THREE-WAY CONTROL VALVES

TYPE Z®3

without drive

and with pneumatic,

electric actuators

or manual drives

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

TABLE OF CONTENTS

)* - No (Ex) designation on the product plate and page 2 of this manual means that the product in the delivered condition must not be used in explosion-risk atmospheres.

DESIGNATION .....

DN..... PN (ANSI) TS .....°C

PT ..... . bar Pressure test date .....

Body material .....

Category ..... Fluid group..... Liquid☐ Gas ☐

Serial no./year of manuf.....

....

Conformity marking QC mark

Caution:
1. The product is intended to be used within pipelines.
2. Prior to commencing installation and operation, read this manual carefully.

1. PRINCIPLE OF OPERATION

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. An input signal, i.e.:

a) in pneumatic actuators:

compressed air of the nominal control pressure range of 20 - 100 kPa; 40-200 kPa or, in case a valve positioner is used, also within other ranges;

b) in electric actuators:

- with 3-point adjustment
  - an electric signal of supply voltage equal to 220 V AC; 24 V AC; 380 V AC,
- with continuous adjustment
  - voltage signal of 0…10 V; 2…10 V or a current signal of 0…5 mA; 0…20 mA; 4. 20 mA, causes linear movement of the actuator stem. This shift is proportional to the input signal value. Actuators can come with a system of limit switches limiting the valve stem movement and location transmitter for position mapping.

2. STANDARD OPERATING CONDITIONS

Control valves should be operated in conditions whose parameters comply with parameters assumed for calculation of values and defining the structural and material type of a valve. In order to ensure problem-free operation throughout the entire operation period, the control valve, including its fittings and equipment, must be protected against impact and damage, and subjected to regular maintenance and periodical inspections.

Additional operating conditions:

a) with pneumatic actuators:

- ambient temperature from - 40 to + 80°C;
- relative humidity of the atmosphere up to 98%,
- permissible fluctuation of air supplying the valve positioner ±10%;
- supply and control air should not contain any mechanical impurities, oil and substances causing corrosion of steel, copper and aluminium alloys; it must be dried so that the dew point is equal to temperature lower than the minimum operating temperature of the positioner by at least 10°C;,

b) with electric actuators:

- according to the technical data of their manufacturers,

c) with manual drives type 20

- ambient temperature from - 40 to + 80°C;
- relative humidity of the atmosphere up to 98%.

3. STORAGE AND TRANSPORT

Control valves should be stored in closed, dry and airy storage rooms with relative humidity not exceeding 80%. The room atmosphere must be free of vapours and aggressive gases. Valves can be transported by any covered means of transport, with or without packaging, with necessary protection against impact, tipping over and excessive vibrations. While packing, loading or unloading, valves should be handled using flexible clamping rings (e.g. rubber V-belts) wrapped around valve body flanges and actuator housing (through an eye bolt - for pneumatic actuators).

4. INSTALLATION

Prior to assembling the valve with a pipeline, carefully remove all impurities, metal chips, rust, welding and mill scale, fats and grease as well as other foreign bodies from the pipeline. Caps and elements of transport packaging should be removed in the installed valve. If you need information about the weight of the product, contact the manufacturer. Install the valve so that the directions of the working medium flow are in accordance with the arrows on the information plate. The working pressure of the medium flowing through the valve must conform to the content assumed to determine the nominal pressure, as specified on the valve rating plate.

In case the valve nominal diameter is smaller than the pipeline diameter, apply reducing pipes of length conforming to applicable standards. In such cases, avoid using reducing pipe connectors, e.g. threaded, screw-in/screw-out and other pipe connectors. After assembling the valve with a pipeline, it is necessary to:

a) *in valves with pneumatic actuators:*
   connect the lines supplying the pneumatic control signals to the actuator (from a regulator or operating panel). The supply of the pneumatic signal must be made with a copper, acid-proof or plastic tube. For a pneumatic signal line up to 7.5 m long, use φ 6 x 1 mm tubes. For longer sections, use φ 8 x 1 mm (OD x thickness) tubes. The lines supplying the pneumatic control signal must be connected, in straight P-type actuators to the upper diaphragm case, and, in reverse R-type actuators, to the lower diaphragm case. The connection is made using straight or elbow joints with StB 1/4" threads (1/4" NPT). While installing a valve equipped with a pneumatic or electro-pneumatic positioner, the lines supplying respectively pneumatic or current control signal from a regulator or operating (control) panel must be connected to the terminal labelled as (Signal). Moreover, the compressed air supply line with a pressure of 140; 250; 400 or 600 kPa (depending on the needs), must be routed and connected, through a filter-regulator, to the positioner terminal labelled as (Supply), taking into account the recommendations regarding line length and diameter stated above.
b) *In valves with electric actuators:*
   Connect electric supply and control lines to the actuator by soldering them to correct terminals of the connection socket.
   See separate "Maintenance documentation" for an electric actuator for detailed instructions regarding preparation of an installation to operate with an electric actuator and the control method.

NOTE!

In valves fitted with pneumatic actuators, connections and lines supplying control signals and supply air must be fully tight. Their tightness must be checked using an inspection pressure gauge, after air under pressure equal to the upper limit of the control pressure range is supplied and lines are cut off using a cut-off valve.

The allowed position of the control valve is with the stem vertically up. In justified cases, it is possible to install a valve with a permissible deviation from the vertical by 30°. 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 position of the valve on the pipeline than the permitted one, it is obligatory to consult the valve manufacturer. Without the approval of the manufacturer, an unauthorised installation position will result in the loss of the warranty.

5. START-UP

Prior to process installation commissioning, check the operation of the valve installed. To this end, activate an actuator or manual drive and check if the valve stem (5) moves smoothly without jamming, within the entire range of the nominal lift. During process start-up, the bonnet seals (8) can be slightly pressed by tightening the bonnet nuts (11), until necessary tightness within the plug stem is obtained. No adjustments of actuator spring tension set points or loosening the connection between the actuator stem or drive and valve plug stem are permissible.

6. MAINTENANCE AND REPAIRS

Maintenance of the control valve during operation consists in ensuring correct tightness of the valve stem in the bonnet. For this purpose, periodically press the package by tightening the nuts (11) (except for the package in the form of a package of "V" gaskets, where the pressure sleeve is inserted to the stop, and the constant pressure is ensured by a spring made of acid-resistant steel).

If the pressure sleeve retracts (to the groove) in the bonnet chamber, it must be removed together with the thrust ring of the sealing set (8) and add at least one gasket. After installation, adjust the pressure. Compulsory, documented periodical inspections ensure long-lasting and safe operation of the valve.
As regards valves operated continuously, periodical inspections should be conducted at least once every 6 months. As far as valves operating in a mode other than continuous are concerned, such inspections must be conducted at least every 12 months.

During inspections, the valve must be maintained and repaired as required. As necessary, the scope of maintenance and repairs must include:

- cleaning the valve and assessing the wear and tear of components;
- grinding in the seats and plug contact surfaces;
- replacing the seats and valve plug;
- replacing the valve bonnet seals,
- replacing the pneumatic actuator diaphragm;
- replacing the pneumatic actuator (for type R) seals;
- replacing the valve body seals,

6.1 Disassembly of the valve

Each time, during a periodical inspection, the following actions must be taken to clean, inspect or repair the valve:

a) disconnect the lines supplying the input signal to the actuator and remove the valve from the system, In the case of a pneumatic actuator with a positioner, disconnect the lines supplying the pneumatic control signal and the supply air.
b) disassemble the connection between the plug stem and actuator stem.
   - in valves with pneumatic actuators or manual drives, by unscrewing the connecting nut (32), after loosening the low-counter nut (34),
   - in valves with electric actuators, by removing the valve stem from the connector (73) by rotating the stem – plug unit.
c) unscrew the fastening nut (13) of the actuator or manual drive and disconnect it from the valve,
d) unscrew and remove from the valve stem:
   - locking nut (33)
   - connecting nut (32)
   - low (lock) nut (16) (on valve with electric actuator or manual drive)
e) loosen the pressure of sealing packages in the bonnet chamber.
f) unscrew nuts (11) and remove stub (2) with body gasket (7)
g) remove the matching socket (4.2)
h) slide the plug and stem unit out of the valve body sealing chamber and remove it.
i) clean the contact surfaces of the sockets and the plug as well as the inside of the body,
k) check the condition of the contact surfaces of the seat (4.1; 4.2) and the plug (3), the guiding surfaces of the stem and the plug and the degree of wear of the body gasket (7).

6.2 Grinding-in the seats and plug

In case it is determined that the assembly is not tight enough, it is necessary to perform the grinding-in procedure of valve seat (4.1; 4.2) and plug faces. To this end, disassemble the valve and proceed as follows:

a) apply a thin and even layer of lapping paste to the plug contact surfaces and insert the plug unit with stem back into the sealing chamber of the valve body.
b) insert the valve seat,
c) put the stub pipe on the valve body, securing it slightly with two nuts on opposite sides, d) lapping the contact surfaces of the seats and the plug by turning the stem several times by hand by 45° in both directions, while pressing slightly on the sealing surface,
e) lift the plug, turn it by approx. 30°, insert carefully into the seat and repeat the actions described in item d)
f) repeat the above-mentioned actions several times until the plug makes a full turn.,
g) after grinding in, remove the bonnet, use petrol to carefully remove residues of the paste from the seat and plug and inspect the condition of the ground-in faces.,
h) Reassemble the valve with the actuator in a manner depending on the method of valve operation (see 6.6),
i) adjust the pressure of packages - according to the note to point 6.5.1.

NOTE!

The grinding-in procedure must be performed carefully, using slight amounts of grinding-in paste. Prevent local dents on ground-in surfaces. Applying too much pressure may result in deterioration of face quality.

6.3 Seat replacement

If the seats cannot be reached due to wear or damage to the rolled ring (PTFE / silicone rubber) in the sealed seats, they must be replaced. To do this, after removing the valve according to 6.1 you should:

a) unscrew the screw-in seat using a special seat wrench and remove it together with the fitted seat.
b) clean the thread and the entire interior of the body.
c) check the condition of the sealing surfaces of the body gasket and replace it with a new one if it is found to be worn.
d) screw in a new screw-in seat and insert a new fitted seat and, after installing the remaining elements, check the tightness of the valve closure on each of the seats.

NOTE!

- Before screwing in the new seat, carefully lubricate its thread with a thin layer of sealing and anti-baking paste, e.g. LOCTITE 767. After tightening the seat, remove the excess paste.
- Seat wrenches can be purchased at POLNA.

6.4 Plug replacement

In case the plug face is excessively worn out or the profile section is eroded, the head must be replaced. Replacement of the plug after removing the valve according to point 6.1 shall be performed as follows:

a) knock out the pin (17) with a punch and remove the plug (3),
b) screw the new plug with the stem, drill through both parts and pin it,
c) carefully insert the stem with the plug into the bonnet chamber, taking care not to damage the sealing package.

After replacement, pre-tighten the nuts of the gland screws (11) and install the actuator or drive. The final adjustment of the package tightness is made in accordance with the point 6.5.1.

6.5 Seals replacement.

6.5.1 Replacement of body throttling chamber seals

In case adding single seals to the packing box chamber is insufficient or it is necessary to change the sealing type, the entire packing must be replaced. To do this, after disassembling the valve (item 6.1), proceed as follows:

a) remove the nuts (11), take off the pressure lever (12),
b) remove the pressure sleeve (14) and the sealing set (8),
c) clean the bonnet chamber,
d) insert the valve stem into the bonnet chamber,
e) insert a new sealing set into the bonnet chamber,
f) tighten the seals using the sleeve and pressure lever and assemble the valve in the reverse order of disassembly.

NOTE!

The final adjustment of the sealing package pressure is made during the start-up of the repaired valve. A small leak may occur at the pre-pressure. It should be eliminated by tightening the nuts (11) in such a way that the leakage stops but there is not much resistance to stem movement.

6.5.2 Replacing the valve body seals

If excessive wear of the body gasket (7) is found, replace it.

6.6 *Reassembly*

6.6.1 Valves with pneumatic actuator with the following operation:

air pressure increase - CLOSES (actuator P)

a) insert the plug, stem and fitting seat unit into the valve body; on the valve stem. Insert the connecting nut (32), tighten the locking nut (33) and install the position indicator (35),
b) put the stub pipe together with the body gasket and tighten the nuts securing it,
c) move the stem with the plug so that the plug settles on the face of the fitted seat, d) put on the actuator and pre-tighten (slightly) the fastening nut (13),

e) supply the control air and move the actuator stem by the stroke travel value,
f) connect and lock the actuator and valve stems using the connecting and locking nut, tighten the position indicator using the low (locking) nut of the actuator,
g) set the stroke plate in the fully closed position of the valve,
h) tighten the actuator mounting nut firmly on the valve,
i) lower the control pressure to zero; the stroke indicator should show the position of the total opening on the stroke plate.

6.6.2 Valves with pneumatic actuator with the following operation:

air pressure increase - OPENS (actuator R)

a) assemble the valve analogously to 6.6.1 a...d,
b) connect and lock the actuator and valve stems using the connecting and locking nut, tighten the position indicator using the low (locking) nut of the actuator,
c) set the stroke plate in the fully closed position of the valve,
d) supply the control air and move the stem by the stroke travel value,
e) unscrew the connecting nut and, making half a turn with the locking nut, move the actuator and valve stems apart (by about 0.6 mm); lock the pins,
f) tighten the actuator mounting nut firmly on the valve,
g) lower the control pressure to zero and correct the position of the stroke plate; the plug should be pressed to the lip of the fitting seat with the pre-tension force of the actuator springs.

6.6.3 Valves with an electric actuator

a) insert the plug, stem and fitting seat unit into the valve body; screw the low counter nut onto the valve stem,
b) put the stub pipe together with the body gasket and tighten the nuts securing it,
c) put the actuator (with the stem set in the closing position "Z") and the nut securing the actuator on the valve,
d) connect the valve stem with the actuator stem by screwing the valve stem into the connector (73) until the yoke is seated on the bearing surface of the body,
e) lock the stems with the locknut and tighten the nut (13) of the actuator on the valve.
f) the travel indicator should indicate the fully closed position of the valve,
g) connect electrical wires and supply power to the actuator with parameters compliant with the actuator manual,
h) correct the stroke if necessary by setting the limit switches accordingly.

6.6.4 Type 20 manual drive valves

a) assemble the valve analogously to point 6.6.1 a...c,
b) install the manual drive on the valve and pre-tighten the fixing nut.
c) connect and lock the valve stem with the drive stem (83) using the low (locking) nut (16),
d) set the stroke plate in the fully closed position of the valve,
e) tighten the drive mounting nut (13) tightly.
f) correct the pitch if necessary by unscrewing the fixing nut and adjusting the locking nut accordingly.

6.7 Replacing the diaphragm

6.7.1 Valves with pneumatic actuator with the following operation:

air pressure increase - CLOSES (actuator P)

a) disconnect the line supplying control air to the actuator.,
b) remove the upper actuator housing (24) or (59), making sure that the tension nuts (76) are unscrewed at the end - according to the attention on the warning plates (75),
c) unscrew the special nut (31) from the actuator stem and remove the distance ring (27),
d) replace the diaphragm (26) and assemble the actuator,

e) connect the control air line to the actuator,
f) bring a pneumatic control signal: adjust the spring tension by turning the packing box (29) so that the beginning of the stem movement occurs at the pressure corresponding to the lower value of the spring range specified on the actuator company plate.

6.7.2 Valves with pneumatic actuator with the following operation:

air pressure increase - OPENS (actuator R)

a) disconnect the line supplying control air to the actuator,
b) remove the upper housing of the actuator, making sure that the tension nuts (76) are unscrewed at the end - according to the note on the warning plates,
c) remove the springs (28),
d) unscrew the special nut from the actuator stem, remove the diaphragm plate (25) with the distance sleeve (40) and washer (38),
e) replace the diaphragm and reassemble the actuator,
f) connect the control air line to the actuator,
g) supply the pneumatic control signal and adjust the spring tension in such a manner that the stem movement begins at the pressure value equal to the lower spring range limit, as specified on the valve nameplate.

6.8 Replacing the gaskets of the pneumatic actuator bonnet

In order to replace the packing box gaskets (which is important for the R actuator), it is necessary to:
a) disconnect the valve stem from the actuator stem according to point 6.1 b) and remove the position indicator,
b) unscrew the two nuts securing the actuator on the connecting plate and remove the actuator from the valve,
c) unscrew the lock nut (34) from the actuator stem together with the position indicator,
d) remove the spring snap ring (58) from the stem and remove it together with the stop ring (41),
e) remove the stem cover (77), unscrew the bonnet unit and remove it from the actuator stem, remembering or marking its initial position,
f) replace worn O-rings (54), (55) and scraper ring (53),
g) put the bonnet unit on the stem and screw it to the position before replacement,
h) install the remaining elements on the actuator and the entire actuator on the valve in reverse order of removal.

7. CHANGE OF VALVE OPERATION AND CONTROL AIR RANGE

7.1 Change of valve operation with pneumatic actuator

Reversible design of P/R type pneumatic diaphragm actuators allows to change the operation of the valve assembled with this actuator with an increase in the control air pressure "CLOSES" to the increase of the control air pressure "OPENS" and vice versa. To do this, change the operation mode of the actuator. To this end:
a) disassemble the connection between the plug stem and actuator stem,
b) screw in (up to the stop in the P-action actuator) or unscrew (until the "O" sealing ring appears in the R-action actuator) the bonnet unit to reduce the initial tension of the springs,
c) remove the upper housing of the actuator, remembering that the tension nuts should be unscrewed at the end - according to the note on the warning plates.

Further actions depend on the operation of the actuator before the change.
If the action of the actuator is changed from P to R:
d) unscrew the special nut of the actuator stem,
e) remove the diaphragm together with the diaphragm plate, spacer ring, washer and spacer sleeve (or spacer sleeves in the 630 and 1000 actuator), remembering to prevent the stem from falling out of the bonnet unit,

f) remove the springs from the lower housing,
g) reverse the diaphragm with the set of the above-mentioned parts by 180° and install it on the actuator stem,
h) screw the special nut on the actuator stem while tightening the entire above-mentioned set of parts,
i) place the springs on the diaphragm plate, so that the springs run into the guide notches with their ends aligned to the stem axis,
j) place the upper housing on the springs and first screw the tension nuts under which the warning plates should be inserted, evenly compress the springs until the upper housing comes into contact with the lower housing, then install the remaining screws and tighten with the nuts of both housings,
k) pre-tension the springs by rotating the bonnet unit, connect the pins and adjust the actuator,

If the actuator operation is changed from R to P:
j) remove the springs from the diaphragm plate,
k) unscrew the special nut of the actuator stem,
l) remove the diaphragm together with the diaphragm plate, distance ring, washer and distance sleeve (or spacer sleeves in the 630 and 1000 actuator), remembering to prevent the stem from falling out of the bonnet unit,
m) place the springs in marked places on the lower housing,
n) reverse the diaphragm with the above-mentioned parts by 180° and install it on the actuator stem so that the φ 6 hole at the bottom and the groove on the edge of the diaphragm plate are in the axis of one of the holes on the diaphragm circumference,
r) screw the special nut onto the actuator stem, while compressing the entire set of parts mentioned above,
s) place the diaphragm unit over the springs so that they fit over the guiding grooves in the diaphragm plate. To check if the springs are in the right places, bend the diaphragm (at the groove cut on the edge of the plate) until the φ 6 hole in the bottom of the diaphragm plate is exposed and observe whether there is a spring underneath,
t) place the upper housing on the plane of the stem face and first screw the tension nuts (under which the warning plates should be inserted), evenly compress the springs until the upper housing comes into contact with the lower housing, then install the remaining screws and tighten with the nuts of both housings,
v) pre-tension the springs by rotating the bonnet unit, connect the pins and adjust the actuator,

7.2 Changing the operation of the manual drive in pneumatic actuators

When changing actuators equipped with upper manual drive, from straight operation (P) to reverse operation (R), also change the operation of the manual drive.
Due to its universal design, this change consists only in another method of connecting the drive with the actuator. The element connecting the sliding parts of the actuator (stem) and the drive (carrier) is a special nut (31), included in the actuator and also acting as a mounting clamp for the diaphragm unit (diaphragm, diaphragm plate, spacer sleeve, washer, spacer ring) on the upper part of the actuator stem. Depending on the type of actuator, the method of mounting the special nut on the actuator stem and its connection with the drive carrier should be as follows:
a) in straight-acting actuators (P)
   • the special nut should be screwed onto the stem in such a position that the flange (larger diameter) with milled surfaces for a wrench is at the lower part. The carrier, through its hole in the lower part, overlaps the smaller diameter of the special nut and, based on its flange, pushes the actuator stem together with the diaphragm unit down.
b) in a reverse-acting actuator (R)
   • the special nut should be inserted inside the carrier (through one of the side windows created after milling its planes) in a position where the flange (larger diameter) with milled planes for a wrench is in the upper part (turned vertically by 180 degrees in relation to the mounting position in a straight-acting

actuator - P). Then, the special nut should be turned so that its key milling coincides with the milling on the carrier, and then using a flat wrench, turning it together with the carrier, screw it onto the actuator stem. The protrusion in the carrier hole, resting against the special nut flange, pulls the actuator stem together with the diaphragm unit upwards.

NOTE!

- in actuators with manual drive, during their automatic operation, the manual drive should be in the extreme position:
  a) upper - in the PN actuator (wheel rotation to the right),
  b) lower - in the RN actuator (wheel rotation to the left),
- during automatic operation, when it is necessary to determine (secure) the proper opening of the valve, the manual drive can be used as a valve plug stroke limiter.

7.3 Changing the control air range (spring range) in pneumatic actuators

The design of the actuator allows to obtain different ranges by using different numbers of springs or changing their initial tension by adjusting the bonnet unit or appropriate assembly of spacers:

- 6 mm thick washers - 1 pc. (in 250; 400 actuators),
- distance sleeves 10 mm high - 2 pcs. (in actuator 630)
- distance sleeves:
  9.5 mm high - 2 pcs. (for 38 mm stroke),
  12.5 mm high - 2 pcs. (for 50 mm stroke),
  16 mm high - 2 pcs. (for 63 mm stroke) - in 1000 actuator.

For nominal ranges, these elements are mounted on the actuator stem inside the diaphragm plate. Additional spring tension is obtained by mounting one or two spacers on the outside of the diaphragm plate depending on the desired range.

The selection of parts and their assembly are specified in Table 1.

Actuator size	Stroke	Spring range (kPa)													
		1		2		3		4		5		6		7	
		20 - 100		40 - 200		40 - 120		80 - 240		60 - 140		120 - 280		180 - 380	
		number of springs	add. tens. mm	number of springs	add. tens. mm	number of springs	add. tens. mm	number of springs	add. tens. mm	number of springs	add. tens. mm	number of springs	add. tens. mm	number of springs	add. tens. mm
250	20	3	-	6	-	3	-	6	-	3	6	6	6	-	-
400	20	3	-	6	-	3	-	6	-	3	6	6	6	-	-
630	38	3	-	6	-	3	10	6	10	3	10+ 10	6	10+ 10	12	10+ 10
1000	38	3	-	6	-	3	9.5	6	9.5	3	9.5+ 9.5	6	9.5+ 9.5	12	9.5+ 9.5
	50	3	-	6	-	3	12.5	6	12.5	3	12.5+ 12.5	6	12.5+ 12.5	12	12.5+ 12.5
	63	3	-	6	-	3	16	6	16	3	16+ 16	6	16+ 16	12	16+ 16

NOTE!

All spacers and adjustments are included in the actuator design. An additional number of springs should be ordered directly from the manufacturer.

To make the above-mentioned changes in the control air range:

a) perform the steps according to point 7.1 item a; b; c;
b) unscrew the special nut from the stem and remove the diaphragm together with the diaphragm plate, spacer ring, washer and spacer bushing (or spacer bushing in the 630 and 1000 actuator), remembering to prevent the stem from falling out of the bonnet unit,

c) reassemble (position) the spacers accordingly and add (or subtract) the springs as required in accordance with Table 1,
d) screw in the special nut, install the housing and adjust the actuator.

8. TYPICAL PROBLEMS AND SOLUTIONS

Item	Problem symptoms	Causes	Solutions	Comments
1	The valve demonstrates excessive hysteresis.	Excessive compression of gasket in the bonnet	Loosen screw tightening	
2	The valve fails to make the full stroke.	The plug stem or actuator stem surface is dirty.	Clean the surfaces of the plug stem or actuator stem	
		The space over the unloaded plug in the bonnet is dirty.	Clean the valve.	
		The seats are contaminated with hard particles.	Clean the valve.	
3	The plug stroke is not proportional to the air pressure.	The actuator spring is maladjusted.	Adjust the pre-compression of the springs	
		The connection between the plug stem and actuator stem is maladjusted.	Adjust the connection between the plug stem and actuator stem.	
4	The plug does not move.	The plug is jammed in the guiding sleeve or seat.	Replace the plug, plug stem and plug guide or the seat.	
		The actuator diaphragm is damaged.	Replace the diaphragm in the actuator.	
5	Closing is not tight.	Plug or seat faces are damaged.	Grind in the plug and seats or replace them.	
		The plug or seats are eroded.	Replace the plug and seats.	
		The seats are contaminated with hard particles.	Clean and flush the valve.	
		Ring damage in the sealed seat	Replace the sealed seat	
		Sealing ring damage in the relieved plug	Replace sealing ring	

NOTE!
Operating problems caused by erroneous operation of electric actuators, positioners, filter-reducers, solenoid valves and other fixtures installed on the control valve must be solved in line with maintenance manuals provided by their manufacturers.

9. OPERATION SAFETY CONDITIONS

The following rules must be adhered to in order to ensure operation safety:
- The valve can be detached from a pipeline or parts coming into contact with a medium can be dismantled not before the user ensures that these elements are no longer under the medium pressure,
- The springs of the actuator are under preload and during operation are protected by design against total expansion. If springs are replaced, the tension nuts (with warning plates) must be unscrewed at the end.
- While operating in high temperatures, the hazard of burning/scalding is present, so provide guards where possible,
- Only qualified personnel can assemble/disassemble the valve,
- Other operating hazards are marked with “!” in this document.

10. PRODUCT DISPOSAL

After the product life is over, it must be dismantled and its components must be grouped according to their materials, i.e. metal components (non-ferrous metals, acid-resistant and carbon steels), rubber components (diaphragms, seals) and plastic components (plat seals and packing, electric components, plugs). Recycled materials must be reused in line with general rules regulating individual groups of materials. The product does not contain materials whose disposal is harmful for the environment.

11. LIST OF SPARE PARTS

Part No. in figures	Part name
3	Plug
4.1	Screwed-in seat
4.2	Fitted seat
5	Stem
6	Guiding sleeve
7	Body gasket
8	Sealing kit

Part No. in figures	Part name
17	Pin
26	Diaphragm
53	Scraper ring
54	Sealing ring "0"
55	Sealing ring "0"
56	Sealing ring "0"
57	Sealing ring "0"

NOTE!
It is recommended that genuine valve manufacturer's parts should be used. Failure to observe this rule releases the manufacturer from any liability connected with the product.

12. FIGURES

Part designations and names.

Part No. in figures	Part name
1	Body
2	Connector
3	Plug
4.1	Screwed-in seat
4.2	Fitted seat
5	Stem
6	Plug guide
7	Body gasket
8	Sealing kit
9	Disc spring
10	Screw
11	Nut
12	Packing flange
13	Locking nut
14	Pressure sleeve
15	Distance sleeve
16	Low nut
17	Pin
18	Pressure plate
19	Valve nameplate
20	Groove pin 3x6
21	Column
22	Bracket
23	Lower housing
24	Upper housing (unit)
25	Diaphragm plate
26	Diaphragm
27	Distance ring
28	Spring
29	Bonnet unit
30	Actuator stem
31	Special nut
32	Connecting nut

Part No. in figures	Part name
54	Sealing ring "O"
55	Sealing ring "O"
56	Sealing ring "O"
57	Sealing ring "0"
58	Snap ring
59	Upper housing case
60	Drive screw
61	Carrier
62	Holder
63	Drive handwheel
64	Special screw
65	Washer
66	Washer
67	Thrust bearing
68	Screw
69	Washer
70	Sealing ring "0"
71	Sealing ring "0"
72	Snap ring "Z"
73	Connector
74	
75	Warning plate
76	Tension nut
77	Stem cover
78	Sealing ring "0"
79	Drive yoke
80	Drive handwheel
81	Drive sleeve
82	Handwheel cap
83	Drive stem
84	Key
85	Travel indicator scale
86	Ball bearing

33	Locking nut
34	Low nut (locking)
35	Position indicator
36	Column clamp
37	Travel indicator scale
38	Washer
39	Washer
40	distance sleeve
41	Stopper ring
42	Pipe plug
43	Actuator nameplate
44	Screw
45	Screw
46	Screw
47	Screw M4x8
48	Nut M4-A
49	Nut
50	Nut
51	Spring washer
52	Washer ring
53	Scraper ring

87	Grease nipple
88	Indicator
89	Plug pin
90	Screw
91	Connecting plate

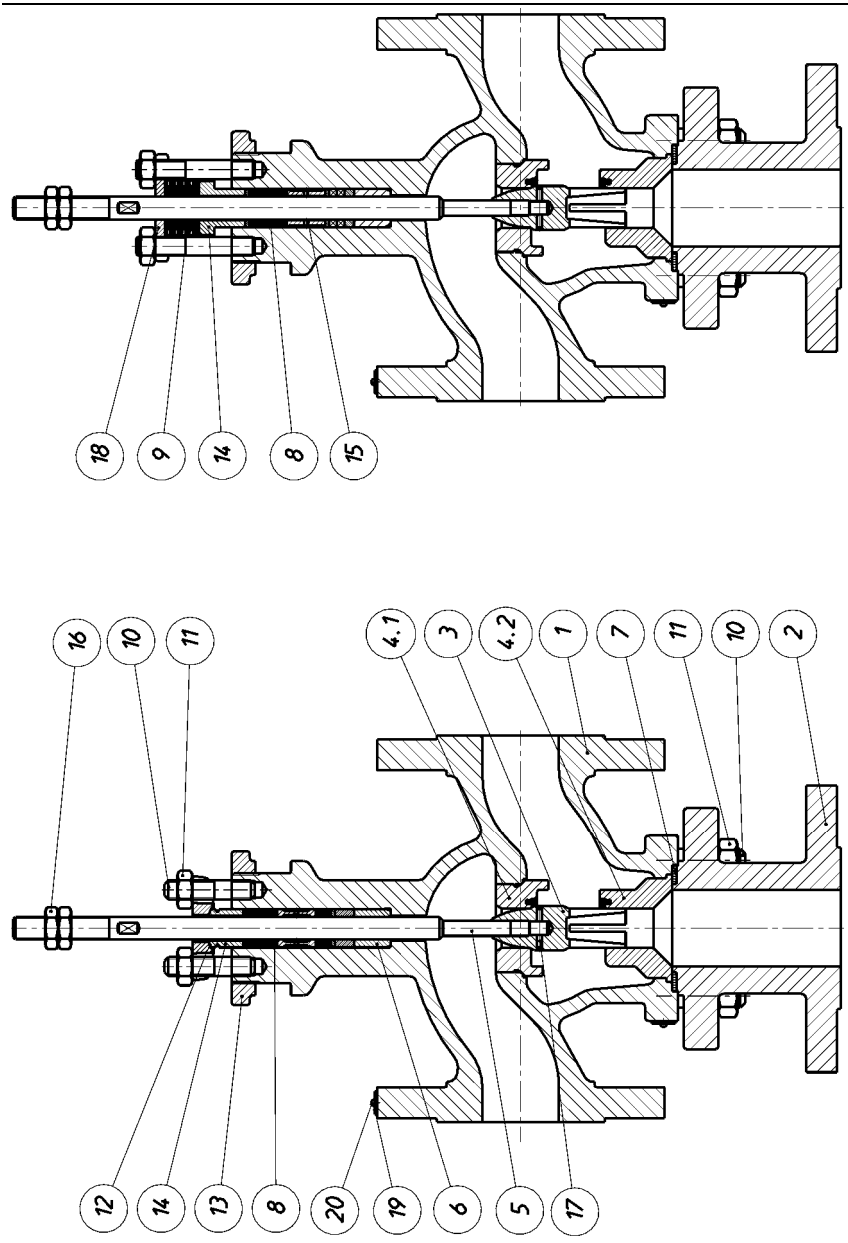

Figure 1. Valve type Z3

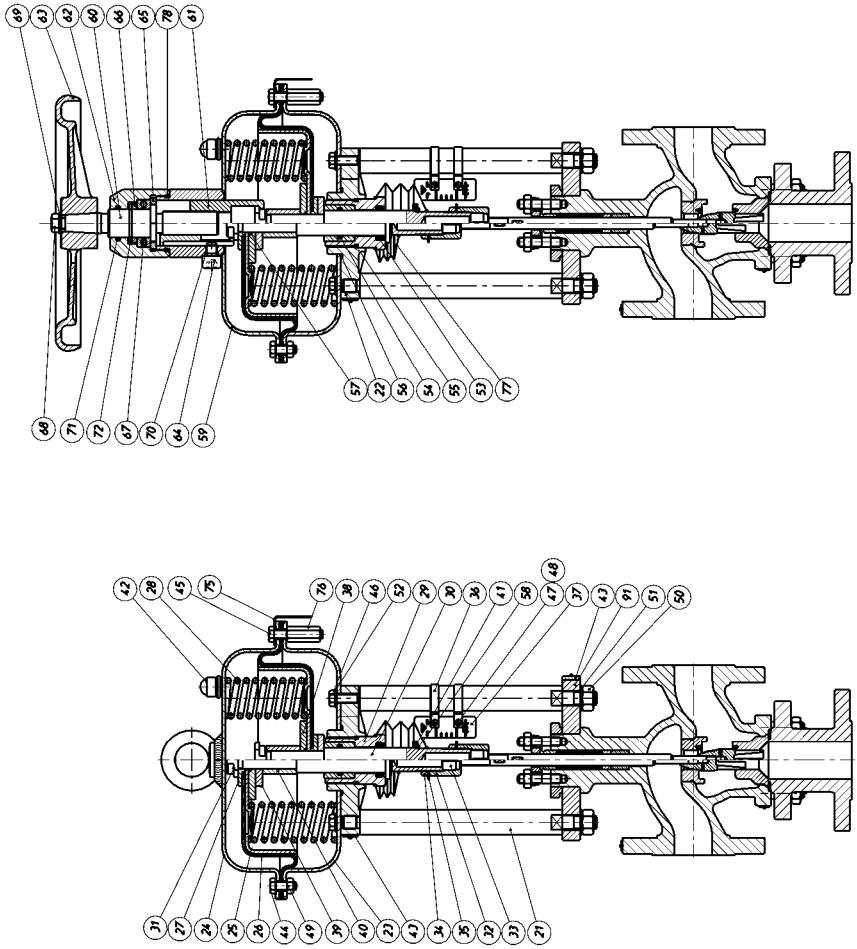

Figure 2. Valve type Z3 with pneumatic actuator P/R

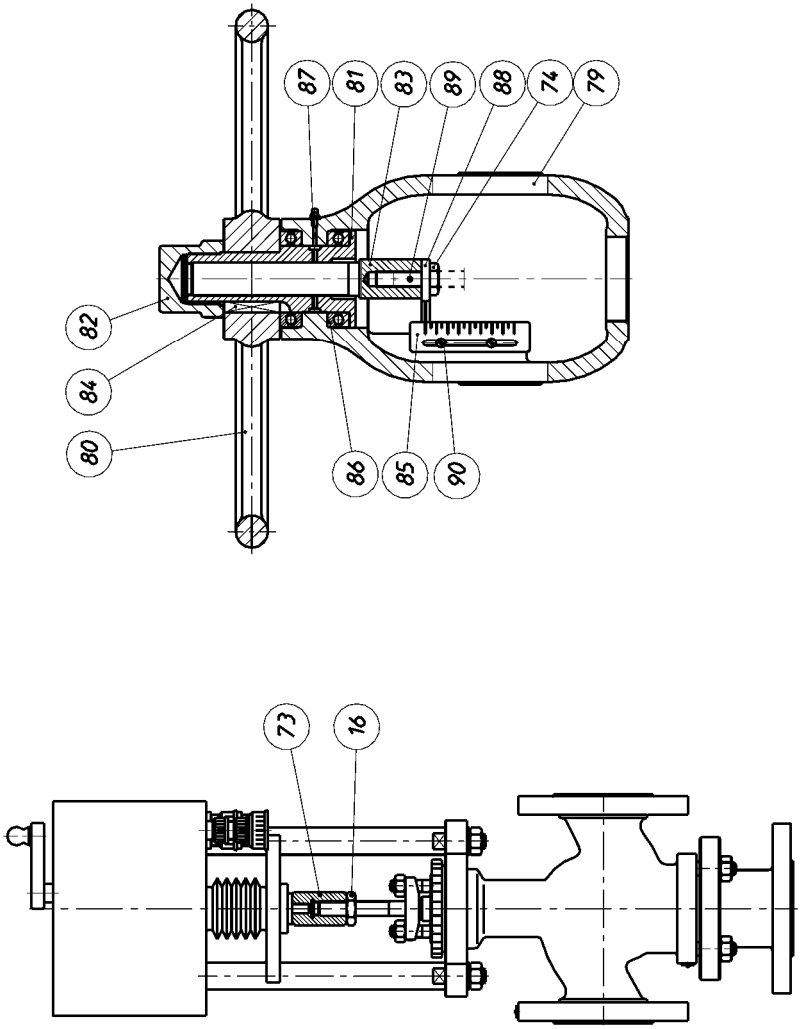

Figure 3. Valve type Z3 with electric actuator and drive type 20

13. ADDITIONAL REQUIREMENTS RESULTING FROM EQUIPMENT OPERATION IN EXPLOSIVE ATMOSPHERES, AS PER 2014/34/EC (ATEX) DIRECTIVE

13.1. **Design requirements**

Type “Z3” valves with type P/R or P3/R3 pneumatic actuators are designed in line with the requirements applicable to equipment operating in explosive atmospheres, for Group II, Category 2, as per PN-EN 13463-1; 2002, with particular consideration of:

- ensuring operation in line with technical parameters defined by the manufacturer and high level of protection,
- operation in rooms where explosive atmospheres caused by mixtures of air with gases, mists, vapours or dust-air mixtures are likely to occur,
- providing explosion protection measures ensuring a high degree of protection, even in the event of frequent problems and faults.

13.2. Application requirements

“Z3” valves with P/R or P3/R3 pneumatic actuators designated as can be operated in the following zones, as per PN-EN 1127-1; 1997:

a) Zone 1 for gases / vapours including locations in which explosive atmosphere may sometimes occur during standard operation; the Zone may encompass, e.g.:
   - direct vicinity of Zone “0”;
   - direct vicinity of locations where raw materials are supplied or elements are filled and emptied;
   - direct vicinity of equipment vulnerable to damage or insufficiently protected seals.

b) Zone 2 for gases / vapours covering places where the explosive atmosphere does not occur during normal operation or in case of occurrence takes a short time. This Zone may include, e.g. the vicinity of Zone “0” and “1”.

c) Zone 21 for dust including locations in which explosive atmospheres in the form of a flammable dust cloud in the air may sometimes occur during standard operation and may include, e.g. locations in the direct vicinity of facilities where the dust is loaded/unloaded and locations with dust layers which, during standard operation, may create flammable mixtures of dust with air, within explosive concentration limits.

d) Zone 22 for dust including locations in which explosive atmosphere in a form of flammable dust cloud in the air does not occur during standard operation or it occurs for limited periods of time. This Zone may include, e.g. locations in the direct vicinity of equipment where dust may accumulate or be released.

e) In case the explosive atmosphere comprises acetylene, carbon disulphide, hydrogen, hydrogen sulphide or ethyl oxide, the actuator non-pressure (spring-actuated) chamber must be connected by means of piping with non-explosive atmosphere in order to eliminate the risk of explosion caused by mechanically induced sparking, e.g. in case the spring breaks.

13.3. Repair and maintenance requirements

While performing inspections, repairs and maintenance activities in explosive atmospheres, ensure safety conditions relating to the used tools and zones in which they can be utilised in line with EN 1127-7, Annex A.

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