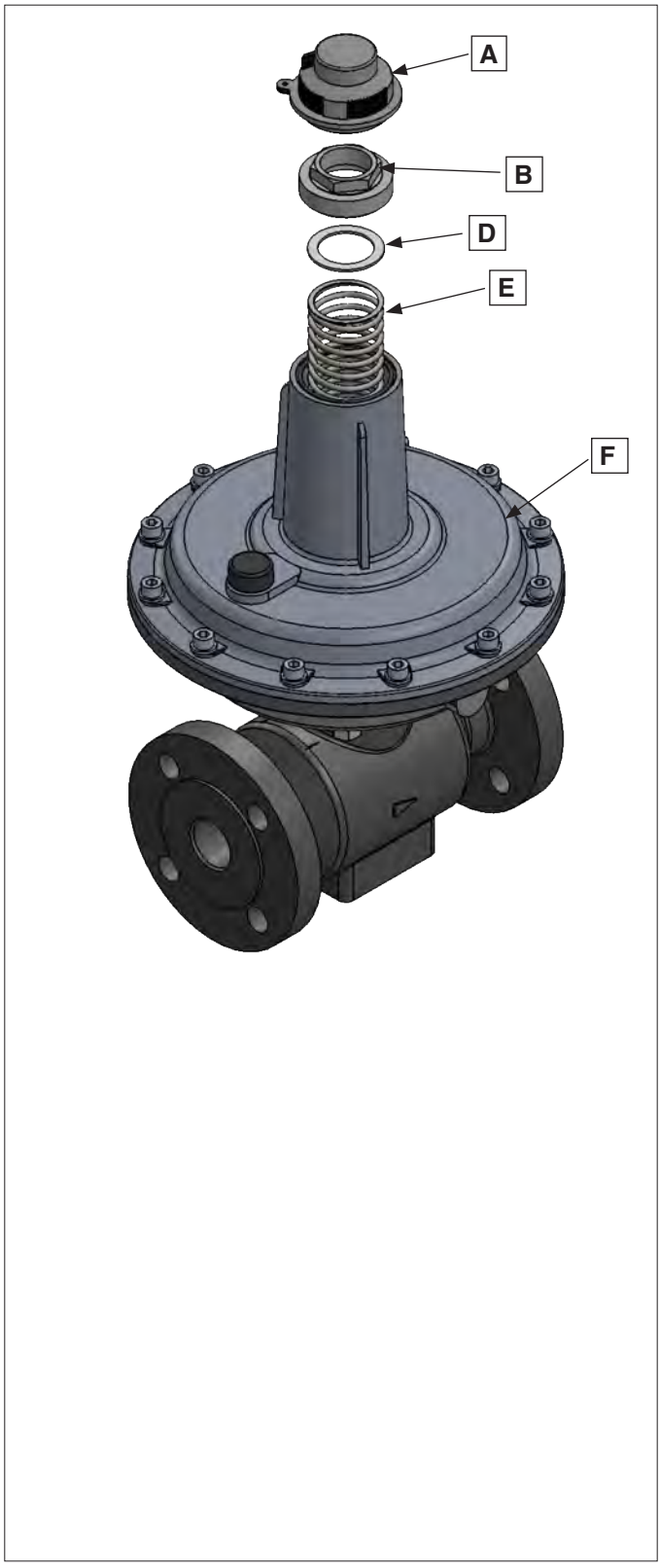
1. Remove the protective cap **A**.
2. Turn the external adjusting screw **B** using the spanner **size 24**.
3. Clockwise rotation: Increases the initial tension of the adjustment spring, thus increasing (+) the outlet pressure p_{ds}.
4. Counterclockwise rotation: Reduces the tension of the adjustment spring, reducing (-) the outlet pressure p_{ds}.
5. After the setting: Screw on the protective cap **A** again.



Adjusting the outlet pressure (type HD and ND,MD for 1", 1 ½" i DN25)

The regulator is adjusted by turning the adjustment screw **B**.

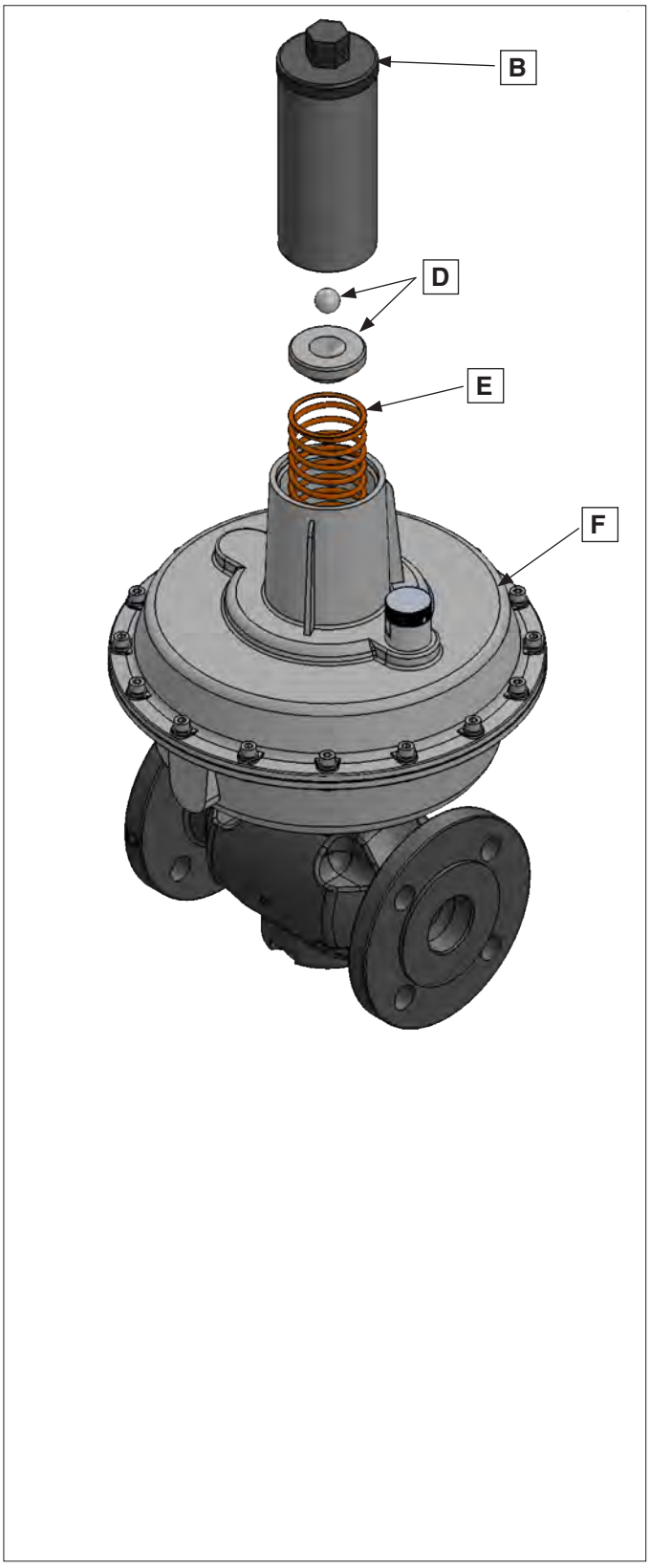
1. Remove the protective cap **A**.
2. Turn the external adjusting screw **B** using the Allen key size.
3. Clockwise rotation: Increases the initial tension of the adjustment spring, thus increasing (+) the outlet pressure p_{ds}.
4. Counterclockwise rotation: Discharges the adjustment spring, reducing (-) the outlet pressure p_{ds}.
5. After the setting: Screw on the protective cap **A** again.



Adjusting the outlet pressure (type ND,MD for 2", DN40 i DN50)

The regulator is adjusted by turning the adjustment screw **B**.

1. Turn the adjusting screw **B** using the spanner size
2. Clockwise rotation: Increases the initial tension of the adjustment spring, thus increasing (+) the outlet pressure p_{ds}.
3. Counterclockwise rotation: Discharges the adjustment spring, reducing (-) the outlet pressure p_{ds}.



11.2 Adjusting the SAV

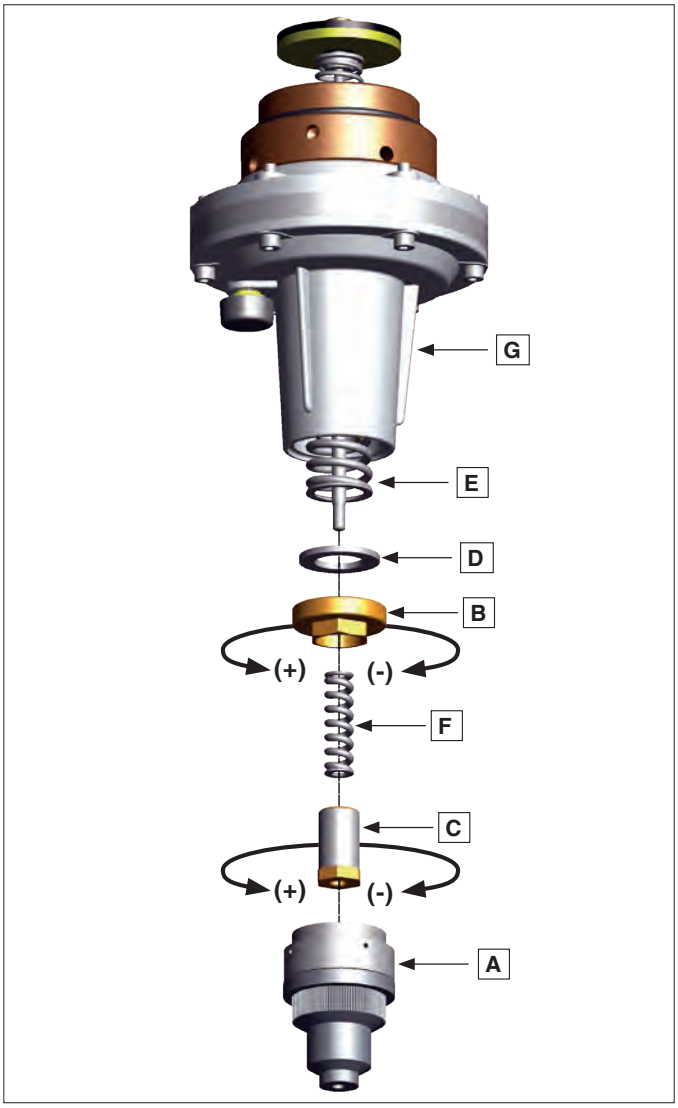
Setting the over pressure trip point

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

Setting the under pressure trip point

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

NB: Adjusting the low pressure cut-off pressure affects the overpressure cut-off pressure. Set the low pressure cut off first.



A mutual influence of the pressure regulator and the safety shut-off valve must be excluded.	
Calculation of the recommended set values according to the outlet pressure of the regulator p_d	• The SAV must lock as soon as 1.1 times the max. system-specific operating pressure is reached. • The SAV set values must be defined taking into account the settings and tolerances of the pressure regulator. • The tolerances and set values of additional safety devices must also be considered when setting the SAV. • In case of a fault or regular shut-down of the downstream shut-off valve, the SAV may not respond. The upper shut-down pressure must be determined accordingly.
$p_d \leq 100$ mbar $p_{do} = p_d + 50$ mbar	
100 mbar < $p_d \leq 200$ mbar $p_{do} > p_d + 100$ mbar	
$p_d > 200$ mbar $p_{do} > p_d$ **x** 1.5	

11.3 Example of calculations of adjustment values

Determination of the setting values by means of a pressure graduation table	
Regulator chosen	**FRM-NOC 100025 MD / SAV MD**
Outlet pressure of the regulator p_d	**200 mbar**
System-specific operating pressure after the regulator p_{adm}	**500 mbar**
Pressure limit in the case of failure	**550 mbar**
Accuracy class	**AC 5**
Upper cut-off pressure accuracy class SAV	**AG_o 10**
Lower cut-off pressure accuracy class SAV	**AG_u 10**
Response group of the SBV	**AG 5**

Result			
Group of devices	**Device data**	**Pressure graduation**	
Safety devices against over-pressure	Pressure limit in the case of failure: 1,1 * $p_{adm.}$	550 mbar	
	AG_o 10		440 mbar
	SAV	p_{do} =	400 mbar
	AG_o 10		360 mbar
	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 under-pressure	AG_u 20		60 mbar
	SAV	p_{du} =	50 mbar
	AG_u 20		40 mbar

11.4 Regulating spring replacement

11.4.1 Type UHD

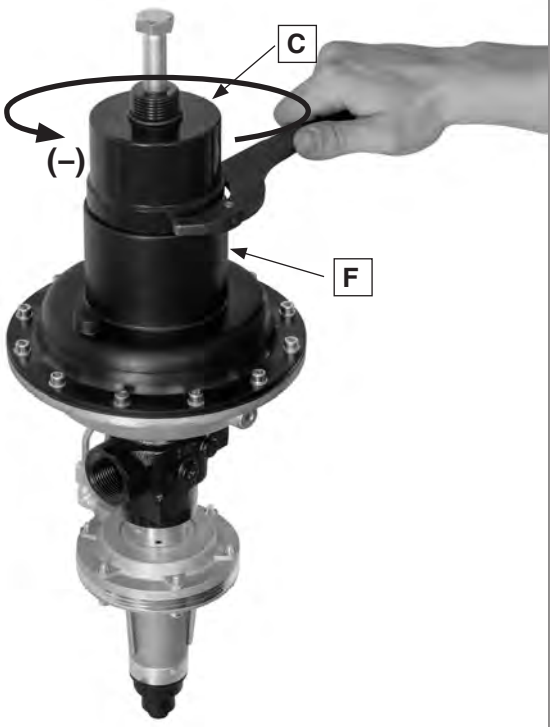
1

Remove the protective cap **A**.

2

Unscrew adjustment screw **E**: Unscrew the adjusting nut **B** counterclockwise as far as it will go.

3

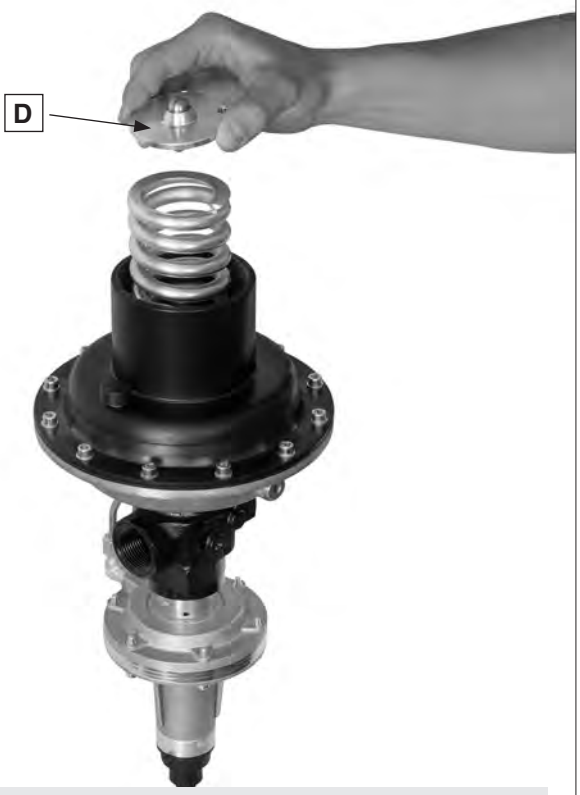


Remove from the spring housing **F** the shut-off cover **C** using a hook wrench **90-155**.

4

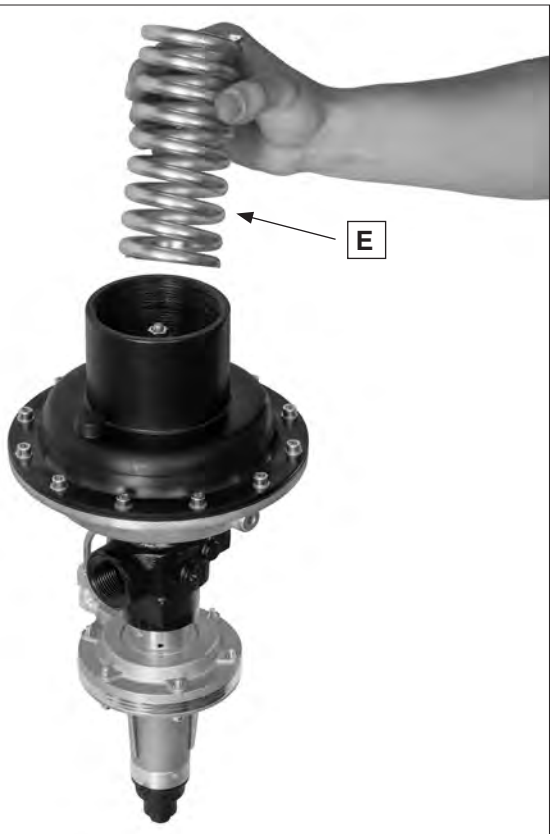
Remove the cap **C**.

5



Remove the disc from the spring **D** incl. ball.

6

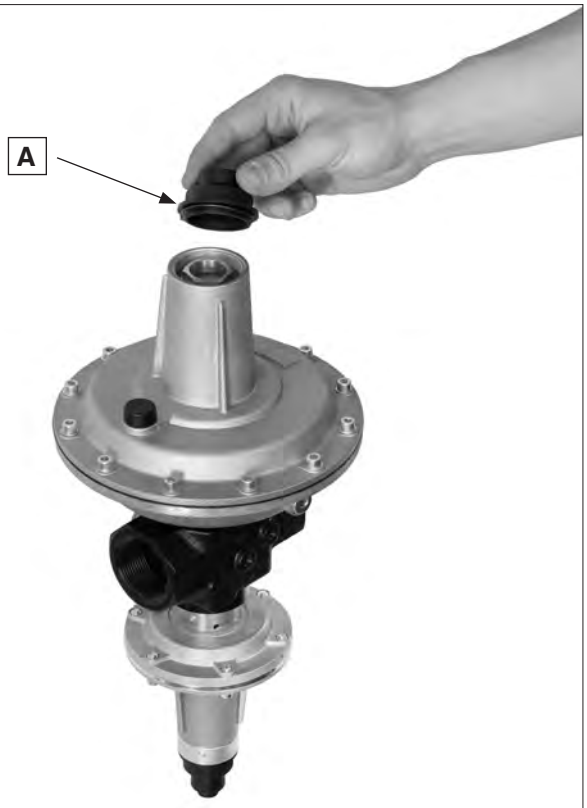


Remove the adjustment spring **E** from the spring chamber **F**.

7. Insert a new spring with the appropriate adjustment range.
8. Place the disc **D** with the ball back on the spring
9. Screw on the shut-off cap **C again** on the spring dome. Tighten the adjusting screw **B** until the desired spring pre-load is reached. Re-fit the protective cap **A**.

11.4.2. Type ND, MD for 1", 1 ½", DN25 and type HD

1

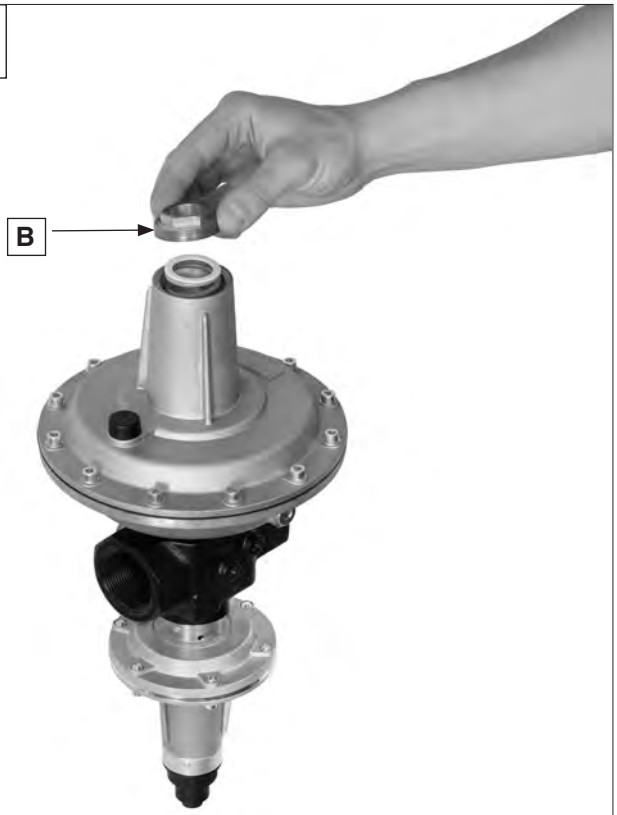


Remove the protective cap **A**.

2

Release the setpoint spring **E**: Completely loosen adjusting nut **B** counterclockwise.

3

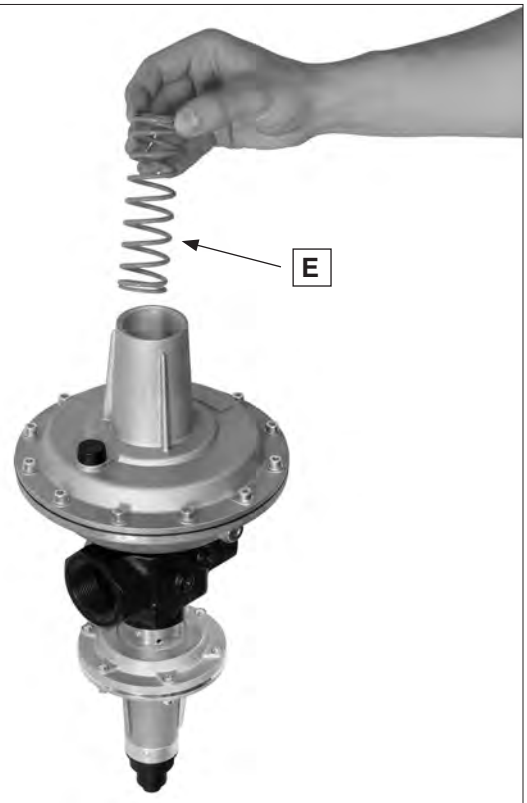


Remove the adjusting nut **B**.

4

Remove the washer **D**.

5



Remove the adjustment spring **E** from the spring chamber **F**.

6. Insert a new spring with the appropriate adjustment range.
7. Place the washer **D** back on the spring.
8. Screw the adjusting nut **B** back into the spring dome until the desired initial spring tension is reached. Re-fit the protective cap **A**.

11.4.3 Type ND, MD for 2", DN40 and DN50

1

Release the setpoint spring **E**: Unscrew the adjusting cap **B** counterclockwise as far as it will go.

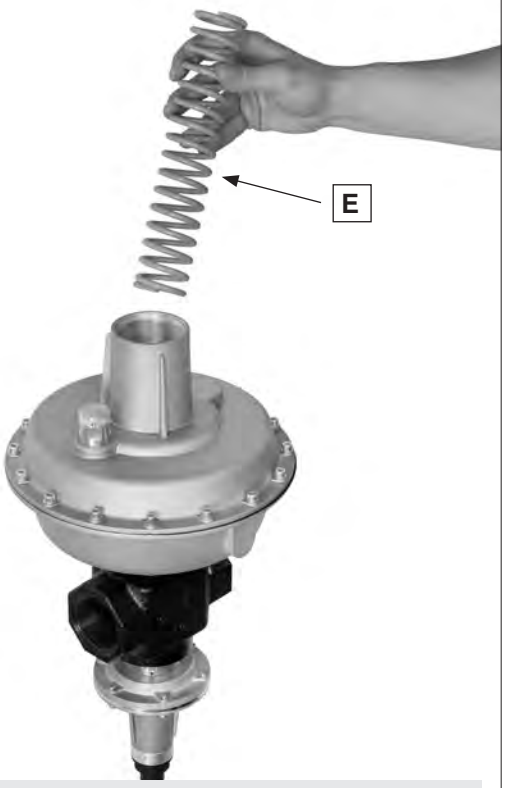
2

Remove the cap **C**.

3

Remove the disc from the spring **D** incl. ball.

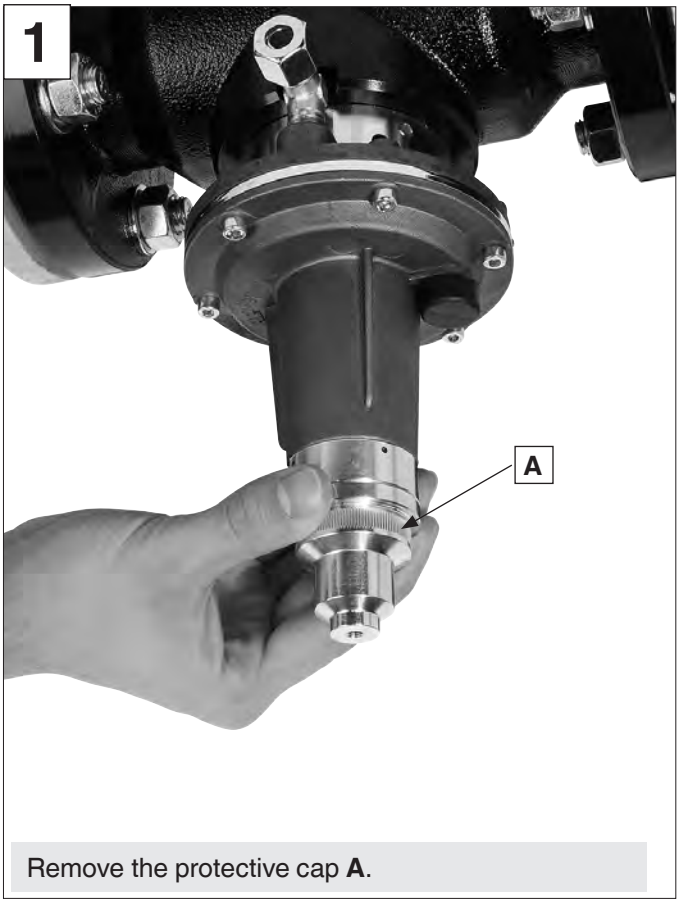
4



Remove the adjustment spring **E** from the spring chamber **F**.

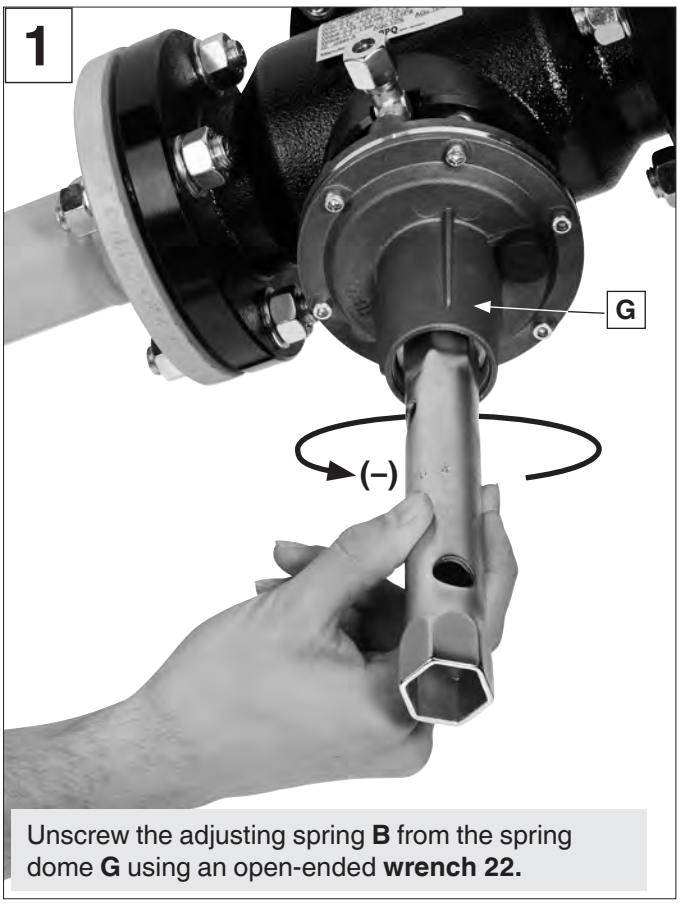
5. Insert a new spring with the appropriate adjustment range.
6. Place the disc **D** with the ball back on the spring.
7. Screw the adjusting cap **B** into the spring dome until the desired initial spring tension is reached.

11.5 Spring replacement SAV

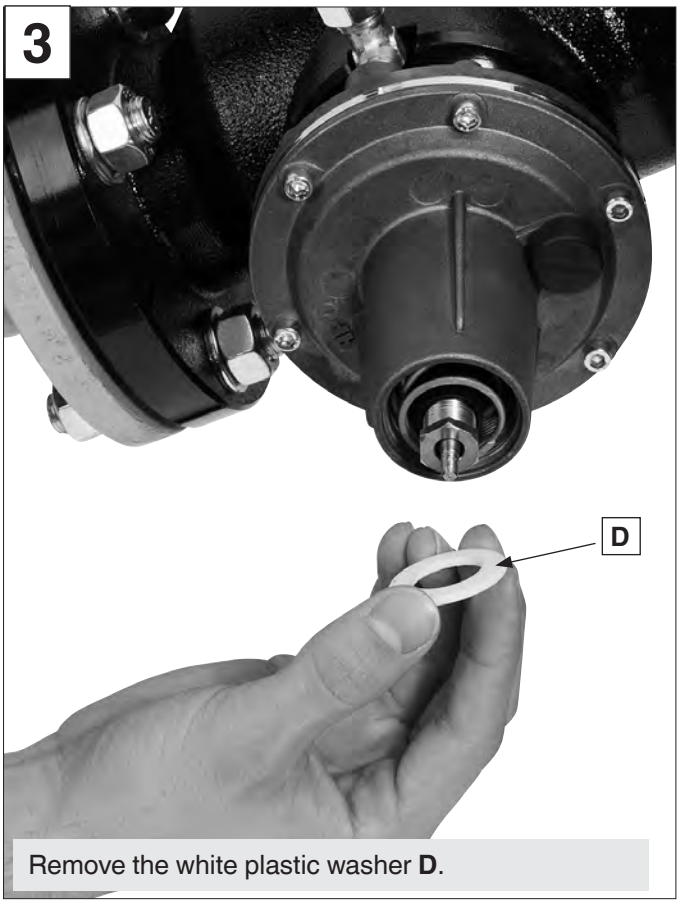


Remove the protective cap **A**.

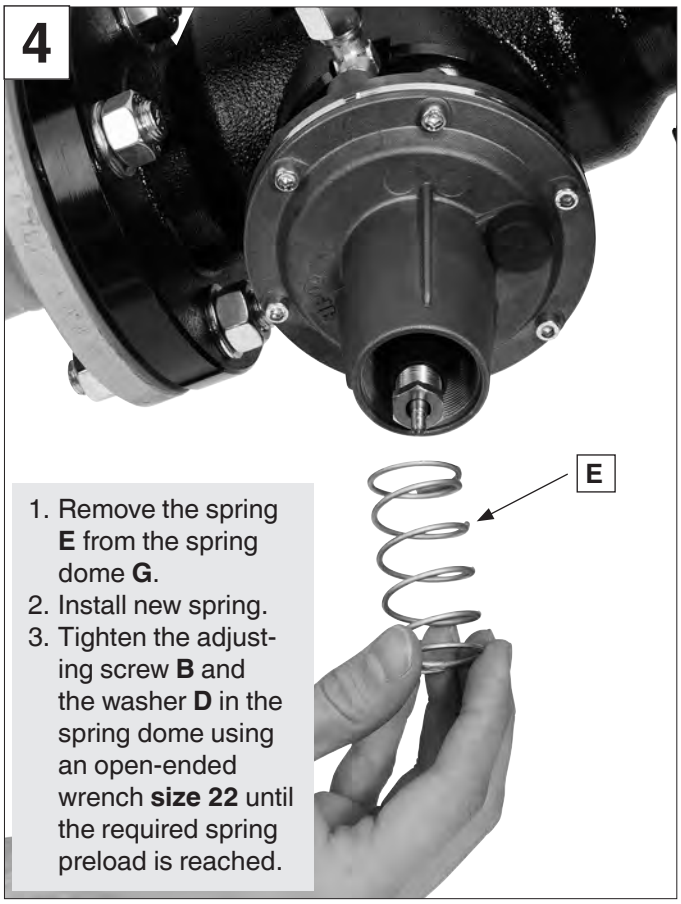
11.5.1 Spring replacement W_{dso}



Unscrew the adjusting spring **B** from the spring dome **G** using an open-ended **wrench 22.**



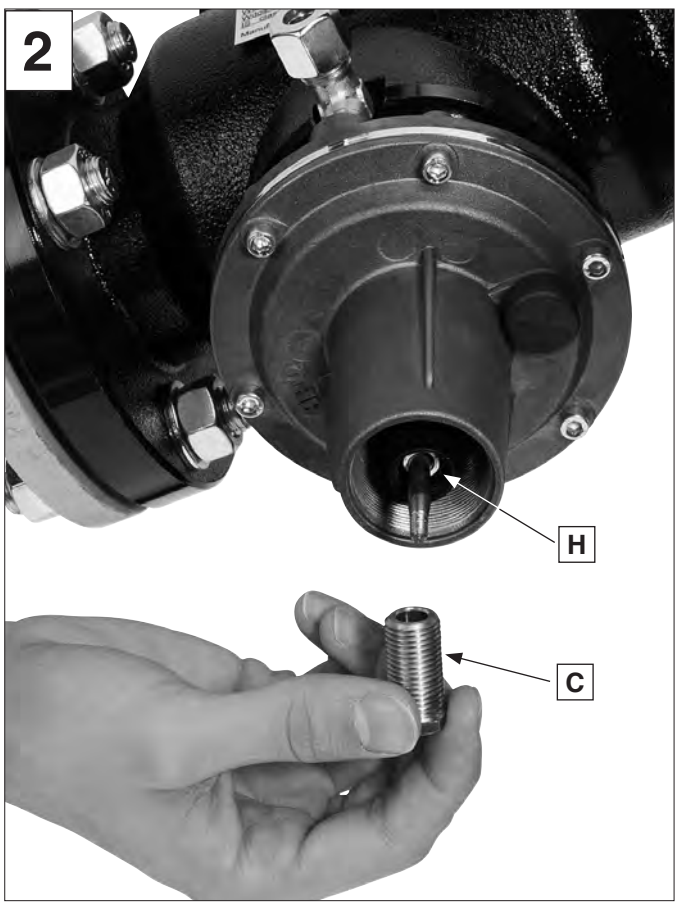
Remove the white plastic washer **D**.



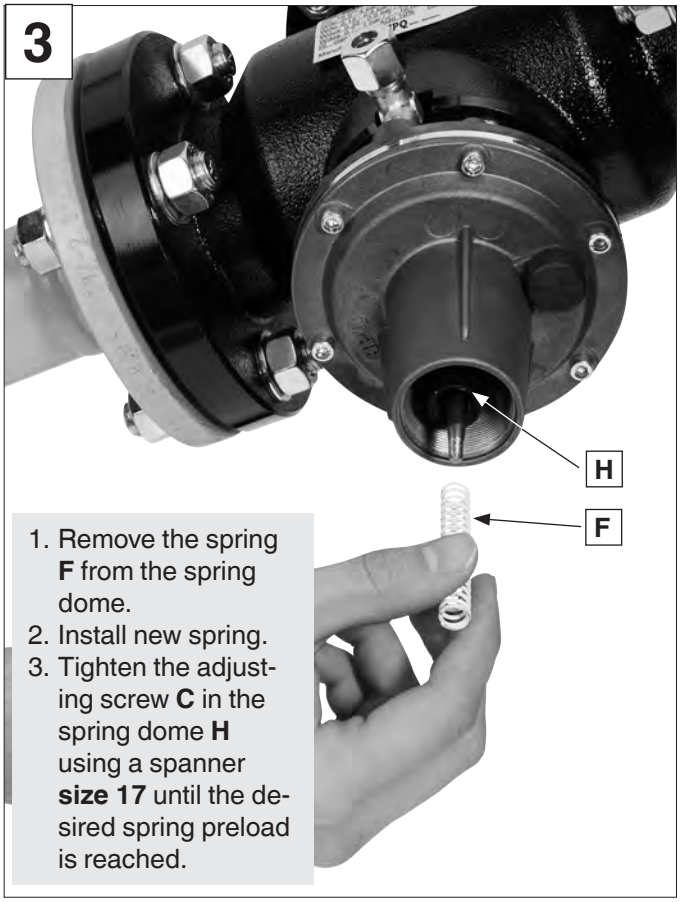
1. Remove the spring **E** from the spring dome **G**.
2. Install new spring.
3. Tighten the adjusting screw **B** and the washer **D** in the spring dome using an open-ended wrench **size 22** until the required spring preload is reached.

11.5.2 Spring replacement W_{dsu}

Remove adjusting screw **C** from the inner black spring dome **H** using a spanner **size 17.**

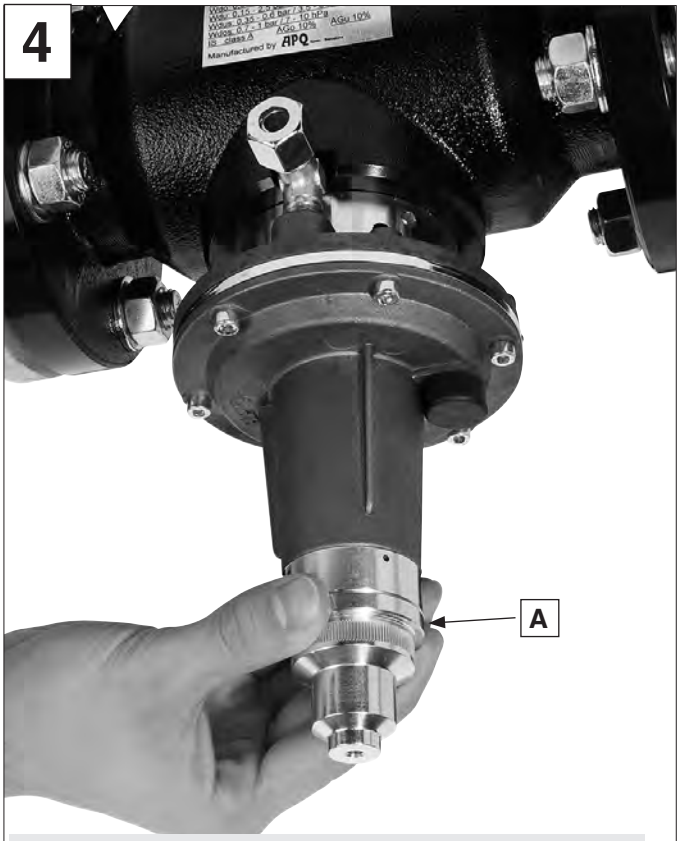


3



1. Remove the spring **F** from the spring dome.
2. Install new spring.
3. Tighten the adjusting screw **C** in the spring dome **H** using a spanner **size 17** until the desired spring preload is reached.

4



Screw on the protective cap **A** again.

12. Commissioning and Decommissioning

12.1 General information

Prior to commissioning

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

12.2 Leakage test

Prior to commissioning, check the device for any external and internal leakage.

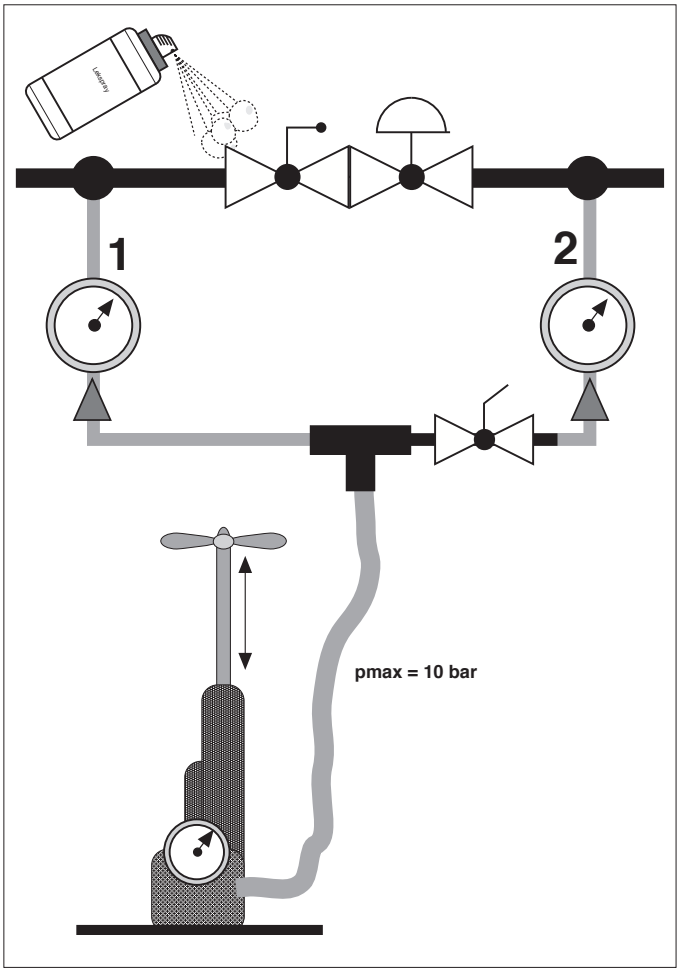
1. Test gas of the leakage test: air or inert gases.
2. Upstream and downstream shut-off valves must be closed.
3. Release the test section. Release gas in the test section in a controlled and safe manner into the atmosphere.
4. Test pressure > blow-off pressure SBV: Block the line upstream of the SBV.
5. Connect the test section to the test device and apply pressure.
6. Test pressure: 1.1 x system-specific operating pressure. PS maximum of the device. Please take into account the different compressive strengths of the system.
7. Observe the waiting time necessary for the pressure compensation according to the system-specific volume.

External leakage.

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

Internal leakage.

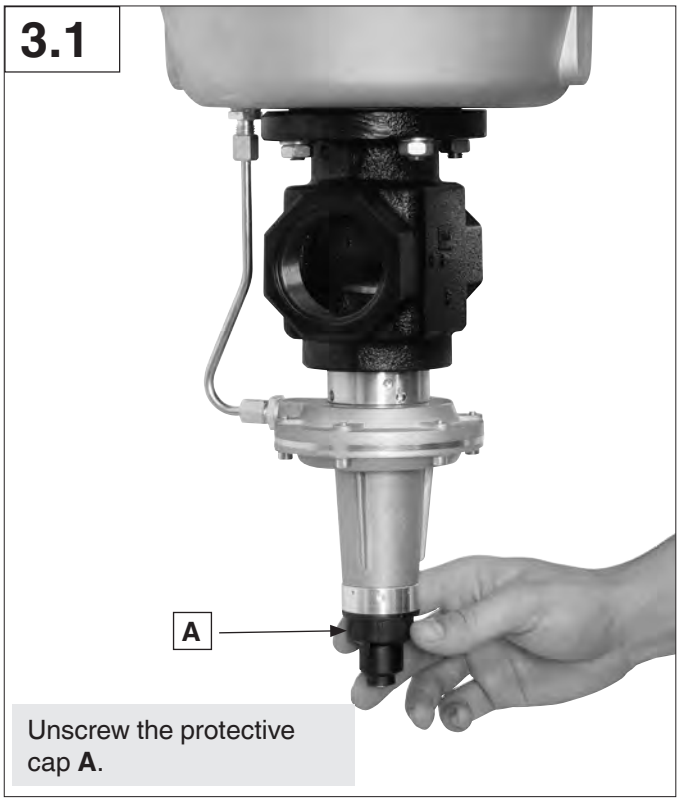
10. Release the pressure in the test section downstream of the device.
11. Monitor the pressure increase on the outlet side. Pressure gauge accuracy 0.1 mbar
12. Once the leakage test has been carried out, open the shut-off valve upstream of the SBV.
13. Release pressure in the test section.



12.3 Commissioning/unlocking/control of adjustment values

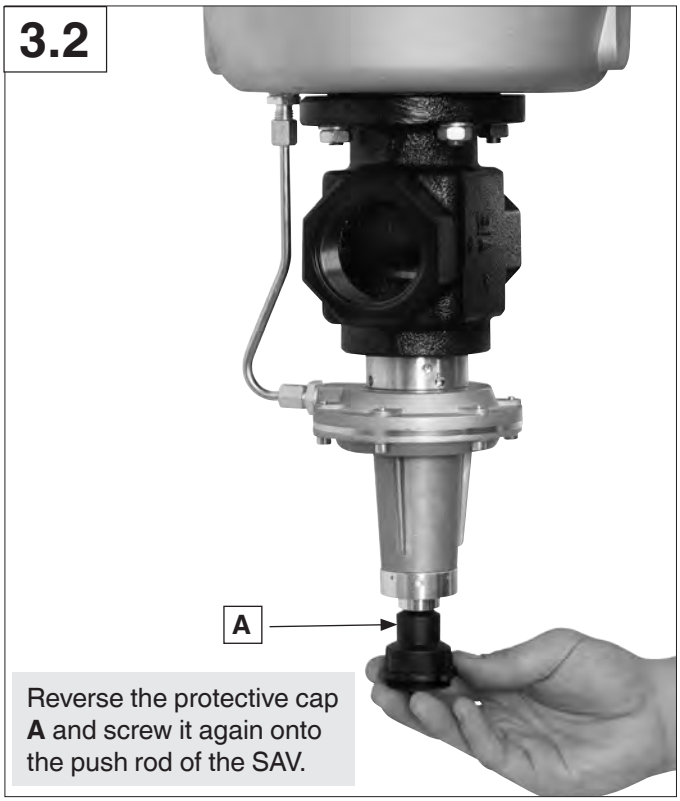
**1. Slowly open the shut-off valve on the inlet side.
The ball wrench on the outlet side remains closed.**
2. Monitor the pressure increase upstream of the device with the pressure gauge on the inlet side.
3. Unlocking the SAV:

3.1



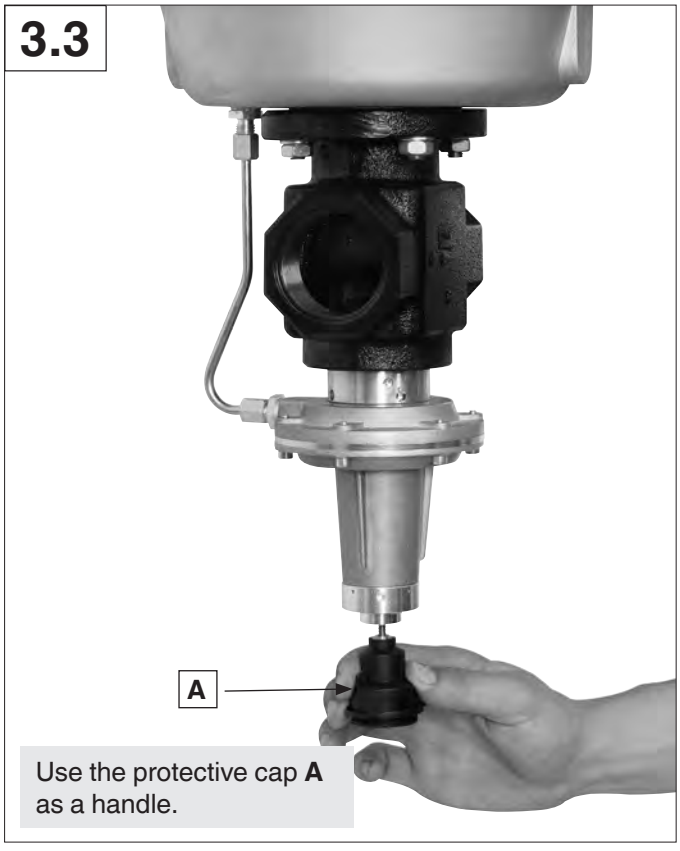
Unscrew the protective cap **A**.

3.2



Reverse the protective cap **A** and screw it again onto the push rod of the SAV.

3.3



Use the protective cap **A** as a handle.

3.4 Compensate the pressure by slowly opening the compensation valve on the valve head: Pull the protective cap **A** downwards approx. 2 mm.
3.5 Monitor the pressure increase on the outlet side of the pressure gauge.
3.6 Operating pressure on the outlet side is reached: pull the protective cap **A** to the stop and lock it.
3.7 TheSAV is open.
3.8 Unscrew the protective cap **A** from the push rod and screw it again on the spring dome **G**.

4.0 Venting

4.1 Vent the test section into the atmosphere 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 and screw on the plug.

5.0 Checking the outlet pressure

5.1 Checking the shut-off pressure of the regulator.
5.2 Open the bleed valve and check the setting value of the regulator (outlet pressure) on the pressure gauge and correct according to item 11.1 if necessary.
5.3 Close the drain cock, remove the hose and tighten the closing plug.

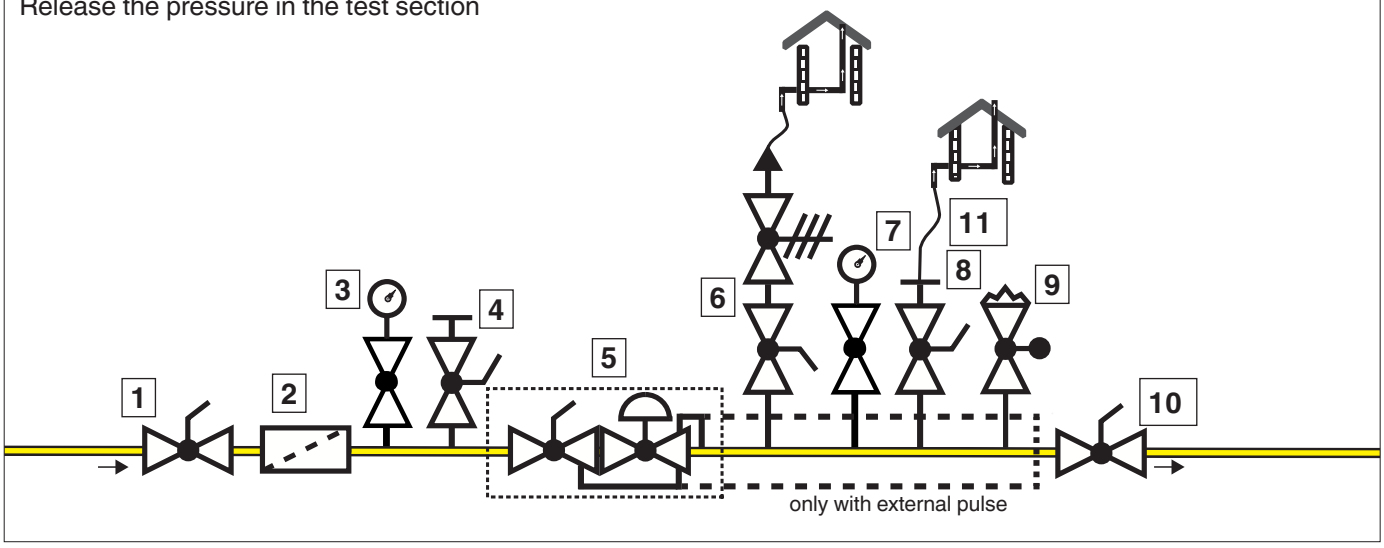
6.0 Checking the upper shut-down pressure p_{do}

6.1 Assembly of the SBV on the outlet side: Block the line upstream of the SBV.
6.2 Check the upper trip pressure of the SAV: create a backpressure downstream.
6.3 Create a direct, lockable connection between the inlet and outlet sides.
6.4 Conduct the inlet pressure to the outlet side by slowly opening the stopcock in the bypass.
6.5 Monitor the pressure increase on the outlet side on the pressure gauge.
6.6 Avoid an inadmissibly high pressure on the outlet side: After triggering the SAV, close the bypass immediately.
6.7 Read the upper locking pressure on the pressure gauge on the outlet side and compare it with the setpoint.
6.8 The determined activation pressure must lie within the response tolerance (AG_o) of the set-point.
6.9 If necessary, correct the response pressure according the specifications under point 11.2 and check it again.

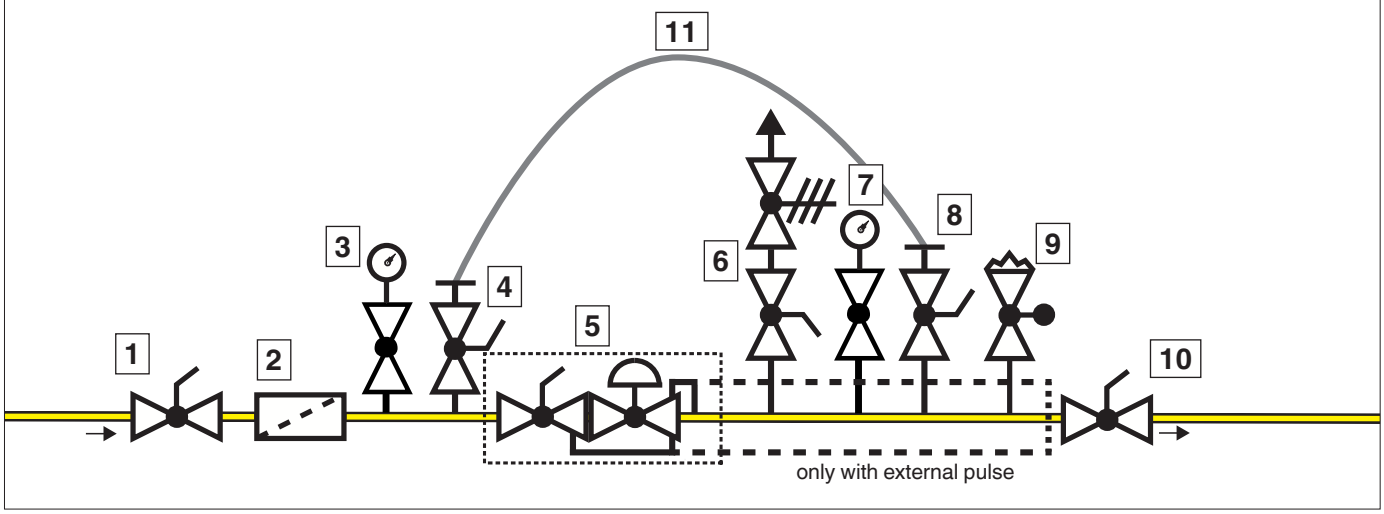
7.0 Check the lower shut-down pressure p_{du}

7.1 Release the pressure in the test section on the outlet side until the operating pressure is reached.
7.2 Release the gas in a controlled and safe manner into the atmosphere.
7.3 Monitor the pressure drop on the pressure gauge.
7.4 Unlock the SAV.
7.5 Slowly close the shut-off valve on the inlet side.
7.6 Establish counter-pressure: Continue to release the gas from the pipe on the outlet side outwards in a controlled and safe manner.
7.7 After triggering the SAV: 6.7 Read the lower blocking pressure on the pressure gauge on the outlet side and compare it with the set point.
7.8 The determined activation pressure must lie within the response tolerance (AG_u) of the setpoint.
7.9 Close the drain cock, remove the hose and tighten the closing plug.
7.10 Slowly open the shut-off valve on the inlet side.

Release the pressure in the test section



Generate back-pressure



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

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

12.4 Recommissioning

1. Close the shut-off valve before bypassing.
2. Remove the hose.
3. Open the ball valve upstream of the SBV.
4. Reset slowly the SAV, see point 11.3.
5. Once SAV has been opened completely, open the shut-off valve on the outlet side.

12.5 Decommissioning

1. Slowly close the shut-off valve on the outlet side.
2. Slowly close the shut-off valve on the inlet side.
3. Release gas in the test section in a controlled and safe manner into the atmosphere.

13. Faults and their causes

- **Repair work on the device must only be performed by authorised and skilled personnel.**
- **Use only original spare parts.**

Fault in the SAV	Possible causes	Troubleshooting
The SAV cannot be opened/unlocked	The pulse line is not connected.*	Install the pulse line.
	The pulse line is clogged.*	Clean the pulse line.
	The pulse line has leaks.*	Seal the pulse line.
	The pulse line is damaged.*	Replace the pulse line.
	The pulse pressure is outside the adjustment range.	Adjust the locking pressure of the SAV or the outlet pressure.
	The adjusting springs are not suitable for the application.	Replace the adjusting spring.
	The adjustment range of the SAV is outside the outlet pressure.	Replace the SAV or the ASE.
The SAV does not switch or does not respond.	The pulse line is not connected.*	Connect/install the pulse line.
	The pulse line is clogged.*	Clean the pulse line.
	The pulse line has leaks.*	Seal the pulse line-
	The pulse line is damaged.*	Replace the pulse line.
	The pulse pressure is outside the adjustment range.	Adjust the locking pressure of the SAV.
	The adjustment springs are not suitable for the application.	Replace the adjusting spring.
The SAV switches, but does not seal.	The valve head is damaged or worn.	Replace the ASE or have it repaired by DUNGS.
	The seat of the valve 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 ASE and housing of the SAV is damaged.	Replace the ring or the ASE.
	The O-ring junta on the ASE is damaged.	Replace the O-ring or the ASE.

Fault in the regulator	Possible causes	Troubleshooting
There is no gas	The regulator is not receiving gas.	Check the gas installation prior to the regulator.
	The SAV is closed.	Unlock the SAV.
The regulator supplies the wrong outlet pressure.	The regulator contains a spring with the wrong set point.	Replace the set point spring.
	The desired output pressure is outside the possible output pressure range.	Replace the regulator model.
	Inlet pressure is too low.	Check the gas system or resize the regulator.
Without flow, the outlet pressure corresponds to the inlet pressure	The pulse line is not connected.*	Install the pulse line.
	The pulse line is closed.*	Check the pulse line
	The pulse line has leaks.*	Seal the pulse line.
	The seal is damaged.	Replace the seal.
	The seat of the seal is damaged.	Replace the seat of the seal.
	The working diaphragm is damaged.	Replace the working membrane.
	The lever system is damaged.	Replace the lever system.
	The O-rings juntas on 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.
The outlet pressure corresponds to the inlet pressure during operation	The pulse line is not connected.*	Install the pulse line.
	The pulse line is closed.*	Check the pulse line
	The pulse line has leaks.*	Seal the pulse line.
	The working diaphragm is damaged.	Replace the working membrane.
	The lever system is damaged.	Replace the lever system.
As the flow rate increases, the outlet pressure drops.	The desired flow rate exceeds the capacity of the regulator.	Re-size the regulator and replace it.
	Incorrect dimensioning of the gas pipe.	Increase the nominal diameter of the line.
	The gas filter before the regulator is dirty.	Clean the gas filter, replace the filter screen.
	The lever system is damaged.	Replace the lever system.
	The pulse line is closed.	Check the pulse line
	The SAV is damaged.	Check the SAV.
In the vent connection there is a gas leak.	The working diaphragm is damaged.	Replace the working membrane.
	The O-rings on the compensation shaft are damaged.	Replace the lever system.

* in the case of regulator with external line

14. Maintenance

14.1 General information

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

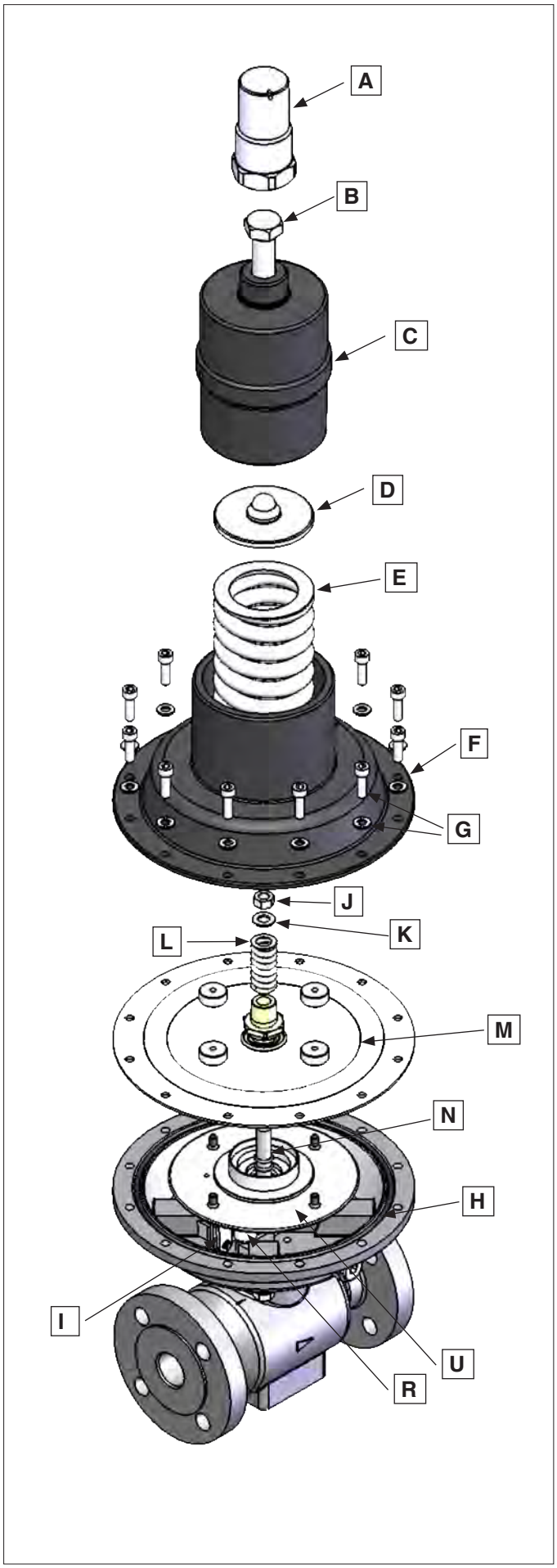
- **The maintenance of the device can only be carried out in compliance with the applicable rules and standards and in accordance with current local regulations.**
- **Repair work on the device must only be performed by authorised and skilled personnel.**
- **Adhere to the maintenance intervals indicated.**
- **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.**
- **Use only original spare parts.**
- **Do not use alcohol-based or solvent-containing cleaning solutions for cleaning the device.**

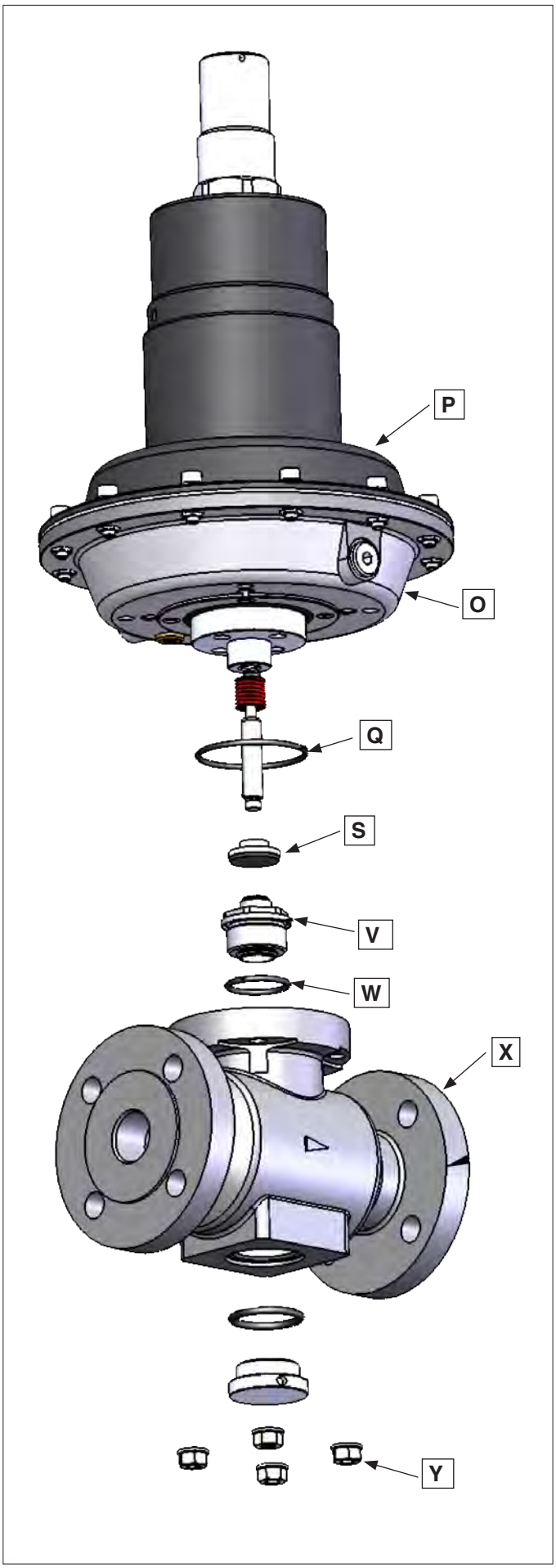
Prior to maintenance

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

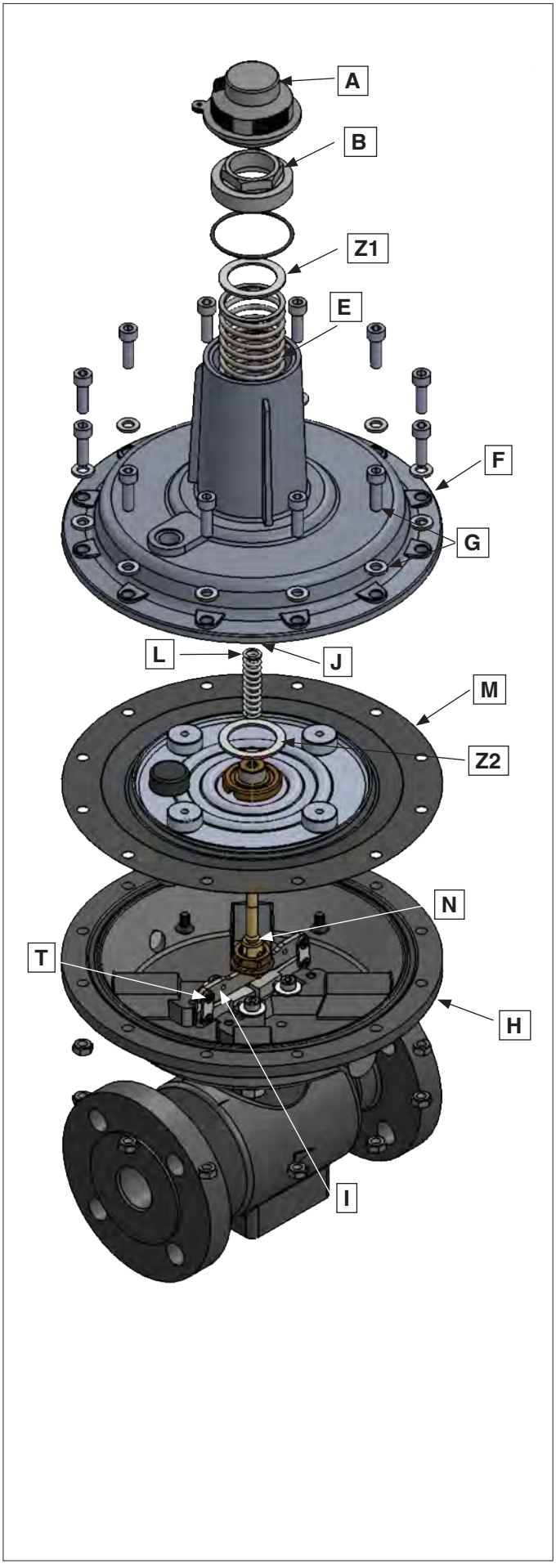
Pos.	Designation
A	Protective cap
B	Adjusting screw + washers
C	Sealing plug
D	Spring disc with ball
E	Adjusting spring
F	Membrane cover
G	Hexagonal screws + nuts + washers
H	O-ring
I	Lever system
J	Safety nut
K	Spring disc
L	Safety spring
M	Working diaphragm
N	Guide bar
O	Bottom membrane enclosure
P	Lower diaphragm disc
Q	Sealing ring
R	Washers
S	Seal
T	Mounting screws
U	Mounting plates
V	Seat of the seal
W	O-ring
X	Body of the regulator
Y	Hexagon screws + nuts + washers
Z1	Upper washer
Z2	Lower washer

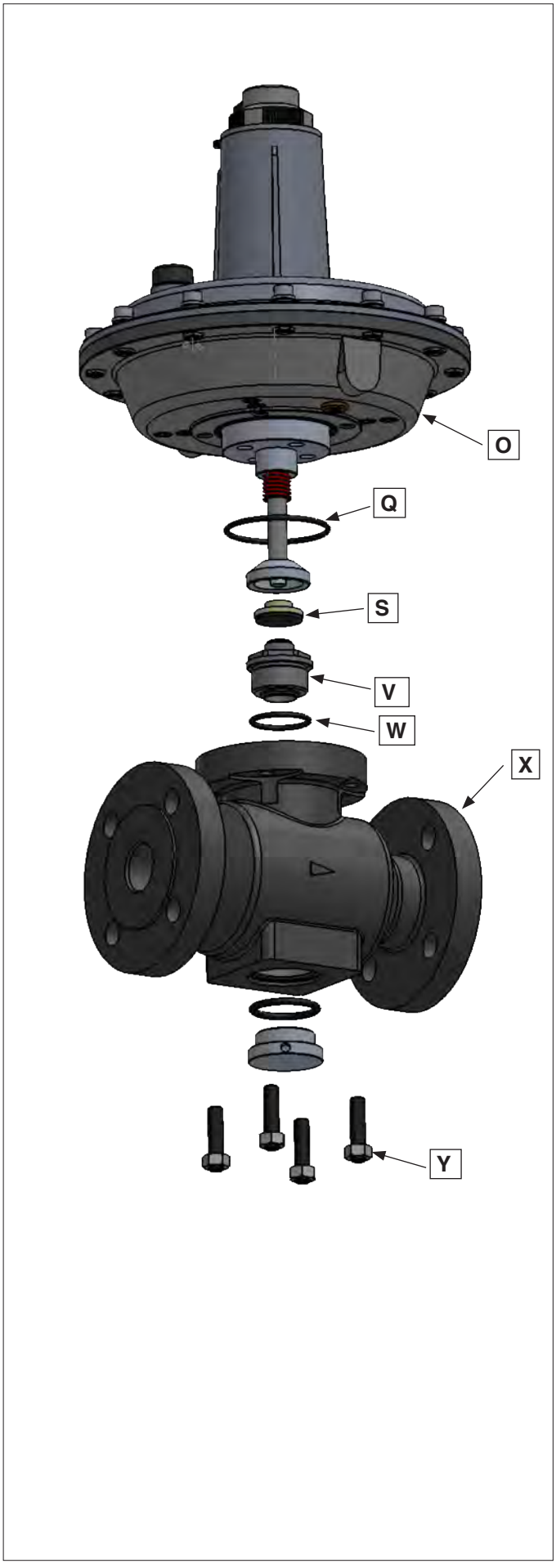
Type UHD



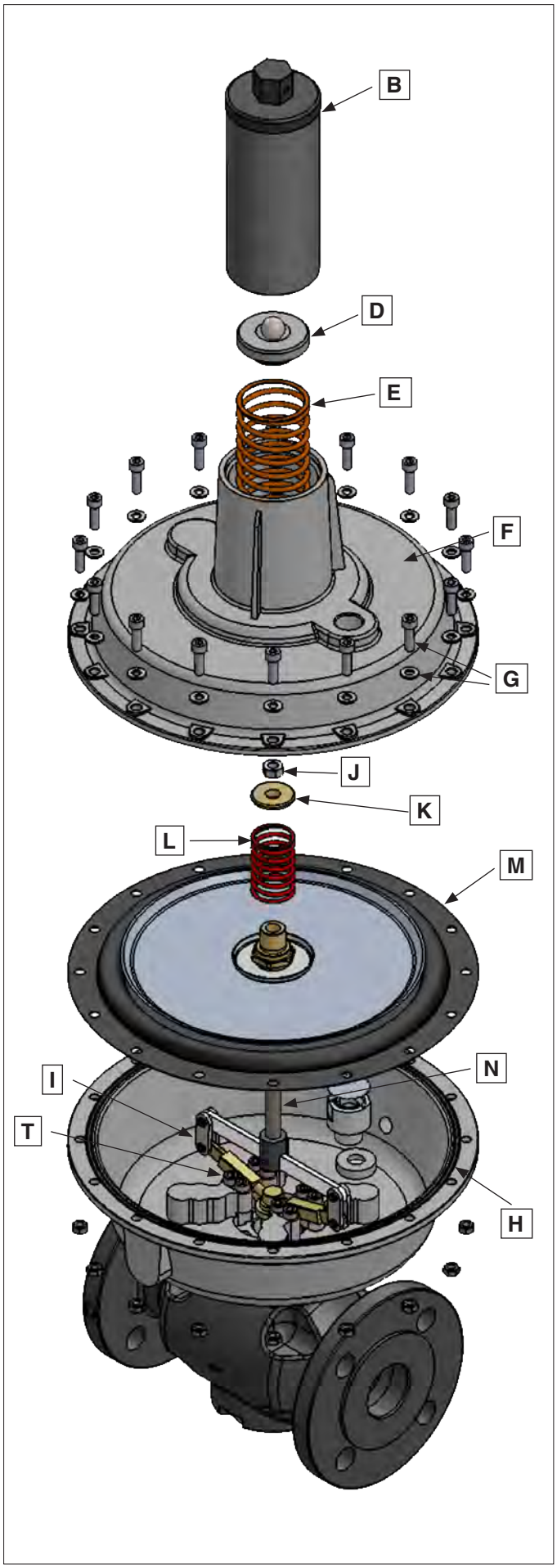


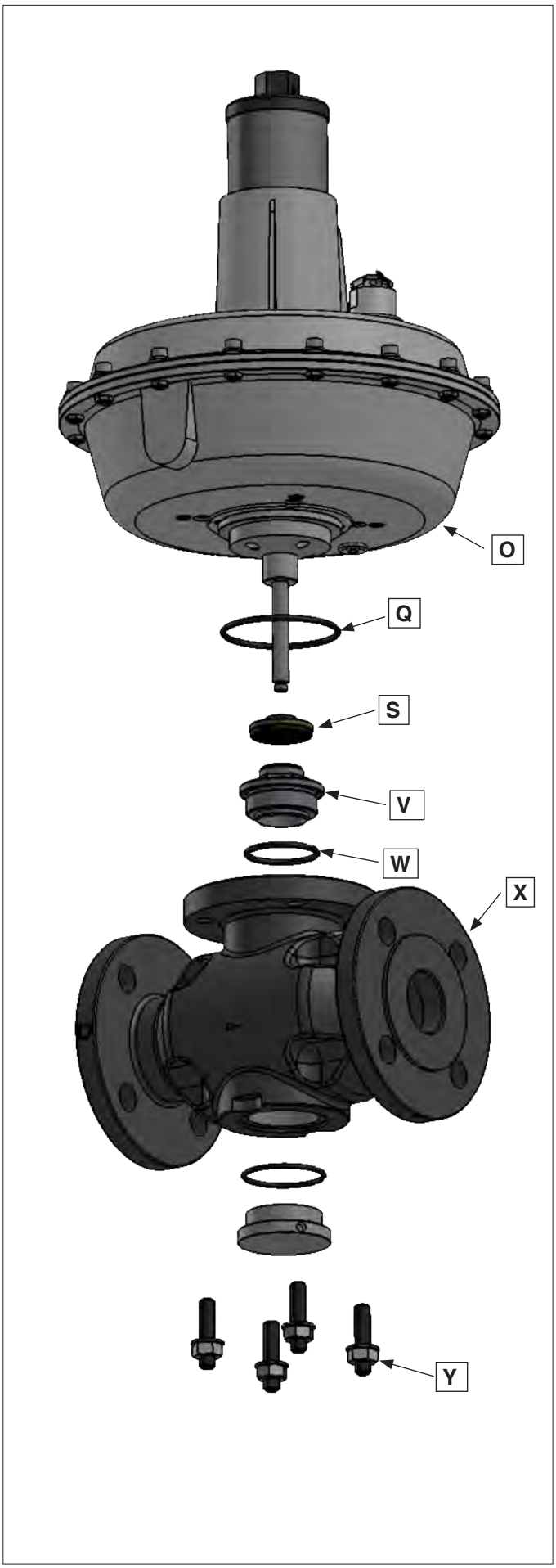
Type ND, MD for 1", 1 1/2" and DN25 and type HD





Type ND, MD for 2", DN40, DN50





14.2 Regulatory maintenance instructions

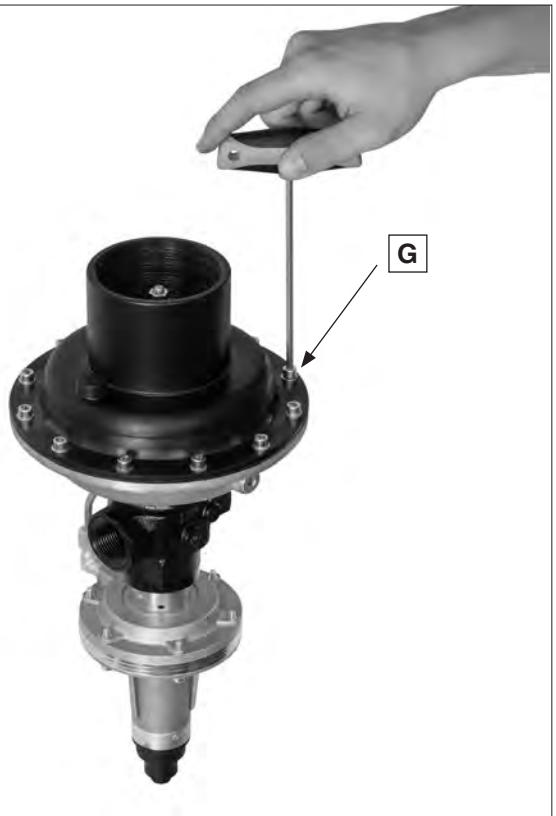
14.2.1 Preparation

Follow the steps shown in section 11.4
to extract the regulating spring.

14.2.2 Replace working membrane

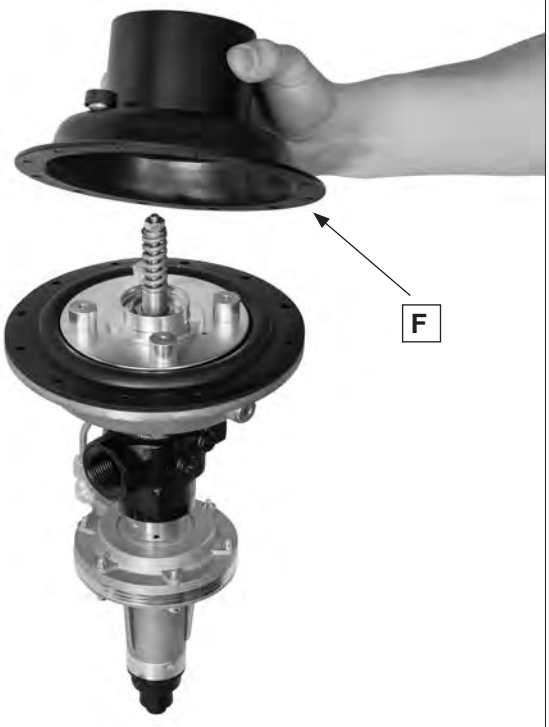
14.2.2.1 Type UHD

1



Loosen the screws **G** using an Allen key **size 5**.

2



Remove the upper membrane cover **F**.

3

Loosen the nut **J** (M 8) using a spanner **size 13**.

4

Remove the disc from the spring **K**.

5

Remove the safety spring **L**.

6

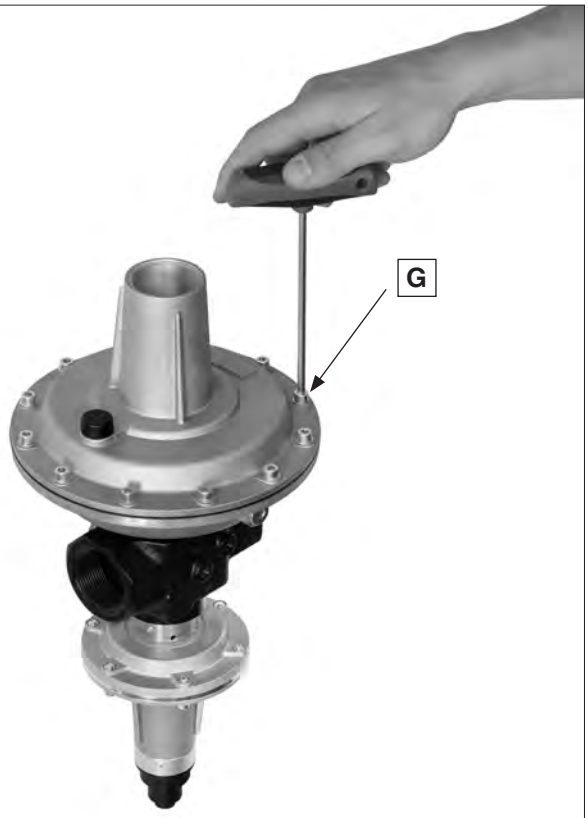
Remove the working membrane **M** from the guide rod **N.** Check the condition of the working membrane. If necessary, use a new working membrane **M** (maintenance set 20 or 24 as appropriate) when reassembling.

14.2.2.2 Type ND, MD for 1", 1 ½", DN25 and type HD

7

Replace the O-ring **H**.

1



Loosen the screws **G** using an Allen key size **5**.

2

Remove the upper membrane cover **F**.

3

Remove the washer **Z2**.

4

Loosen the nut **J** using a spanner size **13** (15 for 1", 1 1/2" and DN25 ND and MD).

5

Remove the safety spring **L**.

6

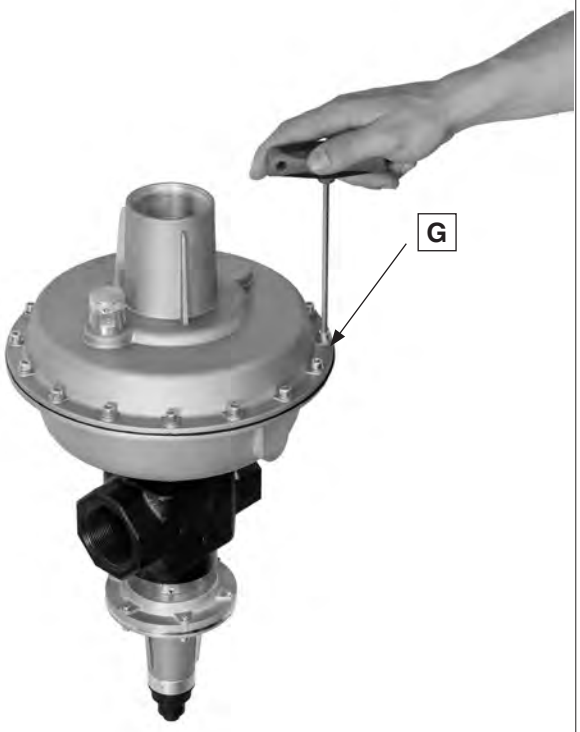
Remove the working membrane **M** from the guide rod **N.** Check the condition of the working membrane. If necessary, use a new working membrane **M** (maintenance set 17, 18, 19 or 23 as appropriate) when reassembling.

7

Replace the O-ring **H**.

14.2.2.3 Type ND, MD for 2", DN40 and DN50

1



Loosen the screws **G** using an Allen key size **5**.

2

Remove the upper membrane cover **F**.

3

Loosen the nut **J** using a spanner size **13**.

4

Remove the disc from the spring **K**.

5

Remove the safety spring **L**.

6

Remove the working membrane **M** from the guide rod **N.** Check the condition of the working membrane. If necessary, use a new working membrane **M** (maintenance set 21 or 22 as appropriate) when reassembling.

7

Replace the O-ring **H**.

14.2.3 Replace valve seat

14.2.3.1 Type UHD

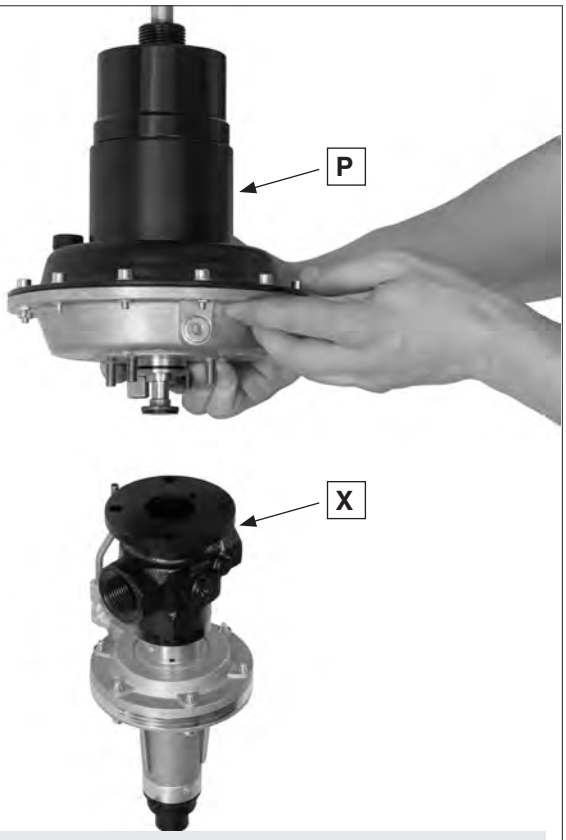
1

Loosen the pulse line outlet of the SAV with a spanner measuring **14**.

2

Remove the screws **O** from the body X using a spanner size **13** (1", 1 1/2", DN25) or **17** (2" DN40, DN50).

3



Remove the regulator hood **P** from the body **X**.

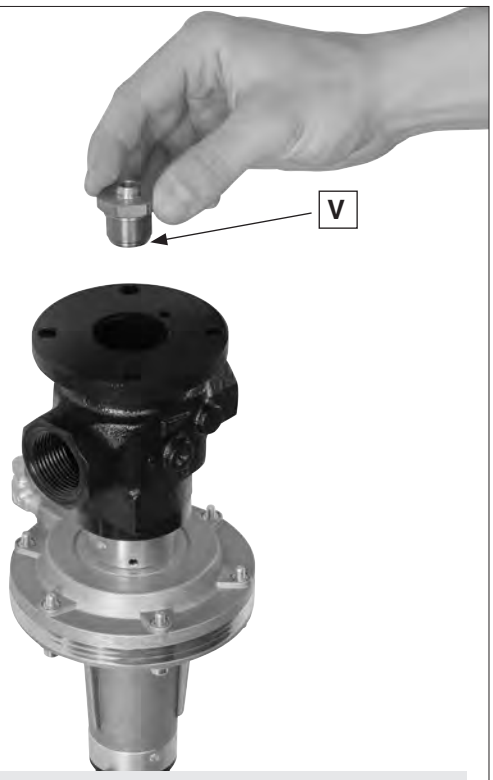
4

Replace the O-ring **Q.**

5

Replace valve seat **V**: Unscrew from the body **X** the valve seat **V** using the socket wrench.

6



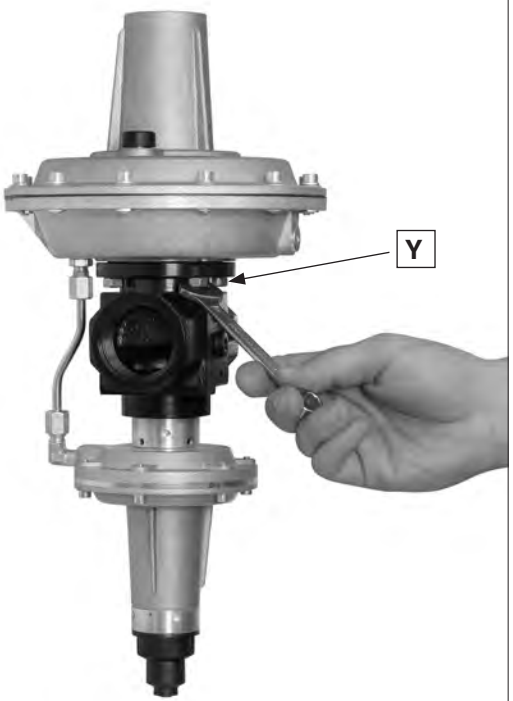
Screw a new valve seat **V** of the desired size with a new O-ring **W** (maintenance set 3, 4, 5, 6 as required) onto the body **X**.

14.2.3.2 Type ND, MD for 1", 1 ½", DN25 and type HD

1

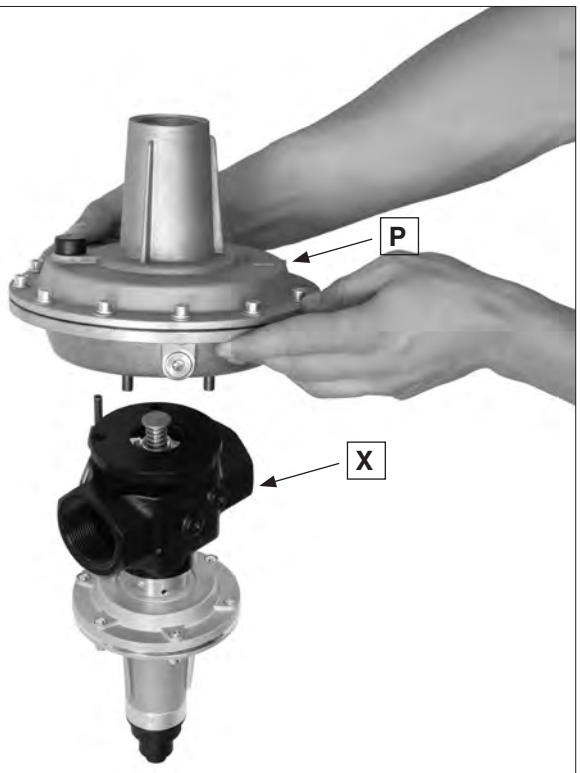
Loosen the pulse line outlet of the SAV with a spanner measuring **14**.

2



Remove the screws **Y** from the body **X** using a spanner measuring **13.**

3



Remove the regulator hood **P** from the body **X**.

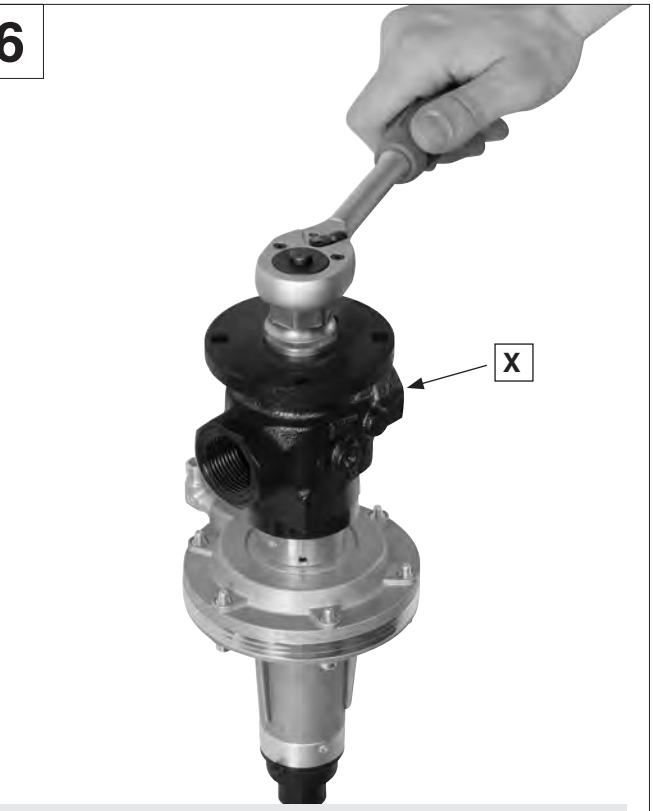
4

Replace the O-ring **Q**.

5

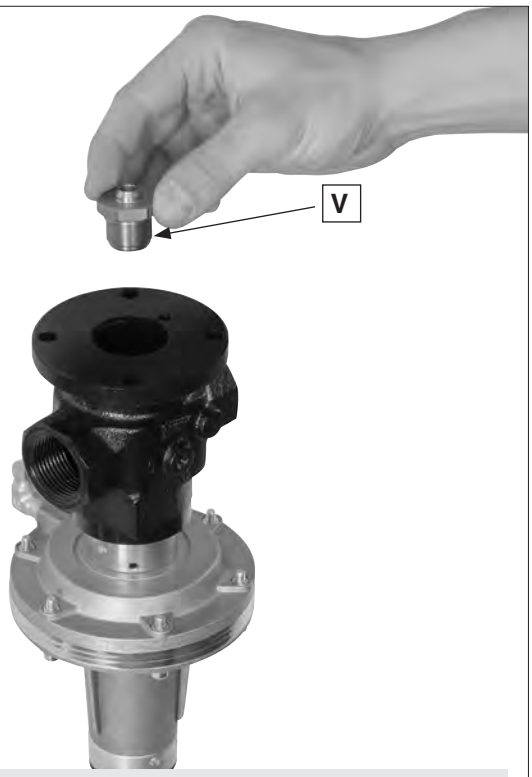
Remove the seal assembly **S**.

6



Replace valve seat **V**: Unscrew from the body **X** the valve seat **V** using the socket wrench.

7



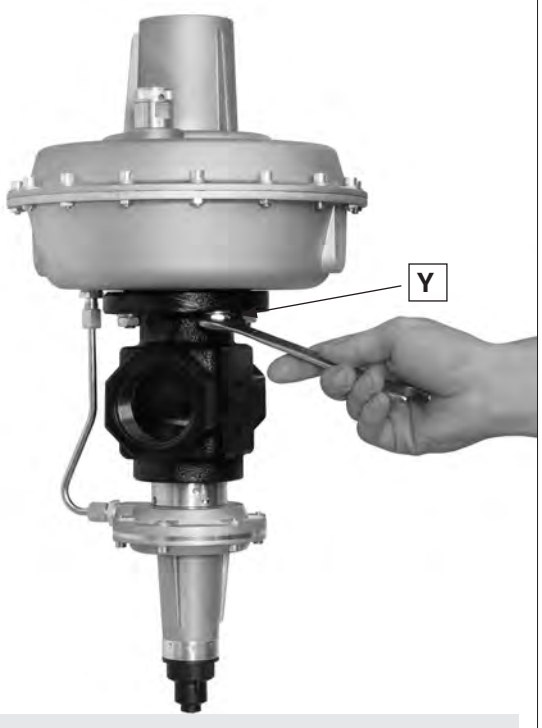
Screw a new valve seat **V** of the desired size with a new O-ring **W** (maintenance set 3 or 4 as required) into the body **X**.

14.2.3.3 Type ND, MD for 2", DN40 and DN50

1

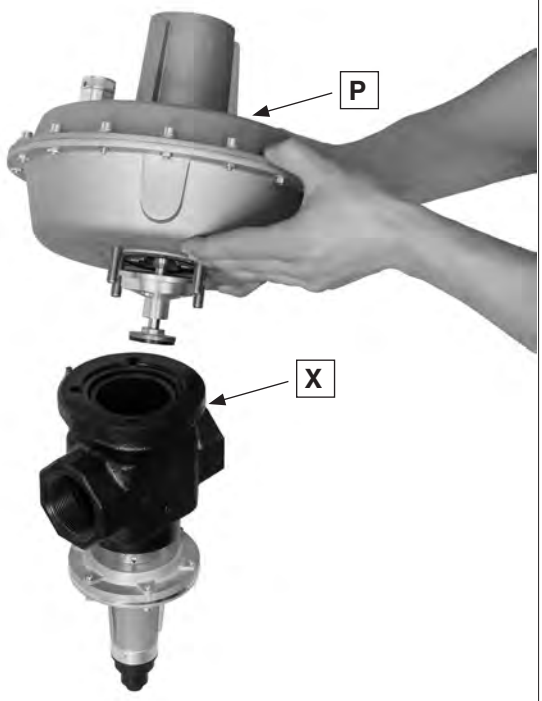
Loosen the pulse line outlet of the SAV with a spanner measuring **14**.

2



Remove the screws **Y** from the body **X** using a spanner measuring 17.

3



Remove the regulator hood **P** from the body **X**.

4

Replace valve seat **V**: Unscrew from the body **X** the valve seat **V** using the socket wrench.

5

Screw a new valve seat **V** of the desired size with a new O-ring **W** (maintenance set 5 or 6 as required) onto the body **X**.

6

Replace the O-ring **Q**.

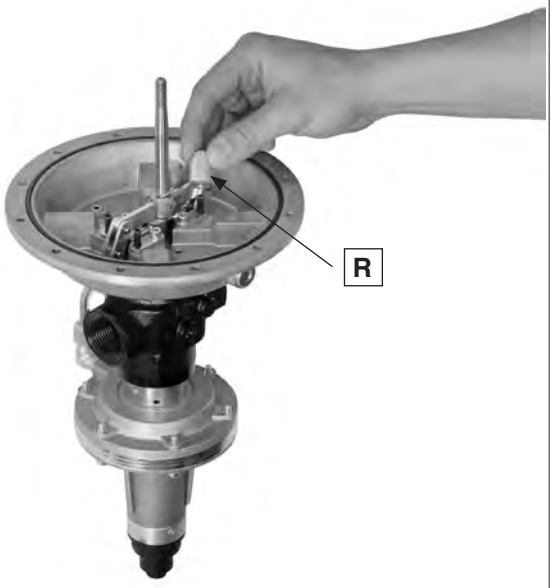
14.2.4 Replace seal

14.2.4.1 Type UHD

1

Loosen the nuts **R**.

2

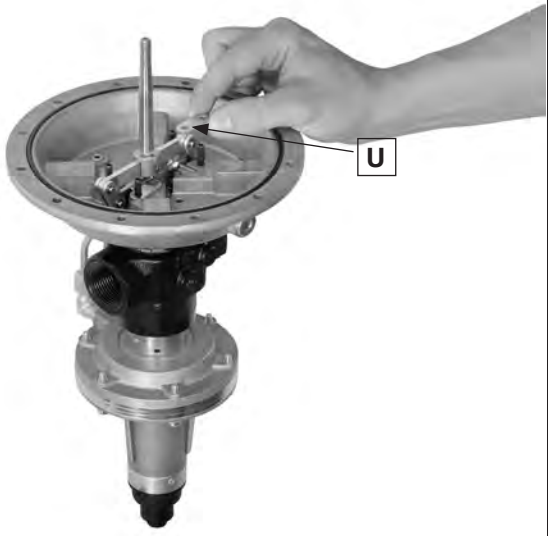


Remove the **R** nuts.

3

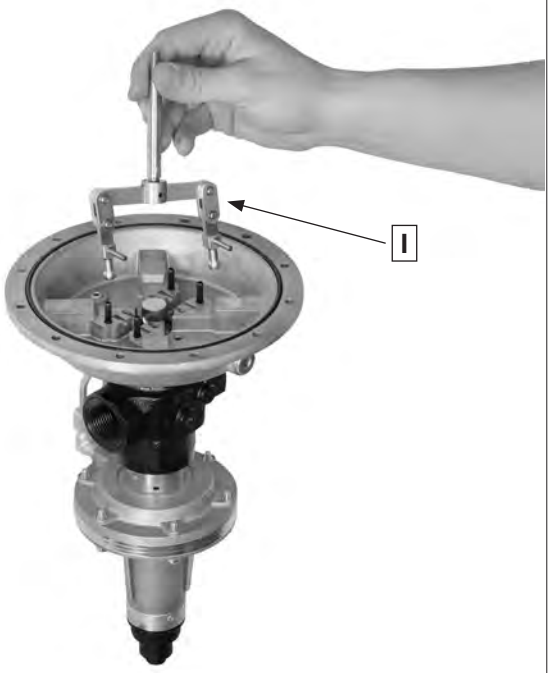
Remove the fastening screws**T** from the lever set with a size **4** Allen key.

4



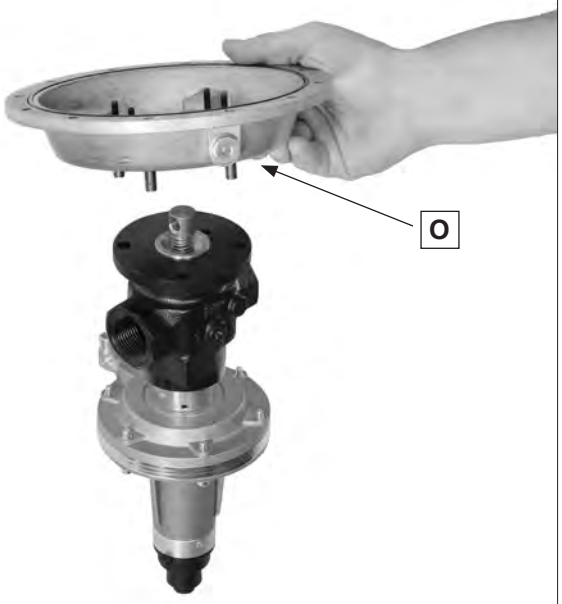
Remove the **U** clamping plates from the lever set.

5



Remove the lever set **I**.

6



Remove the bottom cover **O**.

7

Replace the O-ring **Q**.

8

Replace seal assembly **S** (maintenance set 8, 11, 13 or 16 as required).

14.2.4.2 Type ND, MD for 1", 1 ½", DN25 and type HD

See section 14.2.3.2, steps 1 to 5 and replace with maintenance kit 7, 8, 10, 12, 13 as appropriate).

14.2.4.3 Type ND, MD for 2", DN40 and DN50

1

Remove the fastening screws **T** from the lever set with a size **5** Allen key.

2

Remove the lever set **I** by unlocking the seal.

3

Remove the lever set **I**.

4

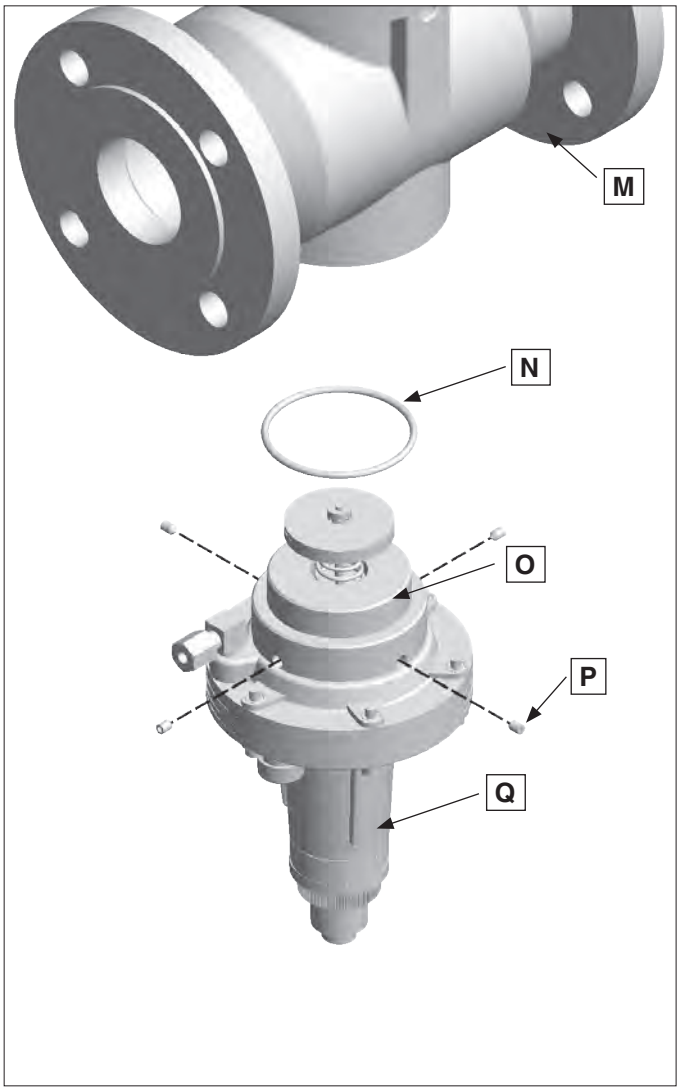
Remove the bottom cover **O**.

5

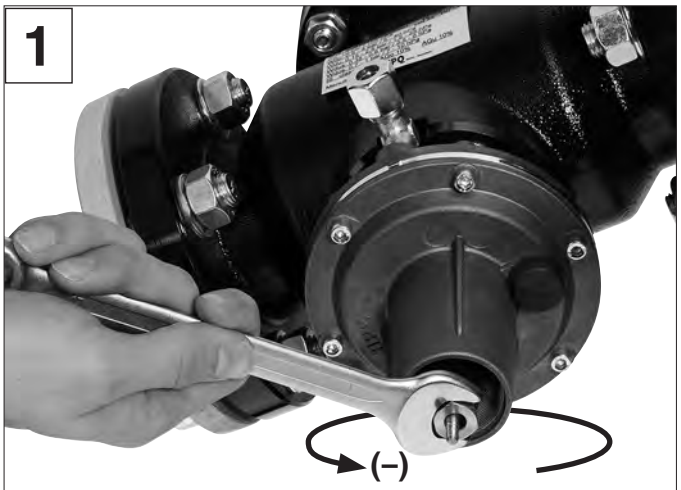
Replace seal assembly **S** (maintenance set 9, 14, 21 or 22 as required).

14.3 Maintenance instructions SAV

Pos.	Designation
A	Diaphragm shell
B	Push rod
C	O-ring diaphragm shell
D	Lower diaphragm disc
E	Working diaphragm
F	Bottom locking pressure adjustment spring
G	Upper diaphragm disc (only in the version HD)
H	Allen screws, 6 units.
I	Spring dome ASE
J	Top locking pressure adjustment screw
K	Bottom locking pressure adjustment screw
L	Protective cap
M	ASE housing
N	O-ring
O	Connecting piece ASE/housing
P	Threaded Allen screws, 4 units.
Q	ASE

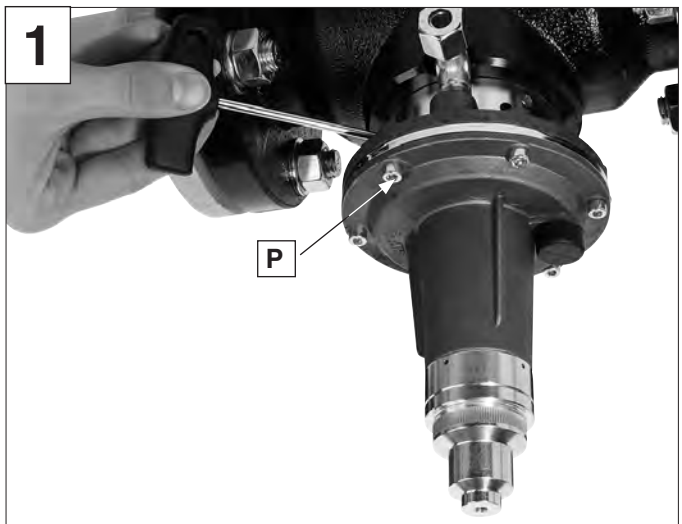


14.3.1 Preparation

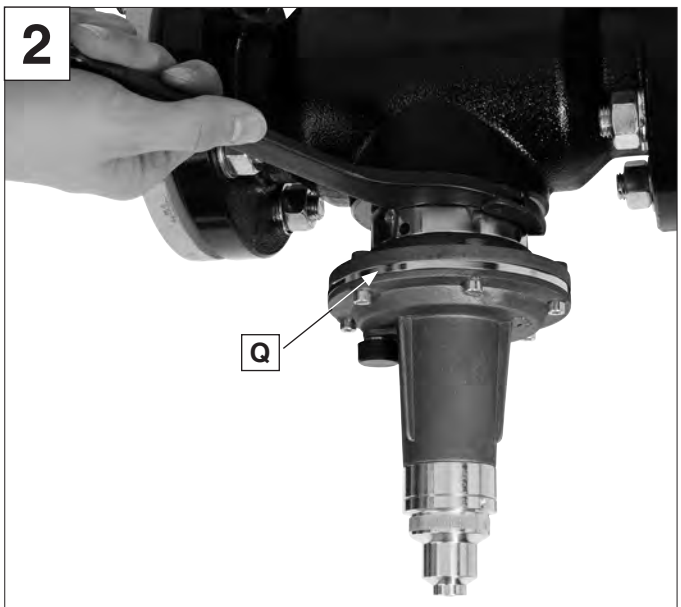


1. Loosen the pulse lines and the vent lines and remove them.
2. Remove the protective cap **L**.
3. Release the adjusting springs at the adjusting screws **J** and **K**.

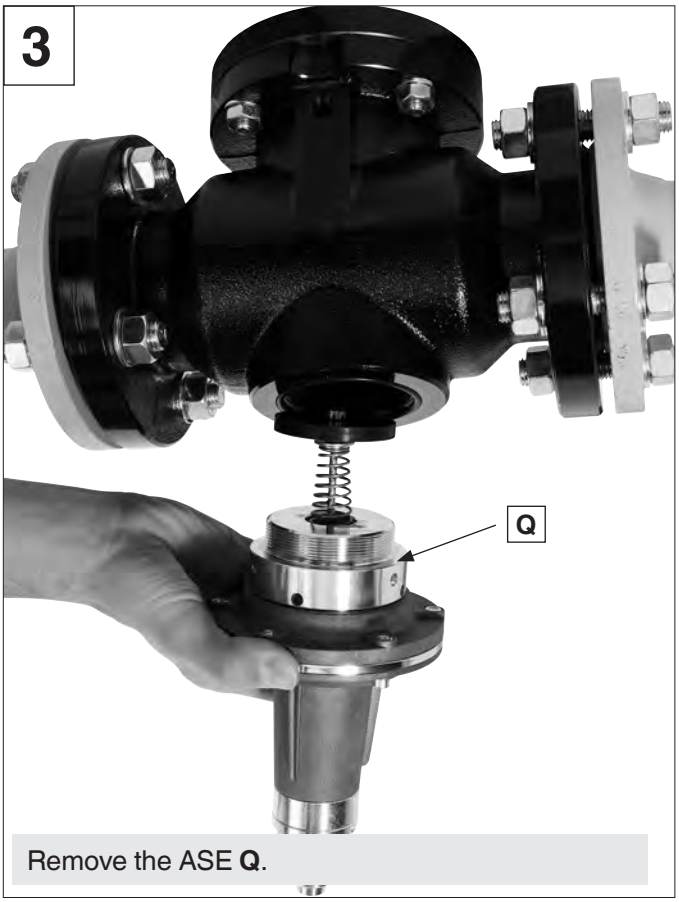
14.3.2 Separate the ASE from the body



Loosen the four hexagonal socket grub screws **P** (M 5x8) using an Allen key **size 2,5**.



Remove the ASE **Q** from the body using a hook wrench **60-90**.



Remove the ASE **Q**.

14.3.3 Mounting the ASE on the body

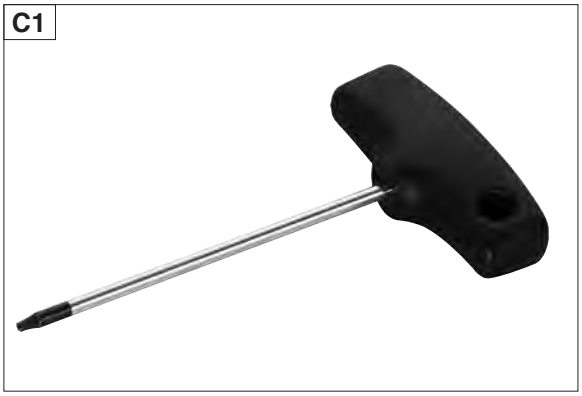
1	Insert a new O-ring **N** (maintenance set 4 or 5) into the groove provided in the housing **M**.
2	Screw the thread of the connecting piece **O** onto the body **M** using a hook wrench **60-90**.
3	Fix the connecting piece **O** of the ASE **Q** using 4 hexagonal socket grub screws **P** (M5x8).

14.4 Tools required

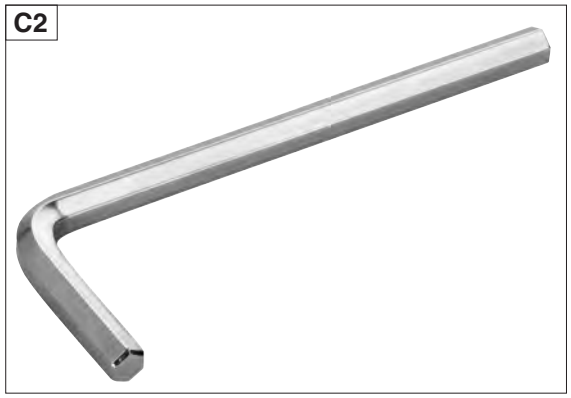
A

B

C1



C2



D

SAV

Work step		Tool designation	Pressure rating	Wrench size		
				DN 25	DN 40	DN 50
1	Loosen the pulse line.	Open-ended wrench (A)	ND/MD/HD	24	24	24
2	Release the adjusting springs.	Socket wrench (B)	ND/MD/HD	17	17	17
		Socket wrench (B)		22	22	22
3	Separate the ASE from the body	Internal hex key (C1)	ND/MD/HD	2.5	2.5	2.5
		Jointed hook wrench with pins according to DIN 1810 (D)		60-90	60-90	60-90
4	Replace the working membrane in the ASE.	Internal hex key (C2)	ND/MD/HD	4	4	4

Regulator

Work step		Tool designation	Pressure rating	Wrench size		
				DN 25	DN 40	DN 50
1	Loosen the pulse line.	Open-ended wrench (A)	ND/MD/HD	24	24	24
2	Release the adjusting springs.	Open-ended wrench (A)	ND/MD/HD	24	24	24
		Jointed hook wrench with pins (D) (UHD)		90-155	90-155	90-155
3	Replace the working membrane.	Internal hex key (C1)	ND/MD/HD	5	5	5
		Open-ended wrench (A)		13	13	13
4	Replace the seal.	Open-ended wrench (A)	ND/MD/HD	13	17	17
5	Replace the valve seat.	Socket wrench (B)	ND/MD/HD	27	46	46

14.5 Leakage test

After carrying out maintenance or repair work, check the device for internal and external leakages.

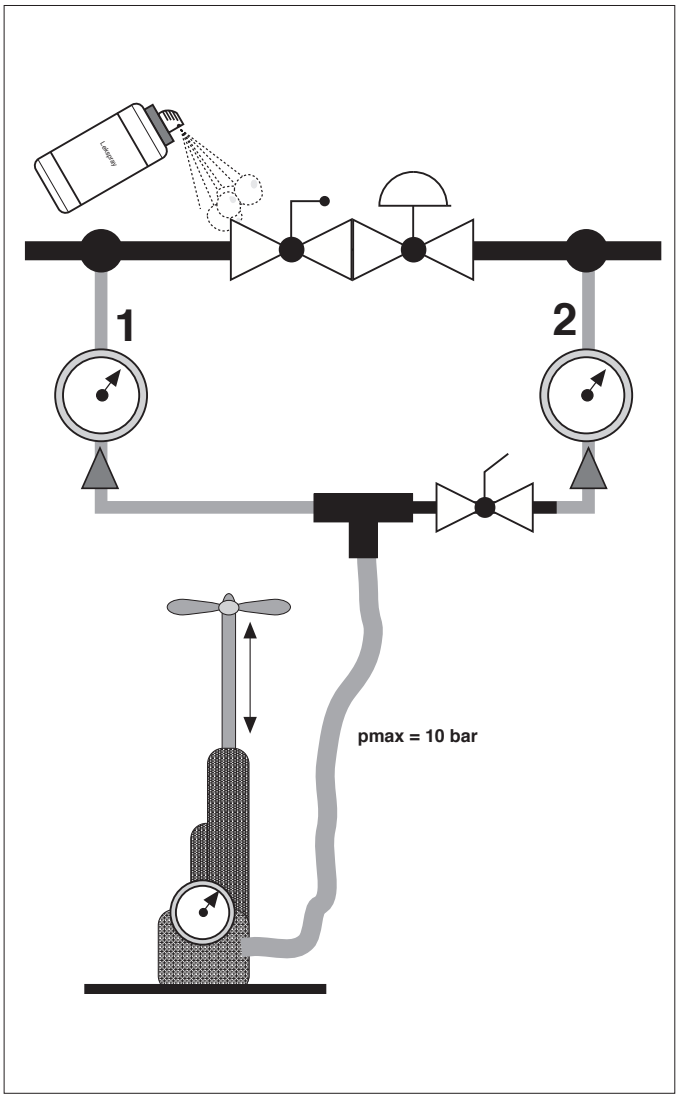
1. Test gas of the leakage test: air or inert gases.
2. Upstream and downstream shut-off valves must be closed.
3. Test pressure > blow-off pressure SBV: Block the line upstream of the SBV.
4. Connect the test section to the test device and apply pressure.
5. Test pressure: 1.1 x system-specific operating pressure. PS maximum of the device (SAV 100… 10 bar/ SAV 60…6 bar). Please take into account the different compressive strengths of the system.
6. Observe the waiting time necessary for the pressure compensation according to the system-specific volume.

External leakage.

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

Internal leakage.

9. Release the pressure in the test section downstream of the device.
10. Monitor the pressure increase on the outlet side. Pressure gauge accuracy 0.1 mbar
11. Once the leakage test has been carried out, open the shut-off 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, condition of the pipelines, etc.
2. The maintenance intervals have to be set by the system operator according to the system requirements.
3. To guarantee the system availability, we recommend **a monthly function check and annual maintenance.**
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 Regulatory list of spare parts

Set	Spare part	Version	Item Nº	Spare part/ illustration
1	TOP COVER ALUMINI CAP	FRM-NOC10010/12/025 ND/MD FRM-NOC10010/15/20/025/040/050 HD	287754	
2	TOP COVER UHD	FRM-NOC100XXX UHD	270396	
3	KIT SHELL M.22 + O-RING	FRM-NOC10010/15 XX	287755	
4	KIT SHELL M.30 + ORING	FRM-NOC100025 XX	287756	
5	KIT SHELL M.45 + ORING	FRM-NOC10020/040XX	287757	
6	KIT SHELL M.56+ORING	FRM-NOC100050 XX	287758	
7	SEAL + O-RING (BODY AND COVER)	FRM-NOC10010/15 ND/MD	287759	
		FRM-NOC10010/15 HD/UHD	287760	
		FRM-NOC10020/040 ND/MD	287761	
		FRM-NOC10020/040 HD	287762	
		FRM-NOC10020/040 UHD	287763	
		FRM-NOC100025 ND/MD	287764	
		FRM-NOC100025 HD/UHD	287765	
		FRM-NOC100050 ND/MD	287766	
		FRM-NOC100050 HD	287767	
		FRM-NOC100050 UHD	287768	

Set	Spare part	Version	Item №	Spare part/ illustration
17	MEMBRANE(1000411) 10/15/25 ND + MEMBRANE JOINT	FRM-NOC10010/15/025 ND	287769	
18	MEMBRANE(1000412) 10/15/25 MD + MEMBRANE JOINT	FRM-NOC10010/15/025 MD	287770	
19	MEMBRANE(1000413) 10/15/25 HD + MEMBRANE	FRM-NOC10010/15/025 HD	287771	
20	MEMBRANE(1000414) 10/15/25 UHD + MEMBRANE JOINT	FRM-NOC10010/15/025 UHD	287772	
21	MEMBRANE(1000421) 20/40/50 ND + MEMBRANE JOINT	FRM-NOC10020/040/050 ND	287773	
22	MEMBRANE(1000422) 20/40/50 MD + MEMBRANE JOINT	FRM-NOC10020/040/050 MD	287774	
23	MEMBRANE(1000413) 20/40/50 HD + MEMBRANE + SPACER JOINT	FRM-NOC10020/040/050HD	287775	
24	MEMBRANE(1000424) 20/40/50 UHD + MEMBRANE JOINT + SPACER JOINT	FRM-NOC10020/040/050UHD	287776	

15. 2 List of spare parts SAV

Set	Spare part	Version	Item Nº	Spare part/illustration
25	Protective cap	FRM-NOC	278005	
26	ASE WITH O-RING	FRM-NOC10010/15ND	287777	
		FRM-NOC10010/15MD	287778	
		FRM-NOC10010/15HD/UHD	287779	
		FRM-NOC10020/040ND	287780	
		FRM-NOC10020/040MD	287781	
		FRM-NOC100025ND	287783	
		FRM-NOC100025MD	287784	
		FRM-NOC100025HD/UHD	287785	
		FRM-NOC100050ND	287786	
		FRM-NOC100050MD	287787	
		FRM-NOC100050HD/UHD	287788	

15.3 Storage conditions

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

The ageing process depends mainly on the following factors:

- Temperature
- Thermal radiation
- Solar radiation
- Humidity
- Relative humidity
- Ozone
- Stress condition of the component

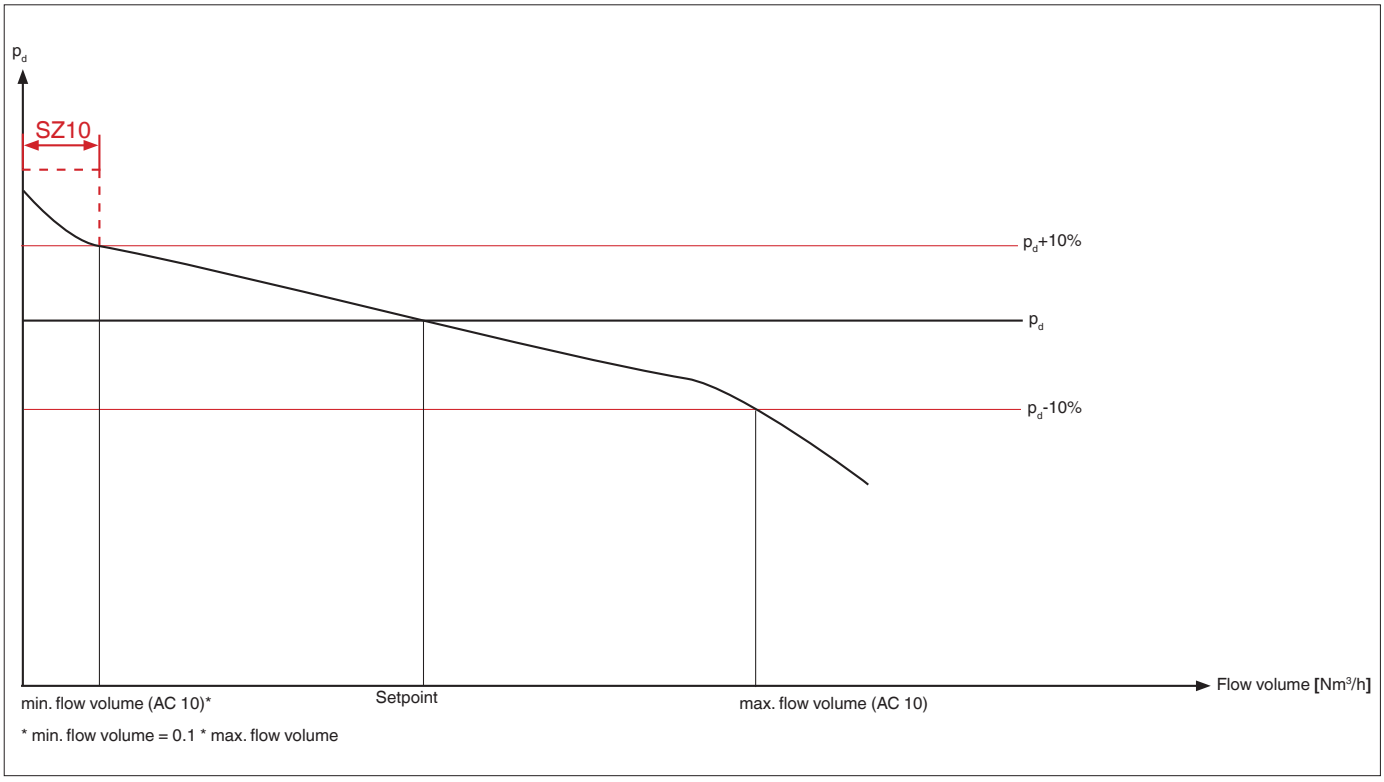
Proper storage

- 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 diagram

16.1 Flow diagrams AC 10 explanation

Flow diagram AC10: Please, refer to document number. 288127 “Flow diagrams FRM-NOC”.



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

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

$$f = \sqrt{\frac{\text{Specific mass of the air}}{\text{Spec. mass of the gas used}}}$$

Type of gas	Density [kg/m³]	dv	f
Natural gas	0.81	0.65	1.24
City gas	0.58	0.47	1.46
GLP	2.08	1.67	0.77
Air	1.24	1.00	1.00

16.2 Flow volume coefficient of the valve K_G

Model	Thread	Ø6	Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø30	Ø35
1", 1 ½"	M22	34	61	87	115	144					
DN25	M30	34	61	87	115	144					
2", DN40	M45			105			279	396	546		
DN50	M56				151		282	412	575	737	900

The flow coefficient of the valve K_G of the FRM is equal to the flow rate with the actuator fully open, with an absolute inlet pressure of $p_{u,\ abs.}$ = 2,01325 bar and an absolute outlet pressure of $p_{d,\ abs.}$ = 1.01325 bar. The value K_G refers to natural gas with a relative density of d = 0.64, corresponding to a standard density of p_n = 0.83 kg/m³ and and a gas inlet temperature of t = 15 °C

The mass flow through a nozzle increases with a constant inlet pressure and a decrease in pressure after the nozzle, until it reaches its maximum when the pressure ratio is critical and thereafter remains constant. With constant outlet pressure, an additional increase in inlet pressure causes an increase in the mass flow through the regulator. For this reason, to calculate the mass flow that flows through a nozzle, two areas are distinguished:

a) sub-critical or critical relative pressure $\frac{p_{d,\ abs.}}{p_{u,\ abs.}} \geq 0.53$

$$K_G = \sqrt{\frac{Q_N}{(p_d+1.013)*(p_u-p_d)}}$$

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

b) super-critical relative pressure $\frac{p_{d,\ abs.}}{p_{u,\ abs.}} < 0.53$

$$K_G = \frac{Q_N{}^*2}{(p_u+1.013)}$$

where
Q_N= regulator power under normal conditions

The Pressure Equipment Directive 97/23/EC 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. This recommendation applies only to heating systems, but not to thermal process applications. DUNGS recommends changing components based on the following table:

Safety relevant component	Designed Lifetime		CEN-Standard
	Operating cycles	Time [years]	
Valve testing systems	250,000	10	EN 1643
Gas 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 (Gas) EN 230 (Oil)
Flame detector UV[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 based on the nominal diameter	10	EN 161
Combined gas/air systems	N/A	10	EN 12067-2 EN 88-1

[1] Decreased efficiency of operating characteristics 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.

Company address:

Karl Dungs GmbH & Co. KG
Karl-Dungs-Platz 1
D-73660 Urbach,
Germany
Telephone +49 (0)7181-804-0
Fax +49 (0)7181-804-166
e-mail: info@dungs.com
Internet: www.dungs.com

Subsidiary:

Karl Dungs, S.L.U.
Av. Can Roqueta 15
Pol. Ind. Can Roqueta
E-08202 Sabadell, Barcelona/Spain
Phone +34-935647550
e-mail: info.e@dungs.com
Internet: www.dungs.com

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