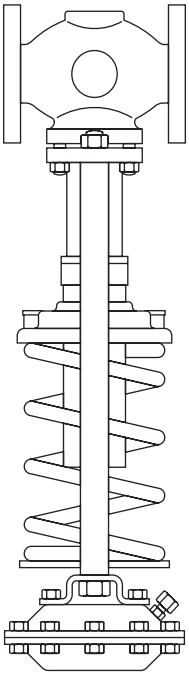
DEP
Excess Pressure Valve
Installation and Maintenance Instructions



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1. Safety information

Safe operation of the unit can only be guaranteed if it is properly installed, commissioned and maintained by a qualified person (see Section 1.11 on page 4) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

1.1 Intended use

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended use/application.

The products listed below comply with the requirements of the EU Pressure Equipment Directive/ UK Pressure Equipment (Safety) Regulations and carry the CE mark when so required.

The products fall within the following Pressure Equipment Directive categories:

Product		Group 1 Gases	Group 1 Gases	Group 1 Liquids	Group 2 Liquids
DEP4	DN15 - DN32	-	SEP	-	SEP
	DN40 - DN100	-	1	-	SEP
DEP7	DN15 - DN40	-	SEP	-	SEP
	DN50 - DN100	-	1	-	SEP
WS4		-	SEP	-	SEP
WS4-3		-	1	-	SEP

i) **The products have been specifically designed for use on steam, water, compressed air, inert industrial gases and certain oils which are in Group 2 of the above mentioned Pressure Equipment Directive. The product's use on other fluids may be possible but, if this is contemplated, Spirax Sarco should be contacted to confirm the suitability of the product for the application being considered.**

ii) **Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.**

iii) **Determine the correct installation situation and direction of fluid flow.**

Note: In the case of liquid service, this product is to be used only on intermittent duty. Applications such as continuous pump recirculation may cause valve and pipework damage due to cavitation which is not covered under the terms of our warranty.

iv) **Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.**

v) **Remove protection covers from all connections and protective film from all name-plates, where appropriate, before installation on steam or other high temperature applications.**

1.2 Access
Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

1.3 Lighting
Ensure adequate lighting, particularly where detailed or intricate work is required.

1.4 Hazardous liquids or gases in the pipeline
Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider; flammable materials, substances hazardous to health, extremes of temperature.

1.5 Hazardous environment around the product
Consider; explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

1.6 The system
Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?
Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.7 Pressure systems
Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.8 Temperature
Allow time for temperature to normalise after isolation to avoid danger of burns.

PTFE components
Within its working temperature range PTFE is a completely inert material, but when heated to its sintering temperature it gives rise to gaseous decomposition products or fumes which can produce unpleasant side effects if inhaled. Smoking should be prohibited in workshops where PTFE is handled because tobacco contaminated with PTFE will give rise to polymer fumes when burnt. It is therefore important to avoid contamination of clothing, especially the pockets, with PTFE and to maintain a reasonable standard of cleanliness by washing hands and removing PTFE particles lodged under the fingernails.

1.9 Tools and consumables
Before starting work ensure that you have suitable tools and/or consumable available. Use only genuine Spirax Sarco replacement parts.

1.10 Protective clothing

Consider whether any protective clothing is required by yourself and/or others in the vicinity to protect against the hazards of, for example, chemicals, high/low temperature, noise, falling objects, and dangers to eyes and face.

1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to these instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

1.12 Handling

Manual handling of Spirax-Sarco products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

PTFE components

Within its working temperature range PTFE is a completely inert material, but when heated to its sintering temperature it gives rise to gaseous decomposition products or fumes which can produce unpleasant side effects if inhaled. Smoking should be prohibited in workshops where PTFE is handled because tobacco contaminated with PTFE will give rise to polymer fumes when burnt. It is therefore important to avoid contamination of clothing, especially the pockets, with PTFE and to maintain a reasonable standard of cleanliness by washing hands and removing PTFE particles lodged under the fingernails.

1.13 Residual hazards

In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature of some products may reach temperatures in excess of 300 °C.

Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions').

1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage if they are inoperative in environments where they may be exposed to temperatures below freezing point.

1.15 Product specific safety information

This product should not be dismantled without first releasing the compression on the central spring.

Care should be excercised when handling gaskets since the stainless steel reinforcing strip can easily inflict cuts.

1.16 Disposal

This product is recyclable. No ecological hazard is anticipated with the disposal of this product providing due care is taken, except:

PTFE components:

- **Can only be disposed of by approved methods, not incineration.**
- **Keep PTFE waste in a separate container, do not mix it with other rubbish, and consign it to a landfill site.**

1.17 Returning products

Customers and stockists are reminded that under UK and EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and safety data sheets relating to any substances identified as hazardous.

Warning

If this product is not used in the manner specified by this IMI, then the protection provided may be impaired.

2. General product information

2.1 Description

The DEP excess pressure valve is a direct acting self-powered valve of robust construction designed to operate under arduous conditions, being ideal for steam and water systems. The valve is controlled by the upstream pressure connected directly to the actuator housing to act on the diaphragm area opposing a 'set' spring force.

Under stable conditions, diaphragm force and spring force are in a state of balance but an increase or decrease in upstream pressure acts against the spring force to open or close the valve. The DEP is 'routine' maintenance free. It is single seat, bellows sealed valve available: **SG iron body** in sizes DN15 to DN100 flanged or **Cast steel body** in sizes DN15 to 100 flanged with upstream set pressure ranges of:

-	0.1 to 16 bar	DN15 to DN40
-	0.1 to 15 bar	DN50 to DN80
-	0.1 to 10 bar	DN100.

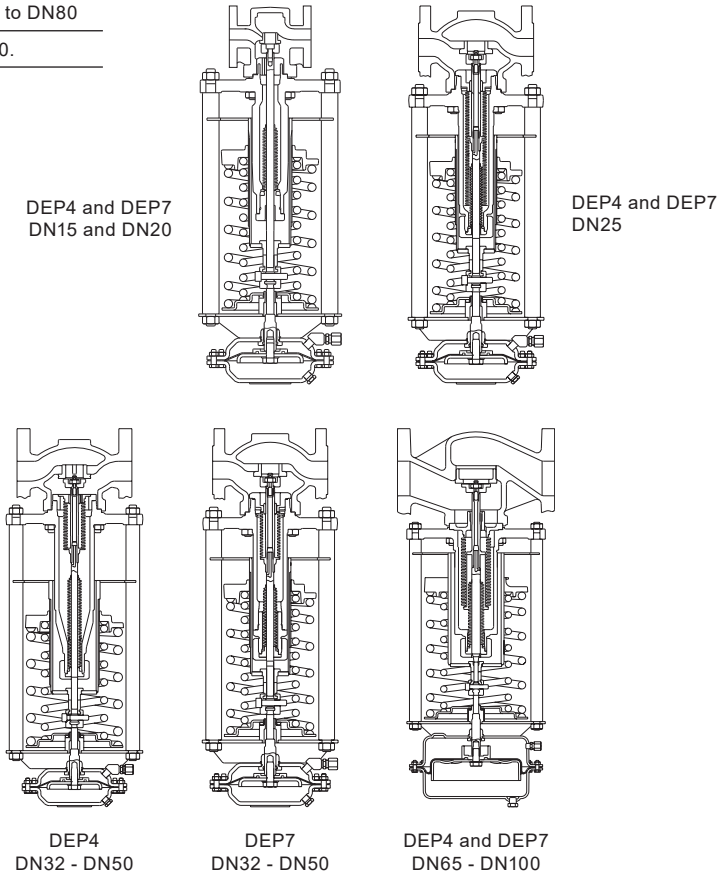
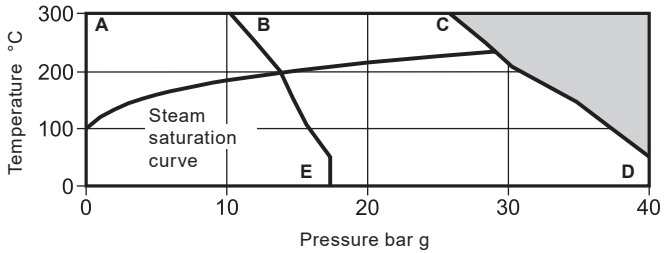


Fig. 1 Cross sectional views of the DEP range of excess pressure valves

2.2 Technical details

Available types	**DEP4 bellows sealed**	Cast steel	Flanged	DN15 - DN100
	DEP7 bellows sealed	SG iron	Flanged	DN15 - DN100
Valve types	Plug balanced design			DN15 and DN20
	Fully Balanced design			DN25 - DN100
Connection types	Flanged EN 1092 PN16, PN25 and PN40 (JIS and ANSI also available on request)			

2.3 Pressure/temperature limits - DEP4



The product **must not** be used in this region.

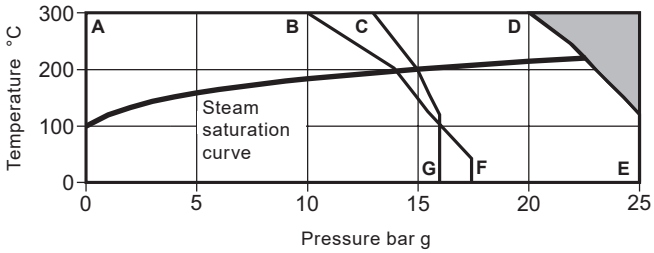
A-C-D Flanged EN 1092 PN40 and ANSI 300

A-B-E Flanged EN 1092 PN16

Note: In the case of liquid service, this product is to be used only on intermittant duty.
Applications such as continuous pump recirculation may cause valve and pipework damage due to cavitation which is not covered under the terms of our warranty.

Body design conditions		PN40
Maximum allowable pressure		40 bar g @ 50 °C
Maximum allowable temperature		300 °C @ 25.8 bar g
Minimum allowable temperature		0 °C
Maximum operating temperature	EPDM diaphragm	125 °C
	Nitrile diaphragm	90 °C
Maximum operating temperature		300 °C
Minimum operating temperature **Note:** For lower operating temperatures consult Spirax Sarco		0 °C
Maximum differential pressure	DN15 to DN50	25 bar
	DN65 to DN100	20 bar
Designed for a maximum cold hydraulic test pressure of:		60 bar g
Note: With internals fitted, test pressure must not exceed:		40 bar g

2.4 Pressure/temperature limits - DEP7



The product **must not** be used in this region.

A-C-D Flanged EN 1092 PN40 and ANSI 300

A-B-E Flanged EN 1092 PN16

Note: In the case of liquid service, this product is to be used only on intermittant duty.
Applications such as continuous pump recirculation may cause valve and pipework damage due to cavitation which is not covered under the terms of our warranty.

Body design conditions		PN25
Maximum allowable pressure		25 bar g @ 100 °C
Maximum allowable temperature		300 °C @ 17.5 bar g
Minimum allowable temperature		0 °C
Maximum operating temperature	EPDM diaphragm	125 °C
	Nitrile diaphragm	90 °C
Maximum operating temperature		300 °C
Minimum operating temperature **Note:** For lower operating temperatures consult Spirax Sarco		0 °C
Maximum differential pressure	DN15 to DN50	25 bar
	DN65 to DN100	20 bar
Designed for a maximum cold hydraulic test pressure of:		38 bar g
Note: With internals fitted, test pressure must not exceed:		25 bar g

2.5 K_v values

Valve size	DN15	DN20	DN25	DN32	DN40	DN50	DN65	DN80	DN100
Maximum K_v	3.4	6.5	11.4	16.4	24	40	58	92	145

For conversion:
C_v (UK) = K_v x 0.963
C_v (US) = K_v x 1.156

2.6 Upstream pressure range and actuator housing PN rating

Note: Maximum actuator continuous working temperature with EPDM diaphragm 125 °C, with Nitrile diaphragm 90 °C

	Pressure bar (psi)					
Range	**DN15 - DN40**	**DN50 - DN80**	**DN100**	**Spring colour**	**Actuator type**	**PN rating**
1	0.1 - 0.5	0.1 - 0.3	0.1 - 0.3	Yellow	11 and 11N	**2.5**
2	0.2 - 0.8	0.2 - 0.5	0.2 - 0.5	Yellow	12 and 12N	**2.5**
3	0.2 - 1.7	0.4 - 1.3	0.4 - 1.0	Blue	13 and 13N	**6.0**
4	1.4 - 3.4	1.0 - 2.6	0.8 - 2.5	Blue	14 and 14N	**16.0**
5	3.2 - 7.5	2.3 - 5.5	2.3 - 5.0	Blue	15 and 15N	**25.0**
6	7.0 - 16.0	5.0 - 15.0	0 4.0 - 10.0	Red	15 and 15N	**25.0**

2.7 Materials (continued on page 12)

No.	Part			Material	
1	Body	DEP 7	DN15 to DN50	SG iron	DIN 1693 GGG 40.3
			DN65 to DN100	SG iron	ENG JS 400-18-L
		DEP 4		Cast steel	GP 240 GH
2	Bonnet	DEP 7		SG iron	DIN 1693 GGG 40.3
		DEP 4		Cast steel	DIN 17245 GSC25
3	Valve seat			Stainless steel	BS 970 431 S29
4	Valve seat gasket		DN15	Mild steel	
			DN20 and DN25	Reinforced exfoliated graphite	
			DN32 to DN50		
5	Valve head			Stainless steel	BS 970 431 S29
6	Valve head screw		DN15 and DN20	Stainless steel	BS 6105 A2
7	Valve head seal			Arlon 1555	
8	Bush		DN15 and DN20	Stainless steel	BS 970 431 S29
9	Bush (part of item 10)		DN25 to DN100	Stainless steel	BS 970 431 S29
10	Balancing bellows assembly		DN25 to DN100	AISI 316L	
11	Balancing bellows gasket		DN25 to DN100	Reinforced exfoliated graphite	
12	Bonnet gasket			Reinforced exfoliated graphite	
13	Bonnet nuts			Steel	DIN 267 Pt13 Gr. 8
14	Bonnet studs			Steel	DIN 267 Pt13 Gr. 8.8
	DN15 to DN25	M10 x 30 mm,		DN50 and DN65	M12 x 35 mm
	DN32 and DN40	M10 x 35 mm,		DN80 and DN100	M16 x 40 mm
15	Pillars			Steel zinc plated	BS 970 230 M07
16	Pillar nuts			Steel zinc plated	BS 3692 Gr. 8
17	Spring adjuster			Cast iron zinc plated	DIN 1691 GG25
18	Spring(s)			Chrome vanadium	
19	Bearing bush (part of item 20)			PTFE/ steel composite	
20	Sealing bellows assembly			Stainless steel	AISI 316L
21	Sealing bellows gasket		DN15 and DN20	Stainless steel 'S' type	
			DN25 to DN100	Reinforced exfoliated graphite	
22	Clamp nut		DN25 to DN100	Steel zinc plated	BS 970 230 M07
23	Adaptor	DEP 7	DN25 to DN50	Stainless steel	BS 970 431 S29

Applies to older valves

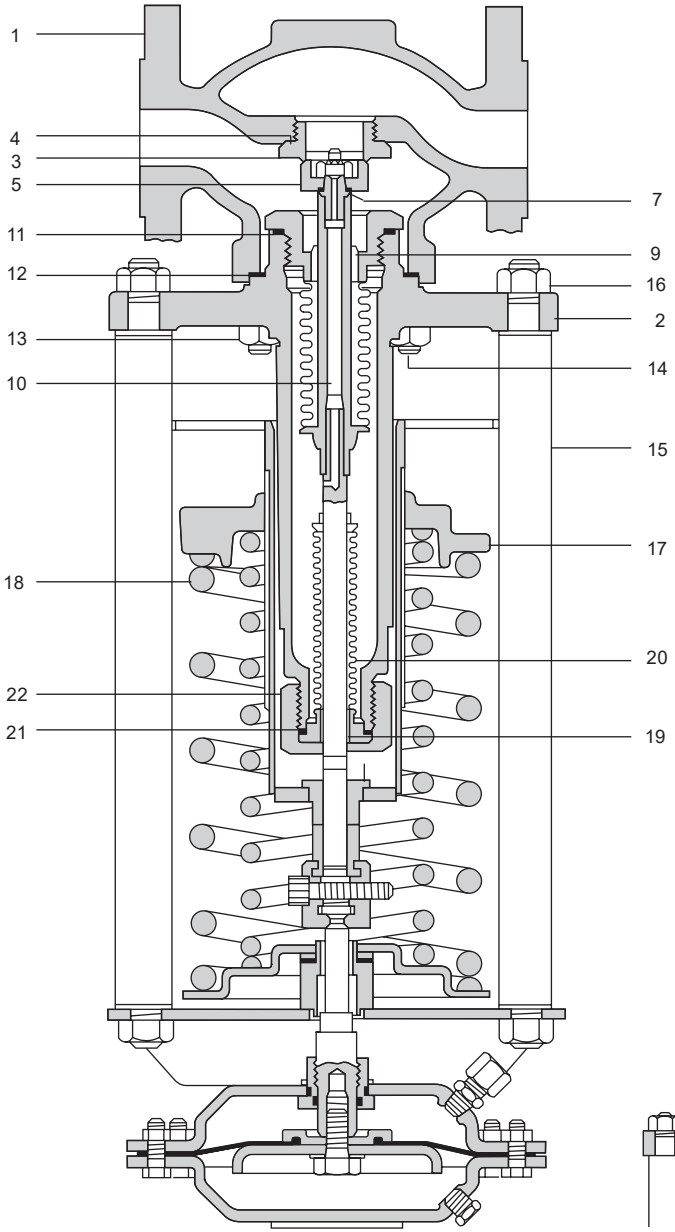
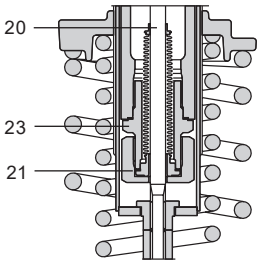


Fig. 2a DN25 to DN50



DEP7
DN25 to DN50

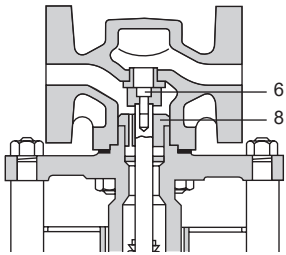


Fig. 2b DN15 and DN20

2.7 Materials (continued on page 14)

No.	Part			Material	
24	Adaptor gasket	DEP 7	DN25 to DN50	Reinforced exfoliated graphite	
25	Lock-nut			Steel zinc plated	BS 970 230 M07
26	Spring plate			Steel zinc plated	BS 1449 Pt1 HR14
27	Needle bearing			Steel	
28	Setting nut			Steel zinc plated	BS 970 230 M07
29	Bearing locator			Steel zinc plated	BS 970 230 M07
30	Adjuster sleeve			Steel zinc plated	

Applies to older valves

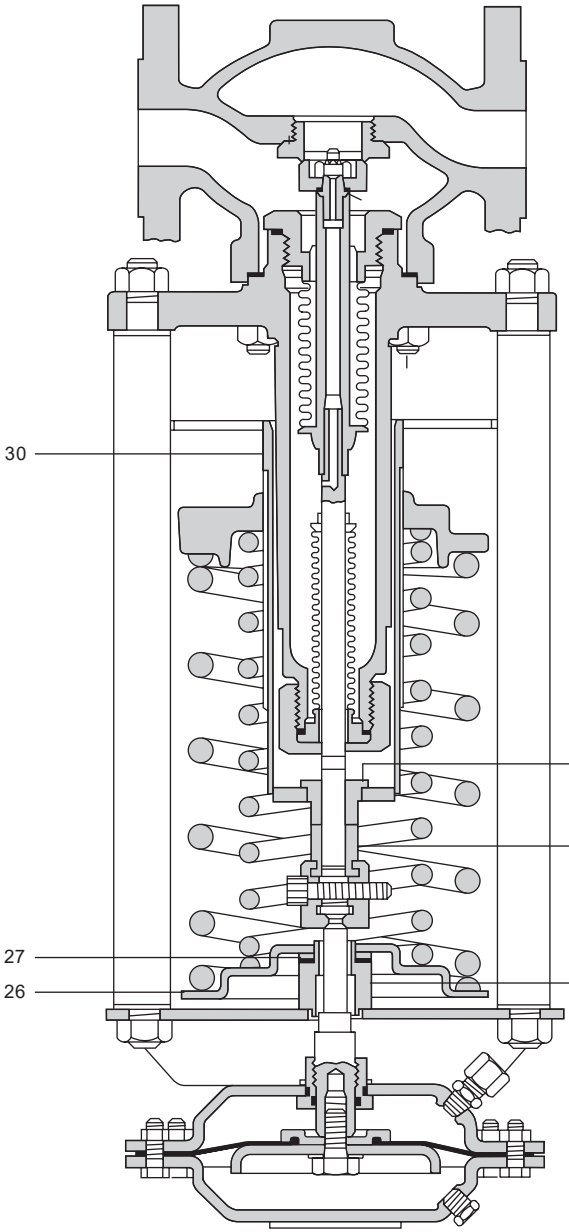
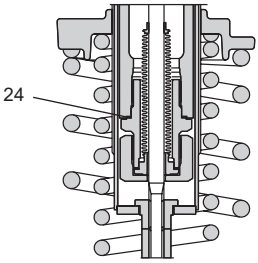


Fig. 2a DN25 to DN50



DEP7
DN25 to DN50

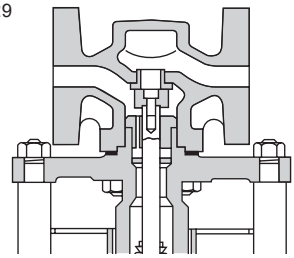


Fig. 2b DN15 and DN20

2.7 Materials (continued from page 12)

No.	Part		Material	
31	Mounting plate		Steel zinc plated	BS 1449 Pt1 HR14
32	Housing	Types 11(N) to 14(N)	Steel	DIN 1514 St W24
		Type 15(N)	Steel	BS EN 10025 S355 J2G3
33	Housing screws	Types 11(N) and 12(N)	Steel zinc plate	BS 3692 Gr. 5.6
		Types 13(N),14(N) and15(N)	Steel zinc plate	BS 3692 Gr. 8.8
34	Housing nuts	Types 11(N) and 12(N)	Steel zinc plate	BS 3692 Gr. 5.6
		Types 13(N),14(N) and 15(N)	Steel zinc plate	BS 3692 Gr. 8
35	Spindle guide		Stainless steel	BS 970 431 S29
36	Diaphragm		EPDM fabric reinforced	
	Diaphragm suffix 'N'		Nitrile fabric reinforced	
37	Hex. headed bolt		Stainless steel	BS 6105 A2
38	Sealing washer		Fibre	
39	Diaphragm clamp		Stainless steel	ASTM A351 CF8M
40	Piston		Carbon steel zinc plated	BS 1449 Pt1 HR14
41	Spindle		Carbon steel zinc plated	BS 970 230 M07
42	Mounting nuts		Steel zinc plated	BS 3692 Gr. 8
43	Coupling		Steel zinc plated	
44	Thread insert	DN15 and DN20	Stainless steel	DTD 734
45	Self-locking nut	DN25 to DN100	Steel zinc plated	BS 1449 CR4
46	Washer (type 12 only)		Steel zinc plated	BS 1449 CR4
47	Circlip		Steel zinc plated	
48	Spindle seal 'O' ring		EPDM	
	Spindle seal 'O' ring suffix 'N'		Nitrile	
49	Bearing bush		PTFE/steel composite	
50	Housing seal 'O' ring		EPDM	
	Housing seal 'O' ring suffix 'N'		Nitrile	
51	Vent plug		Plastic	
52	Coupling clamp		Steel zinc plated	ASTM A216 Gr. WCB
53	Spring		Spring steel	BS 5216 Gr. M4
54	Clamp screw		Steel zinc plated	BS 4168 Gr.12.9
55	Clamp plate	DN65 to DN100 DEP4 only)	Stainless steel	ASTM A276 316
56	Clamp plate gasket	(DN65 to DN100 DEP4 only)	Reinforced exfoliated graphite	

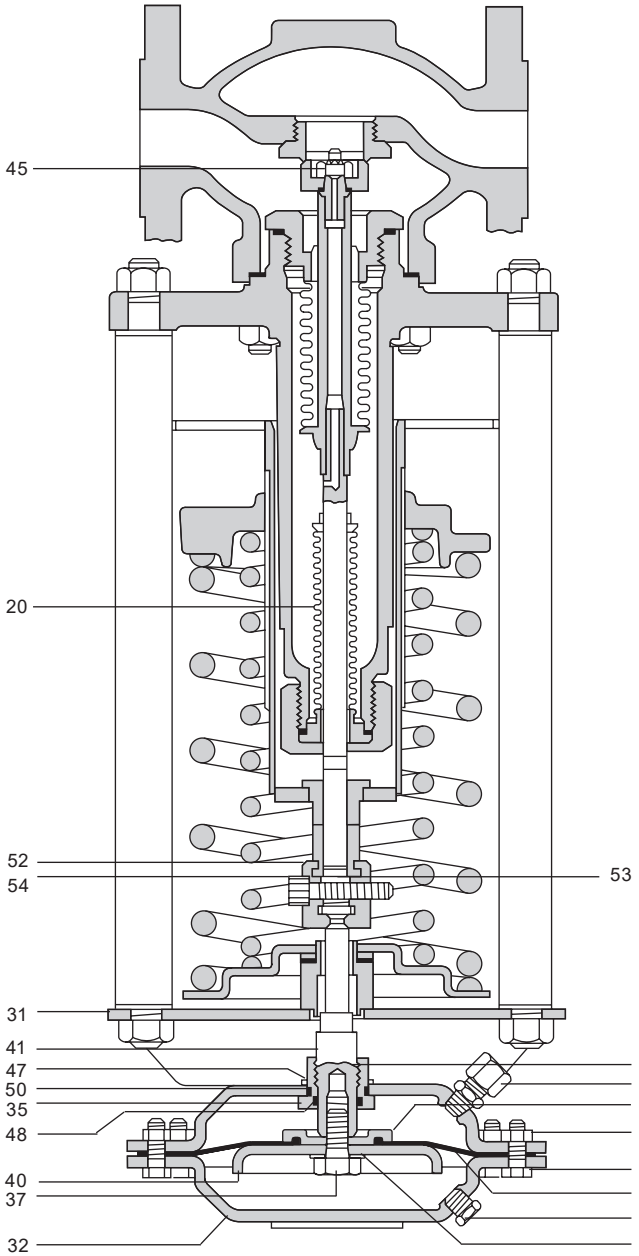


Fig. 2c DN25 - DN50 (Parts 42 and 46 not shown)

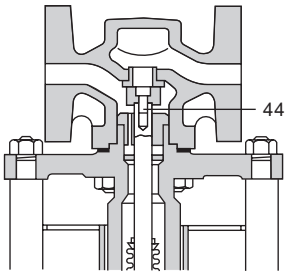


Fig. 2d DN15 and DN20

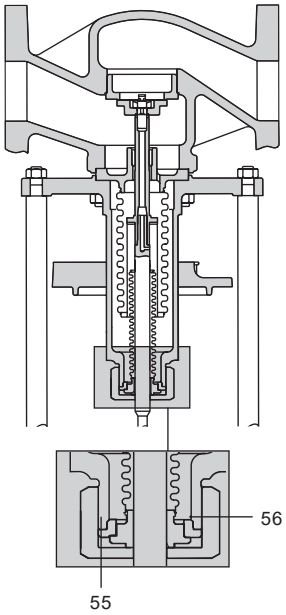


Fig. 2e DN65 - DN100

2.8 Water seal pot - WS4/WS4-3 (optional extra)

Technical details

Available types	**WS4**	The WS4 is for normal applications up to a volume of 1 litre.
	WS4-3	The WS4-3 has a larger 3 litre volume and is recommended where there is rapid fluctuation of pressure or load.

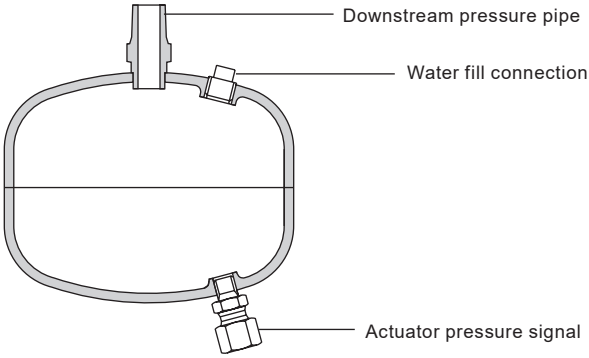


Fig. 3 Water seal pot - WS4/WS4-3

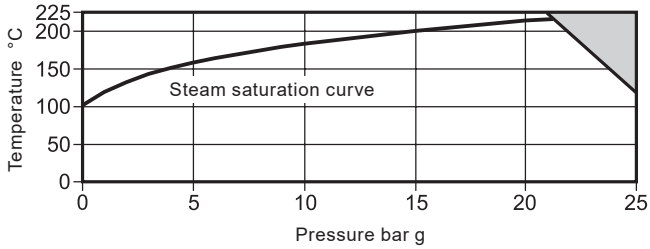
2.8.1 Connection sizes

Inlet	Screwed	**WS4**	⅜ BSP Male BS 21
			⅜ NPT Male
	Screwed	**WS4-3**	½ BSP Male BS 21
			½ NPT Male
	Butt weld	**WS4**	DN10
		WS4-3	DN15
Outlet	Screwed	⅛" BSP Female BS 21 with 8 mm compression fitting.	

2.8.2 Materials

Housing	Carbon steel

2.9 Pressure/temperature limits - WS4/WS4-3



The product **must not** be used in this region.

Body design conditions		PN25
Maximum design pressure		25 bar g @ 100 °C
Maximum design temperature		225 °C @ 21 bar g
Minimum design temperature		0 °C
Maximum operating pressure for saturated steam service		21 bar g
Maximum operating temperature		225 °C @ 21 bar
Minimum operating temperature **Note:** For lower operating temperatures consult Spirax Sarco		0 °C
Maximum differential pressure	DN15 to DN50	25 bar
Designed for a maximum cold hydraulic test pressure of:		40 bar g
Note: With internals fitted, test pressure must not exceed:		25 bar g

2.10 DEP nomenclature/selection

Connections size	DN15, DN20, DN25, DN32, DN40,DN50, DN65, DN80 and DN100			**DN25**
Type	DEP = Direct acting excess pressure valve			**DEP**
Body material	4 = Cast steel			**4**
	7 = SG iron			
Stem seal	B = Bellows			**B**
Pressure range Actuator type/ spring colour	**DN15 to DN40**	1 = 0.1 - 0.5 bar g	Type 11, 11N/Yellow	**4**
		2 = 0.2 - 0.8 bar g	Type 12, 12N/Yellow	
		3 = 0.5 - 1.7 bar g	Type 13, 13N/Blue	
		4 = 1.4 - 3.4 bar g	Type 14, 14N/Blue	
		5 = 3.2 - 7.5 bar	Type 15, 15N/Blue	
		6 = 7.0 - 16 bar g	Type 15, 15N/Red	
	DN50 to DN80	1 = 0.1 - 0.3 bar g	Type 11, 11N/Yellow	
		2 = 0.2 - 0.5 bar g	Type 12, 12N/Yellow	
		3 = 0.4 - 1.3 bar g	Type 13, 13N/Blue	
		4 = 1.0 - 2.6 bar g	Type 14, 14N/Blue	
		5 = 2.3 - 5.5 bar g	Type 15, 15N/Blue	
		6 = 5.0 - 15 bar g	Type 15, 15N/Blue	
	DN 100	1 = 0.1 - 0.3 bar g	Type 11, 11N/Yellow	
		2 = 0.2 - 0.5 bar g	Type 12, 12N/Yellow	
		3 = 0.4 - 1.0 bar g	Type 13, 13N/Blue	
		4 = 0.8 - 2.5 bar g	Type 14, 14N/Blue	
		5 = 2.3 - 5.0 bar g	Type 15, 15N/Blue	
		6 = 4.0 - 10 bar g	Type 15, 15N/Red	
Connection type	Flanged = DN, ANSI or JIS			**PN40**
Water seal pot (if required)	WS4 or WS4-3	connection options	BSP	**WS4 (BSP)**
			NPT	
			Butt weld	

DN25	**DEP**	**4**	**B**	**4**	**PN40**	**WS4 (BSP)**

How to order example: DN25 DEP4B4, EN 1092 PN40, plus WS4 (BSP) water seal pot.

3. Installation

Note: Before actioning any installation observe the 'Safety information' in Section 1.

In the case of liquid service, this product is to be used only on intermittent duty. Applications such as continuous pump recirculation may cause valve and pipework damage due to cavitation which is not covered under the terms of our warranty.

3.1 General information

The valve should be installed vertically into a horizontal pipeline.
For operating temperatures below 125 °C the valve may be installed vertically upwards or downwards (see Figure 4).
For operating on steam or temperatures above 125 °C the valve must be installed vertically downwards with the spring/actuator below the pipework with a water seal pot fitted on the upstream control signal line to the actuator, (as shown in Figure 5). Care should be taken to install the valve correctly as indicated by the direction of flow arrow on the valve body.

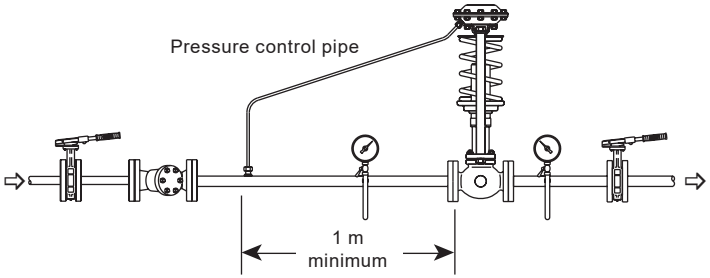


Fig. 4 Typical installation for upstream temperatures below 125 °C the valve can alternatively be mounted vertically upwards

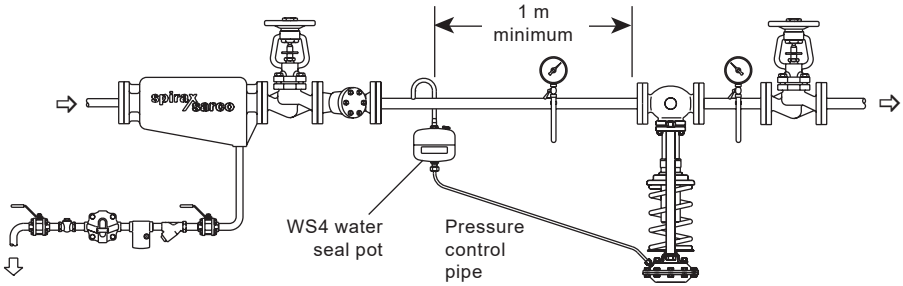


Fig. 5 Typical installation for upstream temperatures above 125 °C

3.2 Pressure control pipe

The valve actuator signal connection must be piped directly to the upstream side. To provide a good control signal the upstream sensing point should be positioned a minimum of 1 metre away from the valve or change in pipework direction.
It is recommended that the actuator signal pipe should be 8 mm diameter copper or stainless steel of 1 m minimum length.

3.3 Preventing dirt

Before installing the valve the system pipework should be flushed out to remove any residual dirt or scale that may be present. The valve should be protected by a pipeline strainer of the same size as the upstream pipework. For steam and air applications the strainer should be installed on its side to prevent the accumulation of water.

3.4 Removal of condensate

For steam installations a separator should be installed on the upstream side of the valve fitted with a suitable steam trap set.

3.5 Pressure gauges

To assist in commissioning the valve and monitoring operating conditions. Note: It is essential that pressure gauges are fitted on both upstream and downstream sides of the valve.

3.6 Safety valve

It is recommended that a suitable safety valve is installed on the upstream of the valve to protect the valve from excess pressure and on the downstream side to protect the downstream installation or equipment.
The valve should be set to lift at a pressure below the safe working pressure of the downstream equipment and sized to pass the full capacity of the DEP should it fail in the fully open position. The safety valve outlet pipework should discharge to a safe place.

3.7 Isolating valves

It is recommended that manually operated isolating valves are installed upstream and downstream of the pressure reducing valve station to provide means of isolation for cleaning and maintenance.

3.8 Water seal pot

If fitted, the water seal pot must be charged with water prior to the valve being put into service. Remove the water seal pot filling plug and fully charge the vessel with soft water. Replace the filling plug.
For applications where there are rapid fluctuations in load or pressure the larger volume WS4-3 is recommended.
To commission the valve, slowly open the upstream manual isolating valve to avoid waterhammer. The pressure reducing valve is now ready for operation.

3.9 Setting the desired upstream pressure

The valve is supplied 'unset' with the spring adjuster at its lowest adjustment position. The upstream pressure may be set against either a dead end condition or flowing condition, depending on the requirements of the application, taking into account the effect of proportional offset.
The desired upstream pressure is obtained by rotating the spring adjuster whilst monitoring the upstream pressure gauge.
Adjustment can be made using a standard open ended spanner size 17 mm for valves up to DN50 and 24 mm for sizes DN65 - DN100. Compressing the control spring increases upstream set pressure and conversely relaxing the spring tension reduces the upstream set pressure (see Figure 6).

3.10 Information regarding bypasses

It may be necessary to ensure that primary fluid flow continues in the event of the main control failing. This is often achieved by fitting a bypass around the control valve assembly. A better option is a duplex valve assembly, installed in parallel with the main valve, as a manual bypass cannot accurately control pressure/flow/temperature without constant manual supervision. Conversely, duplex control station will provide proper control, should the main valve ever need to be removed.

Although not recommended, if a manual bypass valve is fitted, the bypass valve flow coefficient (Kv) should be the same as, or near to that of, the control valve. This means that the manual valve and control valve could have different connection sizes. The bypass valve should also be capable of throttling not just isolating, to reduce wear on the valve when in service and to facilitate manual control.

Ideally, any bypass pipework should be arranged either above or alongside the main assembly. On steam systems, it should never be below it.

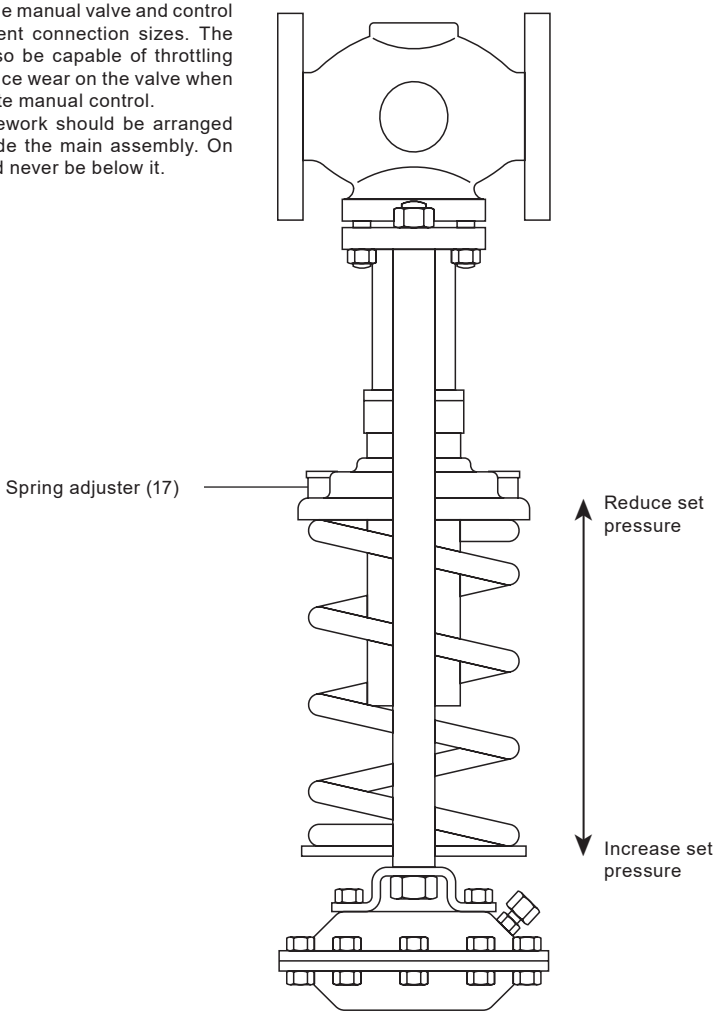


Fig. 6

4. Maintenance

Note: Before actioning any maintenance programme observe the 'Safety information', Section 1.

Important note:

When performing maintenance operations on the DEP do not turn the setting nut (28) without first releasing the lock-nut (25). Failure to do this will result in sealing bellows damage.

4.1 General information

The valve is maintenance free, but it is recommended that the valve is dismantled every 12 to 18 months for routine inspection of the component parts. Items showing signs of wear should be replaced. Details of available spares are given in Section 5.

Prior to routine inspection or fitting spare components, firstly ensure the valve is isolated and that the upstream and downstream pressures are reduced to zero, rotating spring adjuster (17) to reduce spring(s) compression to zero.

The upstream pressure signal pipe should be disconnected from the actuator.

Safety note:

This product contains PTFE/steel composite bushes. The precautions laid down in Section 1.15 should be taken.

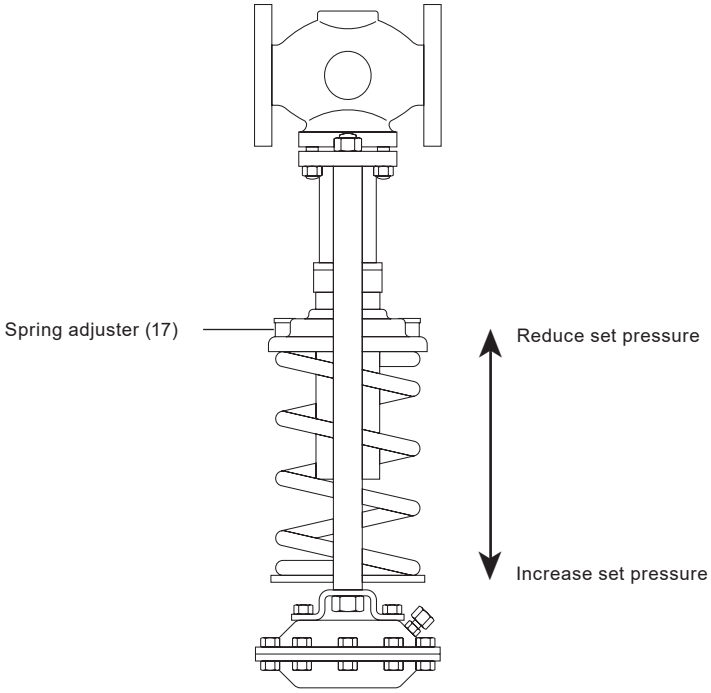


Fig. 7

4.2 Recommended tightening torques

Valve size / Fig	Torque settings N m (lbf ft)					
	Seat (3)	Balancing bellows assembly (10)	Adaptor (23)	Balancing to sealing bellows sealing/ assy. (10/20)	Clamp nut (22)	Bonnet nuts (13)
DN15	50-55					15 - 20
DN20	105 - 110					20 - 25
DN25	160 - 170	90 - 100	55 - 60	2-3	40 - 45	25 - 30
DN32	100 - 110	170 - 180	55 - 60	2-3	40 - 45	25 - 30
DN40	175 - 185	170 - 180	55 - 60	2-3	40 - 45	25 - 30
DN50	165 - 175	220 - 230	55 - 60	2-3	40 - 45	25 - 30
DN65				2-3	60 - 65	40 - 45
DN80				2-3	60 - 65	60 - 65
DN100				2-3	60 - 65	50 - 55

4.2.1 Common recommended tightening torques

Valve

16	Pillar nuts	25 - 35 N m
28/ 25	Setting nut/ lock-nut	10 - 15 N m
20	Sealing bellows assembly (DN15 and DN20 only)	175 - 185 N m
8	Spindle guide bush (DN15 and DN20 only)	50 - 60 N m

Actuator

33/ 34	Housing bolts/ nuts (Types 11, 11N, 12 and 12N)	5 N m
33/ 34	Housing bolts/ nuts (Types 13, 13N, 14, 14N, 15 and 15N)	11 N m
37	Diaphragm clamp bolt	25 N m
42	Actuator mounting nuts	18 N m

Water seal pot Fill plug = Tighten to seal

4.3 Setting 'maximum' valve lift

The maximum valve lift is factory set prior to despatch.
Should you wish to dismantle the valve for inspection or spares replacement the maximum valve lift should be reset (see Section 4.3.1).

Note: Removal of actuator only will not alter the 'set' maximum valve lift. Before setting 'maximum' valve lift the valve should be isolated with both upstream and downstream pressures at zero.

Table 1 Maximum lift settings

Valve size Flanged	Setting dimensions mm
DN15	56.2
DN20	57.0
DN25	58.5
DN32	60.0
DN40	61.4
DN50	63.4
DN65	64.5
DN80	68.1
DN100	71.8

4.3.1 Procedure for setting maximum valve lift (Figure 8):

The maximum valve lift is set with the valve head firmly on the valve seat and using a setting dimension between the setting nut (**28**) and the mounting plate (**31**).

Prior to setting the maximum lift, the following components should be removed from the valve:

- Spring(s) (**18**), spring plate (**26**), needle bearing (**27**), spring locator (**29**), adjustment tube spring adjuster (**30** and **17**) and valve/actuator clamp assembly (**52**, **53** and **54**).
- Ensure that the mounting plate (31), is firmly located onto the valve pillars (**15**) and that the valve head (**5**) is firmly located on the valve seat (**3**).
- Rotate the setting nut (**28**) until the desired clearance setting dimension between the setting nut (**28**) and spring plate (**31**) is achieved. Refer to Table 1 for maximum lift setting dimensions.
- Whilst retaining the setting nut (**28**) in this position, tighten lock-nut (**25**) onto the setting nut to the recommended torque given in Section 4.2. The maximum valve lift is now set.
- Mounting plate (**31**) can now be removed to facilitate fitting of remaining components.
- After fitting, replace mounting plate (**31**) and tighten pillar nuts (**16**) to the recommended torque given in Section 4.2.

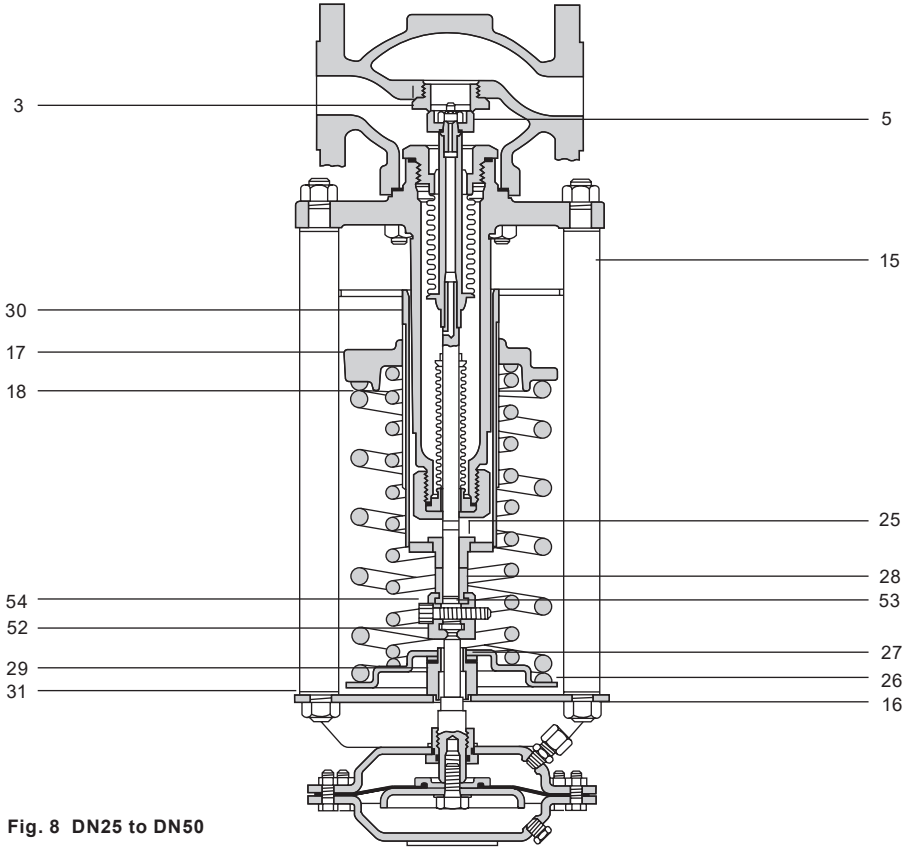


Fig. 8 DN25 to DN50

4.3.2 Fitting of actuator:

- Locate fully extended actuator spindle within bearing locator and loosely fit clamp assembly (**52**, **53** and **54**).
- With actuator mounting studs located within mounting plate (**31**), tighten mounting nuts (not shown) to the recommended torque given in Section 4.2.
- Firmly tighten clamp screw (**54**).
- Reconnect upstream pressure signal line to actuator coupling (**43**).
- If fitted, the water seal pot should be recharged with soft water prior to bringing the valve back into operation.
- The valve is now ready for re-commissioning as described in Section 3.

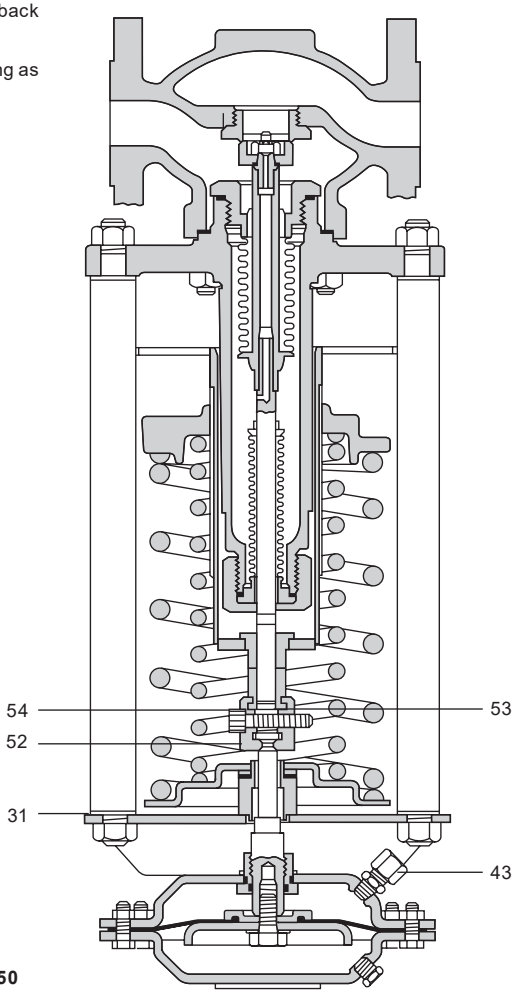


Fig. 9 DN25 to DN50

4.4 Fitting spares

4.4.1 Actuator spares (Figure 10):

Before fitting replacement actuator spares, the actuator should be removed from the valve as follows:

- Disconnect the upstream signal pressure pipe from the coupling (**43**).
- Unscrew the clamp screw (**54**) to loosen the coupling clamp assembly (**52**).
- Remove the actuator mounting nuts (**42**). Remove the actuator stem from the coupling clamp (**52**) and remove the actuator assembly from the valve.

Replacing the actuator diaphragm:

- Remove actuator housing nuts/bolts (**33** and **34**) and remove the upper actuator housing (**32**).
- Whilst retaining actuator spindle (**41**) to prevent rotation, unscrew and remove clamp bolt (**37**), sealing washer (38), piston (**40**) and diaphragm (**36**).
- The new diaphragm can now be fitted, ensuring that the diaphragm sealing lip is correctly located within the diaphragm clamp (**39**). Refit all components ensuring a new fibre washer (**38**) is used and tighten clamp bolt to the recommended torque given in Section 4.2.

Replacing the spindle guide assembly (35, 48, 49 and 50):

- Unscrew and remove actuator housing nut/bolts (**33** and **34**) and remove the actuator housing. Remove piston (**40**), diaphragm (**36**) and spindle (**41**) from upper housing.
- Remove circlip (**47**) and withdraw spindle assembly (**35**) from upper housing (**32**).
- **Note: Type 12 Actuator has an additional spacer washer (46)**.
- Fit a replacement spindle guide assembly (**35**, **48**, **49** and **50**), refitting circlip (**47**) and on Type 12 actuators, spacer washer (**46**). Insert actuator spindle (**41**) into the replacement bearing bush assembly taking care not to damage the spindle seal 'O' ring (**48**) and bearing bush (**49**).
- Refit lower housing and retaining nut/bolts and tighten to the recommended torque given in Section 4.2.
- On completion of the above, the actuator assembly can be refitted to the valve as described in Section 4.3.
- Reconnect upstream pressure signal line ensuring that the water seal pot, if fitted, is recharged with soft water and re-commission as described in Section 3.

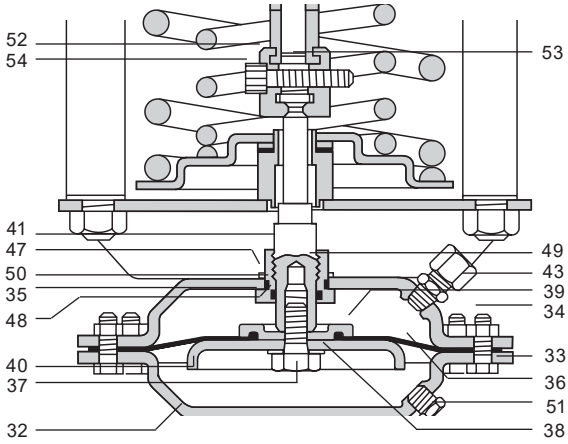


Fig. 10 DN25 to DN50 (Parts 42 and 46 not shown)

4.4.2 To renew or change control spring(s) (Figure 11):

- Rotate the spring adjuster (**17**) to reduce spring compression to zero.
- Disconnect the upstream pressure signal line from the actuator coupling (**43**) and remove the actuator from the valve as described in Section 4.4.1.
- Unscrew pillar nuts (16) and remove mounting plate (**31**), bearing locator (**29**), needle bearing (**27**), spring plate (**26**) and spring(s) (**18**).
- New or replacement spring(s) can now be fitted.
- Reassemble components in reverse order and tighten to the recommended torque (Section 4.2).
- On completion of the above the actuator assembly can be refitted to the valve as described in Section 4.3.
- Reconnect the upstream pressure signal line ensuring that the water seal pot, if fitted, is recharged with soft water and recommission as described in Section 3.

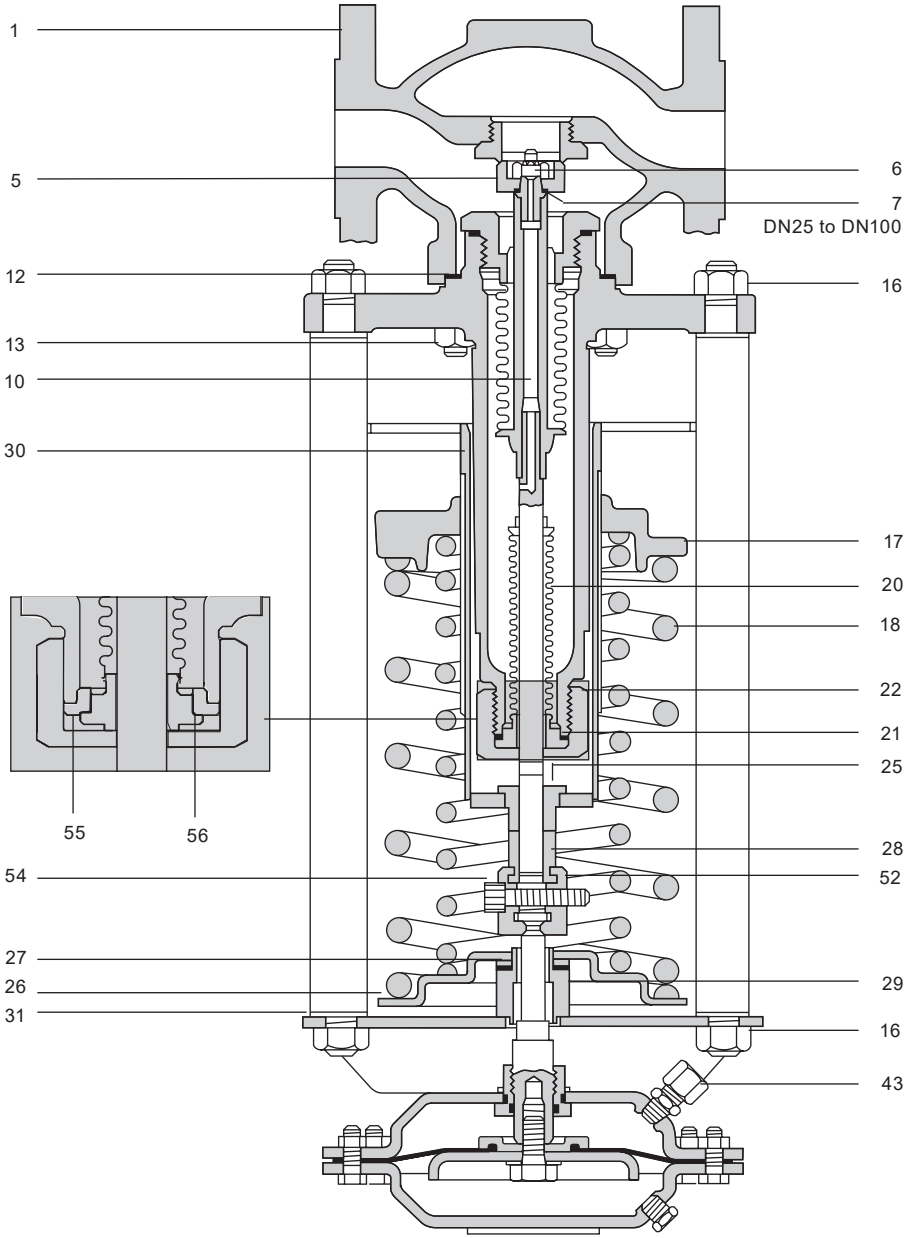


Fig. 11 DN25 to DN50

4.4.3 To renew sealing bellows assembly (Figure 11):

Note: Care should be taken not to touch the bellows as certain contamination can cause corrosion. Rotate spring adjuster (17) to reduce spring(s) (18) compression to zero.

- Disconnect the upstream pressure signal line from the actuator coupling (**43**) and remove the actuator from the valve as described in Section 4.4.1.
- Unscrew pillar nuts (**16**) and remove mounting plate (**31**), bearing locator (**29**), needle bearing (**27**), spring plate (**26**), spring(s) (**18**), clamp screw (**54**), coupling clamp (**52**) and adjuster sleeve (**30**), then proceed as follows:

Valve sizes DN15 and DN20:

- Remove bonnet nuts (**13**) and remove bonnet assembly from valve body (**1**).
- Remove valve head screw (**6**) and valve head (**5**), whilst retaining locking nut (**25**) preventing rotation of the valve spindle/sealing bellows within the bonnet assembly.
- Unscrew sealing bellows assembly (**20**) and remove with gasket (**21**).
- Remove lock-nut (**25**) and setting nut (**28**).
- Refit new/replacement sealing bellows assembly (**20**) using new gasket (**21**).
- Refit valve head seal (**7**), valve head (**5**) and valve head screw (**6**) and tighten to eliminate free movement of the valve head.

Note: Valve head screw to sealing bellows assembly is fitted with a self-locking thread insert to prevent loosening of the valve head screw during normal operation.

- Refit onto body assembly (**1**), using new bonnet gasket (**12**) and refit and tighten bonnet nuts (**13**) to the recommended torque given in Section 4.2.
- Loosely fit lock-nut (**25**) and setting nut (**28**) onto the new sealing bellows spindle and reset the maximum valve lift and reassemble all other components plus actuator as described in Section 4.3.
- The valve should now be recommissioned in accordance with Section 3.

Valve sizes DN25 - DN100:

- Loosen and remove lock-nut (**25**) and setting nut (**28**).
- Remove clamp nut (**22**) and unscrew sealing bellows (**20**) and unscrew from balancing bellows assembly (**10**) and remove, together with gasket (**21**). For the DEP4 DN65 - DN100 a clamp plate (**55**) is used with the sealing bellows requiring an additional gasket (56).

Note: On DEP7 valve sizes DN25-DN50, check that adaptor nut (23) is tightened to the recommended torque given in Section 4.2.

- Apply graphite paste to the thread of the sealing bellows that connects to the balancing bellows.
- The replacement sealing bellows assembly can now be fitted into the balancing bellows ensuring that a replacement gasket (**21**) is used. Fit and tighten clamp nut (**22**) to the recommended torque.
- Loosely refit lock-nut (**25**) and setting nut (**28**) on to the balancing bellows spindle and reset the maximum lift as described in Section 4.3.
- All other components and actuator can now be refitted as described in Section 4.3.
- Reconnect upstream pressure signal line ensuring that the water seal pot, if fitted is recharged with soft water and re-commissioned as described in Section 3.

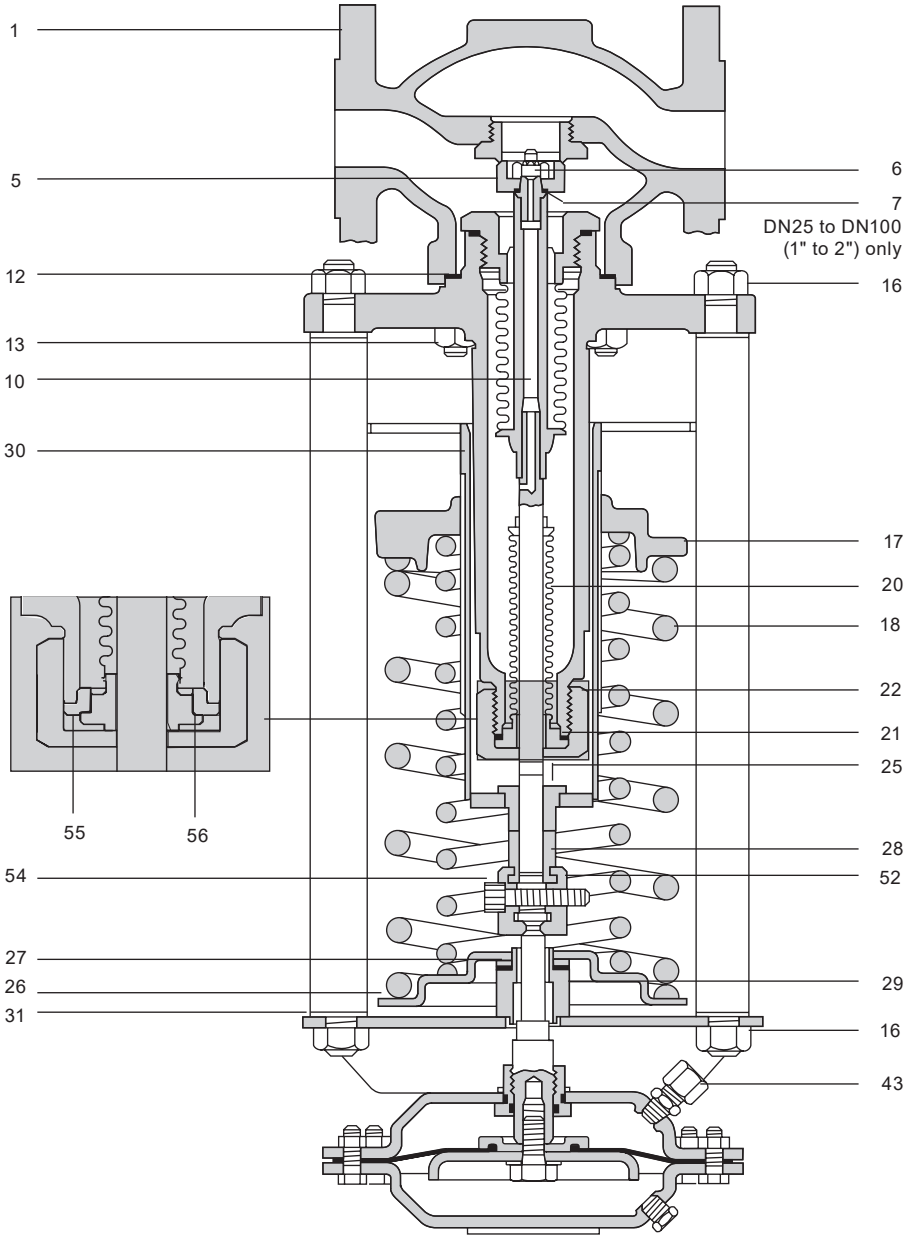


Fig. 11 DN25 to DN50

4.4.4 To renew balancing bellows assembly (Figure 12):

Valve sizes DN25-DN50 valves:

Firstly remove the actuator assembly and sealing bellows following the procedure outlined in Section 4.4.3 then proceed as follows:

- Remove bonnet nuts (**13**) and withdraw bonnet assembly from the valve body (**1**).
- Remove the valve head self-locking nut (**45**), valve head (**5**) and head seal (**7**).
- Unscrew and remove balancing bellows assembly (**10**) and gasket (**11**) from bonnet (**2**).
- The balancing bellows assembly can now be inspected for damage and if necessary replaced.
- Refit balancing bellows assembly (**10**) into bonnet using a new sealing gasket (**11**) and
- tighten to the recommended torque given in Section 4.2.
- Inspect valve head and seat for damage and replace if necessary.
- Using new head seal (**7**) refit the valve head (**5**) and the self-locking nut (**45**), tightening to
- eliminate any free play of the head.
- Refit bonnet assembly (**2**) into valve body (**1**) using a new bonnet gasket (**12**).
- Refit bonnet nuts (**13**) and tighten to the recommended torque given in Section 4.2.
- The sealing bellows, actuator assembly and all remaining components should now be refitted and the valve brought back into service, all as described in Section 4.4.3.

Valves size DN65-DN100:

Note: For DN65-DN100 valves it is not necessary to remove the sealing bellows or actuator to replace the balancing bellows assembly. Therefore, proceed as follows:

- Rotate spring adjuster (**17**) to reduce spring(s) (**18**) compression to zero.
- Remove bonnet nuts (**13**) and withdraw bonnet assembly (**2**) and bonnet gasket (**12**) from the valve body (**1**).
- Remove the valve head self-locking nut (**45**), valve head (**5**) and head seal (**7**).
- Rotate balancing bellows assembly (**10**) to unscrew from sealing bellows assembly (**20**) and withdraw balancing bellows assembly and gasket (**10** and **11**) from the bonnet (**2**).
- The balancing bellows can now be examined for damage and if necessary replaced.
- Apply graphite paste to the sealing bellows thread within the bonnet assembly.
- Inspect the valve head for damage and replace if necessary.
- Using new head seal (**7**) refit the valve head (**5**) and the self-locking nut (**45**), tightening to eliminate any free play of the valve head.
- Refit balancing bellows assembly (**10**) into bonnet (**2**) using a new balancing bellows gasket (**11**).
- Taking particular care to ensure correct location, rotate and tighten balancing bellows assembly into sealing bellows assembly.
- Using new gasket (**12**), refit bonnet assembly onto valve body (**1**) and replace bonnet nuts (**13**), tightening to the recommended torque given in Section 4.2.
- Reconnect upstream pressure signal line ensuring that the water seal pot, if fitted is recharged with soft water and re-commissioned as described in Section 3.

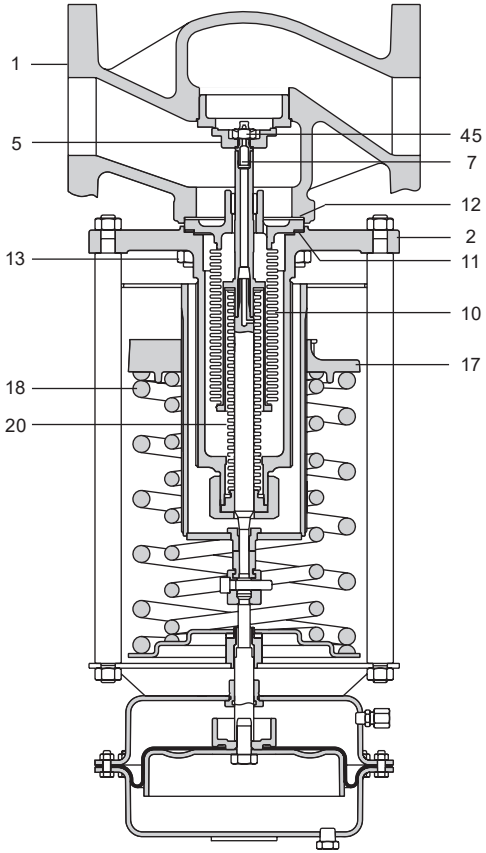


Fig. 12 DN65 to DN100

4.4.5 To renew valve head and seat (Figure 13):

- Rotate spring adjuster (**17**) to reduce spring(s) (**18**) compression to zero.
- Remove bonnet nuts (**13**) and withdraw bonnet/actuator from the valve body (**1**).
- Inspect valve head and seat for damage and replace if necessary.

Note: Valve seats cannot be replaced on valve sizes DN65-DN100.

- To replace the valve seat unscrew old seat and check condition of body seating face.
- Renew seat (**3**) and gasket (**4**) tightening to the recommended torque given in Section 4.2.

  For sizes DN15, DN20 and DN25 it is recommended that a non setting jointing compound (e.g. Stag brand jointing paste) is applied to the seating faces at this stage.

To replace valve head proceed as follows:

- Unscrew and remove the valve head self-locking nut (**45**), valve head (**5**) and the head seal (**7** on DN25 and larger sizes).
- Using new head seal (**7**) fit the replacement head (**5**) and self-locking nut (**45**), tightening to eliminate any free play of the valve head.
- Replace the complete bonnet assembly into the valve body (**1**) using new gasket (**12**).
- Refit bonnet nuts (**13**) and tighten to the recommended torque given in Section 4.2.
- Reconnect upstream pressure signal line ensuring that the water seal pot, if fitted is recharged with soft water and re-commissioned as described in Section 3.

4.4.6 To renew needle bearing assembly (Figure 13):

- Rotate spring adjuster (**17**) to reduce spring(s) (**18**) compression to zero.
- Disconnect upstream pressure signal line from actuator coupling (**43**) and remove actuator from the valve as described in Section 4.4.1.
- Unscrew and remove pillar nuts (**16**) and remove mounting plate (**31**), bearing locator (**29**) and needle bearing (**27**).
- Refit replacement needle bearing applying additional general purpose grease if necessary and ensuring correct location with bearing locator (**29**).
- Refit mounting plate (**31**) and replace pillar nuts (**16**), tightening to the recommended torque given in Section 4.2.
- Refit actuator assembly ensuring correct location within the coupling clamp (52) and tighten clamp screw (**54**).
- Refit actuator nuts (**42**), tightening to the recommended torque given in Section 4.2.
- Reconnect upstream pressure signal line ensuring that the water seal pot, if fitted is recharged with soft water and re-commissioned as described in Section 3.

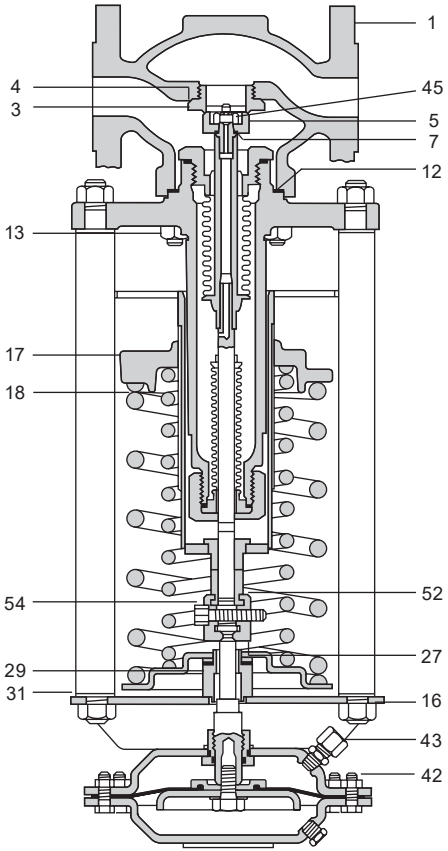


Fig. 13 DN25 to DN50 (Part 42 not shown)

5. Spare Parts

DN15 and DN20 valves

The spare parts available for sizes DN15 and DN20 valves are detailed below. No other parts are supplied as spares.

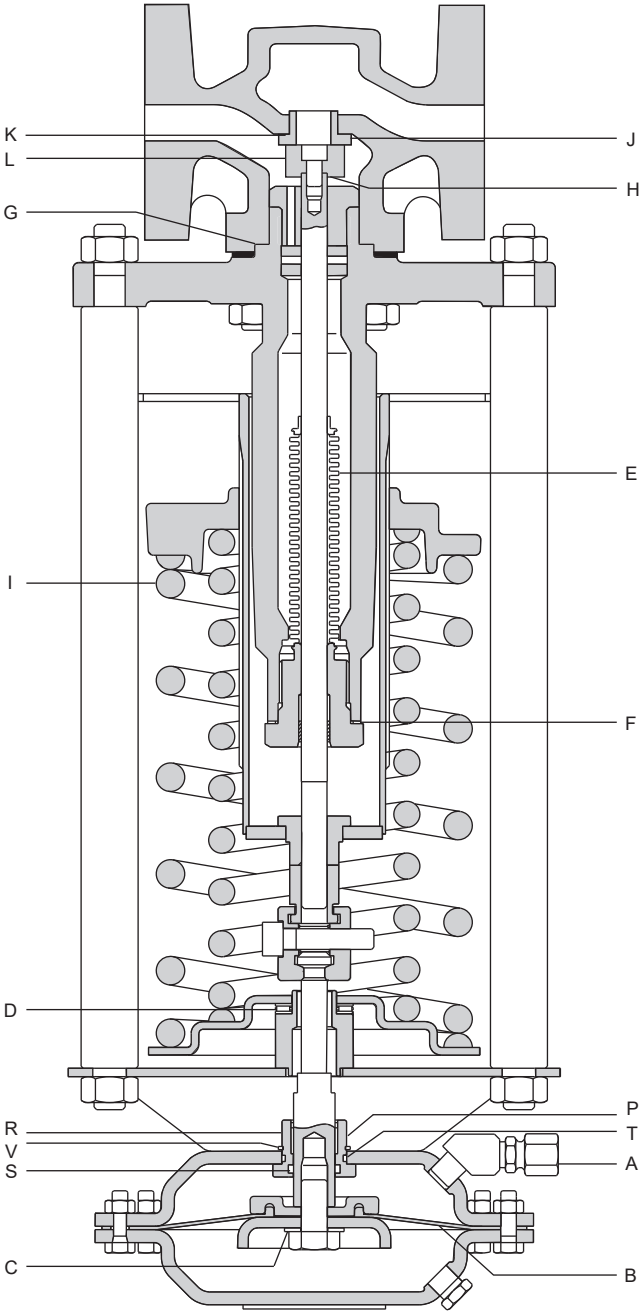
Available spares

Coupling	**A**
Diaphragm set Diaphragm and sealing washer.	**B, C**
Needle bearing	**D**
Sealing bellows set Sealing bellows assemby, sealing bellows gasket, bonnet gasket and head seal.	**E, F, G, H**
Control spring(s)	**I**
Seat/head set Seat, seat gasket, head and bonnet gasket and head seal.	**J, K, L, G, H**
Gasket set Sealing bellows gasket, bonnet gasket and seat gasket.	**F, G, K**
Actuator spindle guide assembly Spindle guide, bearing bush, spindle seal 'O' ring, housing seal 'O' ring and circlip.	**P, R, S, T, V**

How to order spares

Always order spares by using the description given in the column headed 'Available spares' and state the size and type of valve.

Example: 1 - Gasket set for a DN15 DEP7B1 direct acting excess pressure valve.



DN15 and DN20

DN25 - DN100

The spare parts available for sizes DN25 - DN100 valves are detailed below. No other parts are supplied as spares.

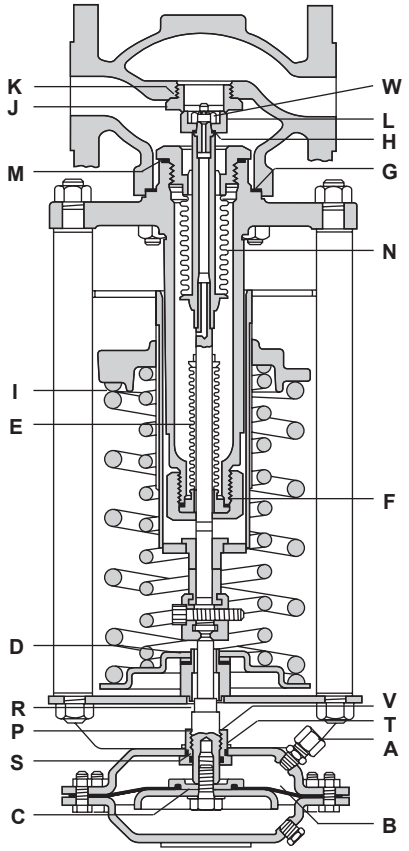
Available spares

Coupling	**A**
Diaphragm set Diaphragm and sealing washer.	**B, C**
Needle bearing	**D**
Sealing bellows set Sealing bellows assembly, sealing bellows gasket: - Clamp plate gasket DN65 to DN100.	**E, F, X**
Control spring(s)	**I**
Seat/head set DN25 to DN50 Seat, seat gasket, head, self-locking nut, head seal and bonnet gasket.	**J, K, L, W, H, G**
Head set DN65 to DN100 Head, head seal, self-locking nut, bonnet gasket and balancing bellows gasket.	**L, H, W, G, M**
Balancing bellows set DN25 to DN50 Balancing bellows assembly, balancing bellows gasket, bonnet gasket, head seal, sealing bellows gasket.	**N, M, G, H, F**
Balancing bellows DN65 to DN100 set Balancing bellows assembly, balancing bellows gasket, bonnet gasket and head seal.	**N, M, G, H**
Gasket set DN25 to DN50 Sealing bellows gasket, bonnet gasket, seat gasket, balancing bellows gasket.	**F, G, K, M**
Gasket set DN65 to DN100 Sealing bellows gasket, bonnet gasket, balancing bellows gasket and clamp plate gasket.	**F, G, M, X**
A**ctuator spindle guide assembly** Spindle guide, bearing bush, spindle seal 'O' ring, housing seal 'O' ring and circlip.	**P, R, S, T, V**

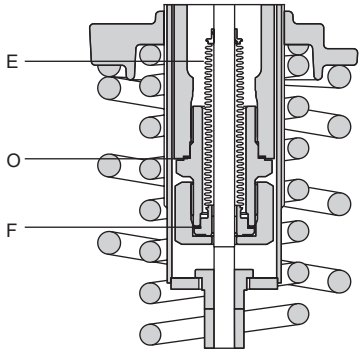
How to order spares

Always order spares by using the description given in the column headed 'Available spares' and state the size and type of valve.

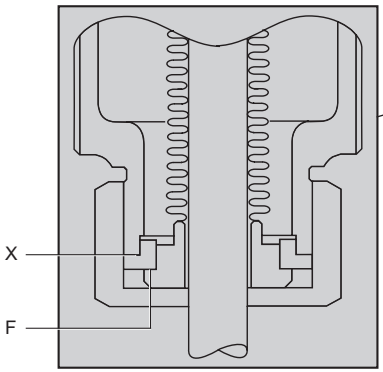
Example: 1 - Gasket set for a DN15 DEP4B1 direct acting excess pressure valve.



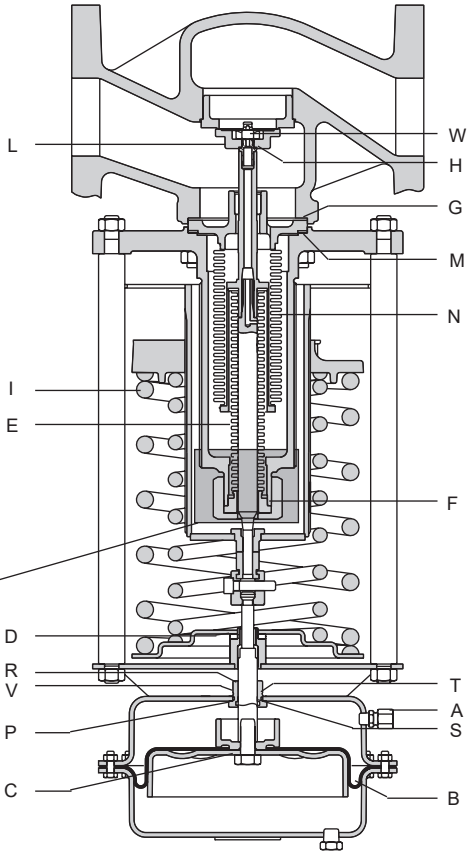
DEP4
DN25 - DN50



DEP7
DN25 - DN50
(Older versions)



DEP4
DN65 - DN100



DEP4 and DEP7
DN65 - DN100

6. Fault finding

Before investigating any fault ensure that both upstream and downstream isolating valves are shut.

Symptom	Possible cause	Remedy
Valve fails to open when upstream pressure is at or above its set point	**1.** Blockage of pressure signal pipe or coupling.	**1.** Disconnect pressure signal pipe from actuator coupling and blow through signal pipe and coupling to clear obstruction.
	2. Leakage across actuator diaphragm or actuator diaphragm clamp gasket.	**2.** Remove actuator housing and inspect diaphragm and diaphragm clamp washer for damage and replace as necessary.
	3. Leakage across actuator spindle 'O' ring.	**3.** Remove actuator from valve and dismantle as described in Section 4.4.1, replacing spindle guide assembly if necessary.
	4. Clamp screw **(54)** not tightened correctly within coupling clamp assembly **(52)**	**4.** Tighten clamp screw **(54)**, ensuring correct location of both valve and actuator spindles within the coupling clamp **(52)**.
Valve fails to close	**1.** Damage to valve head and/ or seat.	**1.** Replace valve head and/ or seat.
	2. Balancing bellows split due to:	**2.** Replace balancing bellow plus:
	(a) Mechanical fatigue.	(a) Check for high frequency pressure variations.
	(b) Frost damage to bellows.	(b) Protect from freezing temperatures.
	(c) Damage by high ΔP.	(c) Reduce DP across valve.
Under full load conditions upstream pressure rises above the valves normaloperating pressure range.	**1.** The valve is achieving maximum lift but is under-sized for the maximum flowrate.	**1.** Check maximum installed load conditions against valve size and if necessary replace with larger size valve.
	2. The valve is not achieving full lift position at maximum load.	**2.** Check the valve lift setting as described in Section 4.3.
Hunting of upstream pressure.	**1.** Over-sensitive pressure control signal.	**1.** Remove 8 mm pressure signal pipe and actuator/ water seal pot couplings and replace with 6 mm signal pipe and couplings.
	2. Disturbance of upstream pressure signal onto valve actuator.	**2.** Ensure the upstream pressure signal tapping is not located within a turbulent area and is at least 1 m from any valve or fitting.