

CONTROL VALVE **Z1B[®] type**



**INSTRUCTION MANUAL FOR INSTALLATION,
OPERATION AND USE**

Technical characteristics of the product

Marking		Conformity marking	
DN/NPS	PN/CLASS	PT [bar]	TS [°C]
Date of pressure test			
Serial number/ year of production			
Category acc. to PED	Category of fluid	Liquid <input type="checkbox"/>	Gas <input type="checkbox"/>

EN

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1. Introduction

The Instruction manual for installation, operation and use is intended for products designed and manufactured according to the requirements of the ISO 9001 quality management system, Pressure Equipment Directive (PED) 2014/68/EU, ATEX directive 2014/34/EU and AD2000 Merkblatt regulations, intended for installation on pipelines.

2. General warnings

WARNING

Prior to the product installation and use, read carefully and follow the Instruction. All activities related to installation, operation and use of the product have to be carried out by appropriately trained and skilled staff. "POLNA" S.A., hereinafter also called the manufacturer, has highly qualified service staff able to assist in installation, maintenance and repairs of our valves.

The warning symbol in the Instruction  means that the content (of a WARNING or CAUTION message) is very important due to safety reasons. Failure to observe the warnings may lead to a hazard to health, life or material losses.

The product is intended for installation on pipelines. Any other use has to be agreed with "POLNA" S.A. at the stage of ordering of the product. If in doubt, contact "POLNA" S.A. for explanation before performing any further actions.

If the product is installed and maintained correctly, its most ergonomic operation is ensured. However, it is necessary to follow the requirements given in the Instruction.

The product has to be installed and maintained according to domestic and industrial regulations and instruction.

The Instruction does not cover all cases and incidents that may occur during installation, use and maintenance or local safety regulations.

The content of the Instruction is of informative nature and is considered to be true. The company reserves the right to modifications, improvements and changes in the technical data without notice.

"POLNA" S.A. is not liable for a valve selection made by the buyer on his own or for operation and use of the valve against its intended use. Failing to comply with the provisions of this document, in particular when it comes to use, repairs etc., will result in losing the guarantee and warranty.


3. Requirements for equipment used in potentially explosive atmosphere according to Directive 2014/34/EU (ATEX)

3.1 Conditions of completing

Z1B type valves are designed according to the requirements for equipment operating in potentially explosive atmosphere for group II, category 2 according to PN-EN 13463-1:2002, considering the following in particular:

- ensuring operation according to technical parameters established by the manufacturer and high level of protection,
- using the product in areas that can become potentially explosive atmosphere caused by air mixtures with gases, vapour, mist or dust.

3.2 Conditions of use

"Z1B" type valves marked as  can be used for operation in the following zones according to PN-EN 1127-1:1997:

- Zone 1,
- Zone 2,
- Zone 21,
- Zone 22.

3.3 Conditions for repairs and maintenance

Safety conditions applying to tools and zones where they can be used according to EN1127-1, Appendix A have to be ensured during inspections, repairs and maintenance in explosive atmospheres.

4. Conditions of safe use

The following rules have to be observed to ensure safe use:

- disassembly of the valve from a pipeline or disassembly of parts in contact with the medium can be performed after making sure that they are not subject to the action of the fluid pressure,
- when working at high temperatures take care to avoid burns caused by hot parts of the valve and use shields wherever possible,
- valves have to be mounted and installed only by qualified staff,
- rotation of the valve stem in the bonnet body is not acceptable in valves with a bellows seal bonnet as the bellows can become damaged.

5. Design and operating principle

The basic components of a Z1B type control valve include: body (1a, 1b), bonnet (2a, 2b, 2c), seat (3), valve plug (4a, 4b, 4c), control cage (6), plug stem (5) and valve plug stem sealing (25). Marking and names of components are presented in Figure 1 and Table 1.

The flow of the working medium through the valve is adjusted by a linear movement of the valve plug with a fixed connection with the stem of the actuator or manual drive.

Input signal being the following:

a) in pneumatic actuators:

compressed air with the nominal range of the control pressure between 140 and 600 kPa or within other ranges if a positioner is used,

b) in electric drives:

with a 3-point control

- electric signal with the supply voltage of 220 V AC; 24 V AC; 380 V AC, 500V AC etc.,

with continuous control

- voltage signal 0...10 V; 2...10 V or current signal 0...5 mA; 0...20 mA; 4...20 mA, profibus and other

causes linear displacement of the drive stem. The movement is proportional to the value of the input signal.

Table 1. Marking and names of components.

No. in Figure 1	Component name
1a	Flanged body
1b	Valve body with butt welded ends (BW type)
1c	Valve body with socket welded ends (SW type)
2a	Standard bonnet
2b	Extended bonnet
2c	Bellows seal bonnet
3	Seat
4a	Piston valve plug (unbalanced)
4b	Piston valve plug balanced with a gasket
4c	Piston valve plug balanced with a pilot
5	Valve stem
6	Control cage
7	Choking cage I
8	Choking cage II
9	Body gasket
10	Seat gasket
11	Control cage gasket
12	Plug stem pin
13	Balanced valve plug nut
14	Packing washer of balanced valve plug
15	Sealing ring of balanced valve plug
16	Pilot
17	Spring
18	Lock nut
19	Retainer ring
20	Locking ring
21	Guiding ring of balanced valve plug
22	Body screw
23	Body nut
24	Guiding sleeve
25	Packing
26	Pressing sleeve
27	Pressing lever
28	Distance sleeve
29	Spring

No. in Figure 1	Component name
30	Packing washer
31	Bonnet screw
32	Bonnet nut
33	Fixing nut
34	Bellows seal bonnet housing
35	Packing set of bellows seal bonnet
36	Retaining plate
37	Packing set gasket
38	Bellows seal bonnet gasket
39	Pin
40	Retaining ring
41	Nut
42	Plug
43	Bellows seal bonnet housing screw
44	Bellows seal bonnet housing nut
45	Spacer sleeve
46	Packing
47	Distance sleeve
48	Packing set
49	Pressing sleeve
50	Disk spring
51	Pressing plate
52	Low nut
53	Nameplate
54	Round-head grooved pin
55	Actuator connector
56	Sealing ring of balanced valve plug (MUPU type)
57	Pressing plate
58	Washer with external tap
59	Hexagon head screw

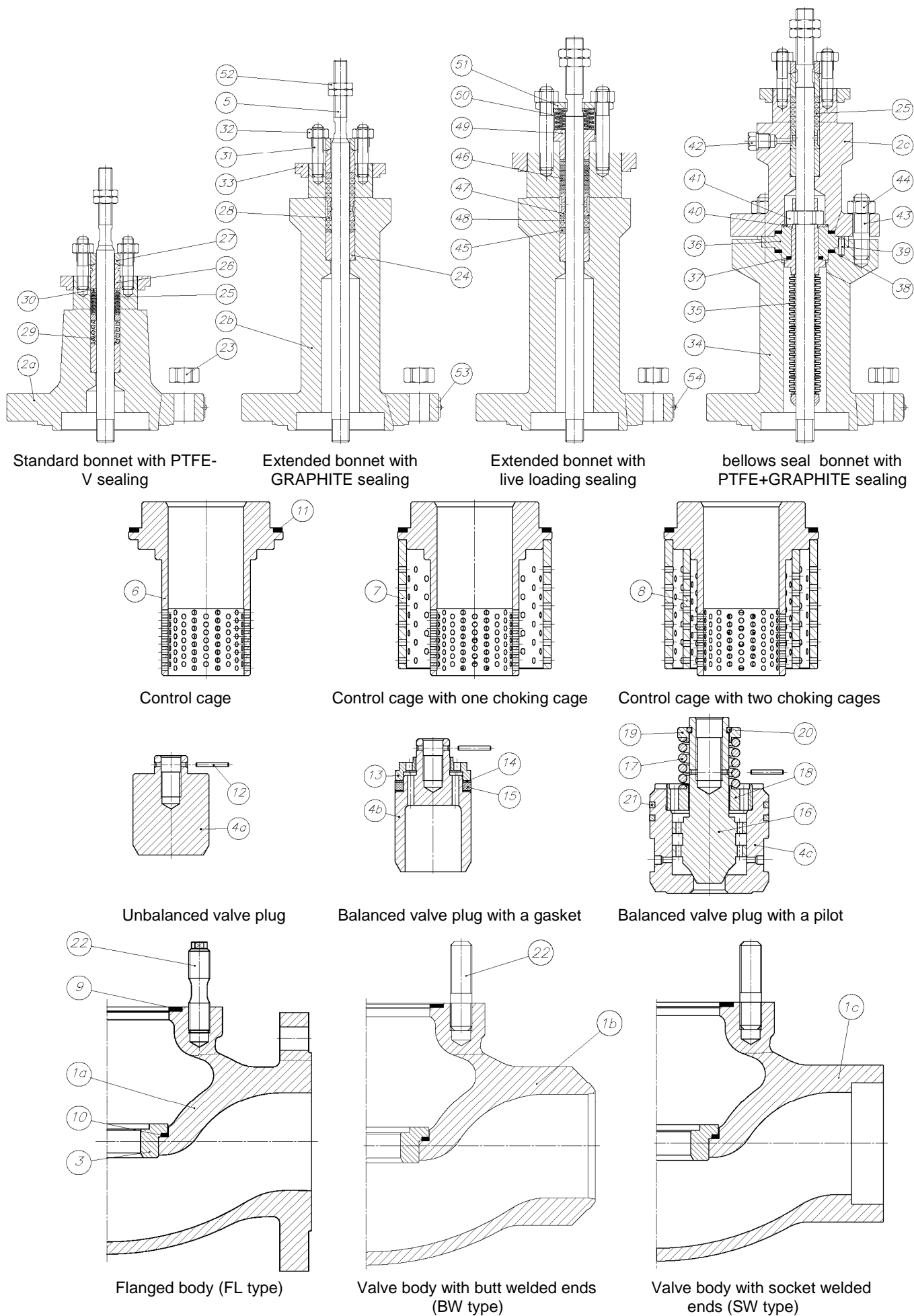


Fig. 1. Z1B type control valve - internal components

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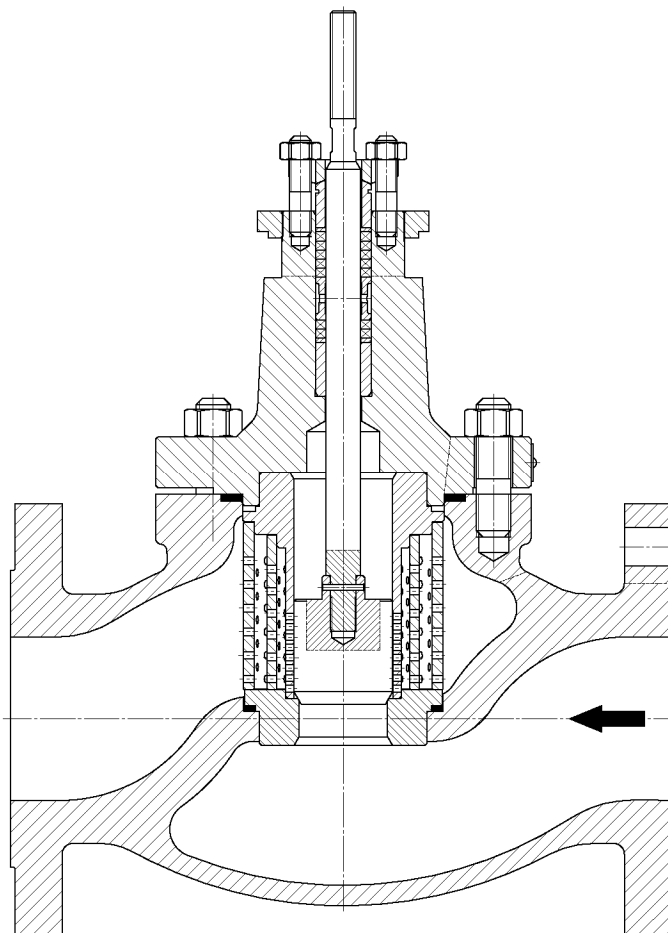


Fig. 2. Z1B type control valve with a unbalanced valve plug

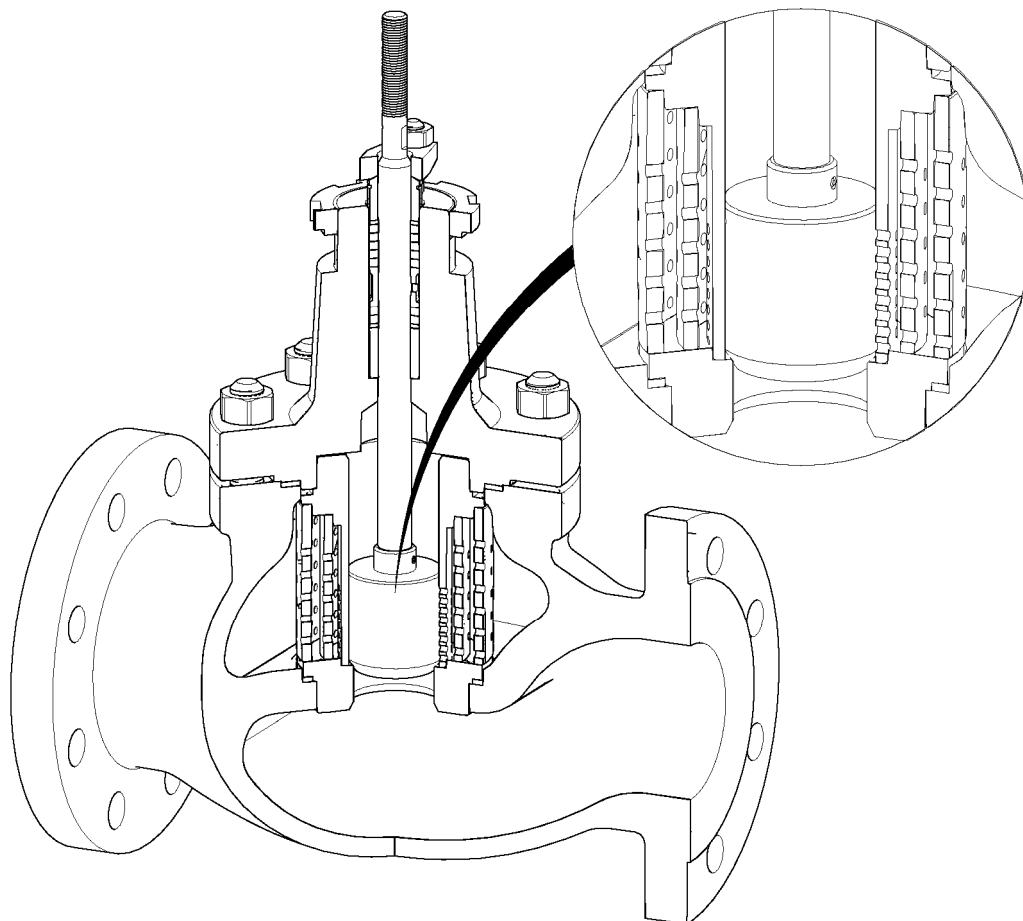


Fig. 3. Z1B type control valve with a unbalanced valve plug

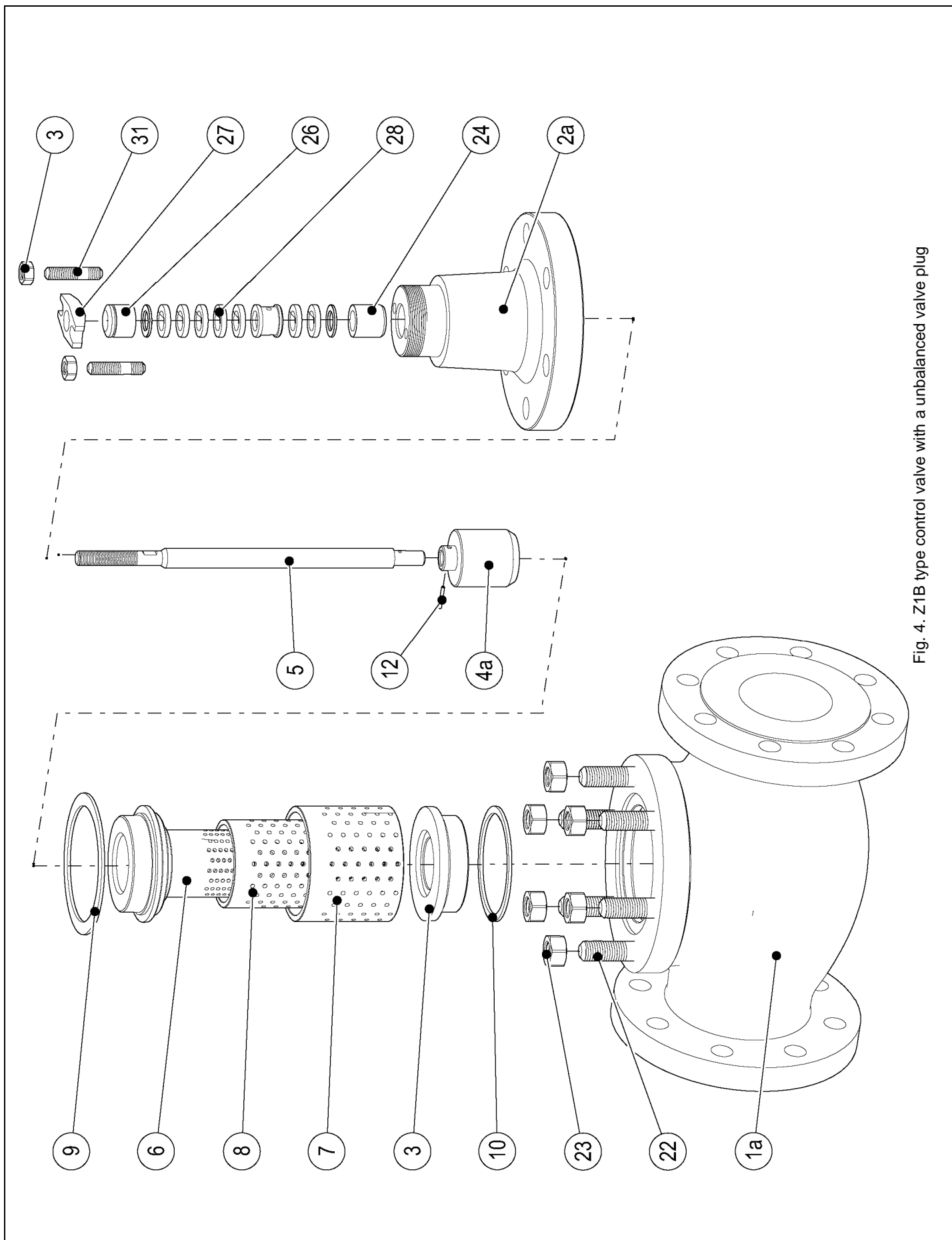


Fig. 4. Z1B type control valve with a unbalanced valve plug

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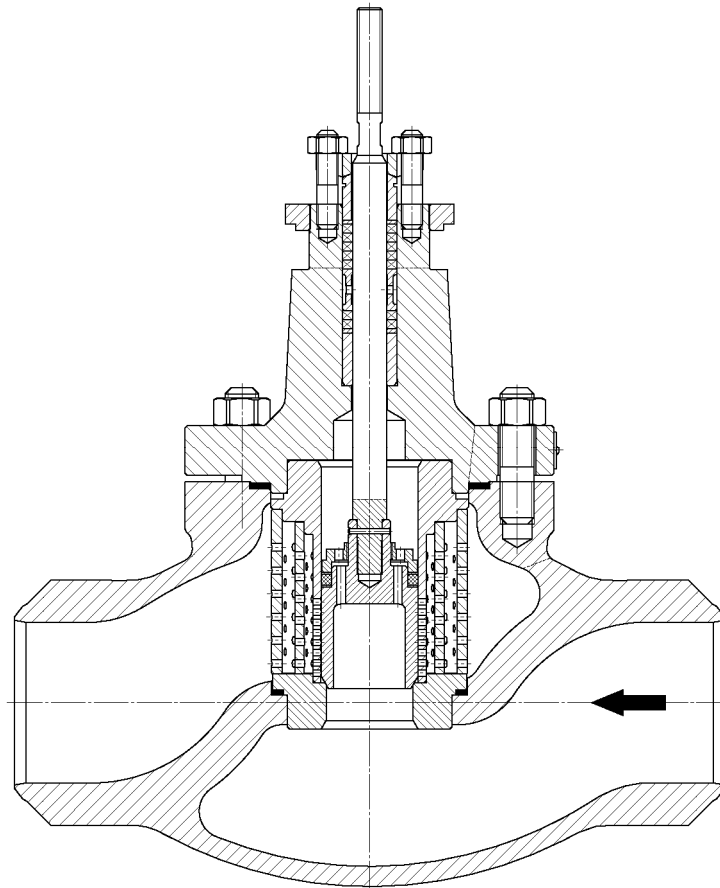


Fig. 5. Z1B type control valve with a balanced valve plug with a gasket

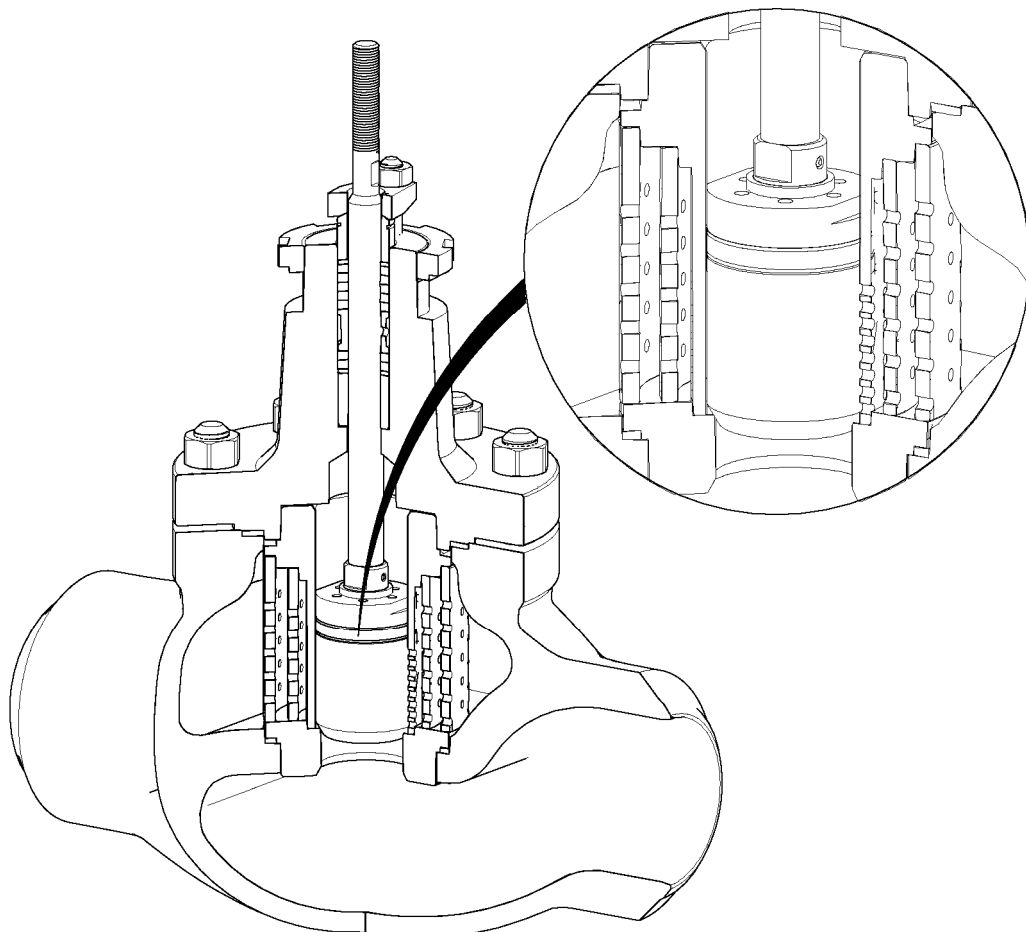


Fig. 6. Z1B type control valve with a balanced valve plug with a seal

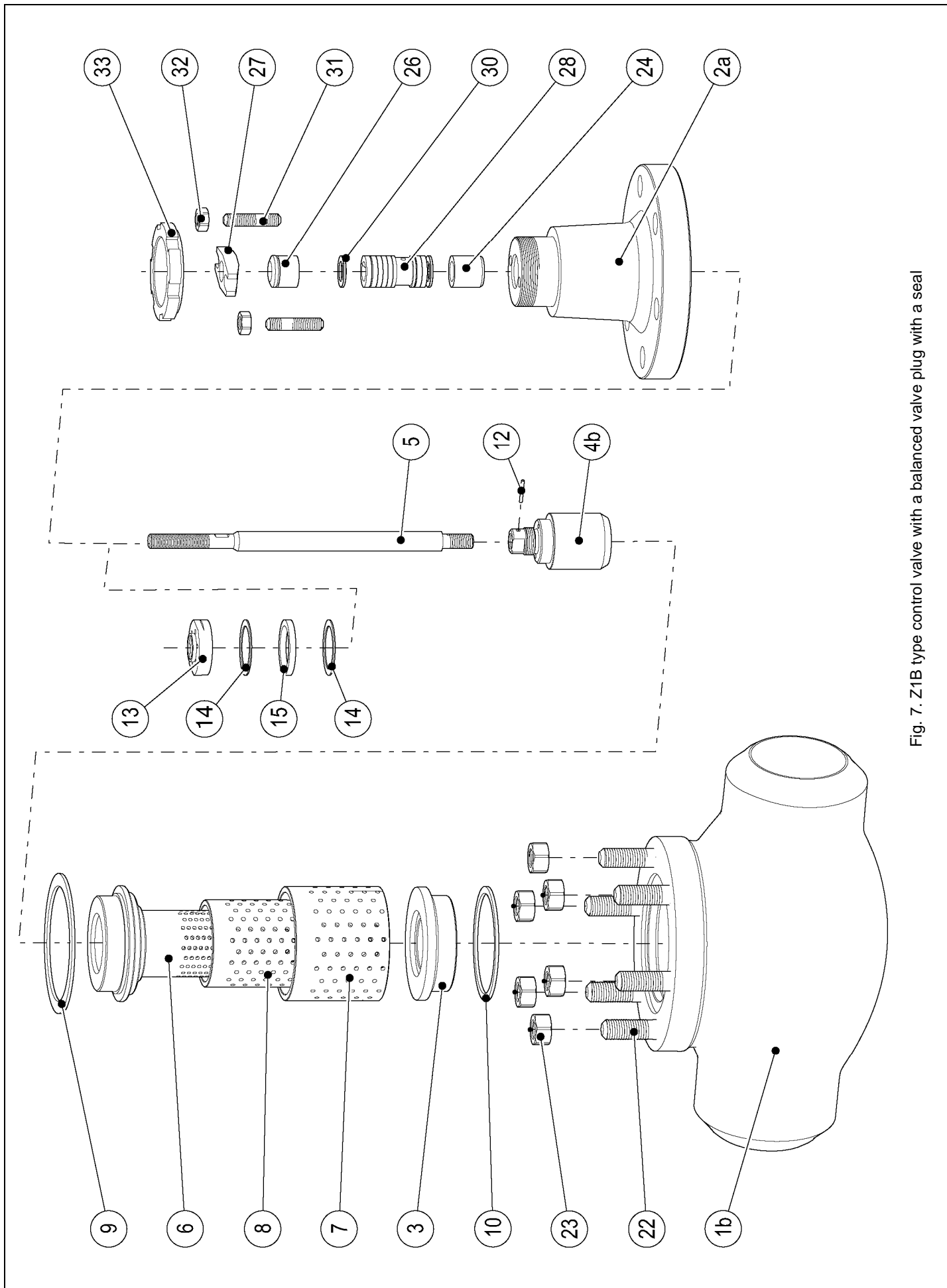


Fig. 7. Z1B type control valve with a balanced valve plug with a seal

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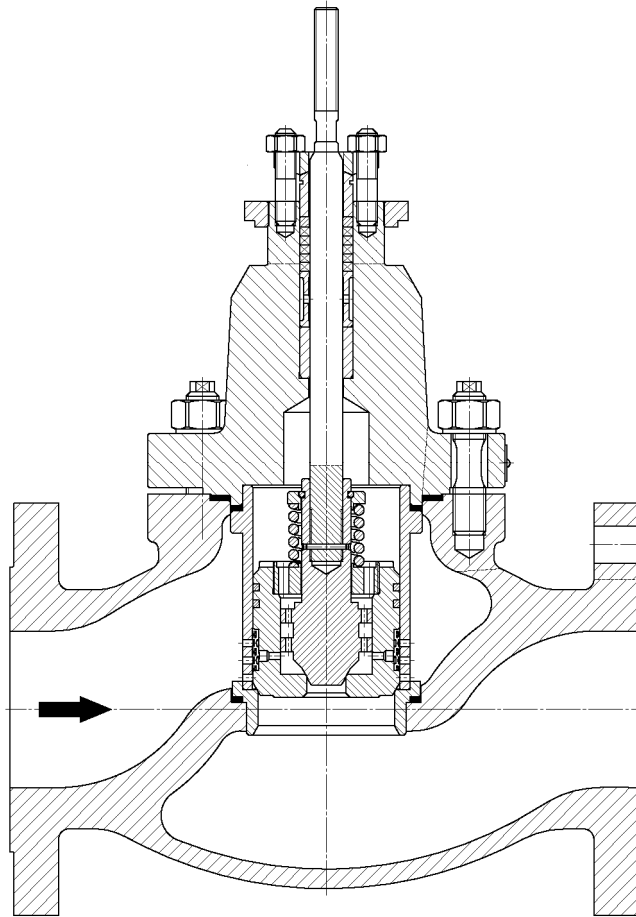


Fig. 8. Z1B type control valve with a balanced valve plug with a pilot

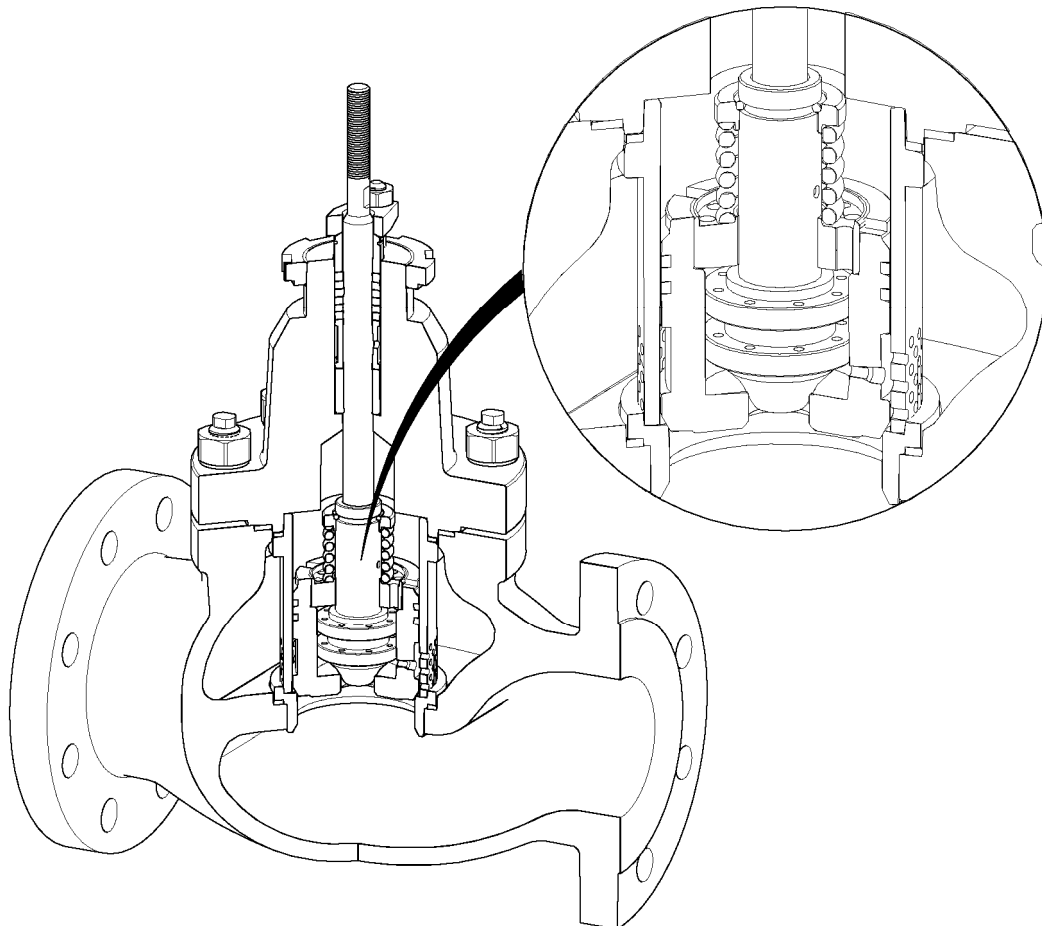


Fig. 9. Z1B type control valve with a balanced valve plug with a pilot

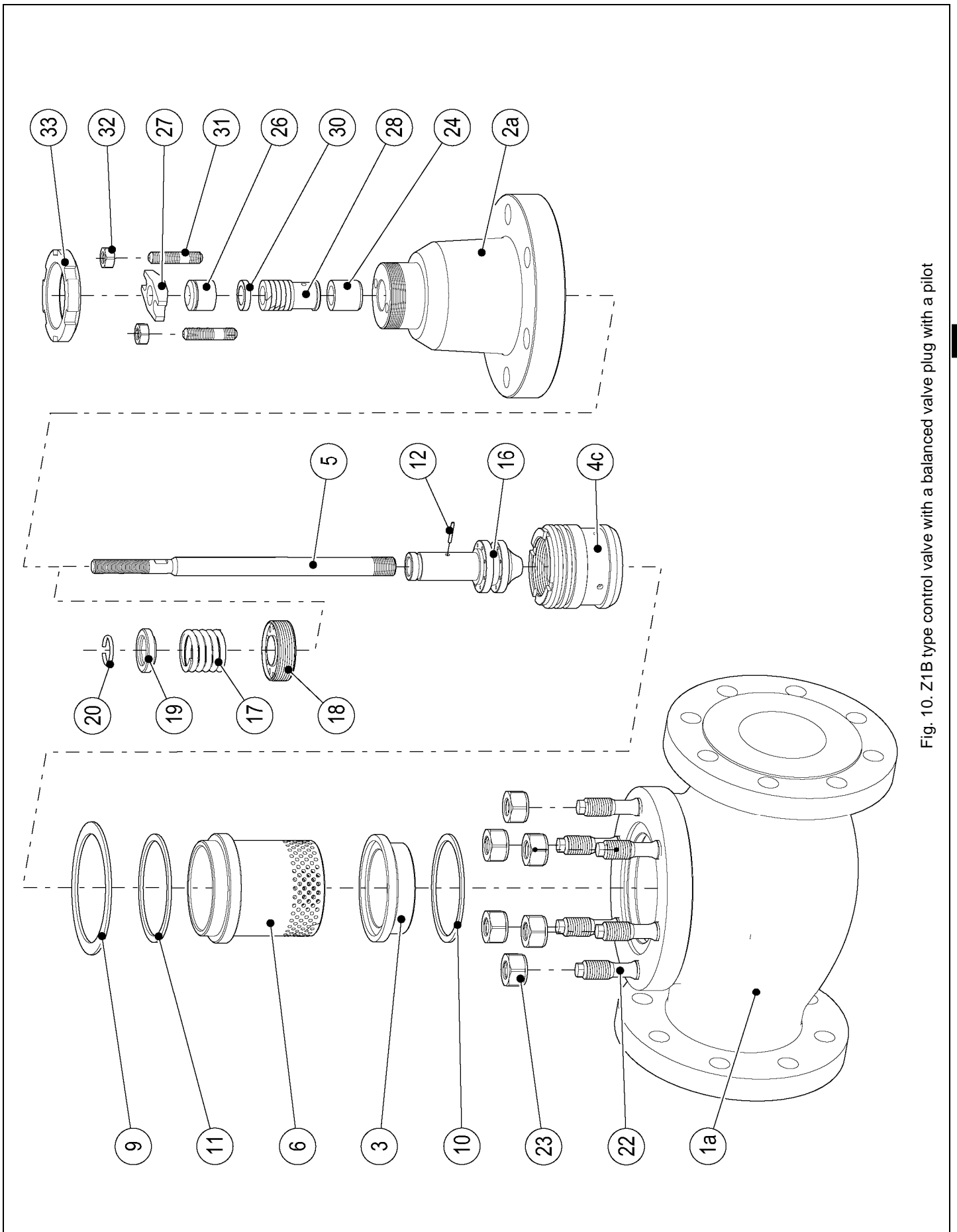
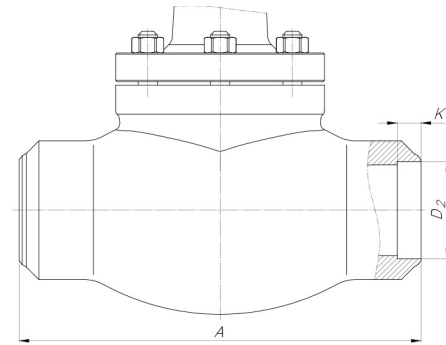
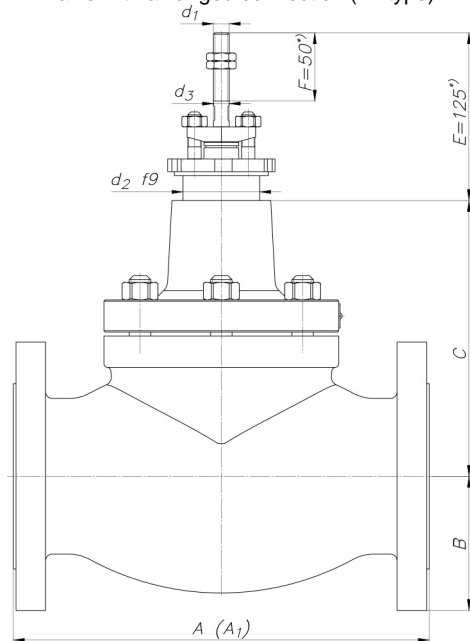


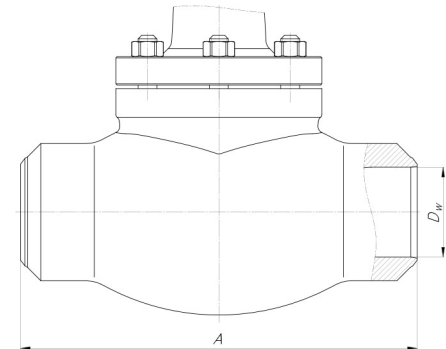
Fig. 10. Z1B type control valve with a balanced valve plug with a pilot

6. Dimensions

Valve with a flanged connection (FL type)



Valve with socket welded ends (SW type) DN 15 ... 50



Valve with butt welded ends (BW type)

Dimension E for the valve plug position - valve closed *) If mounted with P/R 1000 actuator - dimensions: E=195 mm and F=115 mm

Fig. 11. Dimensions of valves

Table 2a. Connection dimensions of control valves.

DN	25						40						50					
PN/CL	PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500	PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320 0	PN400; CL2500	PN10...CL 300	PN63...CL 600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500
B max	63	70	75	80	90	75	85	93	98	110	83	98	108	105	118			
C	DS	135	149	193	145	172	214	155	175	237								
	DW	306	320	364	306	348	385	326	345	402								
	DM	254	-	-	-	-	254	-	-	-	-	-	270	-	-	-	-	-
DN	80						100						150					
PN/CL	PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500	PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320 0	PN400; CL2500	PN10...CL300	PN63...CL600	CL900;PN160			
B max	105	145	120	133	138	153	128	138	145	155	168	185	160	178	190			
C	DS	206	233	257	217	252	329	287	365									
	DW	375	402	447	407	442	498	426	483									
	DM	405	-	-	-	-	405	-	-	-	-	-	470	-	-	-	-	-
DN	200			250														
PN/CL	PN10...CL300			PN63...CL600			PN10...CL300	PN10...CL300 (kv800)	PN63...CL600									
B max	190			235			258			255								
C	DS	439			458			558			660							
	DW	539			558			558			660							
	DM	580			580			660			660							

DN300 and DN400 - special design, technical data according to individual arrangements. (refers to Tables 2a and 2b)

NOTE: Weight of a valve with a standard bonnet without an actuator.

Table 2b. Connection dimensions of control valves.

DN	25...50	50	80	80; 100	80; 100	100	150				200	200; 250				250
Kvs	10...25	40	25	40	63; 94	125; 160	63; 94	125; 160	200; 250	320	94	125; 160	200; 250	320	500	630; 800
Stroke	20	38	20	38	38	50	38	50	63	80	38	50	63	80	1	00
d1	M12x1.25			M16x1.5			M20x1.5			M16x1.5	M20x1.5		M24x1.5			
d1) 2	57,15 / 2 1/4"-16UN2A					84,15 / 3 5/16"-18NS2A					95,25 / 3 3/4"-12UN2A					
d3	12		16			20				24						

NOTE:

¹⁾ Dimension d₂ = 84.15 f9 for valves DN80 and 100 with live loading sealing.

Table 3. Face-to-face dimensions of control valves with flanged connections.

DN	Dimension A [mm]										
	PN / DIN					CL					
	10; 16; 25; 40	63 - 100	160	250 -320	400	CL150	CL300	CL600	CL900	CL1500	CL2500
25	160	230	230	260	300	184	197	210	248	273	308
40	200	260	260	300	350	222	235	251	270	311	359
50	230	300	300	350	400	254	267	286	311	340	400
80	310	380	380	450	500	298	317	336	387	460	498
100	350	430	430	520	580	352	368	394	464	530	575
150	480	550	550	*	*	451	473	508	556	*	*
200	600	650	*	*	*	543	568	610	*	*	*
250	730	775	*	*	*	673	708	752	*	*	*
300	special design, technical data according to individual arrangements										
400											
* technical data according to individual arrangements											

NOTE: "A" face-to-face dimensions given in Table 3 for CL150; CL300; CL600; CL900; CL1500 and CL2500 apply to bodies with face B (RF). For other designs, the A1 lengths can be calculated based on the relation specified in Table 4.

Table 4. Algorithms for calculating the lengths of control valves with flanged connections.

- with a groove
- with races
- with a groove for a ring

Body type and marking	Pressure CL	DN	A ₁
PN / ANSI			
With a groove DL / (GF) With races F / (FF)	CL300	25...250	$A_1 = A + 5 \times 2$
	CL600		$A_1 = A - 1.5 \times 2$
	CL900		
	CL1500		
	CL2500		
With a groove for a ring J / (RTJ)	CL150	25...250	$A_1 = A + 6.5 \times 2$
	CL300	25...40	$A_1 = A + 8 \times 2$
	CL300	50...250	
	CL600	25...40	
	CL900		
	CL1500		
	CL2500		25
	CL600	50...250	$A_1 = A + 1.5 \times 2$
	CL900	50...100	
	CL1500		
CL900	150		
CL2500	80	$A_1 = A + 3 \times 2$	
	100	$A_1 = A + 4.5 \times 2$	

Table 5. Face-to-face dimensions of control valves with butt welded ends

DN	Dimension A [mm]		
	Nominal pressure identification		
	PN 10...CL600	CL900...PN160	PN250...CL2500
25	210	230	300
40	251	260	350
50	286	300	400
80	337	380	500
100	394	430	580
150	508	550	-
200	610	-	-
250	752	-	-
300	special design, technical data according to individual arrangements		
400			

7. Normal operating conditions

The control valve should be used at pressure, temperature and medium type with parameters complying with the ones assumed for calculating the value and for identifying the design and material variant of the valve. To ensure failure-free operation during the whole service life, the control valve and its accessories and equipment have to be protected against impact and damage and subject to regular maintenance and periodical inspections.

A valve used at high ($> 50^{\circ}\text{C}$) or low temperatures ($< 0^{\circ}\text{C}$) has to be properly insulated or marked. Failing to observe this condition may result in personal injury. Failure to observe the instruction may result in body injury.

It is forbidden to disassemble the actuator or drive from the valve, if the valve is under pressure. Moving parts of the valve may cause body injury.

8. Storage and transport

NOTE

The valve shall be stored under conditions ensuring its failure-free operation even after a long period of storage.

Warehouse spaces should be closed, dry and airy with the relative humidity not exceeding 80%. The atmosphere should be free of vapours and aggressive gases.

The valve can be transported by any covered means of transport, with or without its packaging, protected against throwing, collapsing or excess shock. During packing, loading or unloading handle the valves using flexible clamps (e.g. rubber V-belts) wrapped around the valve body flanges and actuator diaphragm case (through an eye bolt - for pneumatic actuators).

9. Installation

Exercise care while unpacking the valve so as not to damage the valve or its accessories. If any problems occur, contact "POLNA" S.A.

WARNING

Prior to installing the valve, read carefully the Instruction. The Instruction contains information and warnings on safety that have to be observed strictly. Otherwise a serious injury to the operator or persons standing nearby may occur or the equipment may be seriously damaged.

Prior to installing the valve in a pipeline system, the following have to be performed:

1. Carefully clean the pipeline of contaminants, metal chips, rust, welding and rolling scale, fat and grease and any other foreign bodies. It is of particular importance for valves with a perforated plug or control cage. Thoroughly clean the surface of gaskets to ensure correct tightness of connections.

2. Remove caps and elements of transport packaging from the valve to be installed.

3. If the valve is activated for the first time after more than 3 months from the date of its purchase, check the stem movement smoothness prior to its installation on the site. Start the actuator or drive and check whether the valve stem (5) moves smoothly and with no disturbance within the entire range of the nominal stroke. If the movement is not smooth, contact "POLNA" S.A. service.

4. The allowed position of the control valve is with the stem vertically upwards. In justified cases, it is possible to install the valve with a permissible deviation of $\pm 30^{\circ}$ from

the vertical. Other positions may cause uneven and accelerated wear of internal parts of the valve (plug, seat, stem, guide sleeve) and seals.

If it is necessary to use a different valve installation position on the pipeline than permitted, consultation with the valve manufacturer is mandatory.

Without the approval of the manufacturer, an unauthorised installation position will result in loss of guarantee.

5. The valve shall be installed so that the direction of the working medium flow in the pipeline is according to the direction marked by the arrow on the valve body. If the direction of the flow is not marked in the centre of the body, it is marked on the flange.

6. The working pressure of the medium flowing through the valve should comply with the value assumed for the nominal pressure given on the valve nameplate.

7. When installing the valve, follow standard procedures for making pipe connections and welding. Use a correct gasket between the valve flange and the pipeline system with flanged connections.

8. The valve location should take the following requirements into account:

- straight sections of the pipeline $20 \times \text{DN}$ before the valve and $10 \times \text{DN}$ after the valve. In systems intended for light working conditions and less serious applications, straight sections with the minimum lengths of $6 \times \text{DN}$ before the valve and $3 \times \text{DN}$ after the valve can be used.

- pressure measurement points ca. $(1-2) \times \text{DN}$ before the valve and $(4-6) \times \text{DN}$ after the valve,

- distances to provide access to the actuator - min. 300 mm around the diaphragm case and min. 500 mm above the actuator.

9. If the valve is welded, welding shall be performed observing safety measures i.e. at many sections so that the body interior is not heated to a temperature exceeding the maximum acceptable temperature or so that no contaminants, e.g. scale, get inside the valve. The valve has to remain open during welding (plug lifted above the seat).

10. If the nominal diameter of the valve is smaller than the diameter of the pipeline, use appropriate reducers whose length complies with relevant standards. In such cases, avoid using threaded, femal-male reducers etc.

In process system units it is recommended to use a bypass system composed of three additional valves, allowing for disconnecting the control valve from the system (e.g. for making repairs, grinding of seats, replacement of parts) with no breaks in the operation.

11. When connecting with adjacent elements pay attention not to stress the body and adapt the connecting elements (screws, sealing rings, flanges) to the shape of the body and its operating conditions. If necessary, use a support to prevent stress to the body (the support can be placed under the valve flanges).

12. Make sure that lifting equipment, chains and slings with appropriate load bearing capacity are used for handling the valve.

13. Do not paint the screws when painting pipelines. If construction works are carried out, protect the fixtures against dust, sand and residues of building materials (they should be covered with appropriate materials).

14. The manufacturer is not responsible for fixtures, if the user fails to observe the provisions of the Instruction.

10. Start-up and assembly with drives

Prior to start-up of the process system, check the operation of the installed valve. Start the actuator or manual drive and check whether the valve stem moves smoothly and with no disturbance within the entire range of the nominal stroke. If the movement is not smooth, contact "POLNA" S.A. service.

NOTE

Prior to start-up, take the following recommendations into consideration:

1. The first filling of the pipeline has to be performed with the valve open.

2. Use the by-pass or completely cut-off the valve from the working pressure and then release process pressure on both sides of the valve. Avoid a sudden release of the working pressure as it may cause injury to the operators. Release the process medium on both sides of the valve.

3. The bonnet nuts are tightened in the plant before delivery but before starting the valve make sure they have not come loose or that there is no leakage within the valve stem. A leaking bonnet may cause injury to the operators.

If there are leaks within the valve stem, perform relevant actions described in the Instruction (Table 9).

4. For pneumatic actuators - vent the actuator system and relieve the tension of its springs.

5. To avoid injury, when doing installation and service works, wear gloves, protective clothing and glasses.

6. Always check occupational safety with the responsible person whether there is no need to take extra precautions against the process medium.

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Assembly with valves

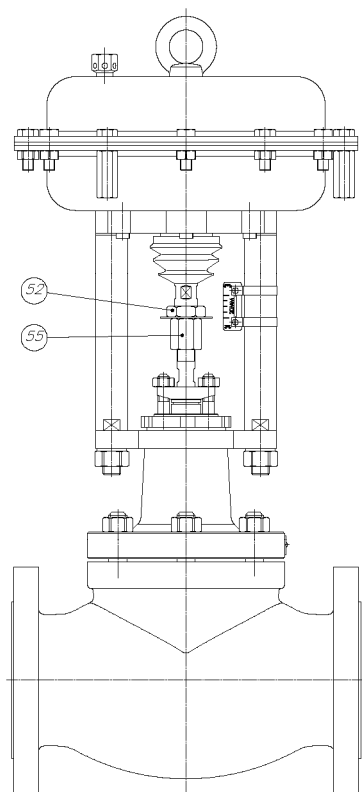


Fig. 12. Z1B type control valve with P/R pneumatic actuator

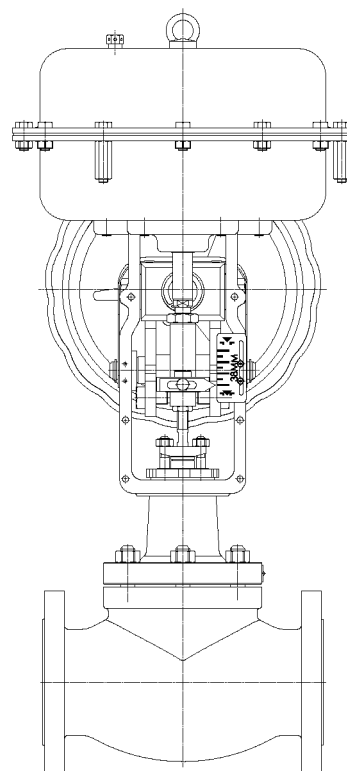


Fig. 13. Z1B type control valve with P1/R1 pneumatic actuator

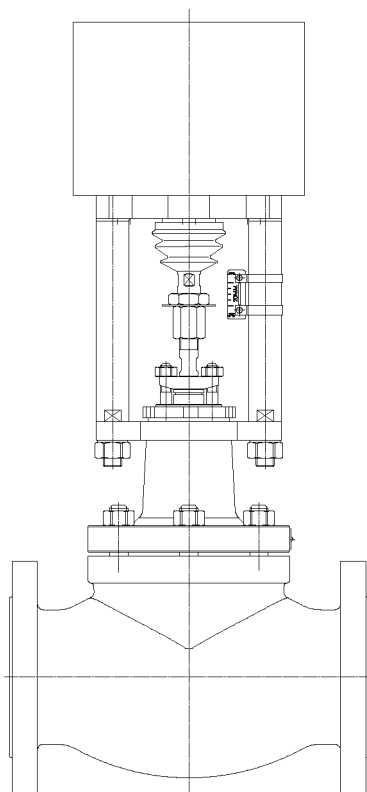


Fig. 14. Z1B type control valve with a post-style electric drive

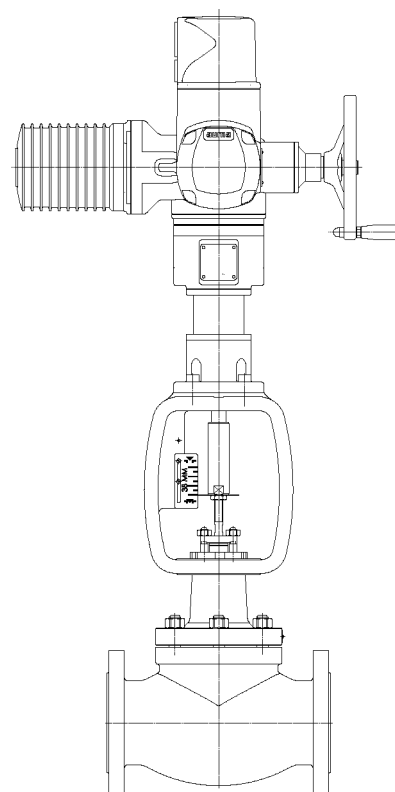


Fig. 15. Z1B type control valve with electric drive and linear gear

Prior to assembly, installation and adjustment of Z1B type control valves with pneumatic and electric drives, read the instructions in the Operation and Maintenance Documentation of the drive manufacturer.

11. Service

The service of a control valve during its use involves maintaining appropriate tightness of the valve pressure chamber and ensuring its operating capacity.

For valves operating on a continuous basis it is recommended to perform regular inspections every 6 months, while for valves operating on a non-continuous basis every 12 months. The inspection covers a visual check of the valve operation, checking its external tightness, settings and correct adjustment. If the valve does not operate correctly, e.g. there are leaks on the bonnet partition or within the stem, the valve jams during operation or reveals poor adjustment, perform relevant actions described in the Instruction (Table 9).

If the valve operates correctly, there is no need to perform disassembly or inspection of internal parts.

12. Repair

The following activities shall be performed within the repair:

- cleaning of the valve and evaluation of the degree of its components wear,
- grinding of the seat and valve plug,
- replacement of the seat, plug, stem and pilot,
- replacement of the valve bonnet gaskets,
- replacement of the body, seat and plug gaskets,
- replacement of the housing gaskets and packing set (for a bellows seal bonnet).

WARNING

Prior to repair, release the pressure in the whole valve and cool it down.

Disconnect all supply cables of compressed air as well as electric and signal supply cables from the actuator or drive. Make sure that the actuator or drive cannot incidentally open or close the valve. Never disassemble an actuator or drive from the valve when the valve is under pressure.

Disconnect the valve from the rest of the system with cut-off valves and release the working fluid.

Disassembly a bonnet under pressure poses a potential hazard to life!

The valve bonnet may contain process medium under pressure, even if the valve has been removed from the process system. The process medium can flow under pressure when the bonnet elements or sealing rings are being disassembled.

To prevent penetration of foreign bodies into the body and to avoid damage to the equipment, cover the hole in the valve body.

NOTE

It is recommended to use original spare parts. If the user fails to observe the rule, it releases the manufacturer from the liability for the product, leads to a loss of guarantee rights and may result in incorrect operation of the valve, constituting hazard to occupational safety.

Internal elements of the valve are accessible after removing the actuator or drive. When removing the actuator or drive, perform the following:

a) disconnect the cables supplying the input signal to the actuator or drive and remove the valve from the system. In the case of a pneumatic actuator with a positioner, disconnect the line supplying the electric control signal and supply air,

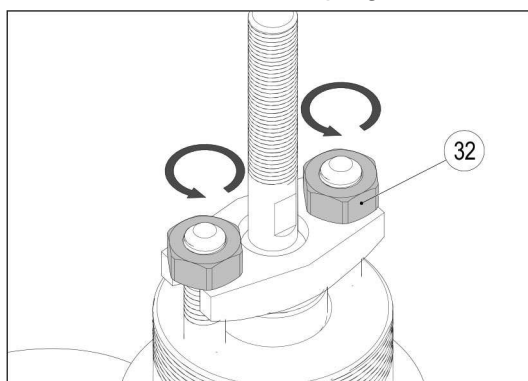
b) disconnect the connection between the valve stem and the actuator or drive stem,

c) loosen the nut (33) mounting the actuator or drive and disconnect it from the valve,

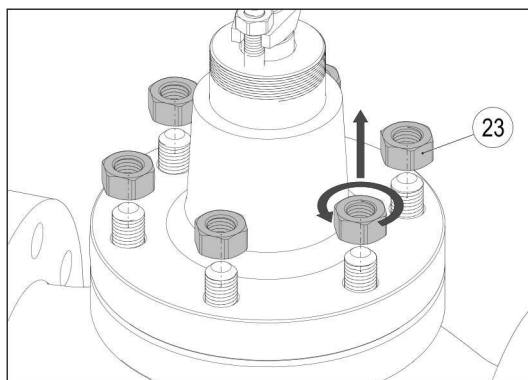
After removing the actuator or drive, disassemble the valve and separate its internal components as described below.

12.1 Disassembly of the bonnet

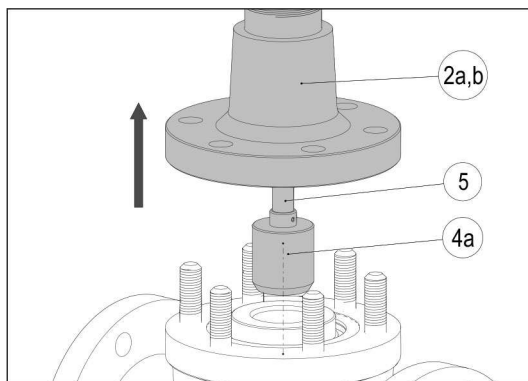
12.1.1 Valve with unbalanced plug



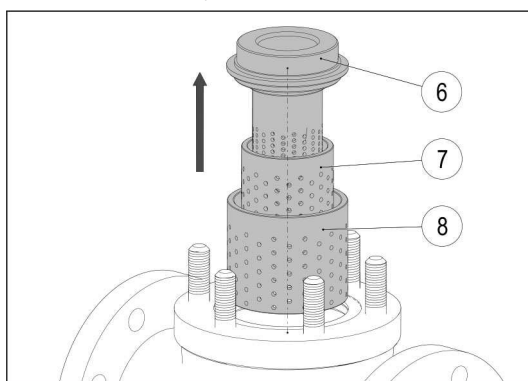
a) loosen the nuts (32) of the bonnet screws,



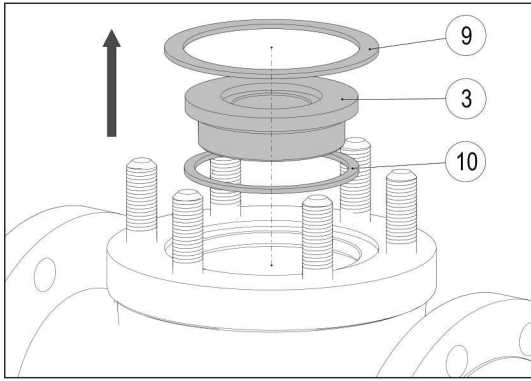
b) undo the nuts (23) on the body screws,



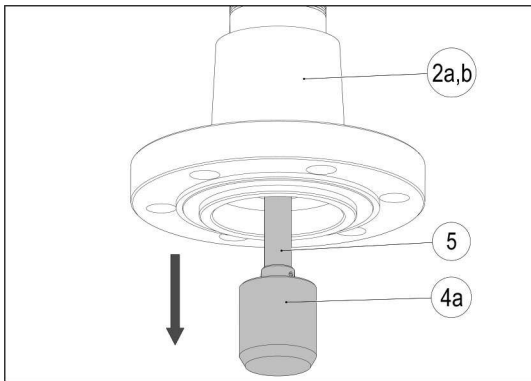
c) disassemble the bonnet (2a, 2b) with the stem (5) and plug (4a) as one assembly,



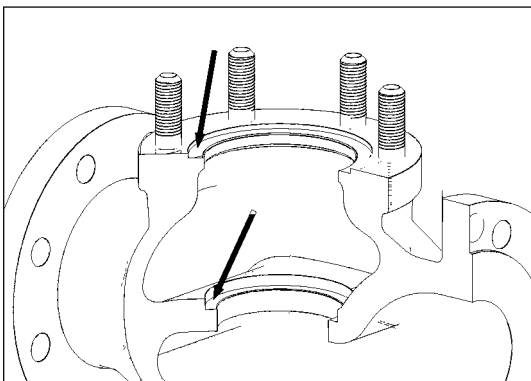
d) remove the control cage (6) with choking cages I (7) and II (8) from the body. If an control cage gasket (11) occurs in the valve, remove the gasket as well.



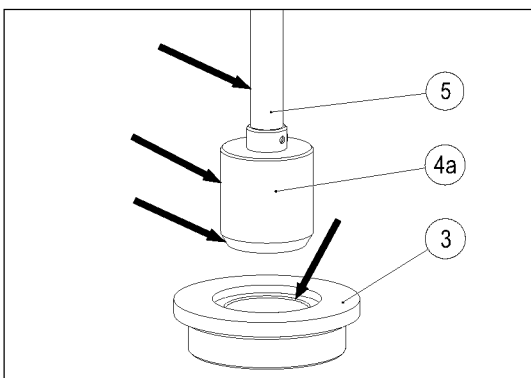
e) remove the seat (3) with gaskets of the body (9) and seats (10),



f) remove the valve plug (4a) with stem (5) from the bonnet as one assembly,



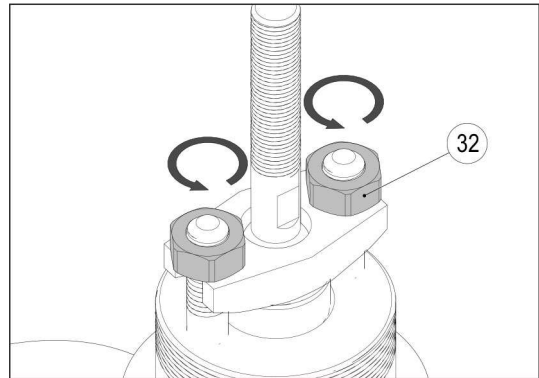
g) clean and check the condition of the sealing surfaces of the body for the seat and bonnet and the body interior,



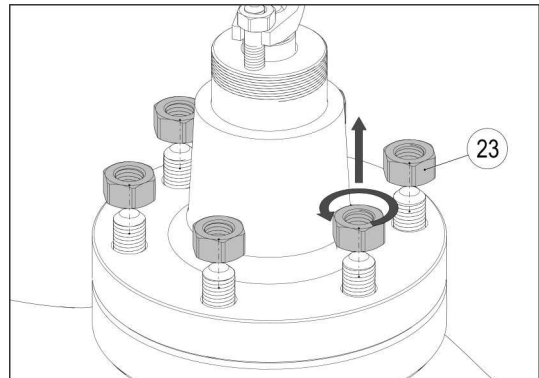
h) clean and inspect the condition of the face surfaces of the seat (3) and plug (4a) and guiding surfaces of the stem and plug,

i) check whether the pass-through holes of the control cage and choking cage are not clogged. Restore passage of the holes, if necessary.

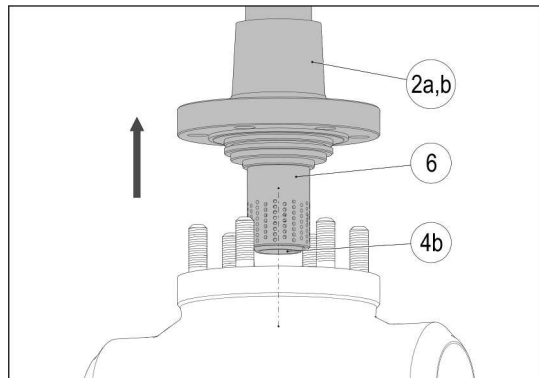
12.1.2 Valve with a valve plug balanced with a seal



a) loosen the nuts (32) of the bonnet screws,



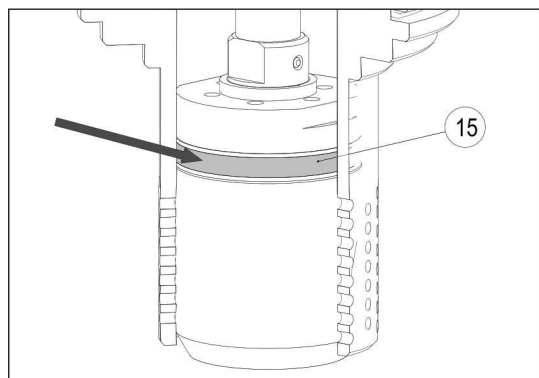
b) undo the nuts (23) on the body screws,



c) disassemble the bonnet (2a, 2b) with the stem (5) and plug (4b) and control cage (6) as one assembly, paying attention not to let the valve plug get out of the control cage.

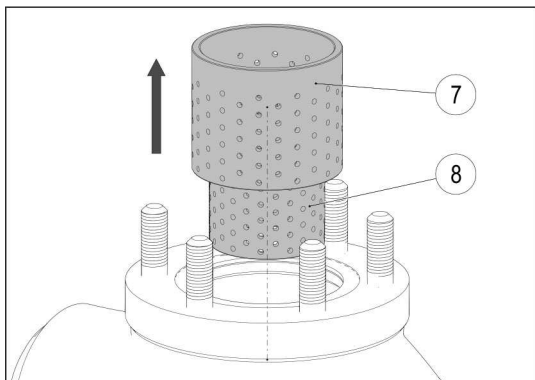
NOTE

The sealing ring of the valve plug (15) is tensioned. Failure to observe the notification will cause damage to the ring.

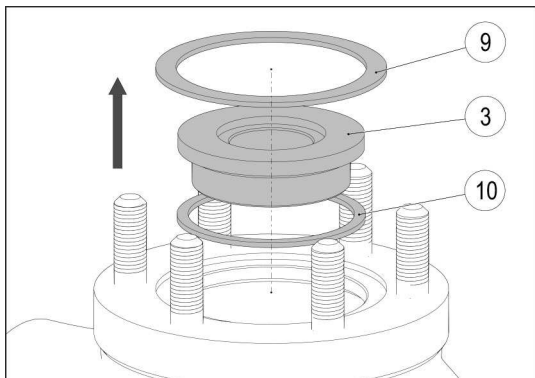


If the ring is damaged, replace it with a new one according to p. 12.6.

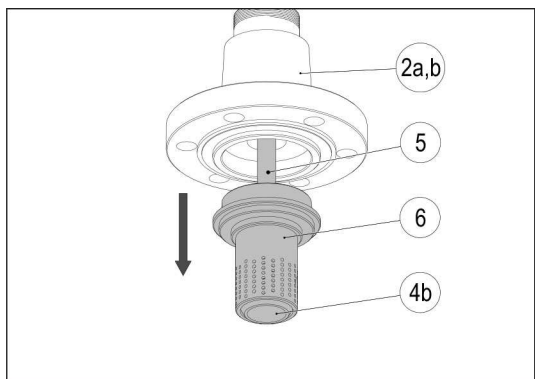
EN



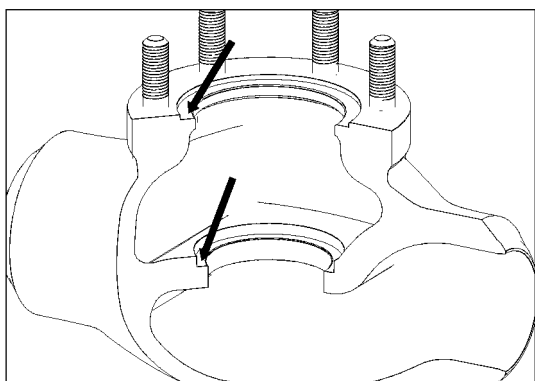
d) remove the choking cages I (7) and II (8) from the body. If an control cage gasket (11) occurs in the valve, remove the gasket as well.



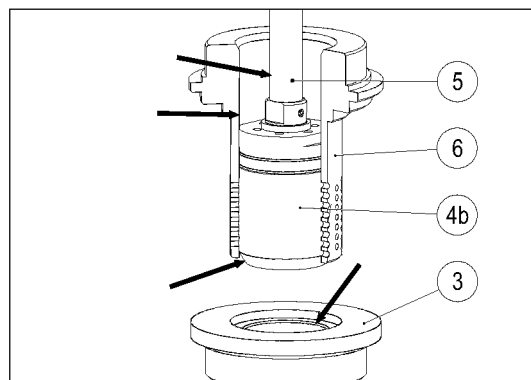
e) remove the seat (3) with gaskets of the body (9) and seats (10),



f) remove the valve plug (4b) with a stem (5) and control cage (6) from the bonnet as one assembly, paying attention not to let the valve plug get out of the control cage,



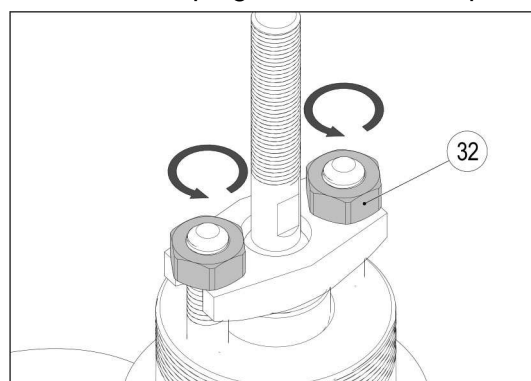
g) clean and check the condition of the sealing surfaces of the body for the seat and bonnet and the body interior,



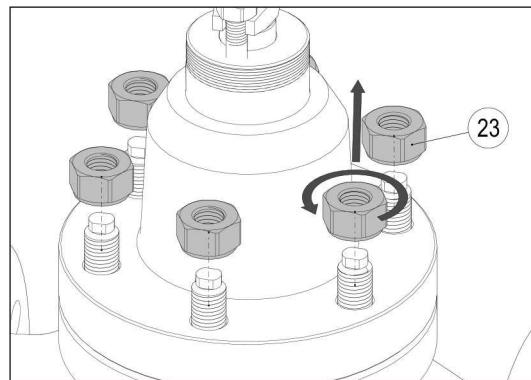
h) clean and inspect the condition of the face surfaces of the seat (3) and plug (4b) and guiding surfaces of the stem (5), plug and control cage (6),

i) check whether the pass-through holes of the control cage and choking cage are not clogged. Restore passage of the holes, if necessary.

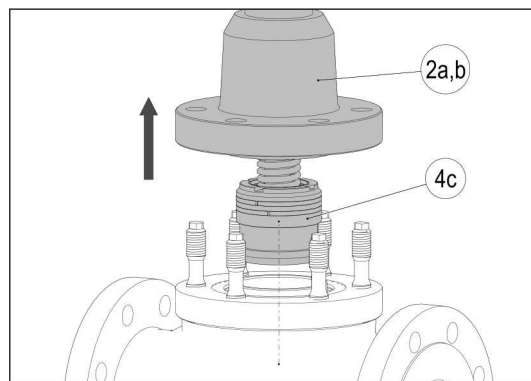
12.1.3 Valve with a plug balanced with a pilot



a) loosen the nuts (32) of the bonnet screws,

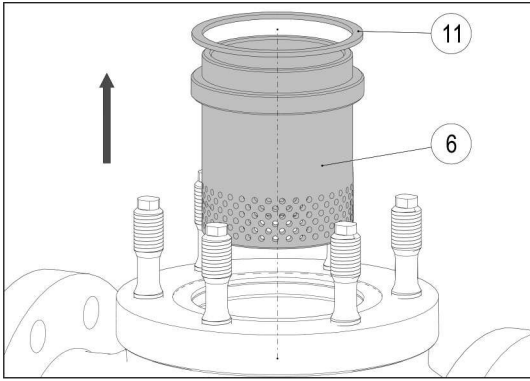


b) undo the nuts (23) on the body screws,

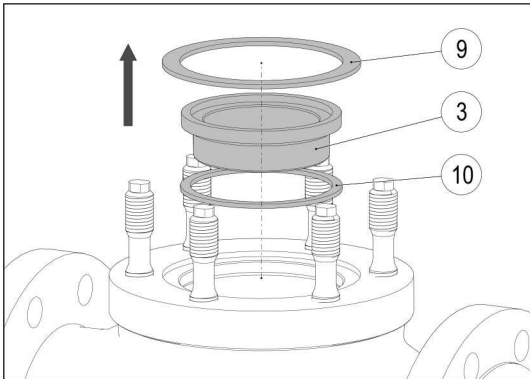


c) disassemble the bonnet (2a, 2b) with the stem (5) and plug (4c) as one assembly,

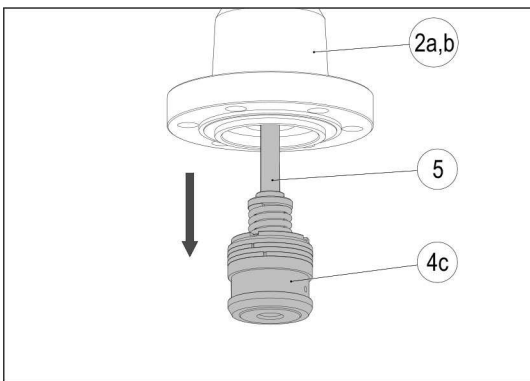
EN



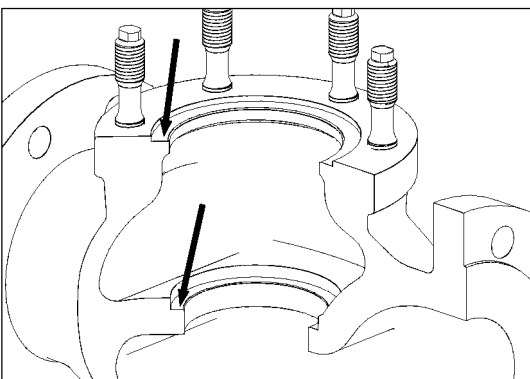
d) remove the control cage (6). If an control cage gasket (11) occurs in the valve, remove the gasket as well.



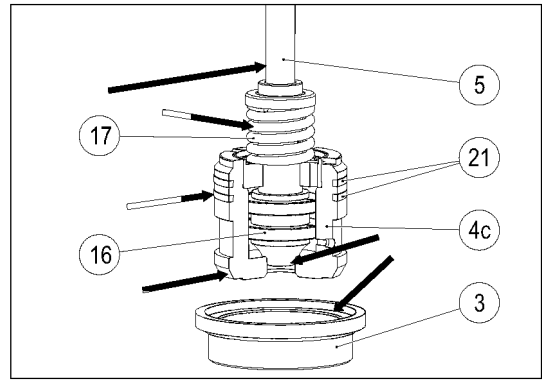
e) remove the seat (3) with gaskets of the body (9) and seats (10),



f) remove the valve plug (4c) with the stem (5) from the bonnet as one assembly,



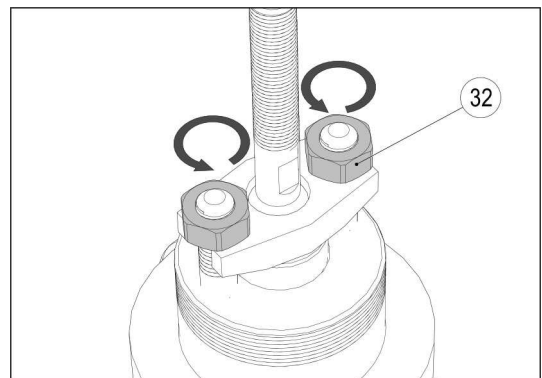
g) clean and check the condition of the sealing surfaces of the body for the seat and bonnet and the body interior,



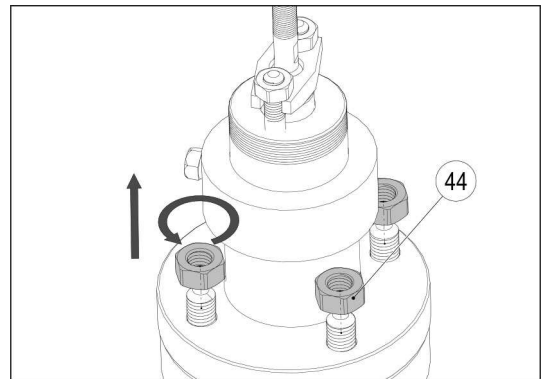
h) clean and inspect the condition of the face surfaces of the seat (3), plug (4c) and the pilot (16), guiding surfaces of the stem (5) and plug, spring (17) and guiding rings (21),

i) check whether the pass-through holes of the control cage and choking cage are not clogged. Restore passage of the holes, if necessary.

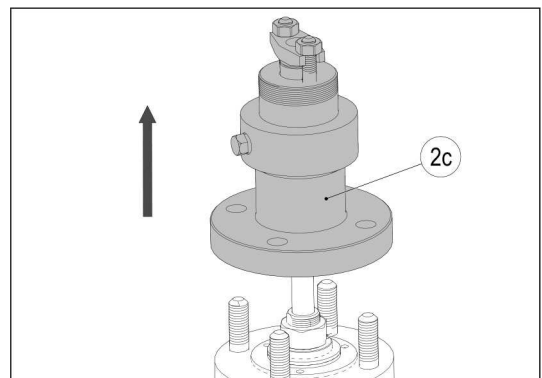
12.1.4 Valve with a bellows bonnet



a) loosen the nuts (32) of the bonnet screws,

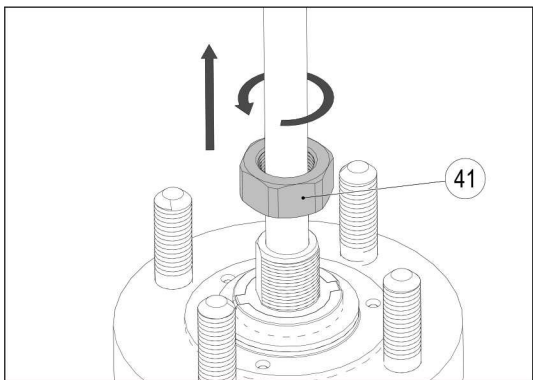


b) undo the nuts (44) on the screws of the bellows seal bonnet housing,

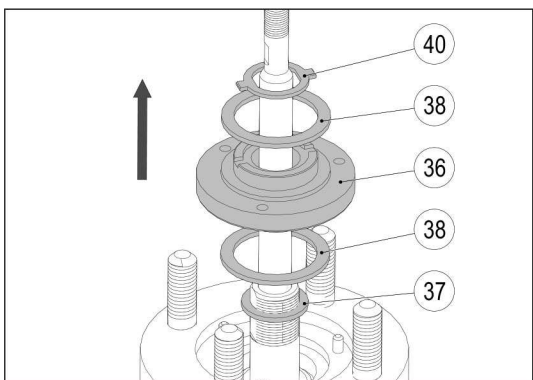


c) disassemble the bellows seal bonnet (2c),

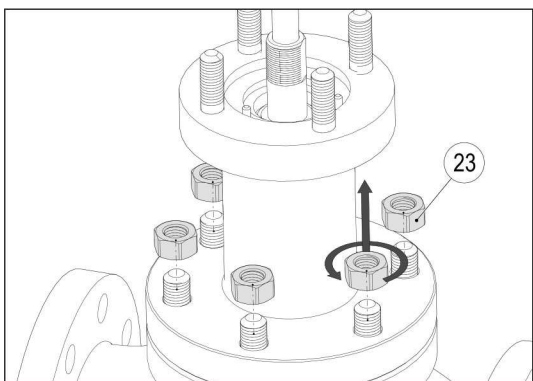
EN



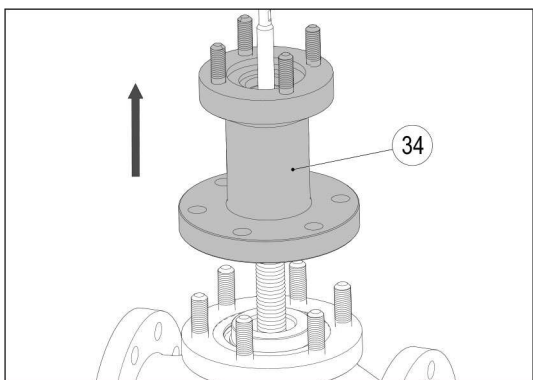
d) undo the nut (41) taking care so as not to overtighten the packing set of the bellows bonnet, as it may result in the damage to the bellows,



e) remove the retaining ring (40), retaining plate (36) and gaskets (37, 38),

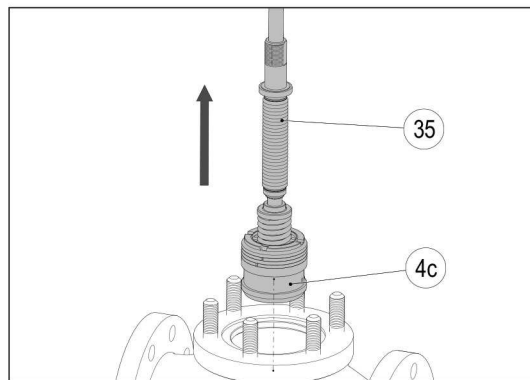
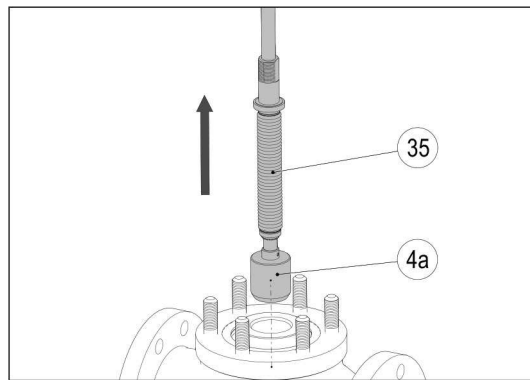


f) undo the nuts (23) on the body screws,

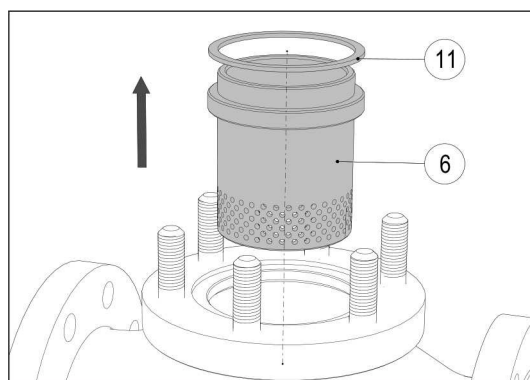
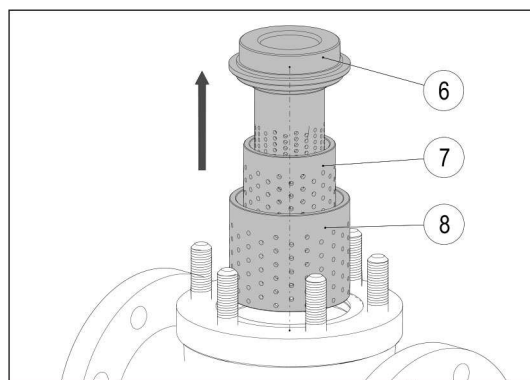


g) disassemble the bellows seal bonnet housing (34) taking care so as not to damage the bellows,

For a valve with a unbalanced plug or plug balanced with a pilot



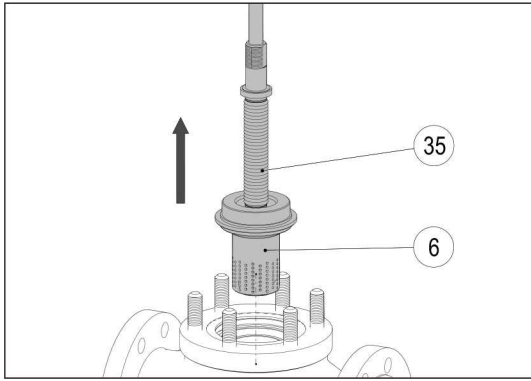
h) remove the valve plug as a whole (4a, 4c) together with the packing set (35), taking care so as not to damage the bellows,



i) remove the control cage (6) with choking cages I (7) and II (8) from the body. If an control cage gasket (11) occurs in the valve, remove the gasket as well.

For a valve with a plug balanced with a seal

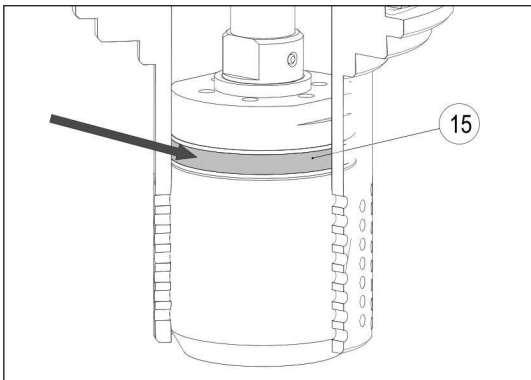
EN



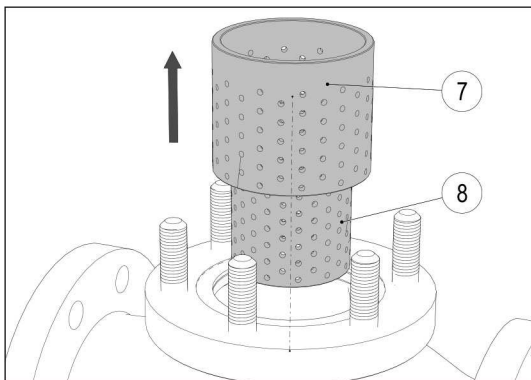
h) remove the valve plug as a whole (4b) together with the packing set (35) and control cage (6), taking care to prevent the valve plug getting out of the control cage and so as not to damage the bellows,

NOTE

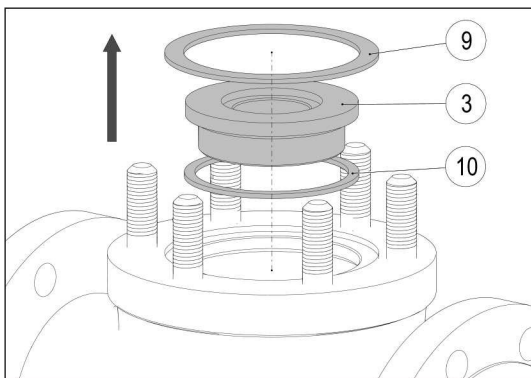
The sealing ring of the valve plug (15) is tensioned. Failure to observe the notification will cause damage to the ring.



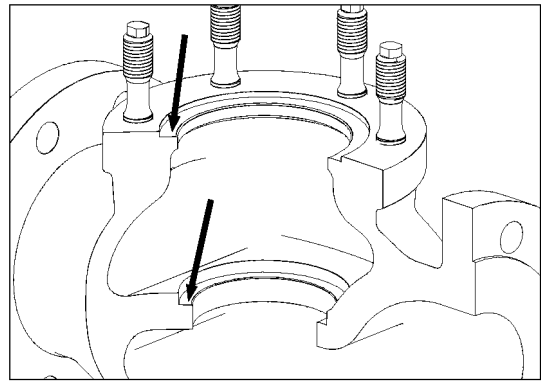
If the ring is damaged, replace it with a new one according to p. 12.6.



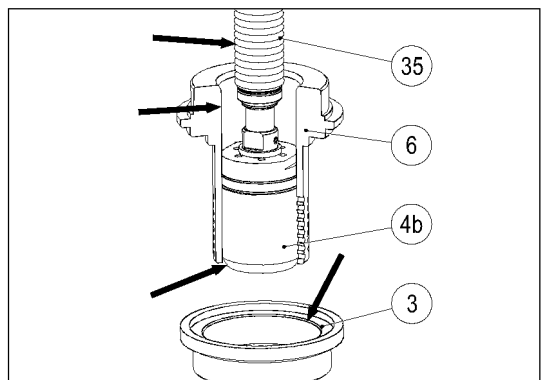
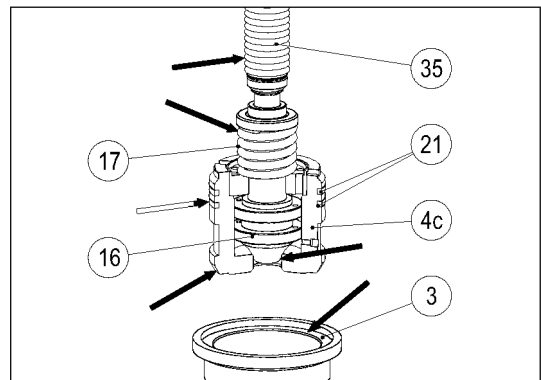
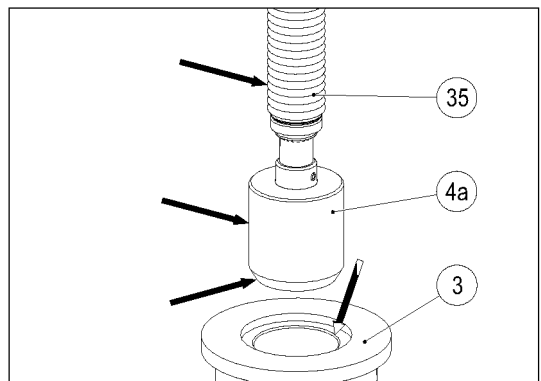
d) remove the choking cages I (7) and II (8) from the body. If an control cage gasket (11) occurs in the valve, remove the gasket as well.



j) remove the seat (3) with gaskets of the body (9) and seats (10),



k) clean and check the condition of the sealing surfaces of the body for the seat and bonnet and the body interior,



l) clean and inspect the condition of the face surfaces of the seat (3), plug (4a, 4b, 4c) and the pilot (16), guiding surfaces of the stem (5) and plug, as well as the packing set of the bellows seal bonnet (35), spring (17) and guiding rings (21),

m) check whether the pass-through holes of the control cage and choking cage are not clogged. Restore passage of the holes, if necessary.

12.2 Grinding of the seat and valve plug

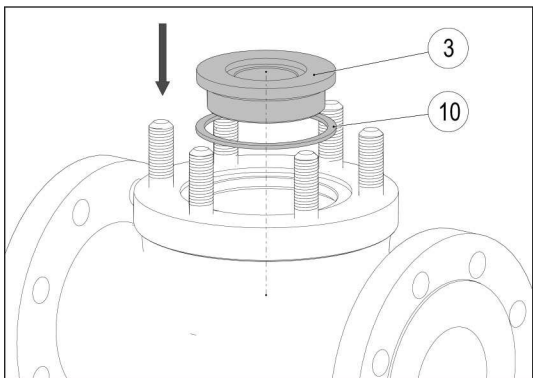
If excess leakage of the shut off is discovered, it is necessary to grind the face surfaces of the seat and plug again.

NOTE

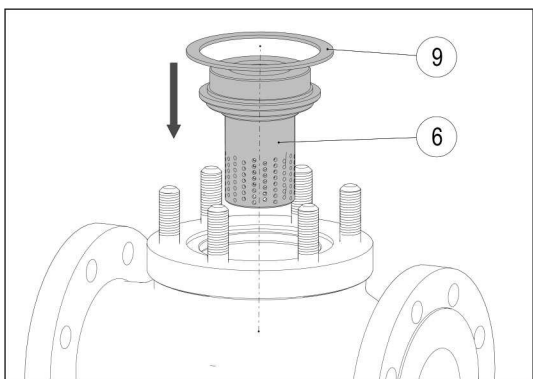
Due to the possible damage to the bellows, grinding of the valve plug at the bellows seal bonnet should be performed by the manufacturer's service.

Grinding is carried out for unbalanced valve plugs. Grinding is not performed for valve plugs balanced with a gasket and with a pilot.

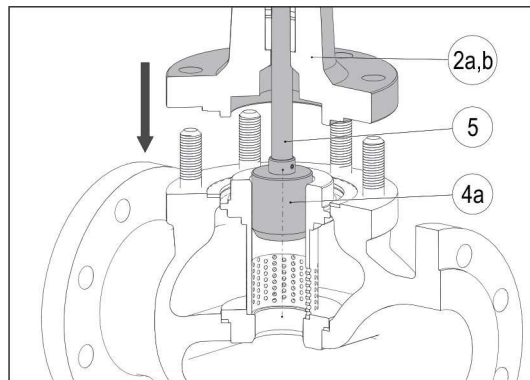
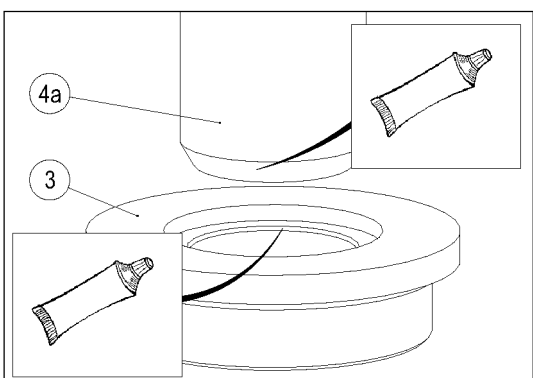
Grinding is carried out for unbalanced valve valve plugs. The following actions shall be performed after disassembly of the bonnet according to p. 12.1.1:



a) insert the seat (3) with the seat gasket (10) into the hole inside the body,



b) apply the control cage (6) and the body gasket (9), paying attention to their coaxial alignment,

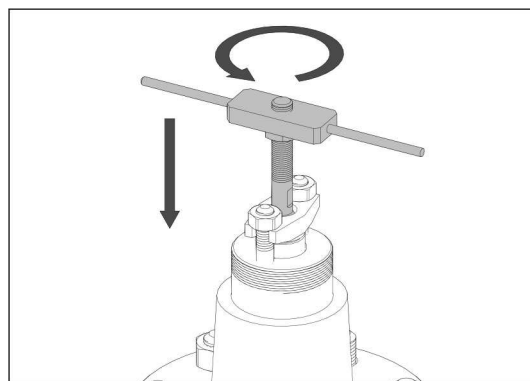


c) apply a thin and homogenous layer of grinding paste to the face surface of the seat (3) and plug (4) and carefully apply the bonnet with the plug and stem to the valve body, fixing it with four nuts on opposite sides,

NOTE

At this point do not tighten the nuts with the torque for normal installation of the valve. The role of the bonnet in this process is only to guide the stem.

EN



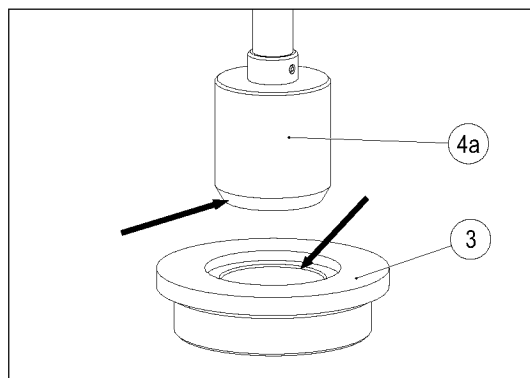
d) grind the face of the seat and plug turning the stem manually several times by 45 degrees in both directions, pressing it slightly towards the seat,

NOTE

Perform the grinding carefully, using fine-grain abrasive agent. Remember that if it is pressed too hard, the quality of the face surfaces can be deteriorated. The sealing surfaces of the plug and seat must be free of any large scratches, cracks, chipping and the contact surface should be as smooth as possible.

e) lift the stem, turn it by about 30 degrees and carefully lower it towards the seat and repeat the actions described in point d),

f) repeat the abovementioned actions several times until the plug performs a full turn,

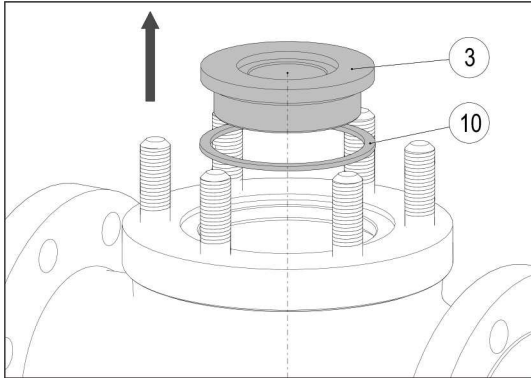


g) once the grinding is completed, remove the bonnet with the plug, stem and gaskets, remove the control cage, seat and

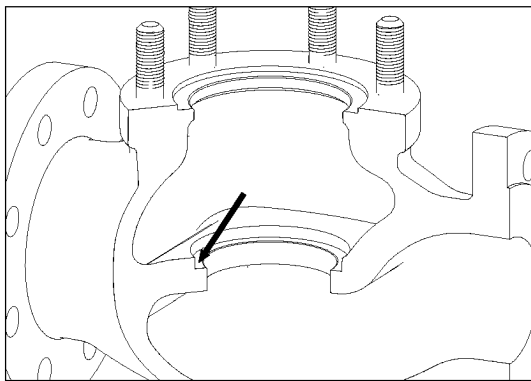
gaskets, thoroughly clean the seat and plug of the residues of the grinding paste with washing benzene and check the condition of the grinding face surfaces.

12.3 Replacement of the seat

If it is not possible to grind the seat due to its excess wear, replace the seat with a new one. The following actions shall be performed after disassembly of the bonnet according to p. 12.1.1...4:



a) remove the old seat (3) and the seat gasket (10) and thoroughly clean the body interior,



b) clean and check the condition of the sealing surfaces of the body for the seat,

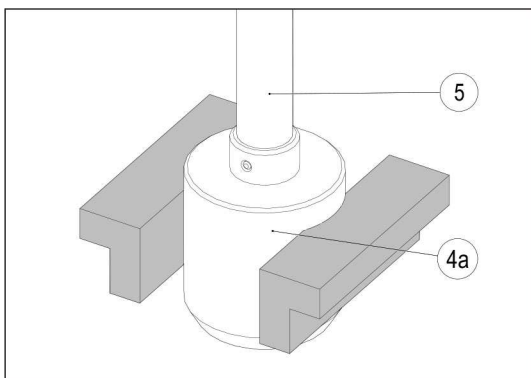
c) insert a new gasket into the seat and the seat into the body interior, and proceed to perform actions as mentioned in the instruction.

12.4 Replacement of the stem

The guiding surface of the stem has the greatest effect on the bonnet tightness. If serious wear of the guiding surface of the stem or damage to the stem is discovered, the stem has to be replaced.

12.4.1 Valve with unbalanced plug

Perform the following actions after removing the bonnet according to p. 12.1.1.:

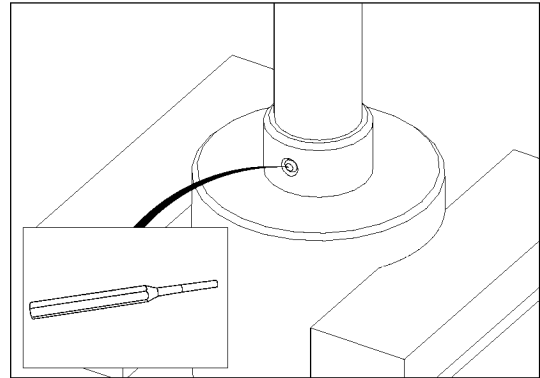


a) fix the plug (4a) with the stem (5) in a vice

NOTE

Be careful when placing the plug in the vice so as not to damage the working surfaces of the plug.

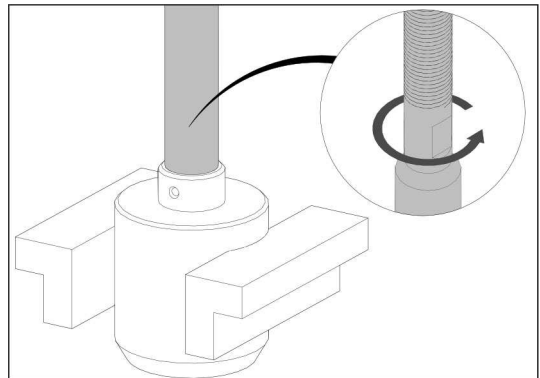
Always use vice jaws made of soft metal or other soft material.



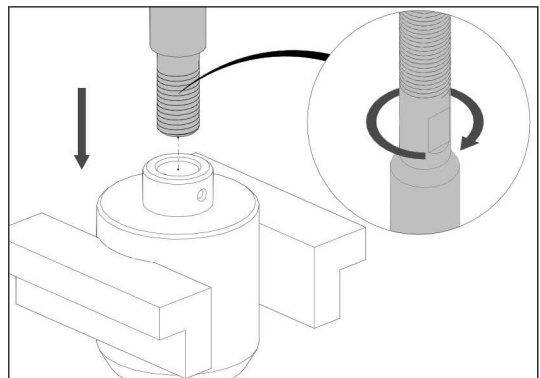
b) beat out the pin with a knocker,

NOTE

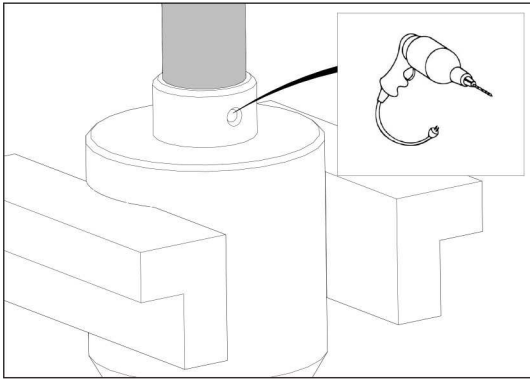
If it is not possible to beat the pin out, it can be drilled with a drill whose diameter is slightly smaller than the diameter of the pin.



c) remove the stem from the plug. Remove the stem turning it anti-clockwise.



d) screw the new stem home into the plug. Screw the plug in turning it clockwise,

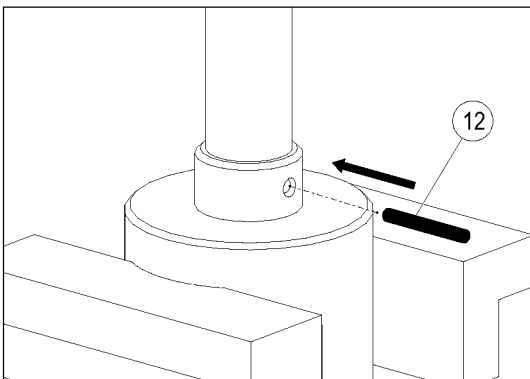


e) drill the stem with a drill whose diameter is the same as the diameter of the hole for the pin (Table 6),

NOTE

Remove all chips after drilling

f) select a pin with the correct size for the diameter of the plug and stem (Table 6),



g) insert the pin (12) into the hole paying attention to maintain uniform distance between the pin and the outer surface of the plug (Fig. 16),

h) after inserting the pin, remove the plug assembly with the stem and centre the combined assembly. The centering is performed by hitting the assembly slightly with a hammer. The acceptable axial throw between the plug and stem is 0.03 mm.

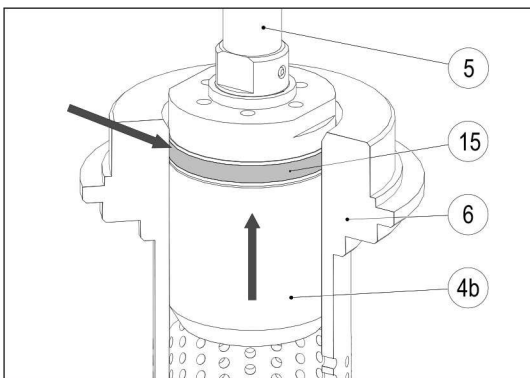
NOTE

Be careful when centering so as not to damage the working surfaces of the plug and stem. Pay special attention to the guiding surface of the stem, which has the greatest effect on the bonnet tightness.

i) after completing the centering, proceed to perform actions described in the Instruction.

12.4.2 Valve with a valve plug balanced with a seal

Perform the following actions after removing the bonnet according to p. 12.1.2:

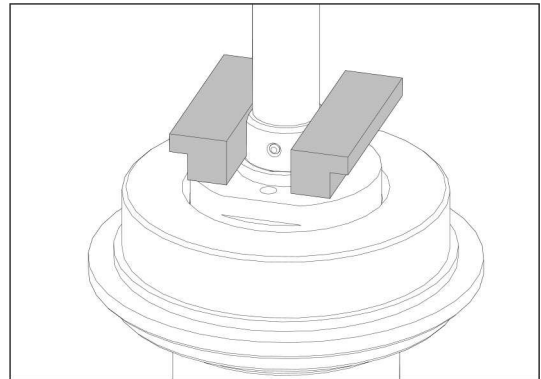


a) slide the valve plug (4b) with the stem (5) off the control cage (6) to the height allowing for fixing the plug in the vice, paying attention not to damage the guiding ring (15) when sliding the valve plug off,

NOTE

The sealing ring of the valve plug (15) is tensioned. Failure to observe the notification will cause damage to the ring.

If the ring is damaged, replace it with a new one according to p. 12.6.

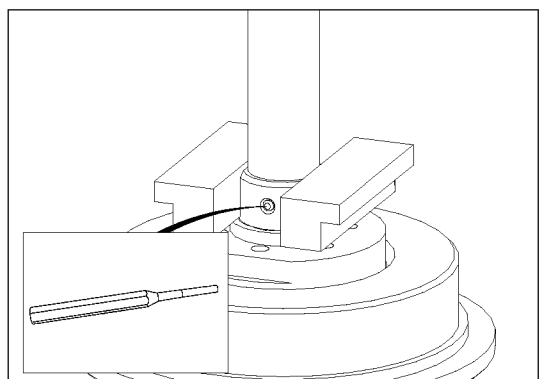


a) fix the plug with the stem in a vice,

NOTE

Be careful when placing the plug in the vice so as not to damage the working surfaces of the plug.

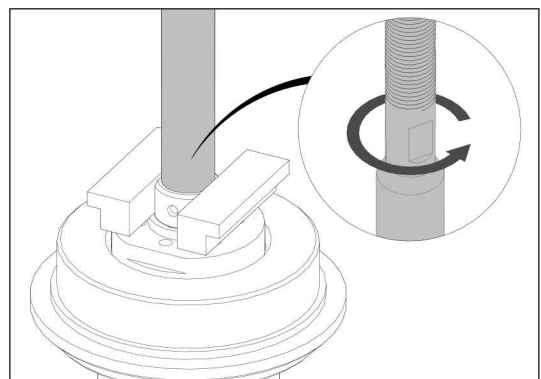
Always use vice jaws made of soft metal or other soft material.



c) beat out the pin with a knocker,

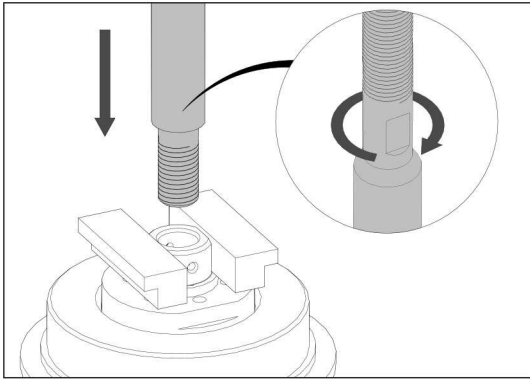
NOTE

If it is not possible to beat the pin out, it can be drilled with a drill whose diameter is slightly smaller than the diameter of the pin.

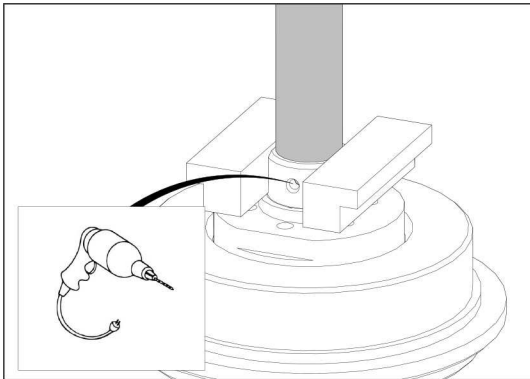


d) remove the used stem from the plug. Remove the stem turning it anti-clockwise.

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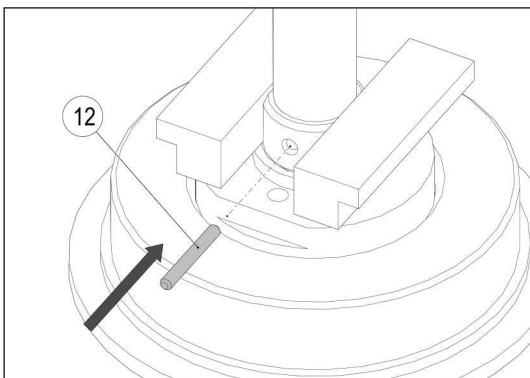
e) screw the new stem home into the plug. Screw the plug in turning it clockwise,



f) drill the stem with a drill whose diameter is the same as the diameter of the hole for the pin (Table 6),

NOTE

Remove all chips after drilling



g) select a pin with the correct size for the diameter of the plug and stem (Table 6),

h) insert the pin (12) into the hole paying attention to maintain uniform distance between the pin and the outer surface of the plug (Fig. 16),

i) after inserting the pin, remove the plug assembly with the stem and control cage and centre the combined assembly. The centering is performed by hitting the assembly slightly with a hammer. The acceptable axial throw between the plug and stem should be 0.03 mm.

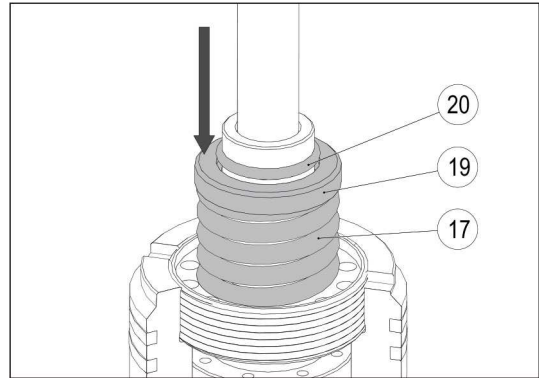
NOTE

Be careful when centering so as not to damage the working surfaces of the plug and stem. Pay special attention to the guiding surface of the stem, which has the greatest effect on the bonnet tightness.

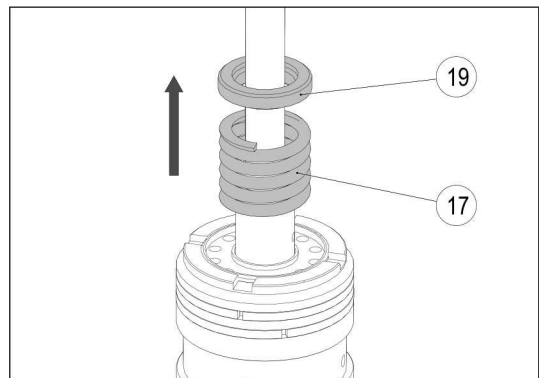
j) after completing the centering, proceed to perform actions described in the Instruction.

12.4.3 Valve with a plug balanced with a pilot

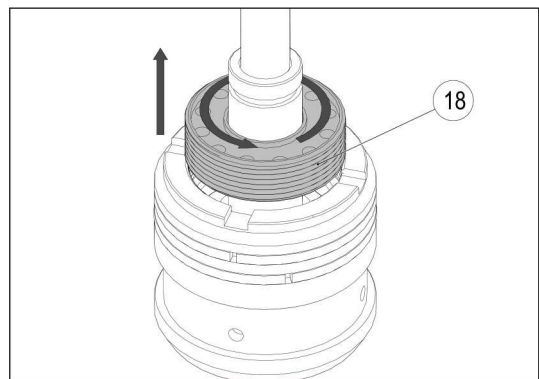
Perform the following actions after removing the bonnet according to p. 13.1.3:



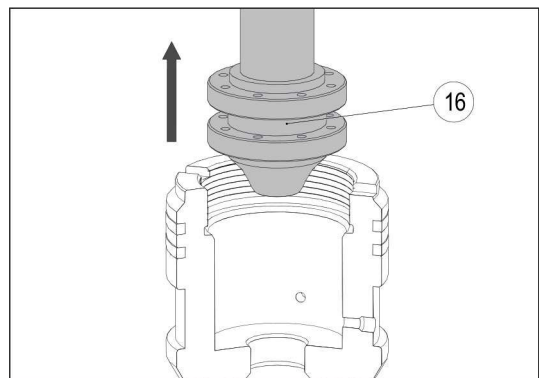
a) pressing the packing washer (19) press the spring (17) and remove the locking ring (20) from the stem groove,



b) remove the packing washer (19) and the spring (17),

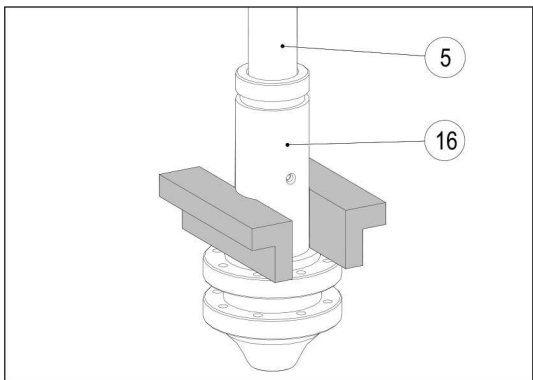


c) remove the protection and loosen the resistance nut of the valve plug (18),



d) remove the pilot (16) with the stem,

EN

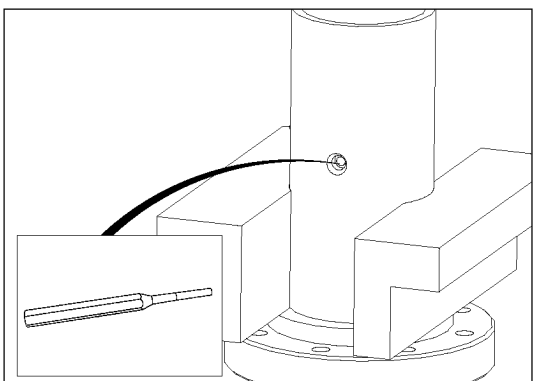


e) fix the pilot (16) with the stem (5) in the vice,

NOTE

Be careful when placing the pilot in the vice so as not to damage the working surfaces of the pilot.

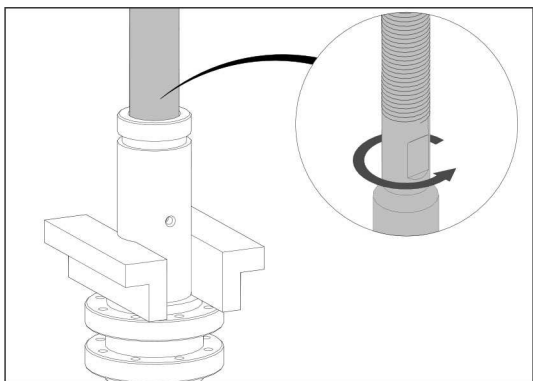
Always use vice jaws made of soft metal or other soft material.



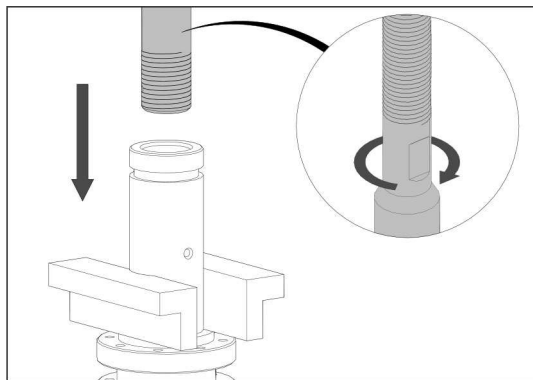
f) beat out the pin with a knocker,

NOTE

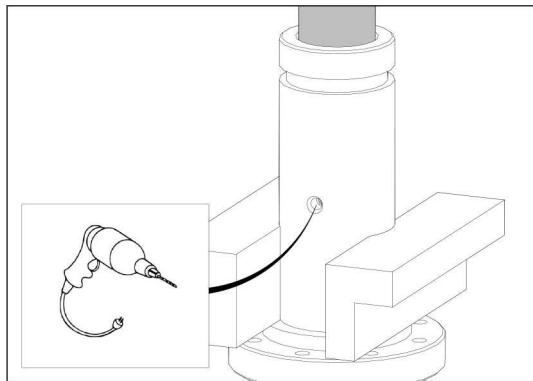
If it is not possible to beat the pin out, it can be drilled with a drill whose diameter is slightly smaller than the diameter of the pin.



g) remove the used stem from the plug. Remove the stem turning it anti-clockwise.



h) screw the new stem home into the plug. Screw the plug in turning it clockwise,

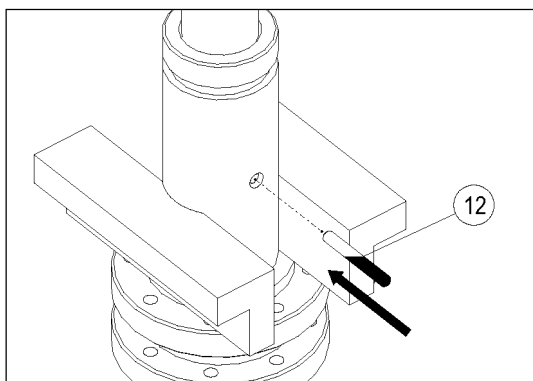


i) drill the stem with a drill whose diameter is the same as the diameter of the whole for the pin (Table 6),

NOTE

Remove all chips after drilling

j) select a pin with the correct size for the diameter of the pilot and stem (Table 6),



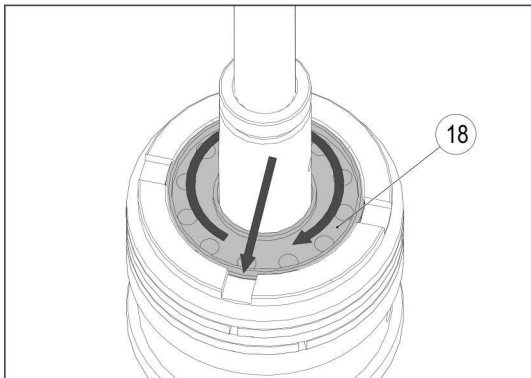
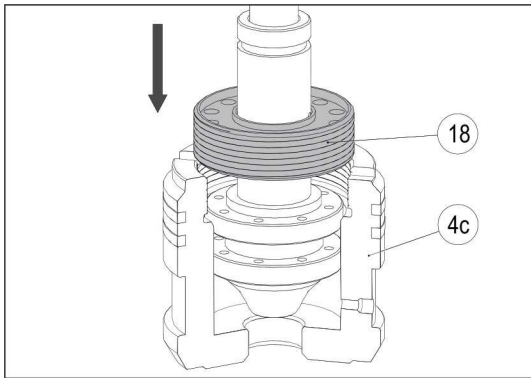
k) insert the pin (12) into the hole paying attention to maintain uniform distance between the pin and the outer surface of the pilot (Fig. 16),

l) after connecting the pilot and the stem with a pin, centre the connected assembly. The centering is performed by hitting the assembly slightly with a hammer. The acceptable axial throw between the pilot and stem should be 0.03 mm.

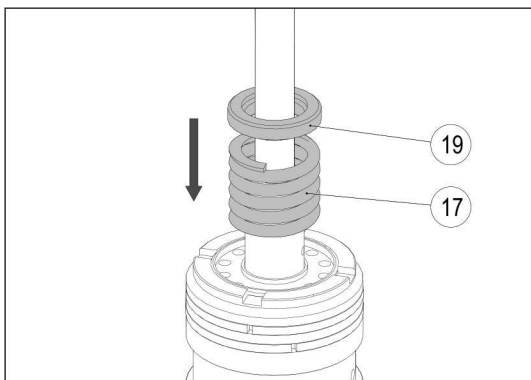
NOTE

Be careful when centering so as not to damage the working surfaces of the pilot and stem. Pay special attention to the guiding surface of the stem, which has the greatest effect on the bonnet tightness.

EN



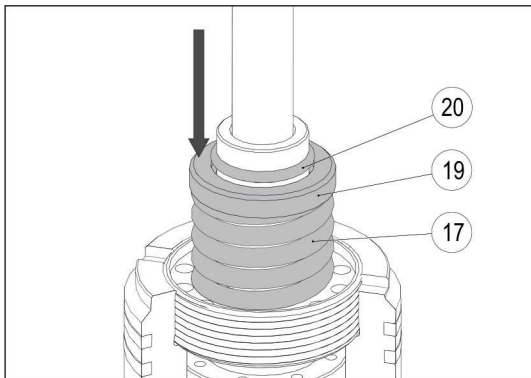
m) once the centering has been completed, carefully insert the pilot assembly with the stem into the valve plug (4c), apply the backup ring (18), tighten and protect the nut against loosening,



n) apply the spring (17) and packing washer (19),

NOTE

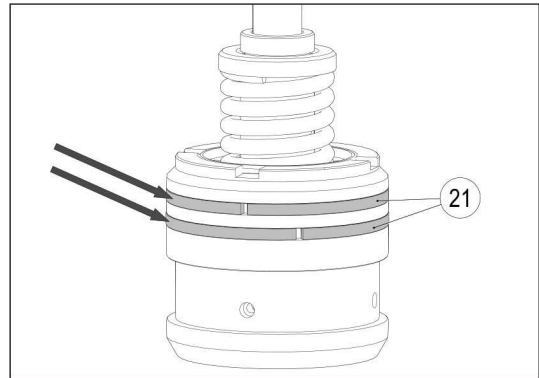
If the spring is damaged, replace it with a new one.



a) pressing the packing washer press the spring and insert the locking ring (20) into the stem groove,

NOTE

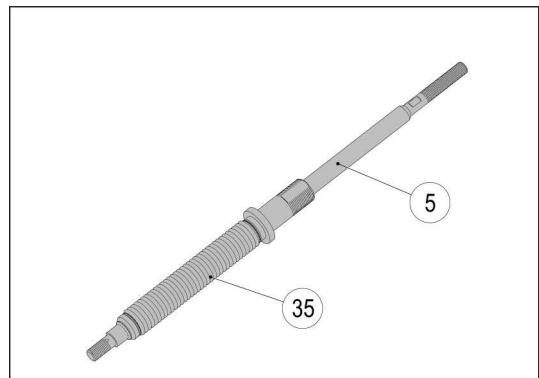
The pressing force of the backup ring should be sufficient for inserting the locking ring. If the force is too high, it may damage the spring.



p) check whether there are guiding rings (21) on the valve plug and proceed to perform actions as mentioned in the instruction.

12.4.4 Valve with a bellows seal bonnet

In valves with a bellows seal bonnet, the valve plug (pilot) stem is permanently fixed to the bellow, forming the sealing set of the bellows seal bonnet (35). If serious wear of the guiding surface of the stem (5) or damage to the stem or bellows is discovered, the whole sealing set has to be replaced. The replacement procedure of the whole sealing set is carried out the same as described in p. 12.4.1....3.



NOTE

Take care when replacing the packing assembly so as not to damage the bellows.

Table 6. Connecting the plug (pilot) and stem with a pin.

Diameter of the pin hole $\varnothing d_1$	Pin diameter $\varnothing d_2$
2 H11	2 h9
3 H11	3 h9
4 H11	4 h11
5 H11	5 h11
6 H11	6 h11

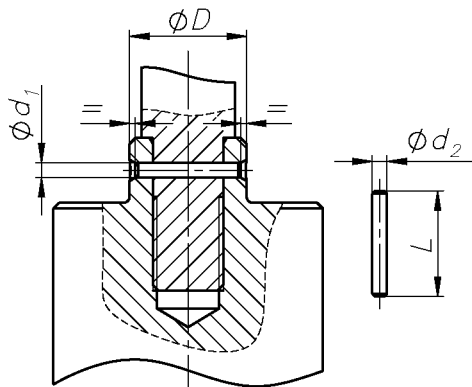


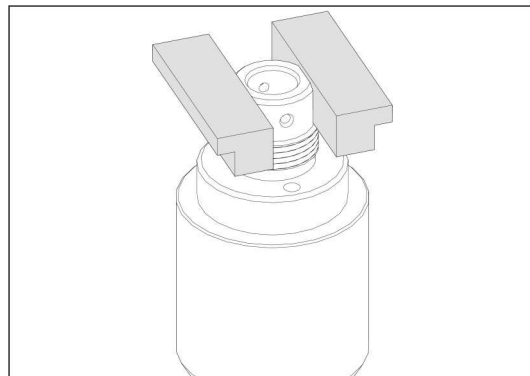
Fig. 16. Connecting the plug (pin) and stem with a pin

b) screw the new stem home into the plug. Screw the plug in turning it clockwise,

c) proceed as described in p. 12.4.1 (items e to h (including)). Then proceed to perform actions as mentioned in the instruction.

12.5.2 Valve with a valve plug balanced with a seal

Perform the following actions after removing the bonnet according to p. 12.1.2:

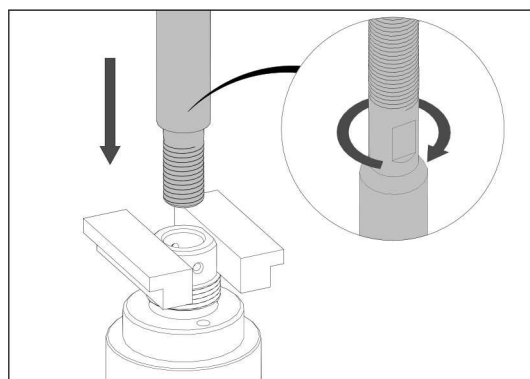


a) fix the new valve plug in a vice,

NOTE

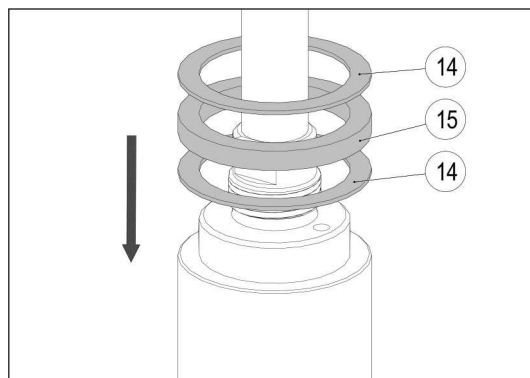
Be careful when placing the plug in the vice so as not to damage the working surfaces of the plug.

Always use vice jaws made of soft metal or other soft material.



b) screw the new stem home into the plug. Screw the plug in turning it clockwise,

c) proceed as described in p. 12.4.2 (items f to i (inclusive)),



d) apply the packing washers (14), new guiding ring (15) and nut (13) onto the valve plug,

NOTE

The pin length L should be similar to the plug diameter ϕD . Holes ϕd_1 , ϕd_2 have to be made within the tolerance values given in Table 6. Other dimensions of the pin according to PN-EN ISO 8740.

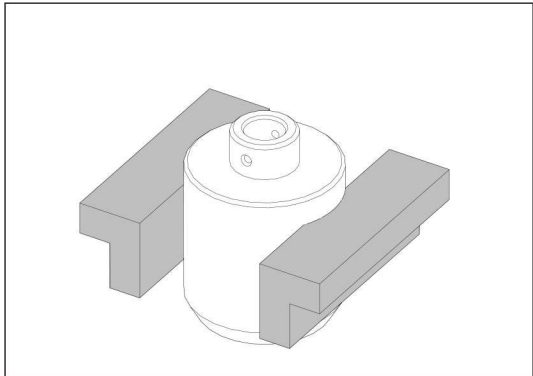
12.5 Valve plug replacement

If serious wear of the face and/or guiding surface of the valve plug or any other damage is discovered, it has to be replaced. When replacing the plug, replace the stem as well, as another hole for a round-headgrooved pin would significantly reduce the life of the assembly.

It is recommended to order and replace a ready-made repair set. If replacement parts are ordered separately, perform relevant actions described in p. 12.5.1...3.

12.5.1 Valve with unbalanced plug

Perform the following actions after removing the bonnet according to p. 12.1.1.:

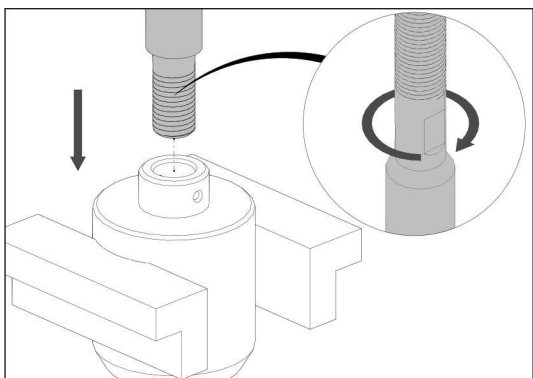


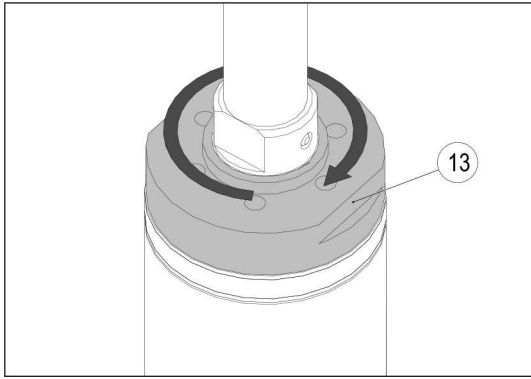
a) fix the new valve plug in a vice,

NOTE

Be careful when placing the plug in the vice so as not to damage the working surfaces of the plug.

Always use vice jaws made of soft metal or other soft material.

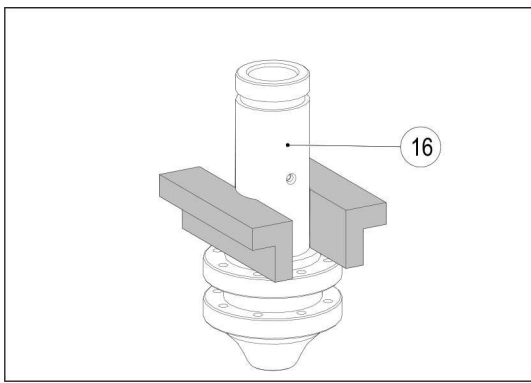




- e) pre-tighten all connected parts,
- f) proceed as described in p. 12.4.3 (items h to p (including)). Then proceed to perform actions as mentioned in the instruction.

12.5.3 Valve with a plug balanced with a pilot

Perform the following actions after removing the bonnet according to p. 12.1.3:



- a) fix the new pilot in a vice,

NOTE

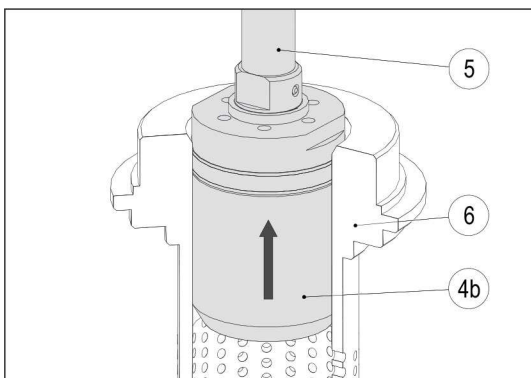
Be careful when placing the pilot in the vice so as not to damage the working surfaces of the pilot.

Always use vice jaws made of soft metal or other soft material.

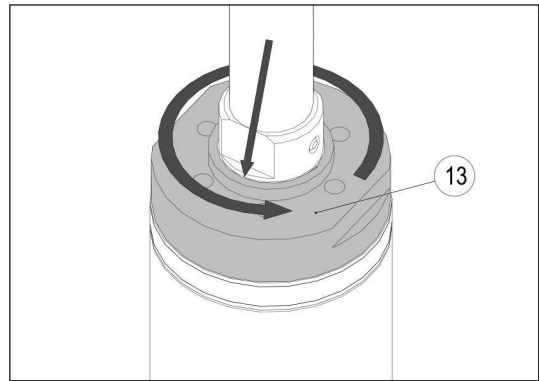
- c) proceed as described in p. 12.4.3 (items h to p (including)). Then proceed to perform actions as mentioned in the instruction.

12.6 Replacement of a sealing ring in a valve with a valve plug balanced with a seal

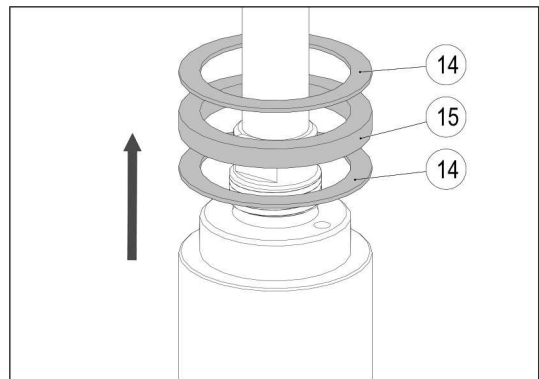
The sealing ring of the valve plug is made of expanded graphite, which can be easily damaged. If excess wear, chirping or damage is discovered, replace it with a new one. Perform the following actions after removing the bonnet according to p. 12.1.1:



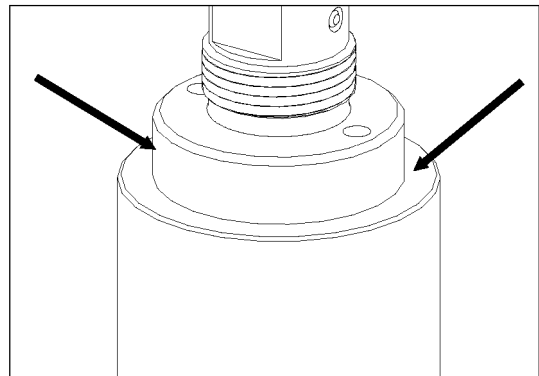
- a) remove the plug (4b) with the stem (5) from the control cage (6),



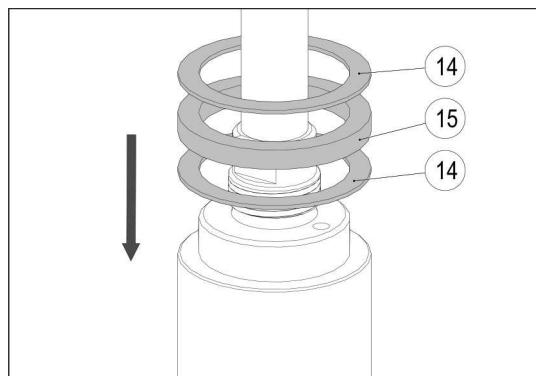
- b) remove the protection and loosen the resistance nut of the valve plug (13),



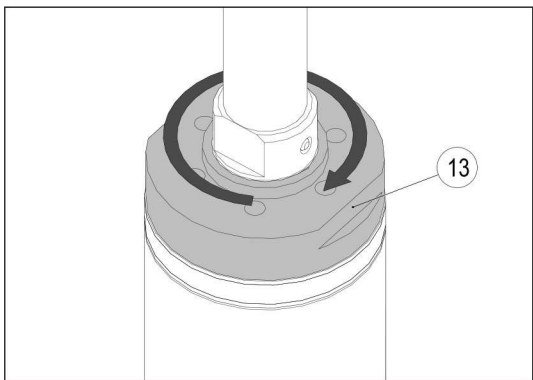
- c) remove the packing washers (14) and guiding rings (15),



- d) remove the seat face surfaces on the valve plug,



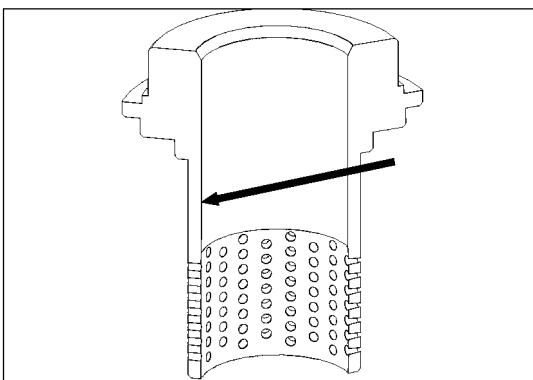
- e) apply the packing washers (14), new guiding ring (15) and nut (13)



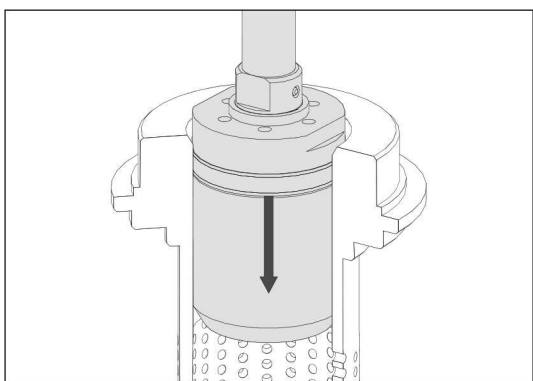
f) pre-tighten all connected parts with a nut (13),

NOTE

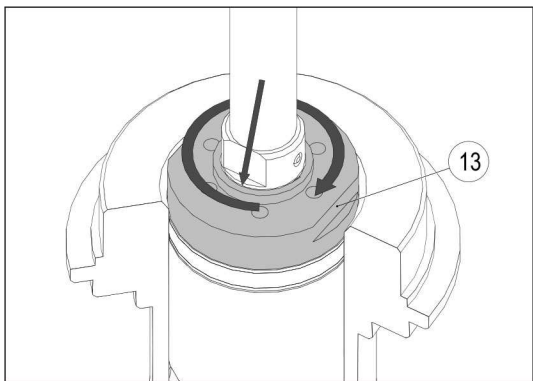
The pre-tightening is intended to protect the rings against falling out of the valve plug and getting damaged.



g) clean the guiding surface in the control cage,



h) insert the connected assembly into the cage,



h) tighten the nut (13) home and protect it against loosening,

i) check whether the connected assembly is straight. If not, proceed to perform the activities described in p. 12.4.2 (item i).

12.7 Replacement and adjustment of the stem packing set pressure in the bonnet

The bonnet is one of the basic elements requiring maintenance. Tightness on the stem in the bonnet is achieved by regular pressing of the packing by tightening of the bonnet nuts (32), except the packing of "V" type gaskets, where the pressing sleeve is inserted home and constant pressure is provided by a spring made of stainless steel (Fig. 17, item a). If the pressing sleeve (26) rests on the top surface of the bonnet, remove it together with the packing washer (30) and add one or two packings (p. 12.7.2).

Fig. 17 presents standard types of bonnet sealing.

12.7.1 Adjustment of the stem sealing

The stem shall be adjusted after applying pressure intended for the valve operation, the pressure of the medium. Information on the test pressure and temperature is marked on the valve nameplate.

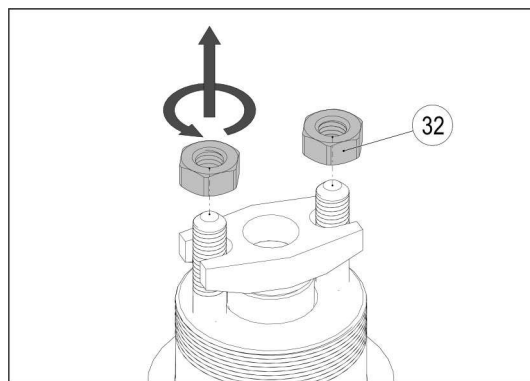
NOTE

The valve should be in an open position during start-up.

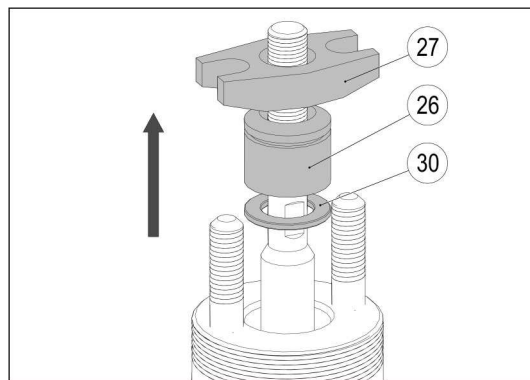
At the initial stage of adjustment, leaks can occur on the sealing. In such cases, after applying pressure, a force pressing the gaskets from the bottom occurs in the bottom part of the packing, exerting pressure on the stem and walls of the bonnet chamber. The pre-stressed packing is prepared for final adjustment. Slightly relieve the pressure and tighten the nuts (32) until the leakage stops but do not allow for significant resistance of the stem movement. If a complete adjustment range is used, add one or two packs to compensate the wear of the sealing (p. 12.7.2). Further adjustment of the sealing is then possible.

12.7.2 Replenishing of the bonnet stem sealing.

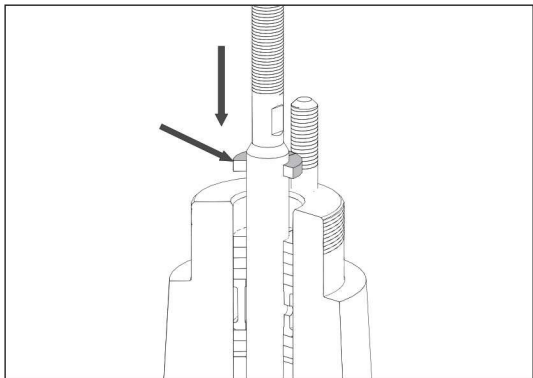
If it is necessary to replenish the bonnet sealing chamber with extra packing, perform the following actions:



a) undo the nuts (32) of the bonnet screws,

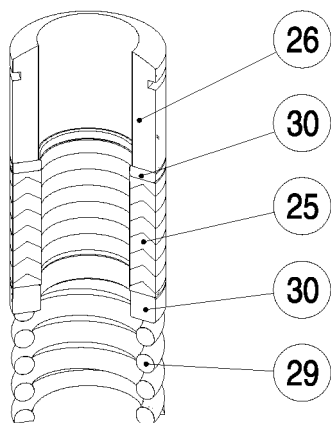


b) remove the pressing lever (27), pressing sleeve (26) and packing washer (30),

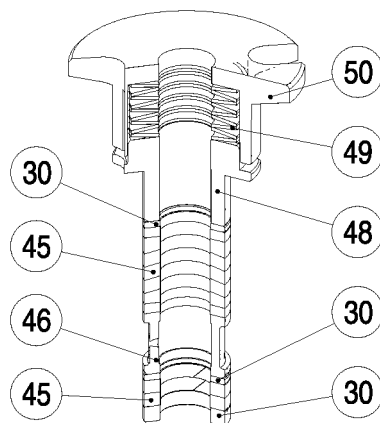


c) add one or more packings,

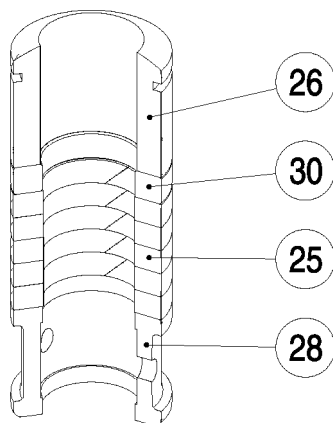
EN



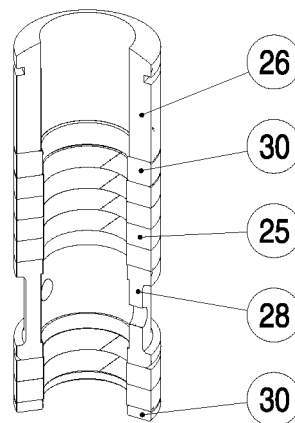
a) PTFE-V



b) maintenance-free

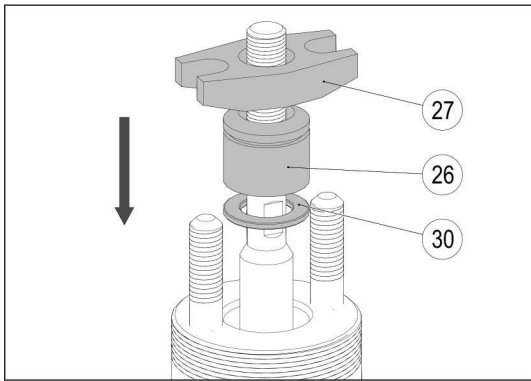


c) PTFE-GRAPHITE

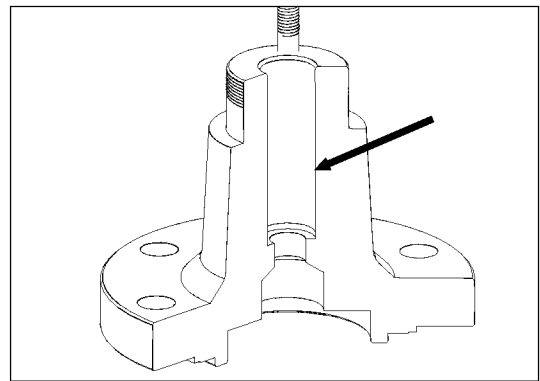


d) GRAPHITE

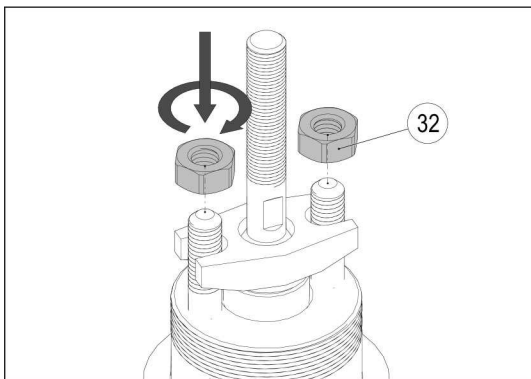
Fig. 17. Standard types of bonnet sealing



d) put on a packing washer (30), sleeves and pressing lever (26, 27)



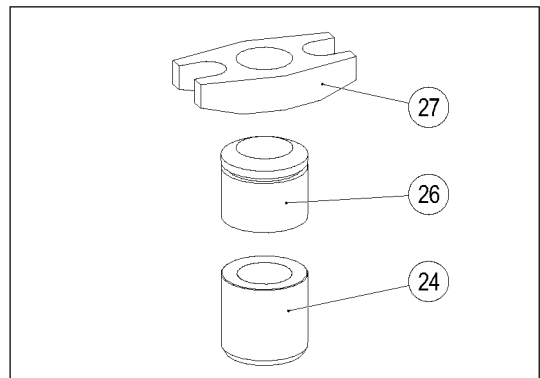
c) clean the bonnet chamber. The bonnet chamber should be clean and free of deposits, corrosion products and other foreign bodies,



e) tighten the nuts (32) of the bonnet screws and proceed to perform actions as mentioned in the instruction.

12.7.3 Replacement of the sealing in the valve bonnet

When starting to replace the whole packing of the bonnet, after disassembly the bonnet according to p. 12.1.1...4:

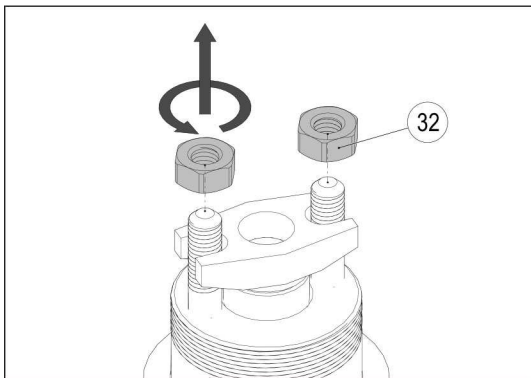


d) clean and check the condition of the lever, pressing sleeve (26, 27) and guiding sleeve (24). If any of the parts is damaged, replace it with a new one.

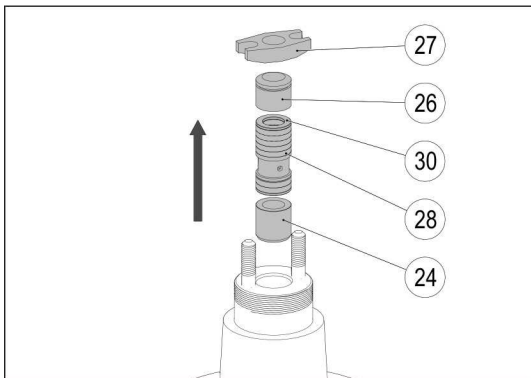
e) begin to mount the bonnet according to p. 12.8.1...4,

NOTE

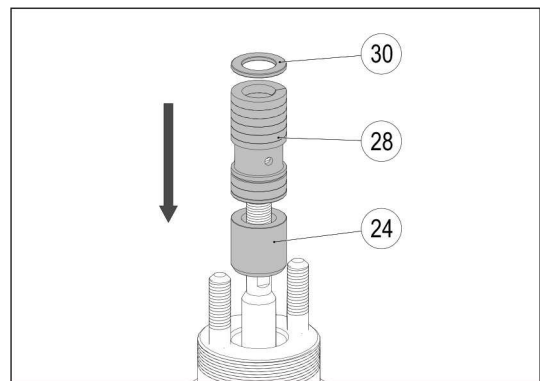
When mounting the bonnet, skip item f, (for a valve with a bellows seal bonnet - item j) concerning checking of the valve housing tightness. The test is performed only after the bonnet packing has been replaced.



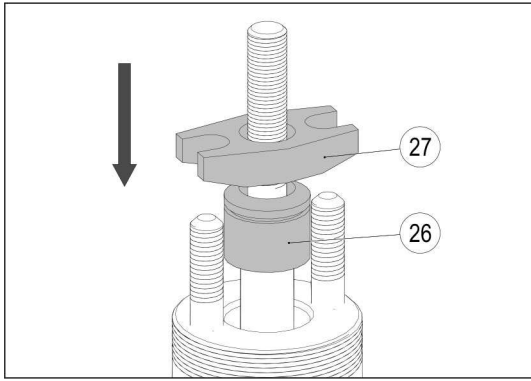
a) loosen the nuts (32) of the bonnet screws,



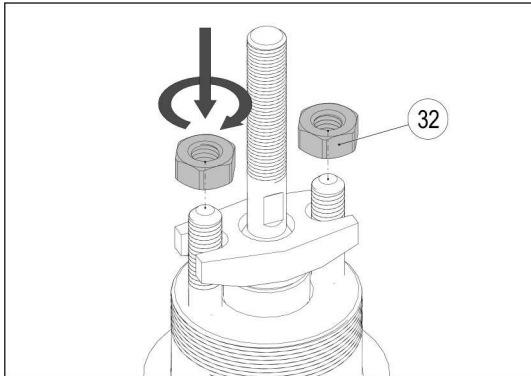
b) remove the pressing lever (27), pressing sleeve (26), packing washer (30), packing (28) and guiding sleeve (24),



f) insert the guiding sleeve (24), a set of new gaskets and other elements into the bonnet chamber (Fig. 17),



g) press the gaskets with the pressing sleeve (26),



h) screw the nuts (32) onto the bonnet screws and check tightness of the valve housing. Information on the test pressure and temperature is marked on the valve nameplate.

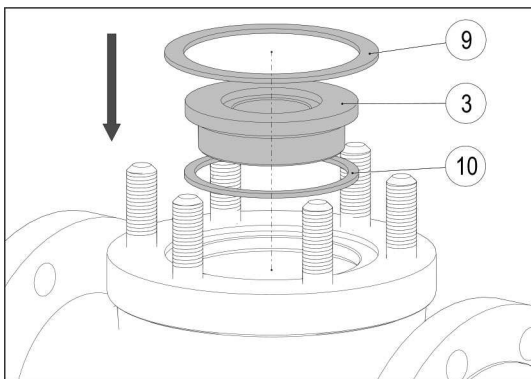
NOTE

The valve should be in an open position during start-up.

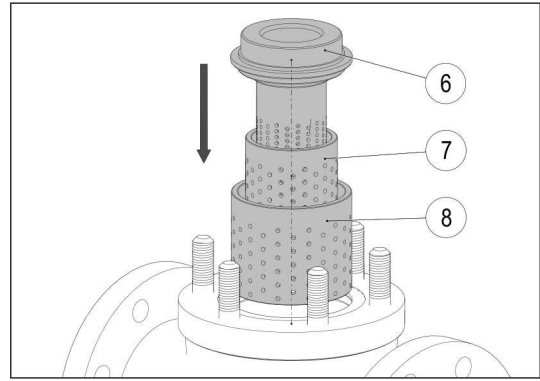
12.8 Bonnet installation

12.8.1 Valve with unbalanced plug

After completing maintenance works on the valve, proceed as follows:



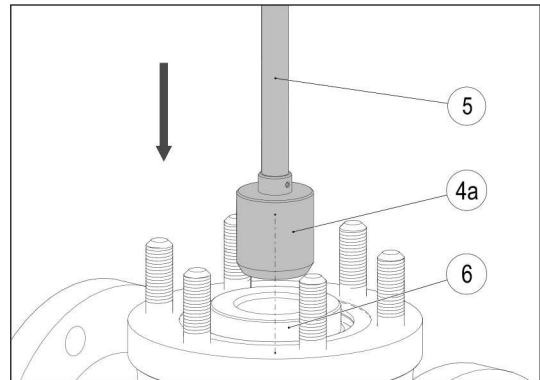
a) insert a new seat gasket (10), seat (3) and a new body gasket (9) into the body interior,



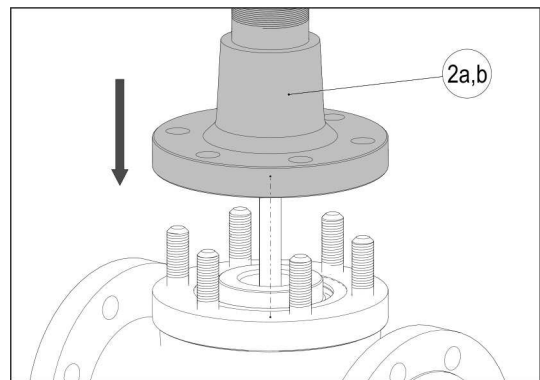
b) insert the control cage (6) with choking cages I (7) and II (8) from the body. If an control cage gasket (11) was present inside the bonnet at disassembly, it should be placed back,

NOTE

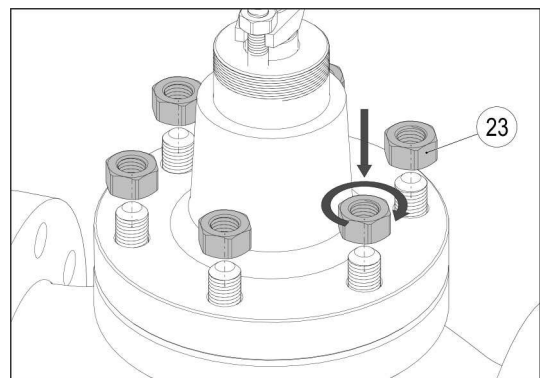
Replace the spiral gasket of the body (9), seat (10) and control cage (11) with new ones. Failure to observe the rule may result in incorrect operation of the valve, constituting hazard to occupational safety.



c) insert plug (4a) with the stem (5) as one assembly into the control cage (6),



d) apply the bonnet (2a, b) onto the valve body,



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e) screw the nuts (23) on the body screws. The sequence of tightening of the nuts is presented in Fig. 18 and the recommended torques are given in Table 8.

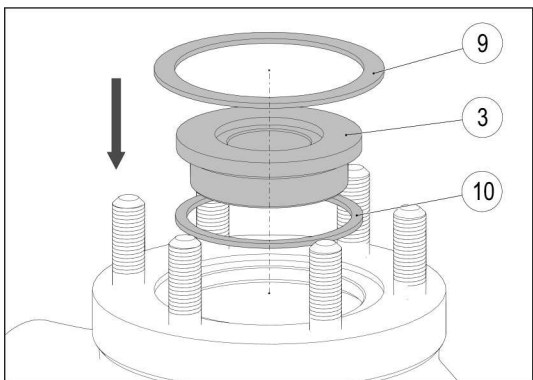
f) check the tightness of the valve housing. Information on the test pressure and temperature is marked on the valve nameplate.

NOTE

The valve should be in an open position during start-up.

12.8.2 Valve with a valve plug balanced with a seal

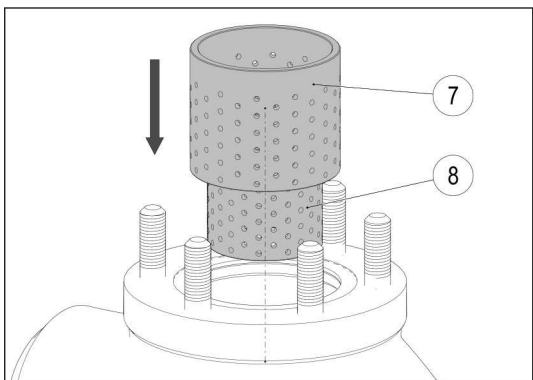
After completing maintenance works on the valve, proceed as follows:



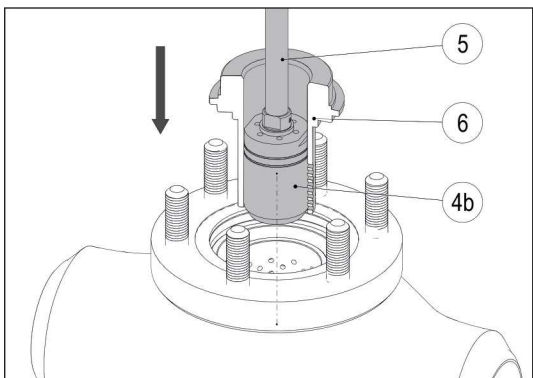
a) insert a new seat gasket (10), seat (3) and a new body gasket (9) into the body interior,

NOTE

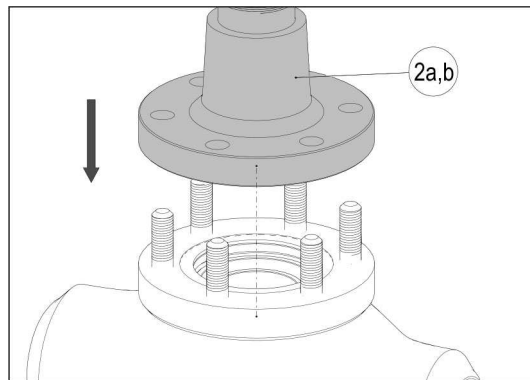
Replace the spiral gasket of the body (9), seat (10) and control cage (11) with new ones. Failure to observe the rule may result in incorrect operation of the valve, constituting hazard to occupational safety.



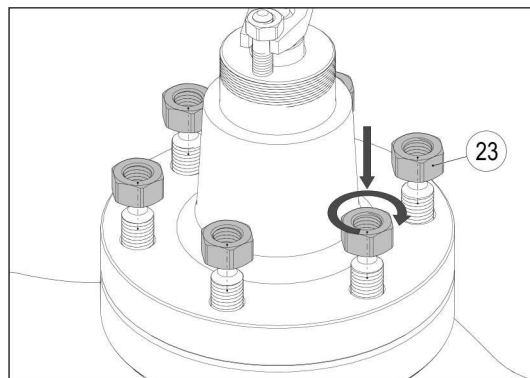
b) insert the choking cages I (7) and II (8),



c) insert the valve plug (4b) with the stem (5) and control cage (6) as one assembly, paying attention not to let the valve plug get out of the control cage. If an control cage gasket (11) was present inside the bonnet at disassembly, it should be placed back,



d) apply the bonnet (2a, b) onto the valve body,



e) screw the nuts (23) on the body screws. The sequence of tightening of the nuts is presented in Fig. 18 and the recommended torques are given in Table 8.

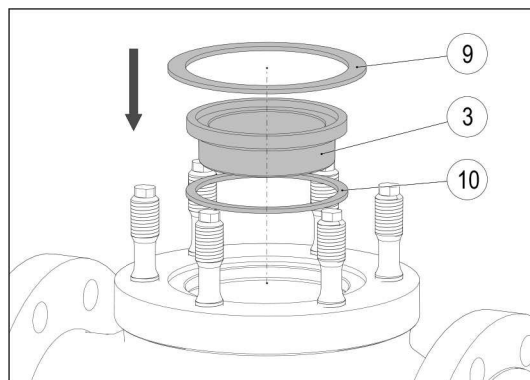
f) check the tightness of the valve housing. Information on the test pressure and temperature is marked on the valve nameplate.

NOTE

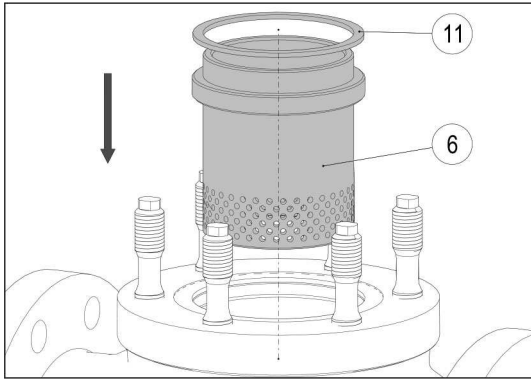
The valve should be in an open position during start-up.

12.8.3 Valve with a plug balanced with a pilot

After completing maintenance works on the valve, proceed as follows:



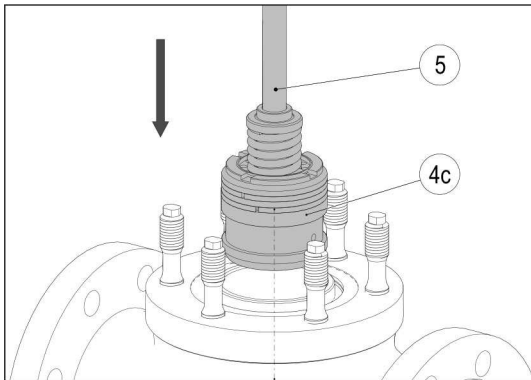
a) insert a new seat gasket (10), seat (3) and a new body gasket (9) into the body interior,



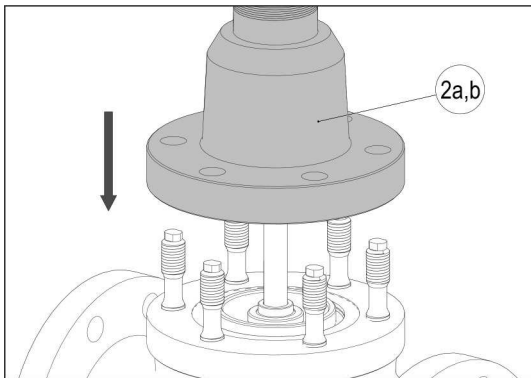
b) insert the control cage (6). If an control cage gasket (11) was present inside the bonnet at disassembly, it should be placed back,

NOTE

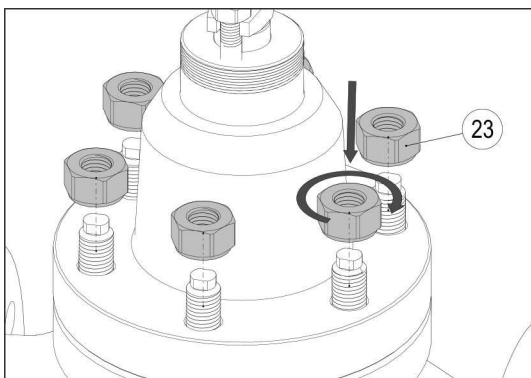
Replace the spiral gasket of the body (9), seat (10) and control cage (11) with new ones. Failure to observe the rule may result in incorrect operation of the valve, constituting hazard to occupational safety.



c) insert the valve plug (4c) with the stem (5) as one assembly into the control cage (6).



d) apply the bonnet (2a, b) onto the valve body,



e) screw the nuts (23) on the body screws. The sequence of tightening of the nuts is presented in Fig. 18 and the recommended torques are given in Table 8.

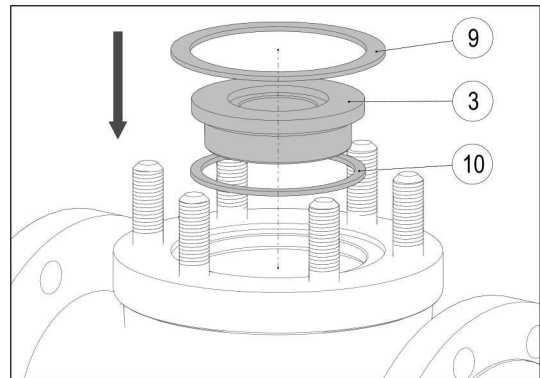
f) check the tightness of the valve housing. Information on the test pressure and temperature is marked on the valve nameplate.

NOTE

The valve should be in an open position during start-up.

12.8.4 Valve with a bellows seal bonnet

After completing maintenance works on the valve, proceed as follows:

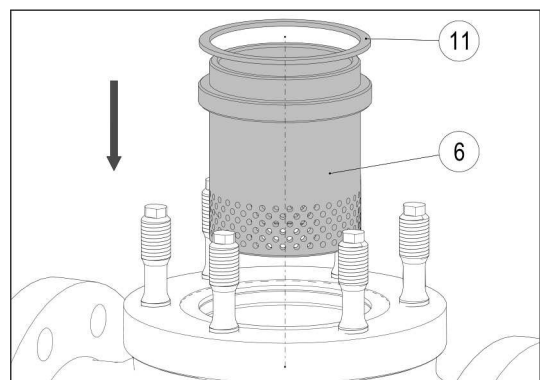
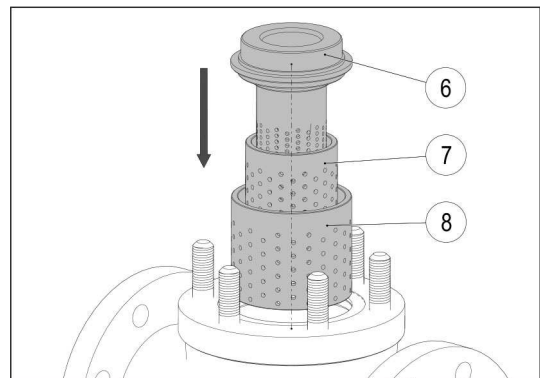


a) insert a new seat gasket (10), seat (3) and a new body gasket (9) into the body interior,

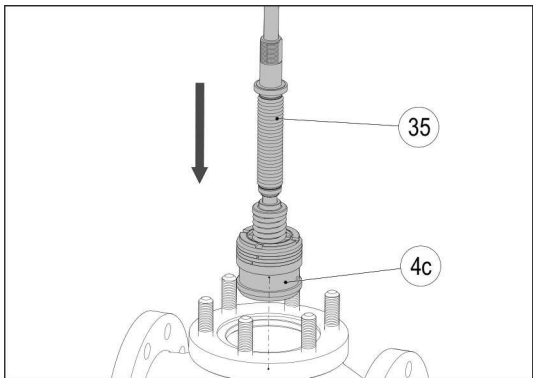
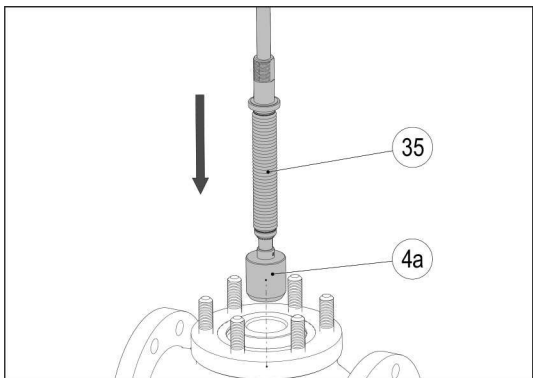
NOTE

Replace the spiral gasket of the body (9), seat (10) and control cage (11) with new ones. Failure to observe the rule may result in incorrect operation of the valve, constituting hazard to occupational safety.

For a valve with a unbalanced plug or plug balanced with a pilot

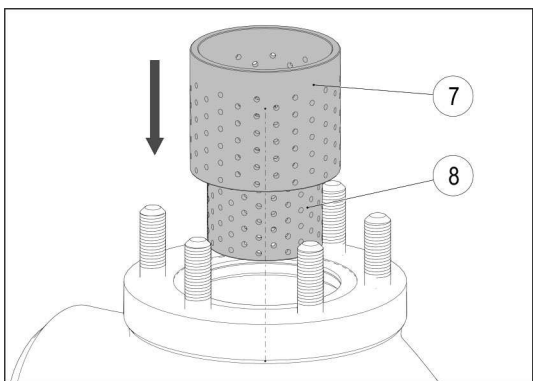


b) insert the control cage (6) with choking cages I (7) and II (8) from the body. If a control cage gasket (11) was present inside the bonnet at disassembly, it should be placed back,

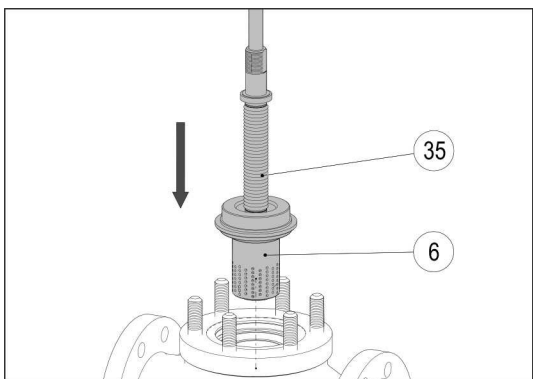


c) insert the valve plug (4a, 4c) as a whole together with the packing set (35) into the control cage (6), taking care so as not to damage the bellows,

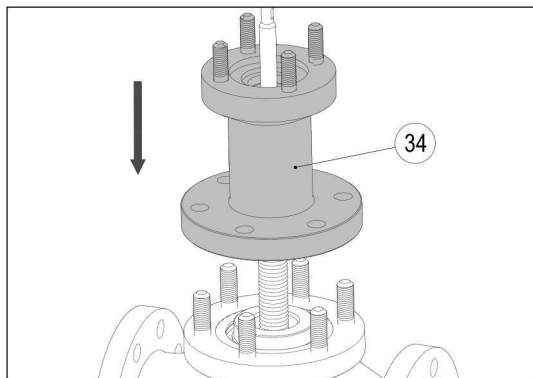
For a valve with a plug balanced with a seal



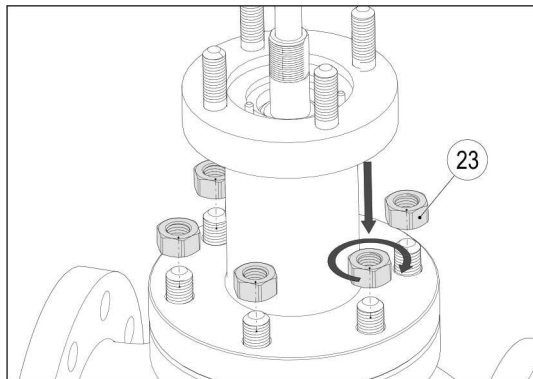
b) insert the choking cages I (7) and II (8),



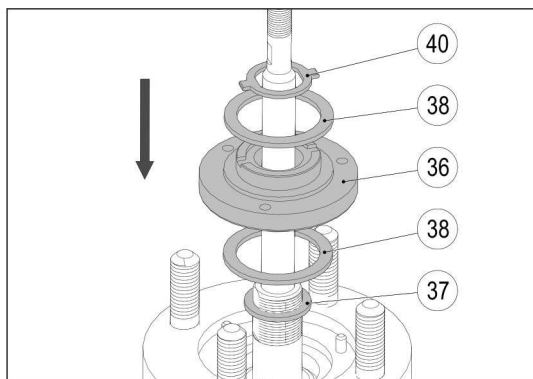
c) insert the valve plug as a whole (4b) together with the packing set (35) and control cage (6), taking care to prevent the valve plug getting out of the control cage and so as not to damage the bellows. If an control cage gasket (11) was present inside the bonnet at disassembly, it should be placed back,



d) place the bellows seal bonnet housing (34) onto the body, taking care so as not to damage the bellows,



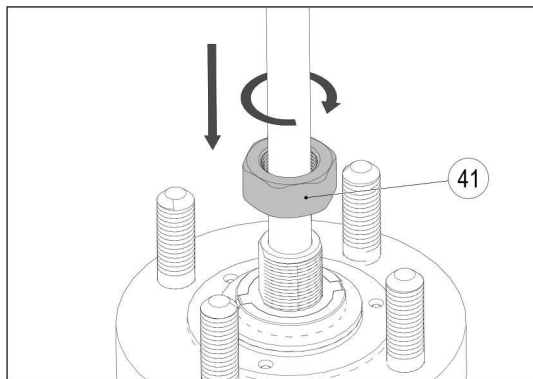
e) screw the nuts (23) on the body screws. The sequence of tightening of the nuts is presented in Fig. 18 and the recommended torques are given in Table 8.



f) insert the retaining ring (40), retaining plate (36) and gaskets (37, 38),

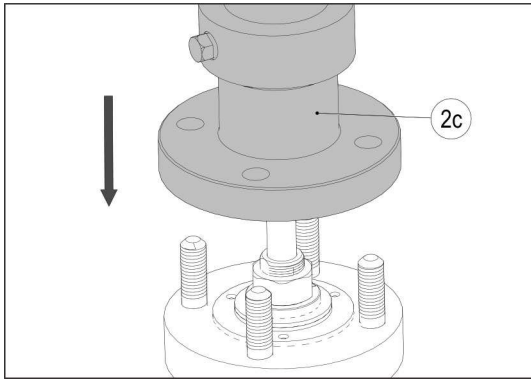
NOTE

Spiral gaskets (37, 38) have to be replaced with new ones. Failure to observe the rule may result in incorrect operation of the valve, constituting hazard to occupational safety.

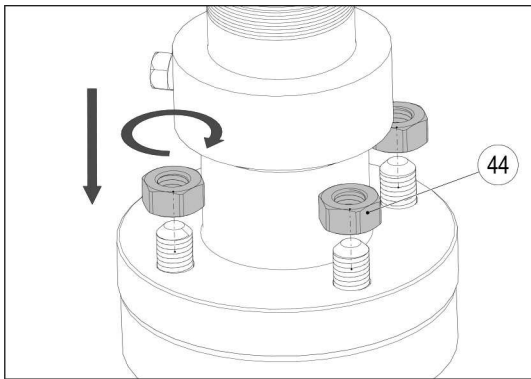


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g) tighten the nut (41) taking care so as not to overtighten the packing set of the bellows bonnet, as it may result in the damage to the bellows,



h) apply the bellows seal bonnet (2c),



i) tighten the nuts (44) on the screws of the bellows seal bonnet housing. Tighten the nuts until tightness is achieved. The sequence of the nuts tightening is presented in Fig. 18.

j) check the tightness of the valve housing. Information on the test pressure and temperature is marked on the valve nameplate.

NOTE

The valve should be in an open position during start-up.

12.9. Replacement of a sealing ring in a valve with a valve plug balanced with a seal MUPU type.

If excess wear or damage seal MUPU type is discovered, replace it with a new one.

a) remove the plug (4b) with the stem (5) from the control cage (6),

b) bend the washers with external tap (58) to secure the screws against unscrewing,

c) unscrew the hexagon screws (59),

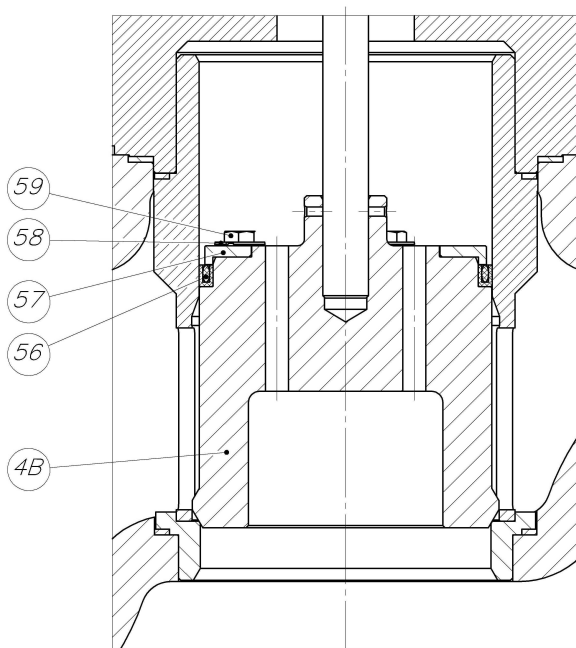
d) remove the pressing plate (57),

e) remove the seal MUPU type (56),

f) remove the seat face surfaces on the valve plug,

g) apply the new seal MUPU type (56), pressing plate (57), washers with external tap (58) and tighten them with screws (59). After tightening the screws, lock them before unscrewing the edges of the washers (58).

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13. List of spare parts

Table 7 contains a list of spare parts for a Z1B control valve, including the quantity

Table 7. List of spare parts

Number on the drawing	Component name	Quantity
3	Seat	1
4a,b,c	Valve plug	1
5	Valve stem	1
6	Control cage	1
10	Seat gasket	1
9	Body gasket	1
11	Control cage gasket	1
15	Sealing ring of valve plug	1
16	Pilot	1
17	Spring	1

24	Guiding sleeve	1
12	Plug stem pin	1
25	Packing	1 set
35	Packing set of bellows seal bonnet	1 set
37	Packing set gasket	1
38	Bellows seal bonnet gasket	2
46	Packing	1 set
48	Packing	1 set

14. Product disposal

At the end of the useful life of the product, it shall be disassembled and components grouped for the material they are made of: metal parts (coloured metals, acidproof and carbon steel) and plastic parts (flat packing and bonnet packing, electrical components, caps). Recyclable materials shall be used according to general principles concerning the material groups. No metals whose disposal causes environmental hazards are used in the product.

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Table 8. Mounting torques for the body nuts

Nominal dimension of the valve DN	Nominal pressure of the valve PN	Mounting torque of the body nuts [Nm]
15 ... 25	16 ... 25	20
	40 ... 50	25
	100 ... 110	50
	150 ... 160	70
	250 ... 320	180
	400 ... 420	200
40	16 ... 25	40
	40 ... 50	50
	100 ... 110	90
	150 ... 160	120
	250 ... 320	190
	400 ... 420	210
50	16 ... 25	40
	40 ... 50	50
	100 ... 110	90
	150 ... 160	120
	250 ... 320	190
	400 ... 420	210
80	16 ... 25	100
	40 ... 50	150
	100 ... 110	170
	150 ... 160	250
	250 ... 320	360
	400 ... 420	400

Nominal dimension of the valve DN	Nominal pressure of the valve PN	Mounting torque of the body nuts [Nm]
100	16 ... 25	150
	40 ... 50	200
	100 ... 110	300
	150 ... 160	500
	250 ... 320	800
	400 ... 420	900
	150	16 ... 25
150	40 ... 50	200
	100 ... 110	350
	150 ... 160	750
	200	16 ... 25
200	40 ... 50	300
	100 ... 110	500
	150 ... 160	800
250	16 ... 25	200
	40 ... 50	300
	100 ... 110	500
	150 ... 160	800
300	special design, technical data according to individual arrangements	
400	special design, technical data according to individual arrangements	

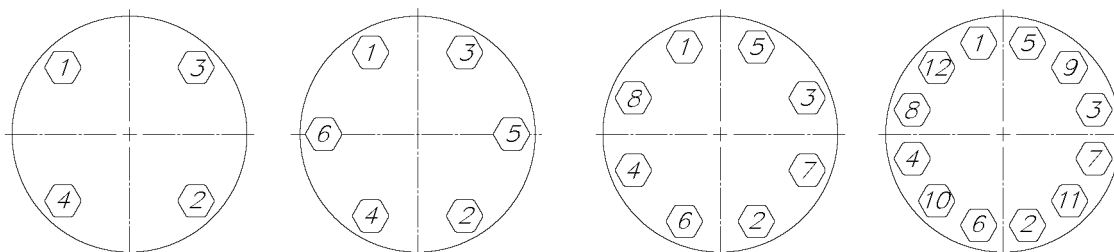


Fig. 18. Sequence of the body nuts tightening

15. Troubleshooting

Table 9 presents the causes of failures and methods of their repairing.

Table 9. Troubleshooting

No.	Symptoms of inefficiency	Causes	Repair method
1	Leakage within the valve plug stem	Bonnet nuts have come loose	Tighten the bonnet nuts until the leakage is eliminated
		Partial or complete wear of the packing.	Add or replace the valve plug stem gaskets with new ones
2	Leakage on the bonnet partition	Damaged gasket of the body	Replace the body gasket with a new one
		Body nuts have come loose	Tighten the body nuts until the leakage is eliminated
3	The valve does not perform a full stroke	Contaminated surface of the valve plug stem or actuator stem	Clean the surface of the valve plug stem or actuator stem
		The seat is contaminated with hard particles	Clean the seat surface
4	The valve plug is immobilised	Seizing of the stem in the guiding sleeve or of the valve plug in the control cage	Replace the valve plug, valve plug stem and guiding sleeve or control cage
5	Too high leakage for the leakage class	Damaged face of the plug or seat	Improve the faces and grind the valve plug and seat or replace them with new ones.
		Erosion of the valve plug or seat	Replace the valve plug and seat
		The seat is contaminated with hard particles	Clean and flush the valve, check the faces of the plug and seat
6	The pass-through capacity of the valve is reduced	Contaminated holes of the control cage perforation. Contaminated interior of the valve	Clean the contaminated surfaces.
7	The sliding movement of the valve stem is not smooth	Contaminated or worn out guiding surface of the valve plug, stem or the control cage of the valve.	Clean the contaminated surfaces
			Replace the worn out parts of the valve

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Zakłady Automatyki „POLNA” S.A.
ul. Obozowa 23, 37 - 700 Przemyśl
Tel. (16) 678-66-01; Fax (16) 678-65-24, 678-37-10
www.polna.com.pl e-mail: marketing@polna.com.pl
Service
Tel. (16) 678-66-25, +48 609-369-265
e-mail: serwis@polna.com.pl