# *CONTROL VALVES*
# TYPE Z®
# without drive and with pneumatic, electric actuators or manual drives

## INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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)* - 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 230 V AC; 24 V AC; 400 V AC,
- with continuous adjustment
  - voltage signal 0...10 V; 2...10 V or current signal 0...5 mA; 0...20 mA; 4...20 mA, results in linear shifting of the actuator stem proportionally 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 manufacturer's technical data;,

*c) with manual NN type drives*
- 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. Plugs 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. The valve must be installed in such a manner that the direction of the working medium flow conforms to the direction defined by the arrow located on the valve body. 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.

In cases particularly vital for the process system, install a by-pass system consisting of three additional valves facilitating isolation of the control valve from the system (to perform repairs, grind in the seats, replace parts) without interrupting the operation.

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 pneumatic signal must be routed via a copper 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 NPT 1/4" threads (StB 1/4"). 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 (9) moves smoothly without jamming, within the entire range of the nominal lift. During technological start-up, the bonnet seals (14) can be slightly pressed by tightening the bonnet nuts (12), until necessary tightness within the plug stem is obtained. No adjustments of actuator spring tension setpoints 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 screw plugs (12) (except for the package in the form of a package of gaskets type "V" where it is screwed to the stop, and a constant pressure is provided by an acid-resistant steel spring) (14B). If the screw plug rests against the upper surface of the bonnet, unscrew it, remove the retaining ring (13) and add at least one gasket. Before unscrewing the screw plug, make sure that the valve is not under pressure. Adjust the pressure after reassembly. 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 the periodic inspection, perform maintenance and repair activities of the control valve, depending on the need:

- cleaning the valve and assessing the wear and tear of components;
- grinding in the seats and valve plug;
- replacing the seats and valve plug;
- replacing sealing rings in the balanced plug,
- replacing the valve bonnet seals;
- replacing the pneumatic actuator diaphragm;
- replacing gaskets of the pneumatic actuator bonnet unit (for type R),
- replacing body seals as well as bellows and elongated bonnet seals,
- removing traces of corrosion and replenishing paint coatings.

### 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) 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 (35), after loosening the low-counter nut (37),
   - in valves with electric actuators, by unscrewing the valve stem from the connector (79) by rotating the stem - plug unit or plug - sealing unit (2C1). Before removing the actuator from the bellows bonnet loosen the screw plug (12) and nuts (99), and when disconnecting the stems, proceed especially carefully due to the possibility of "wrenching" the bellows,
c) unscrew the nuts (53) securing the actuator or manual drive and disconnect it from the connecting plate,
d) unscrew the nuts (21) and dismantle the bonnet with the stem and plug,
e) clean the contact surfaces of the sockets and the plug as well as the inside of the body,
f) check the condition of the contact surfaces of the seat (3) and the plug (4), the guiding surfaces of the stem and the plug and the degree of wear of the body gasket (15).

### 6.2 Grinding in the seats and plug head

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

a) loosen the pressure of sealing packages,
b) Apply a thin and even layer of grinding-in paste on the plug face and reassemble the bonnet with the plug and stem onto the valve body by fixing it lightly with both nuts on the opposite ends.
c) Grind in the valve seat and plug faces by manually turning the stem several times by approx. 45° in both directions, applying light pressure towards the seat.,
d) Lift the plug, turn it by approx. 30°, insert carefully into the seat and repeat the actions described in item),
e) Repeat the above-mentioned actions several times until the plug makes a full turn.

f) 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.,
g) Reassemble the valve with the actuator in a manner depending on the method of valve operation (see 6.6),
h) adjust the pressure of packages - according to the note to point 6.5.2.

***NOTE!***

1. 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.
2. In order to avoid damaging the bellows, the plug by the bellows bonnet should be ground in by the manufacturer.

### 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 (3A), they must be replaced. To do this, after removing the valve according to 6.1 you should:

a) Unscrew the seats using a special wrench for seats. After unscrewing the seats, clean the threads and body interior thoroughly.
b) 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.

NOTE! 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.

#### 6.4.1 Replacing the plug in a valve with a standard or extended bonnet.

Replacement of the plug after removing the valve according to point 6.1 and loosening the pressure of sealing packages is carried out in a manner depending on the Kvs value and as follows:

a) for Kvs = 0.01 ...1 and standard bonnet (where the stem is also a plug):
   - remove the ring (8), stop ring (7) and locking nut (36) or counter nut (80) from the stem plug,
   - put the previously dismantled elements on the new stem plug and insert it carefully into the bonnet, taking care not to damage the sealing package.
b) for Kvs = 1.6...16; Kvs = 63...630 (for DN 150...250) and Kvs = 0.01 ...1 (for extended and bellows bonnet):
   - knock out the pin (6) with a punch and remove the plug,
   - screw the new plug with the stem, drill through both parts and pin it,
   - carefully insert the plug with the stem into the bonnet, paying attention not to damage the seals (the sealing package and the sealing ring - in the balanced plug),
c) for Kvs = 25 ...160 (for DN 40...100):
   - unscrew the stem from the plug and remove the conical insert (5),
   - move the conical insert to the stem and screw on a new plug,
   - carefully insert the plug with the stem into the bonnet, paying attention not to damage the seals (the sealing package and the sealing ring - in the balanced plug),

After replacement, pre-tighten the screw plug and mount the actuator or drive. The final adjustment of the package tightness is made in accordance with the point 6.5.2.

***NOTE!***

- conical insert is used to protect the stem against unscrewing during valve operation,
- the threaded surface of the stem should be inserted / extended into / out of the bonnet by rotation

- "screwing in"

### 6.4.2 Replacing the plug in a valve with a bellows bonnet.

After disassembly according to point 6.1 and loosening the pressure of sealing packages, further proceedings depend on the Kvs value and as follows:

a) for Kvs = 25...160 (for DN 40...100):

- holding the stem (in its upper part) with a flat wrench, unscrew the plug from it, paying attention not to damage ("screw") the bellows unit and remove the conical insert,
- transfer the conical insert to the new plug and screw it with the stem according to the comments above. b) for other executions:
- knock out the pin (6) with a punch and, holding the pin (in its upper part) with a flat wrench, unscrew the plug observing the remarks as above,
- screw on a new plug, drill and pin it with the stem, paying attention to secure the stem against rotation when screwing it on.

After replacing the plug, assemble the bonnet, pre-tighten the screw plug and install the actuator or drive. The final adjustment of the package tightness is made in accordance with the point 6.5.2.

## 6.5 Seals replacement.

### 6.5.1 Replacing sealing rings in the balanced plug

In case of excessive wear of the sealing ring (4A1) in the balanced plug, it is necessary to replace the ring. To this end:

a) remove the plug as for its replacement,
b) remove the used sealing ring from the plug,
c) carefully clean the socket for the new sealing ring on the plug,
d) install a new sealing ring.

After mounting new sealing ring, reassemble the plug in the reverse order. Reassembly of the balanced plug to the valve should be performed in accordance with point 6.4.

### 6.5.2 Replacing the valve bonnet seals

In case adding single seals to the bonnet 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) unscrew and remove the locknut (36) or low locknut (80),
b) remove the valve stem from the bonnet,
c) unscrew the screw plug and remove the stopper rings, sealing packages and sleeves,
d) clean the bonnet chamber,
e) insert the valve stem into the bonnet,
f) insert a set of new gaskets and other parts in the correct order into the bonnet chamber,
g) press the gaskets with a screw plug and assemble the valve in reverse order of removal.

***NOTE!***

1. In order to easily install individual rings of the sealing package, it is recommended to use devices available for purchase at "POLNA".
2. The final adjustment of the sealing package pressure is made during the start-up of the repaired valve. Type V sealing, the screw plug should be screwed in as tight as possible. For other packings, there may be a slight leakage at the initial pressure. It should be eliminated by tightening the nuts in such a way that the leakage stops but there is not much resistance to stem movement.

### 6.5.3 Replacement of body seals as well as extended and bellows bonnet seals

Replace the body seal (15), bellows (87, 93, or 95) or extended bonnet seals (86) if there is visible

wear. The seal material should be adapted to the operating parameters of the valve and the type of medium.

### 6.6 *Reassembly*

#### 6.6.1 Valves with pneumatic actuator with operation of:

| air pressure increase - CLOSES (actuator P) |
|---|

a) insert the bonnet with the connecting plate, plug, stem and body gasket (15) into the body, and put the fixing nut (35) on the stem, screw on the locking nut (36) and put on the position indicator (38),
b) tighten the nuts (21) securing the bonnet,
c) move the stem with the plug so that the plug settles on the seat,
d) put the actuator on the connecting plate and pre-tighten (lightly) two nuts (53) with spring washers (54),
e) supply the control air and move the stem by the stroke travel value,
f) connect and lock the actuator and valve stems with the clamping and locking nut,
g) set the stroke plate in the fully closed position of the valve,
h) tighten the nuts securing the actuator on the connecting plate firmly,
i) Lower the control pressure to zero. The travel indicator should indicate the fully opened position on the stroke plate. correct the pitch if necessary by unscrewing the fixing nut and adjusting the locking nut accordingly.

#### 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 the actuator and valve stems with the clamping and locking nut,
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 nuts securing the actuator on the connecting plate firmly,
g) reduce the control pressure to zero and correct the position of the stroke plate. The plug should be pressed against the seat with the preload force of the actuator springs.

#### 6.6.3 Valves with an electric actuator

a) insert the bonnet with the connecting plate, plug, stem and body gasket into the body, and screw the counter nut (80) onto the stem,
b) tighten the nuts securing the bonnet,
c) install the actuator (with the stem set in the closing position "Z") on the connecting plate,
d) connect the valve stem to the actuator stem by screwing the valve stem into the connector (79) until the column is seated on the connecting plate,
e) lock the pins with a locknut,

***NOTE!***

When connecting the valve to the bellows bonnet(2C), be especially careful to avoid "tearing" the bellows. To do this, loosen the nut (12) pressing the sealing packages and nuts (99) securing the bonnet(91).

f) tighten the nuts with spring washers securing the actuator on the connecting plate,
g) the travel indicator should indicate the fully closed position of the valve,
h) connect electrical wires and supply power to the actuator with parameters compliant with the actuator manual,
i) correct the stroke if necessary by setting the limit switches accordingly.

### 6.6.4 Type NN manual drive valves

a) install the valve analogously to point 6.6.1 a...c,
b) install the manual drive on the connecting plate and pre-screw the two nuts with spring washers,
c) connect and lock the valve stem with the drive carrier (78) using the mounting and locking nut,
d) set the stroke plate in the fully closed position of the valve,
e) tightly tighten the nuts securing the drive on the connecting plate,
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 operation of:

| air pressure increase - CLOSES (actuator P) |
|---|

a) disconnect the line supplying control air to the actuator.,
b) remove the upper actuator housing (27) or (62), making sure that the tension nuts (82) are unscrewed at the end - according to the attention on the warning plates (81),
c) unscrew the special nut (34) from the actuator stem and remove the spacer ring (30),
d) replace the diaphragm (29) 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 bonnet(32) 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 operation of:

| 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 (82) are unscrewed at the end - according to the attention on the warning plates,
c) remove the springs (31),
d) unscrew the special nut from the actuator stem, remove the diaphragm plate (28) with the spacer sleeve (43) and washer (41),
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 bonnet 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 (37) from the actuator stem together with the position indicator,
d) remove the spring snap ring (61) from the stem and remove it together with the stop ring (44),
e) remove the stem cover (83), unscrew the bonnet unit and remove it from the actuator stem, remembering or marking its initial position,
f) replace worn O-rings (57), (58) and scraper ring (56),
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 degrees and install it on the actuator stem,
h) screw the special nut onto the actuator stem, while compressing the entire set of parts mentioned above,
i) place the springs on the diaphragm plate so that they fit onto the guiding grooves and their ends are equally located in relation 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:*

n) remove the springs from the diaphragm plate,
o) unscrew the special nut of the actuator stem,
p) 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,
q) place the springs in marked places on the lower housing,
r) 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,
s) screw the special nut onto the actuator stem, while compressing the entire set of parts mentioned above,
t) 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,
u) 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 (34), 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 range of control air (spring range) in pneumatic actuators** Design of the actuator allows to obtain different ranges by using different numbers of springs or changing their pre-tension by adjusting the bonnet unit or appropriate installation of spacers:

- 6 mm thick washers - 1 pc. (in 250; 400 actuators),
- distance sleeve 10 mm high - 2 pcs. (in actuator 630)
- distance sleeve:
  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 | Photocell | 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 | addit. tens. (mm) | number of springs | addit. tens. (mm) | quantity compress. | addit. tens. (mm) | number of springs | addit. tens. (mm) | number of springs | addit. tens. (mm) | number of springs | addit. tens. (mm) | number of springs | addit. 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 sleeve (or spacer sleeve 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 balanced 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.
- in valves with a bellows bonnet it is not allowed to rotate the valve stem in the bonnet body due to the possibility of damage to the bellows.

## 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 drawing | Part name | Number of parts |
|---|---|---|
| 2C1 | Sealing unit of bellows bonnet | 1 |
| 3 | Seat | 1 |
| 3A | Sealed socket | 1 |
| 4 | Plug | 1 |
| 4A1 | Sealing ring | 1 |
| 6 | Plug pin | 1 |
| 9 | Valve stem | 1 |
| 11A - 11B | Plug guide | 1 |
| 13 | Resistance Ring | 1(2) |
| 14 | Packing | 4 - 6 |
| 14A | Sealing package "V" | 1 set. |
| 15 | Body join ring | 1 |
| 29 | Diaphragm | 1 |
| 56 | Scraper ring of actuator bonnet unit | 1 |
| 57 | Sealing ring "O" of actuator bonnet unit | 1 |
| 58 | Sealing ring "O" of actuator bonnet unit | 1 |
| 59 | Sealing ring "O" of actuator bonnet unit | 1 |
| 60 | Sealing ring "O" of actuator bonnet unit | 1 |
| 73 | Sealing ring "O" of upper drive special screw | 1 |
| 74 | Sealing ring "O" of upper drive P/R-N screw | 1 |
| 85 | Sealing ring "O" of upper drive P/R-N housing | 1 |
| 86 | Extended bonnet housing gasket | 1 |
| 87 | Bellows unit gasket | 1 |
| 93 | Bellows bonnet seal | 1 |
| 95 | Sealing ring "O" of bellows unit | 1 |
| 96 | Sealing ring "O" of bellows bonnet | 1 |
| 97 | Sealing ring "O" of bellows unit | 1 |
| 102 | Sealing ring "O" of bellows unit | 1 |

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 drawing | Part name |
|---|---|
| 1 | Body |
| 2 | Standard bonnet |
| 2A | Balanced valve bonnet |
| 2B | Extended bonnet |
| 2C | Bellows bonnet |
| 2C1 | Sealing unit |
| 3 | Seat |
| 3A | Sealed socket |
| 4 | Plug |
| 4A | Balanced plug (unit) |
| 4A1 | Sealing ring of balanced plug |
| 5 | Conical insert |
| 6 | Notched pin |
| 7 | Resistance Ring |
| 8 | Ring |
| 9 | Valve stem |
| 10 | Connecting plate |
| 11A - 11B | Plug guide |
| 12 | Screw |
| 13 | Resistance Ring |
| 14 | Packing |
| 14A | Sealing package "V" |
| 14B | Spring |
| 15 | Body gasket |
| 16 | Stopper 3/8" NPT (optional) |
| 17 | Cap 1/4" |
| 18 | Valve nameplate |
| 19 | Body stud |
| 20 | Locking nut |
| 21 | Nut |
| 22 | Spacer sleeve |
| 23 | Groove pin 3x6 |
| 24 | Column |
| 25 | Support |
| 26 | Lower casing |
| 27 | Upper housing (unit) |
| 28 | Membrane button |
| 29 | Diaphragm |
| 30 | Distance ring |
| 31 | Spring |
| 32 | Bonnet unit |
| 33 | Actuator stem |
| 34 | Special nut |
| 35 | Connecting nut |
| 36 | Locking nut |
| 37 | Low nut (locking) |
| 38 | Travel indicator |
| 39 | Column clamp |
| 40 | Travel indicator scale |
| 41 | Washer |

| Part no. in drawing | Part name |
|---|---|
| 48 | Screw |
| 49 | Screw |
| 50 | Screw M4x8 |
| 51 | Nut M4-A |
| 52 | Nut |
| 53 | Nut |
| 54 | Spring washer |
| 55 | Washer ring |
| 56 | Scraper ring |
| 57 - 60 | Sealing ring |
| 61 | Snap ring |
| 62 | Upper housing case |
| 63 | Drive screw |
| 64 | Driver |
| 65 | Cast |
| 66 | Drive wheel |
| 67 | Special screw |
| 68 - 69 | Washer |
| 70 | Resistance bearing |
| 71 | Screw |
| 72 | Washer |
| 73 | Sealing ring "O" 8.3x2.4 |
| 74 | Sealing ring "O" |
| 75 | Spring snap ring "Z" |
| 76 | Yoke (yoke unit) |
| 77 | Drive screw |
| 78 | Driver |
| 79 | Connector |
| 80 | Low nut (locking) |
| 81 | Warning plate |
| 82 | Tension nut |
| 83 | Stem cover |
| 84 | Scraper ring |
| 85 | Sealing ring "O" |
| 86 | Extended bonnet housing gasket |
| 87 | Bellows unit gasket |
| 88 | Washer |
| 89 | Bonnet housing DW and DM |
| 90 | Bonnet- DW |
| 91 | Bonnet- DM |
| 92 | Spacing sleeve |
| 93 | Bellows bonnet seal |
| 94 | Sleeve |
| 95 - 97 | Sealing ring "O" |
| 98 | Screw |
| 99 | Nut |
| 100 | Spring washer |
| 101 | Sleeve |
| 102 | Sealing ring "O" |
| 103 | Sleeve |

| | |
|---|---|
| 42 | Washer |
| 43 | Spacer sleeve |
| 44 | Resistance Ring |
| 45 | Pipe plug |
| 46 | Actuator nameplate |
| 47 | Screw |

| | |
|---|---|
| 104 | Compliance plate |
| 105 | Sealing ring "O" |
| 106 | Yoke |
| 107 | Screw |
| 108 | Sealing ring "O" |
| 109 | Screw M6x8 |

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

### 13.1. **Design requirements**

Type “Z” 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

“Z” valves with P/R or P3/R3 pneumatic actuators designated as $\varepsilon_x$ 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.

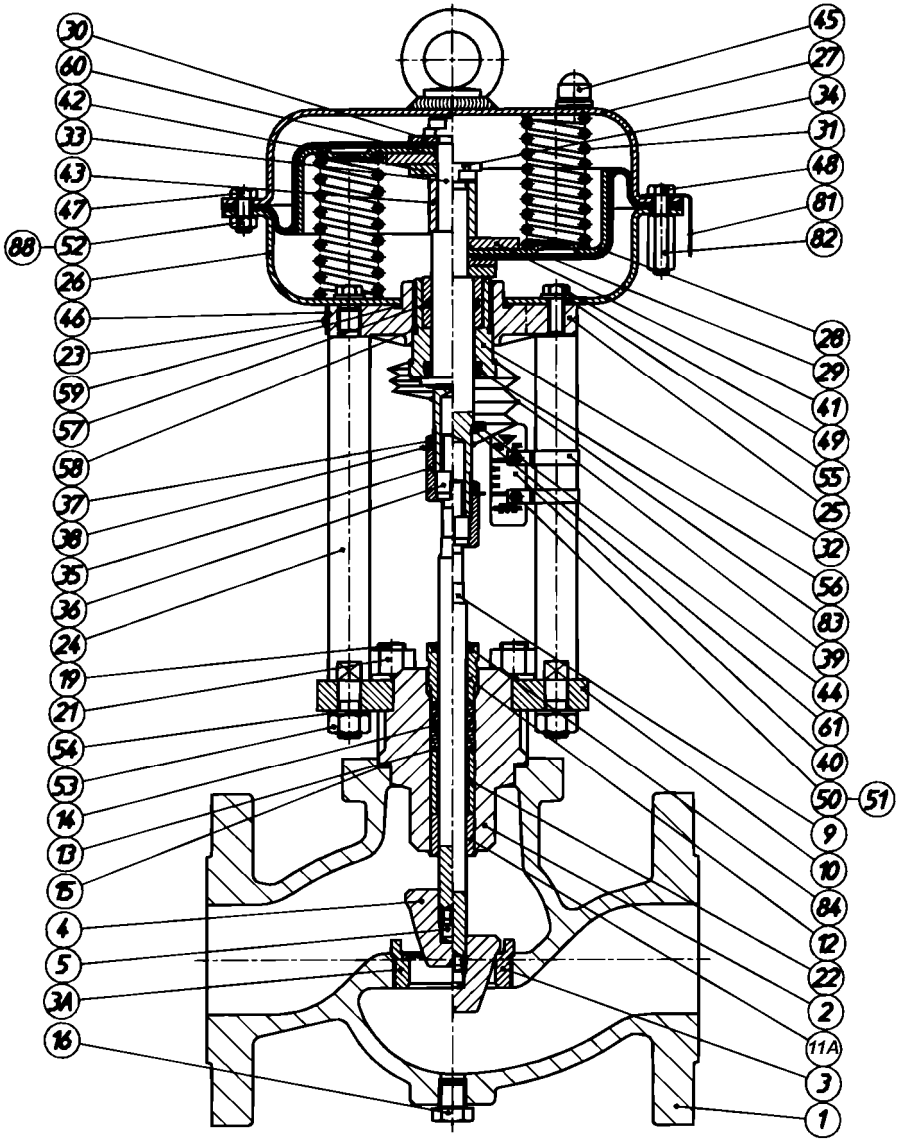

Fig. 1 Control valve DN 15 ... 100 with plug $Kv_s$ = 25 ... 160
with a pneumatic actuator

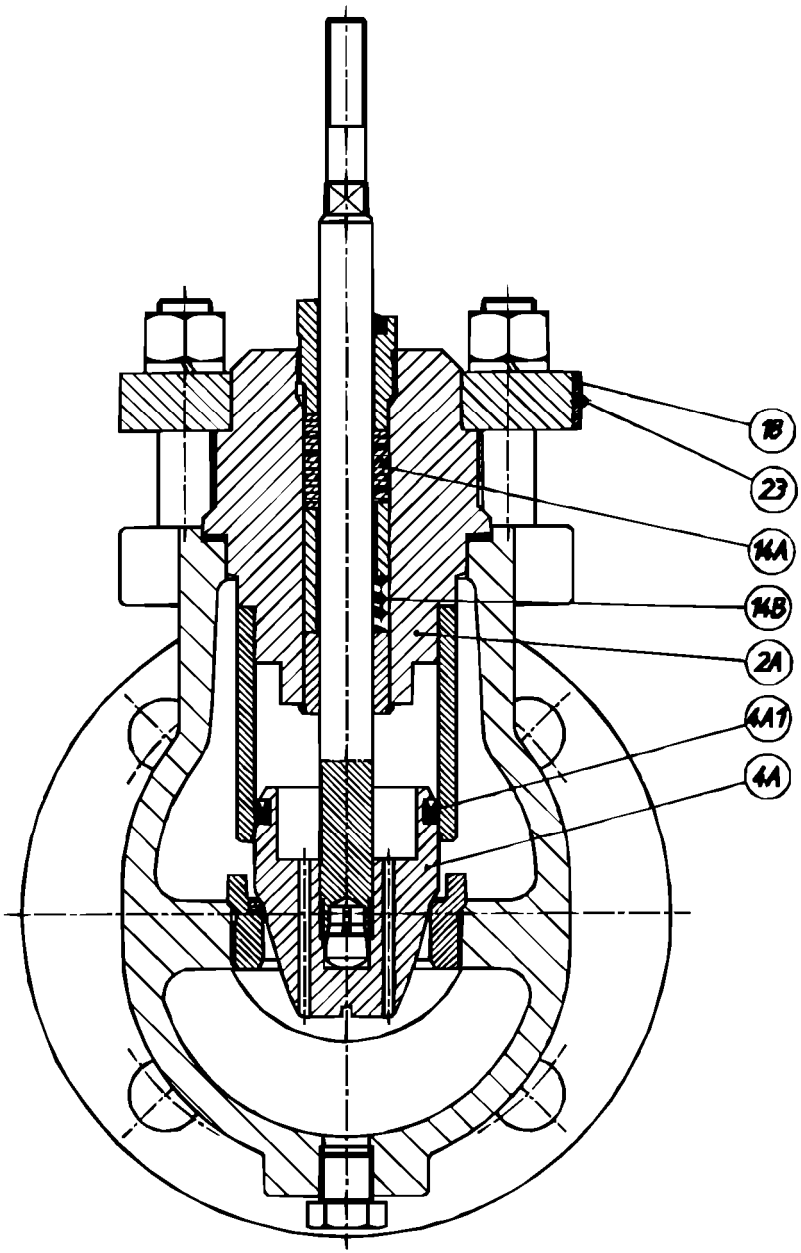


Fig. 2 Control valve DN 40 ... 100 with balanced plug

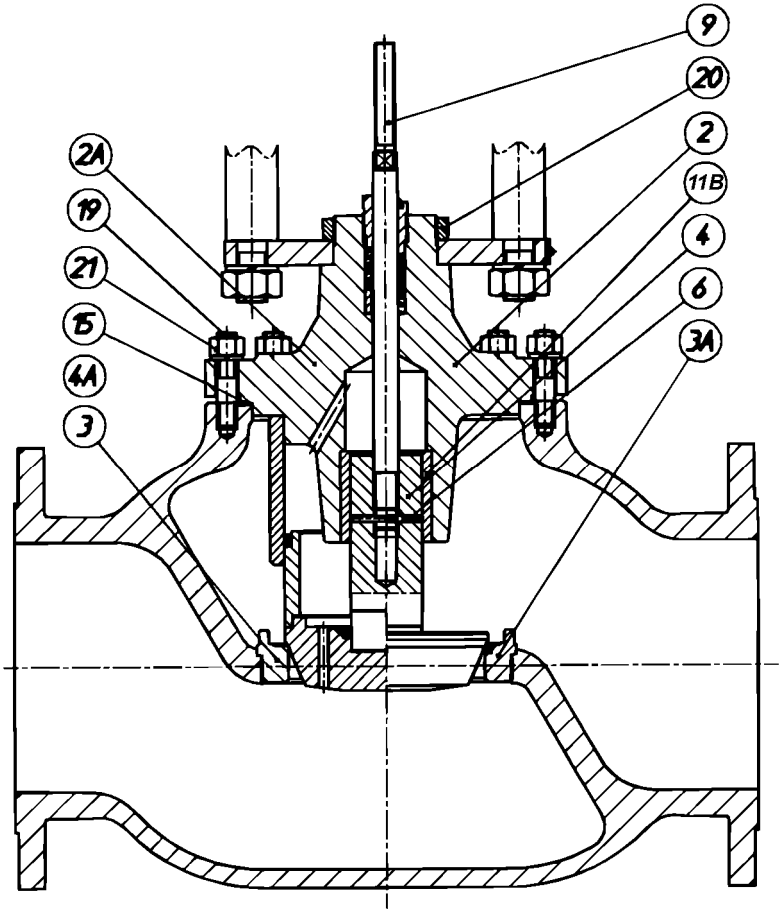


Fig. 3 Control valve DN 150 ... 250 with plug $Kv_s$ = 63 ... 630 standard and balanced

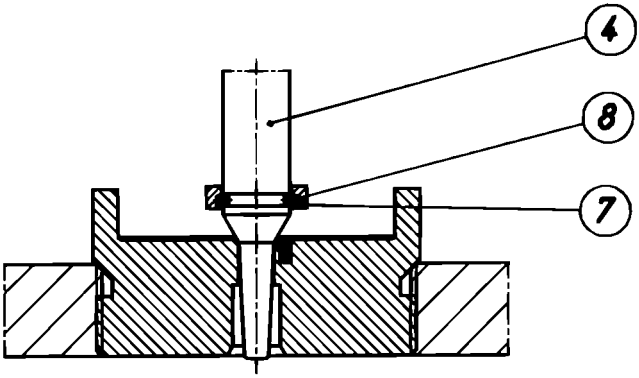


Fig. 4 Stem plug $Kv_s$ = 0.01 ... 1 with standard bonnet

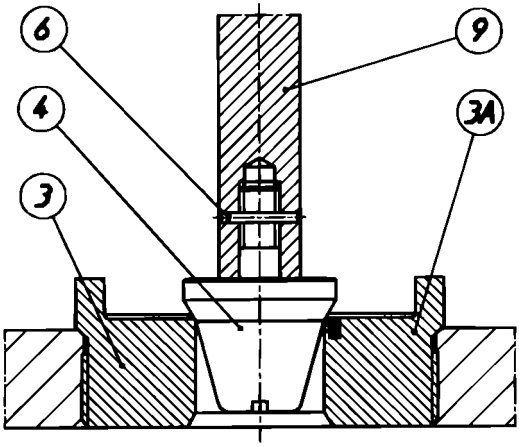


Fig. 5 Plug $Kv_s$ = 1.6... 16, $Kv_s$ = 0.01 ... 1
(with bellows and extended bonnet)

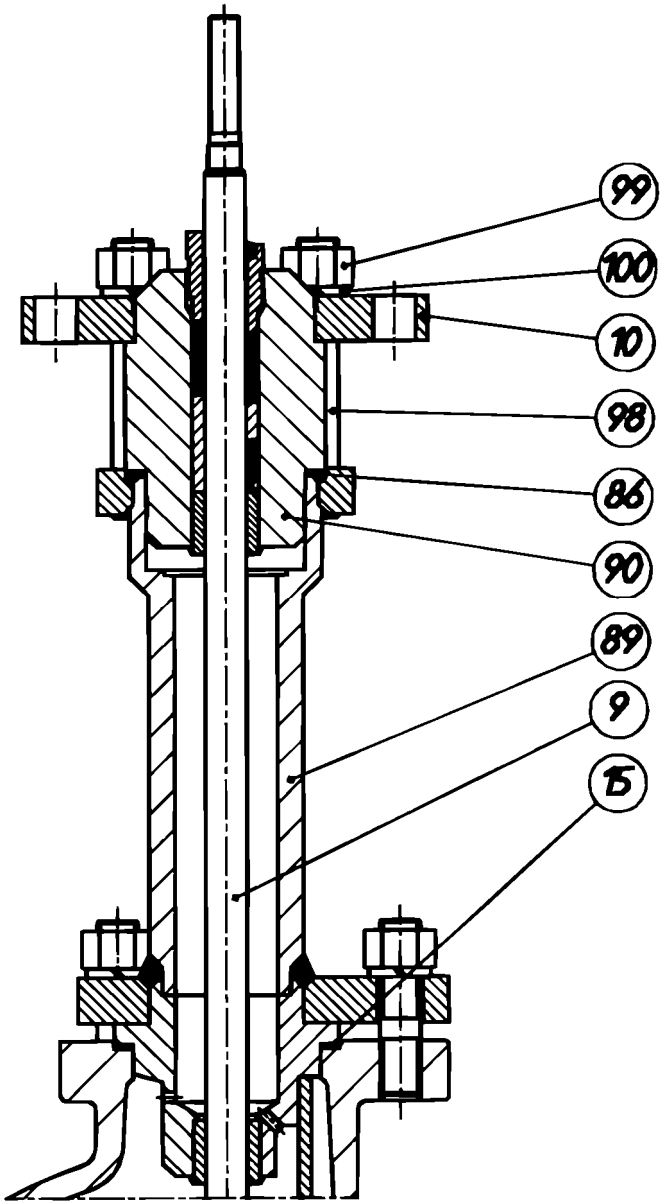


Fig. 6 Extended bonnet- 2B

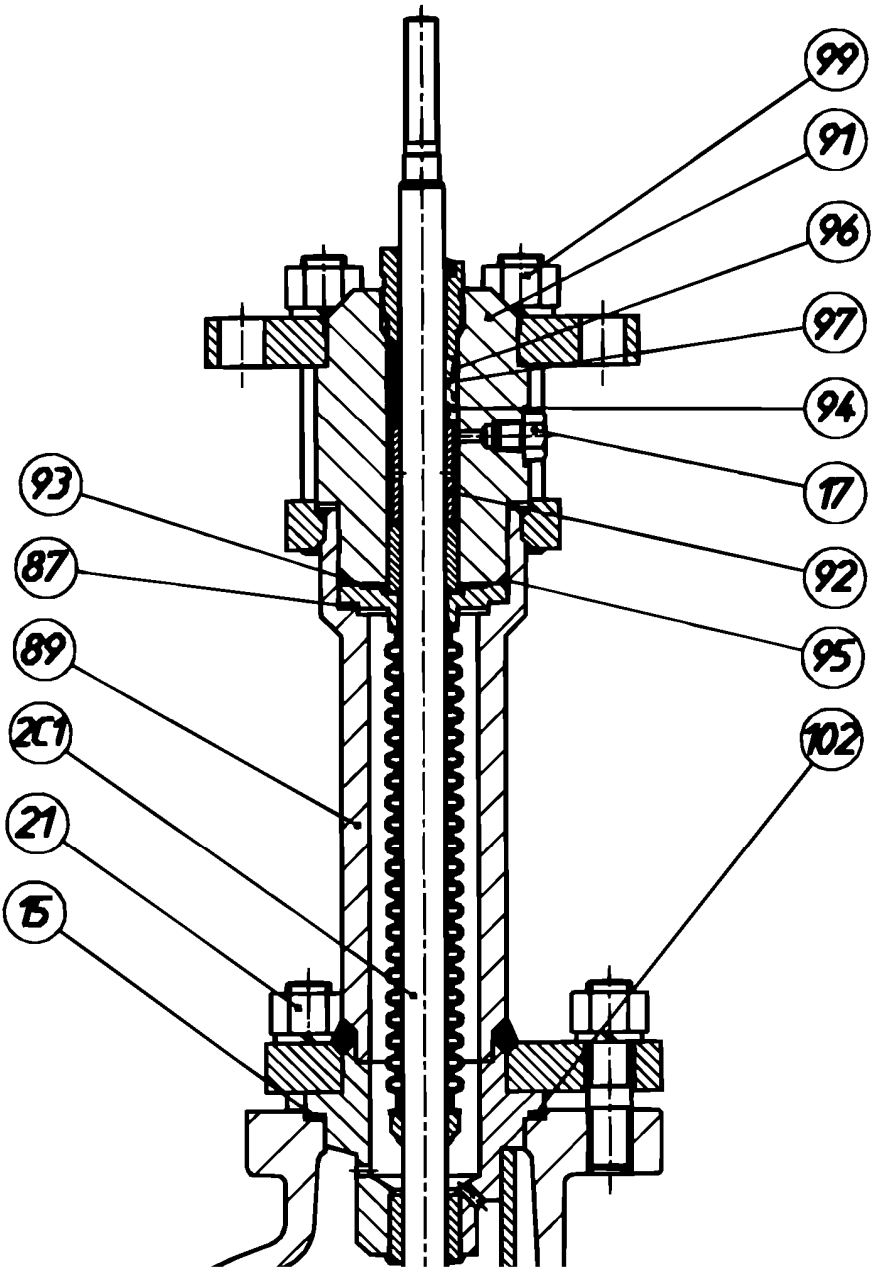


Fig. 7 Bellows bonnet- 2C

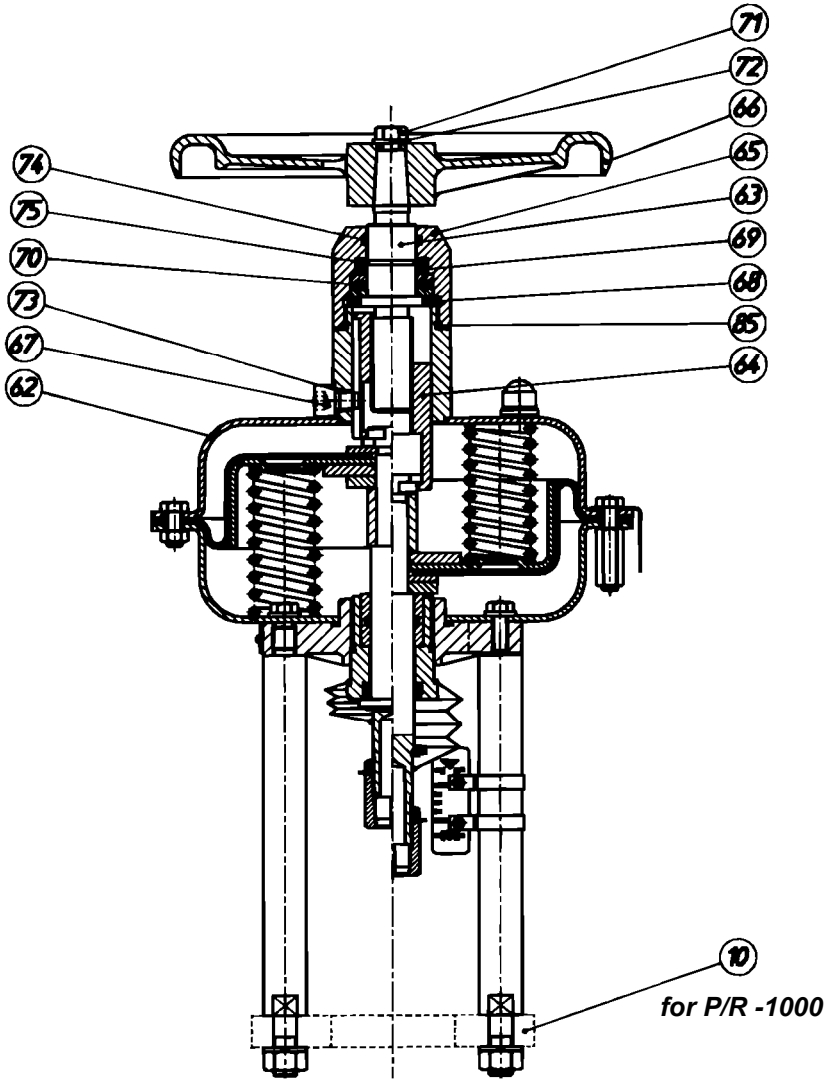


Fig. 8 Pneumatic actuator with manual drive type P/R-N

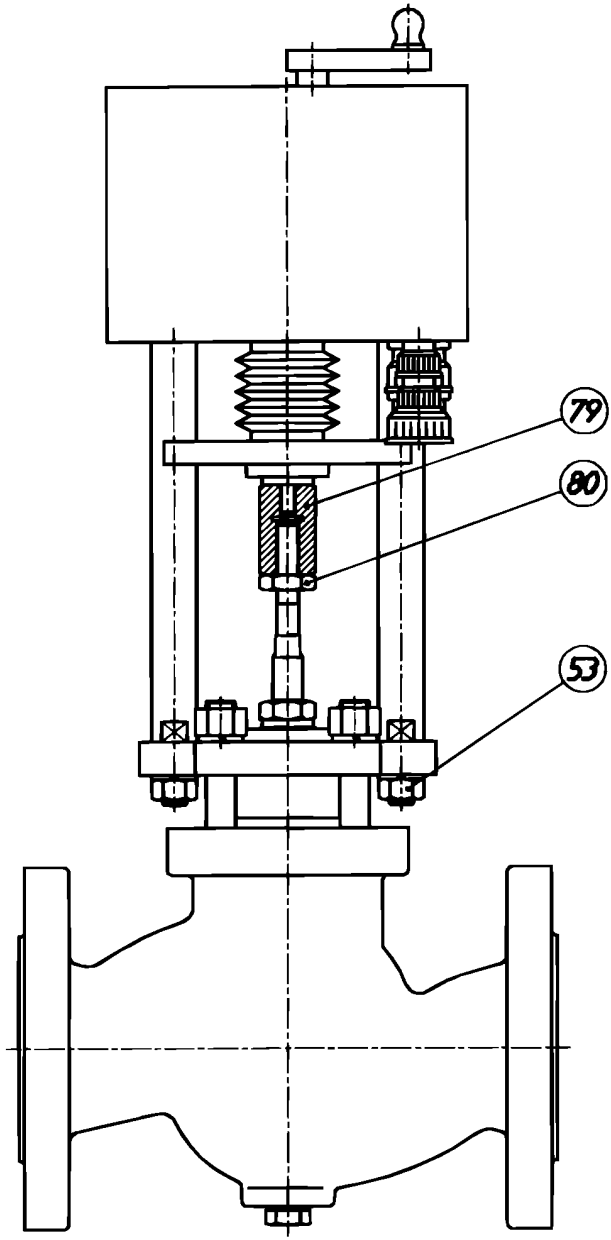


Fig. 9 Control valve with electric actuator ESL - 03 (example)

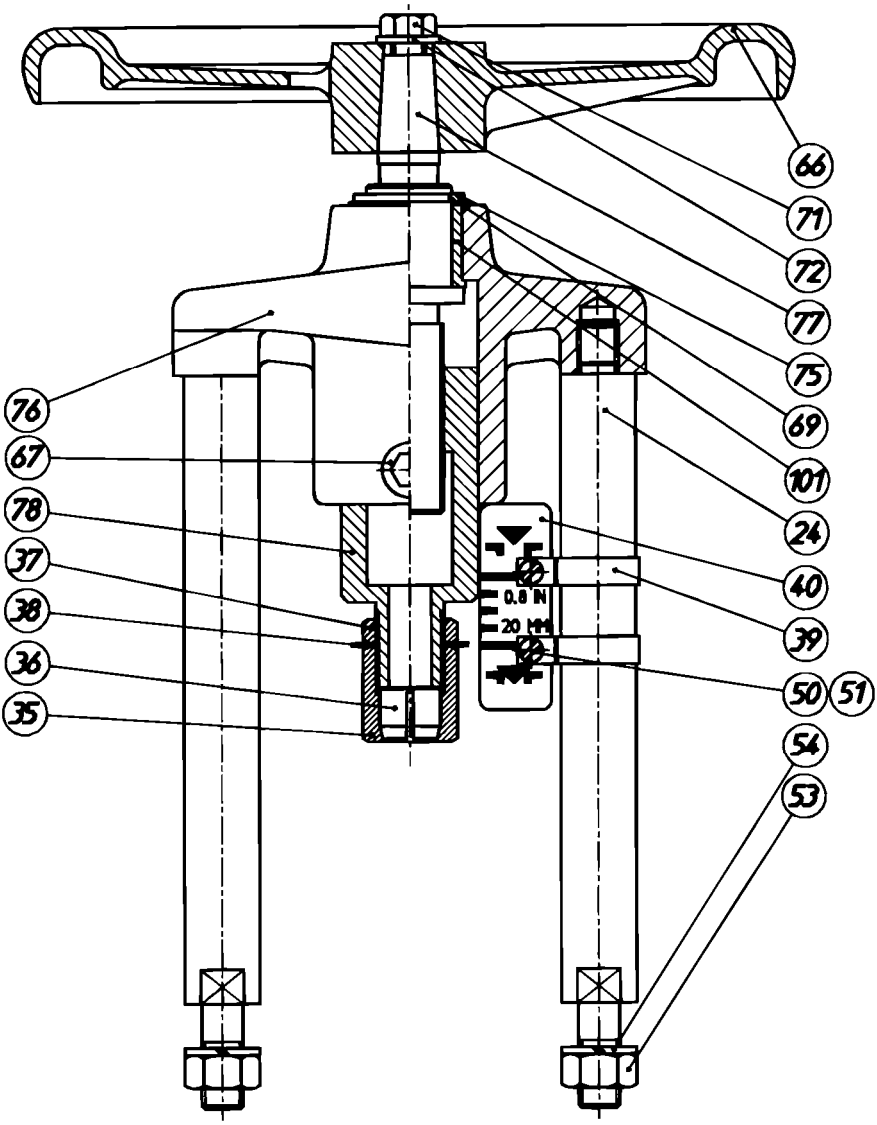


Fig. 10 Manual drive type NN

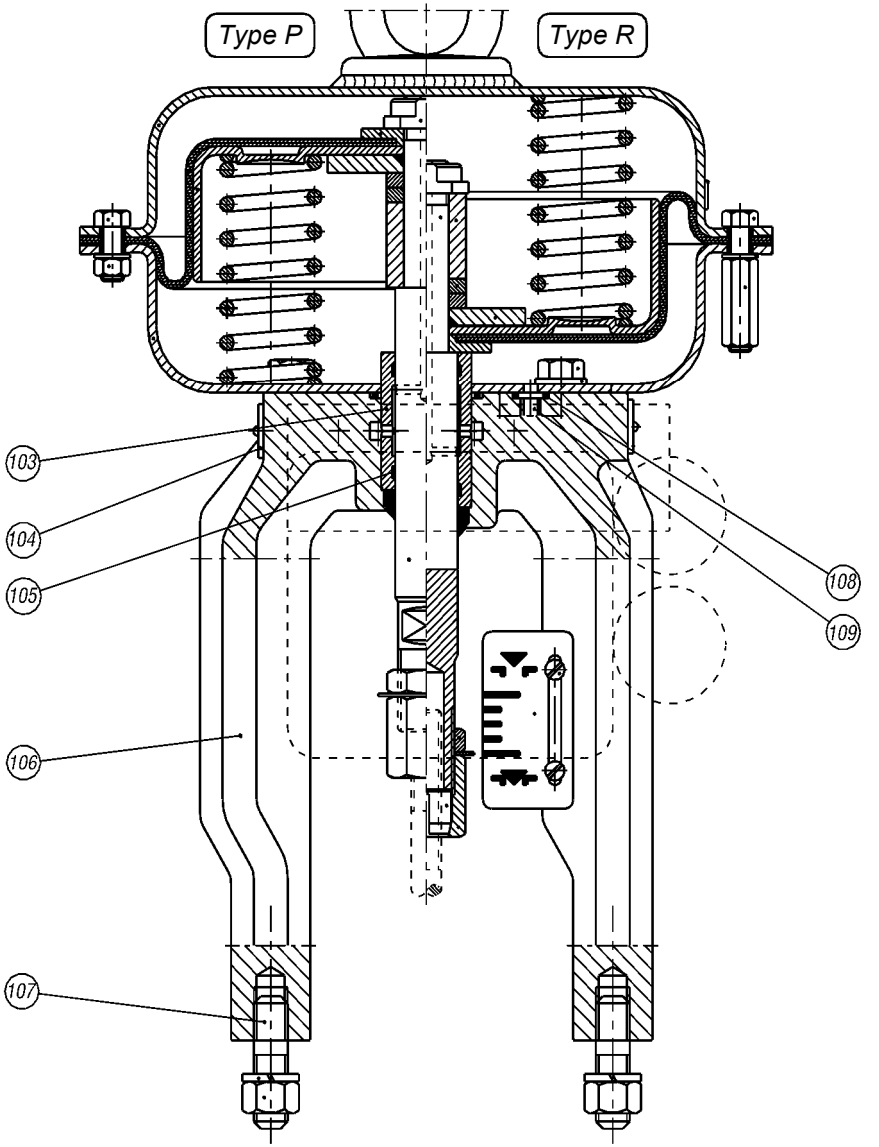


Fig. 11 Pneumatic actuator type P3/R3.

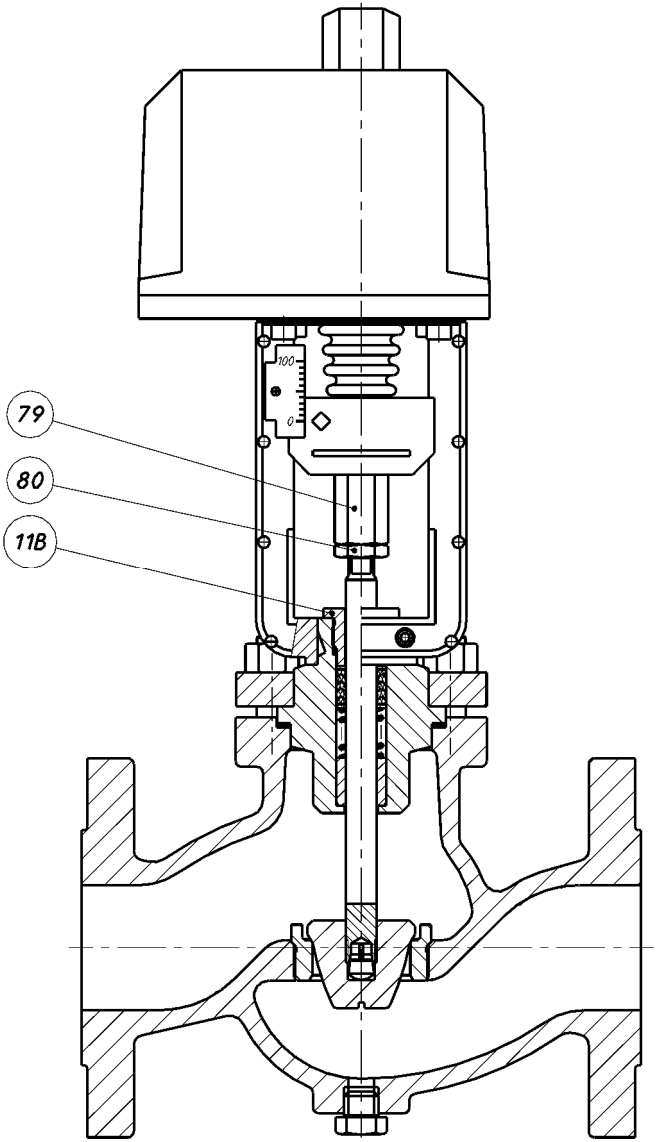


Fig. 12 Control valve with HONEYWELL electric actuator - ZH type


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