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***CONTROL VALVE WITH ROTARY  
PLUG***  
**TYPE BR 33 (Z33)**

**with pneumatic actuators BR 99 (P/R 99)**

**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 <input type="checkbox"/> Gas <input type="checkbox"/>
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 adjustment of the amount of working medium flowing through the valve is carried out by rotating the valve plug connected with the actuator stem and connecting rod.

An input signal, i.e.:

- a) in actuators with pneumatic positioner, compressed air with a pressure range of 20...100 kPa
- b) in actuators with electro-pneumatic positioner, current signal 4...20 mA, causes the valve stem with plug to move through the system of two angular levers. The rotation angle is proportional to the input signal. Actuators can be equipped with limit switches and 4...20 mA position transmitter.

## 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:

- ambient temperature from -40 to + 80°C;
- relative humidity up to 98%
- supply and control air should not contain any mechanical impurities, oil and substances causing corrosion of steel, copper and 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;

## 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. 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.

#### **NOTE!**

**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  $\pm 30^\circ$ . 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 (Figure: 1)**

Prior to process installation commissioning, check the operation of the valve installed. To this end, activate an actuator and check if the valve stem (10) moves smoothly without jamming, within the entire range of the rotation angle. During technological start-up, the bonnet seals (23) can be slightly pressed by tightening the bonnet nuts (29), until necessary tightness within the plug stem is obtained.

#### **6. MAINTENANCE AND REPAIRS**

Maintenance of the control valve during operation consists in ensuring correct tightness of the valve stem in the bonnet. Tighten the sealing pack periodically by tightening the nuts (29).

If the pressure sleeve (16) rests against the upper surface of the bonnet, remove the sleeve and add at least one seal. After installation, adjust the pressure to obtain a tight seal.

As necessary, the scope of maintenance and repairs must include:

- cleaning the valve and assessing the wear and tear of components;
- replacing the plug and seats
- replacing the valve bonnet seals
- replacing the actuator diaphragm;

##### **6.1 Disassembly of the valve (Figure: 1)**

*During* the disassembly of the valve, all protective measures required for a given medium should be taken. The valve should be thoroughly cleaned of residues of the flowing medium.

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,
- b) disconnect the connection of the valve stem with the actuator connecting rod by removing the screws (26C) in the coupling (26),
- c) remove the screws (154) securing the actuator yoke to the valve body and remove the actuator from the valve,
- d) remove the screw plug (8) using a special wrench and remove the socket (6) so as not to damage its seating surfaces,
- e) disconnect the connection of the valve stem (10) with the bridge (2) by turning the valve stem by 90° and knocking out the conical pin (20),
- f) remove the nuts (29), the pressure lever (15) and the valve stem,
- g) remove the pressure sleeve (16), the sealing package (23), the lubricating sleeve (18) or the spacer sleeve (17) and the stem guide sleeve (13),
- h) remove the bridge (2) with the plug (4) by lifting it slightly upwards and extending it to the opposite side of the seat,
- i) remove the plug guide sleeve (12),
- j) disconnect the plug-bridge connection by knocking out the cylindrical pin (21).

### 6.2 Replacing the valve seat (Figure: 1)

If excessive internal leaks are found, it is necessary to replace the seat. To do this, after removing the valve according to 6.1. a, b, c, d it is necessary to:

- a) insert a new seat and centre it on the valve plug (valve in closed position) while holding the valve stem with your hand,
- b) pre-tighten the seat with the screw (8),
- c) set the valve plug in the open position and tighten the screw plug (8) with a wrench.

**NOTE! Before screwing in the screw plug (8), lubricate its thread with a thin layer of sealing and anti-seizing paste (e.g.: LOCTITE 767).**

### 6.3 Replacing the plug (Figure: 1)

In case the plug face is excessively worn out or the profile section is eroded, the head must be replaced.

The plug is replaced after dismantling the valve according to point 6.1.

### 6.4 Replacing the valve bonnet seals (Fig: 1)

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. For this purpose, after removing the valve according to 6.1. a, b, c it is necessary to:

- a) remove the nuts (29), take off the pressure lever (15),
- b) remove the pressure sleeve, sealing package, lubricating sleeve;
- c) clean the bonnet chamber,
- d) insert a set of new gaskets and other parts in the correct order into the bonnet chamber,

- e) press the gaskets evenly by tightening the nuts (29) and assemble the valve in reverse order of disassembly,

**NOTE! The final adjustment of the sealing package pressure is made during the start-up of the repaired valve.**

### 6.5 Disassembly of the actuator (Figures: 1,2)

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

- a) disconnect the lines supplying the input signal to the actuator and the supply air and remove the actuator from the valve according to 6.1 b, c,
- b) remove the front plate (14A and 14B). To do this, use a thin screwdriver to pry the protective plugs (45), remove the screws below them (47) and remove the plugs (46),
- c) remove the screws (30) with nuts and washers, remove the upper housing (5) and remove the diaphragm (74),
- d) remove the cap (66) and unscrew the nut (41). Hold the diaphragm plate (36) lightly until the spring is completely relaxed. Remove the diaphragm plate, spring (73) and washers (43),
- e) remove the BR92 positioner with a set of limit switches if the actuator is equipped with them,
- f) remove the caps (65), remove the spring ring from the bearing pin (72), remove the pressure screw (50), lightly knock out the pin from the actuator body and remove the lever (38) together with the stud screw (76),
- g) disassemble the connector unit (26) and carefully hitting the connecting rod face (3) with a copper punch, knock it out of the actuator body,
- h) remove the sealing ring (55) and replace it if worn.

### 6.6 Replacing the diaphragm (Figure: 1, 2)

To replace a worn diaphragm, follow these steps:

- a) disconnect the air supply lines to the actuator,
- b) remove the upper housing (5) according to 6.5c and remove the worn diaphragm,
- c) install a new diaphragm with the fabric side onto the diaphragm plate and install the upper housing.

### 6.7 Disassembly of the actuator manual drive

**6.7.1 Disassembly of manual drive in BR 99-1 actuators (Figure: 2)** After removing the ring (153) and ring (151), unscrew the drive screw (150) with the drive gear (101) from the actuator body.

**6.7.2 Disassembly of manual drive in BR99-2 and BR99-3 actuators.** After removing the four screws, remove the manual drive from the actuator body.

**7. CHANGING THE  $KV_s$  FLOW RATE VALUE** (*Figure: 1.2*) The design of the actuator allows you to change the  $KV_s$  flow rate value without the need to replace the plug and seat. The change in the flow rate value can be made in the range of 45%, 75%, 120% of the nominal  $KV_s$ .

Flow rate values are given in the data sheet. To change the flow rate:

- a) remove the actuator front plate (14A and 14B). To do this, use a thin screwdriver to pry the protective plugs (45), remove the screws below them (47) and remove the plugs (46),
- b) apply the pressure on the actuator diaphragm or open the valve using a manual drive,
- c) unscrew the groove nut (44), move the pin (62) to the desired  $KV_s$  position according to the marking on the lever (38), tighten the groove nut (44) and reinstall the face plate (14A and 14B).

## **8. CHANGING THE VALVE OPERATION MODE** (*Figures: 1,2,3*)

The reversible design of BR33 actuators allows to change the operation mode of the valve assembled with this actuator from - "increase in the control air pressure OPENS" to - "increase in the control air pressure CLOSES" and vice versa.

To do this, change the operation mode of the actuator. After removing the actuator according to 6.5 a, b, c, d it is necessary to:

- a) remove the screw (51), take off the travel indicator (19), remove the spring ring (36 fig. 3) unscrew the screws (30 fig. 3) securing the positioner cam, remove the feedback lever (4 fig. 3) from the fork pin (77) and remove the pin,
- b) pull out the stud screw (76) together with the fork (78),
- c) remove the caps (60) and insert it into the hole in the body on the opposite side of the actuator,
- d) connect the stud screw and the fork with the pin lever (77) on the free side of the actuator and secure with the slotted set screw (49),
- e) place the feedback lever, turn the positioner cam so that the measuring spring (20 fig. 3) at increasing pressure in the actuator diaphragm chamber is always tensioned, place the travel indicator and screw in the screw (51),
- f) install the other components of the actuator.

## **9. CHANGE THE POSITION OF THE ACTUATOR WITHIN THE VALVE** (*Figure: 1*)

The design of the actuator allows to change its position in relation to the valve by 90° without the need to remove the actuator or valve.

To do this, loosen the fastening screws of the connector unit (26), unscrew the screws fixing the actuator yoke (9) to the valve body, move the actuator to the desired position and tighten the screws.

**10. CHANGE OF INTERNAL VALVE CHARACTERISTICS** (*Figure: 3*) BR33 valve has internal characteristics similar to equal-percentage in the range of opening angles up to

30°, and to linear in the range of opening angles 30...90°.

When using the BR 99-2 positioner, it is possible to select the linear or equal-percentage internal valve characteristics in the entire valve opening angle range. This is carried out by appropriate installation of the cam in the positioner. After dismantling the actuator elements as in 6.5.b it is necessary to:

- a) unscrew and remove the screw (30) with washer (31), remove the spring ring (36) and reverse the cam (6);
- b) install the spring ring, screw in the screw (30) set the cam to the desired characteristics, making sure that the tension spring (20) is tensioned when the air pressure in the actuator diaphragm chamber increases;
- c) adjust the positioner according to its operating instructions;
- d) assemble the actuator components in reverse order of removal

## 11. LIST OF SPARE PARTS

### 11.1 Valve spare parts

<b>Drawing number</b>	<b>Part name</b>	<b>Number of parts</b>
4	Plug	1
6	Seat	1
12	Plug guide sleeve	1
13	Stem guide sleeve	1
23	Packing	1

### 11.2 Actuator spare parts.

<b>Figure number</b>	<b>Part name</b>	<b>Number of parts</b>
44	Grooved nut	1
54	Ball bearing	1
55	Sealing ring	1
58	Needle bearing	1
74	Diaphragm	1

## 12. 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 actuator springs are under tension and, when removing the diaphragm plate (39), hold it by hand until the springs are completely relaxed.
- other operating hazards are marked with "!" in this document.



### 13. 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.

### 14. FIGURES

#### 14.1. Designations and names of valve parts.

<i>Figure number</i>	<i>Part name</i>	<i>number of pcs.</i>	<i>Figure number</i>	<i>Part name</i>	<i>number of pcs.</i>
1	Body	1	16	Pressure sleeve	1
2	Bridge	1	17	Distance sleeve	1
4	Plug	1	18	Lubricating sleeve	1
6	Seat	1	20	Conical pin	1
8	Plug screw	1	21	Cylindrical pin	1
10	Shaft	1	23	Packing	5(10)
12	Plug guiding sleeve	1	27	Spring washer	2
13	Stem guiding sleeve	1	28	Stud bolt	2
15	Pressure lever	1	29	Nut	2

#### 14.2. Designations and names of actuator parts.

<i>Number in Fig.</i>	<i>Part name</i>	<i>Number of pieces</i>	<i>Number in Fig.</i>	<i>Part name</i>	<i>Number of pieces</i>
3	Connecting rod	1	54	Ball bearing	1
5	Top housing	1	55	Sealing ring	1
7	Body	1	56	Spring ring	2
9	Yoke	1	57	Spring ring	2
11	Bearing sleeve	1	58	Needle bearing	1
14A	Front plate with nameplate	1	59	Washer	1
14B	Front plate (plexiglass)	1	60	Cap	1
19	Stroke indicator	1	61	Cylindrical head screw	4
22	Faceplate seal	1	62	Pin	1
24	Safety plate	1	63	Pipe plug	1
25	Security plate seal	1	64	Cap	2
26	Connector unit	1	65	Cap	2
26C	Seat screw	4	66	Cap	1
30	Screw	6	67	Cap	3
31	Nut	6	68	Cap	2
32	Washer	6	69	Cap	2
33	Spring washer	10	70	Bonnet	1
34	Seat screw	4	71	Sliding sleeve	2
35	Cross hole screw	2	72	Bearing pin	1
36	Low nut	2	73A	Spring I	1

37	Seat screw	3
38	Lever	1
39	Diaphragm plate	1
40	Spring washer	3
41	Nut	2
42	Nut with flexible insert	1
43	Washer	2
44	Grooved nut	1
45	Plug	4
46	Plug	4
47	Tapered head screw	4
48	Washer	2
49	Pressure screw with seat	1
50	Pressure screw with seat	1
51	Cylindrical head screw	1
52	Spring housing	1
53	Sliding bearing	2

73B	Spring II	1
74	Diaphragm	1
75	Cheese head screw	1
76	Stud bolt	1
77	Fork pin	1
78	Fork	1
79	Groove pin with a round head	1
101	Wheel	1
103	Counter lever	1
150	Manual drive screw	1
151	Ring	1
152	Ball	1
153	Ring	1
154	Screw	4
155	Spring washer	4
156	Washer	4
157	Nut	4

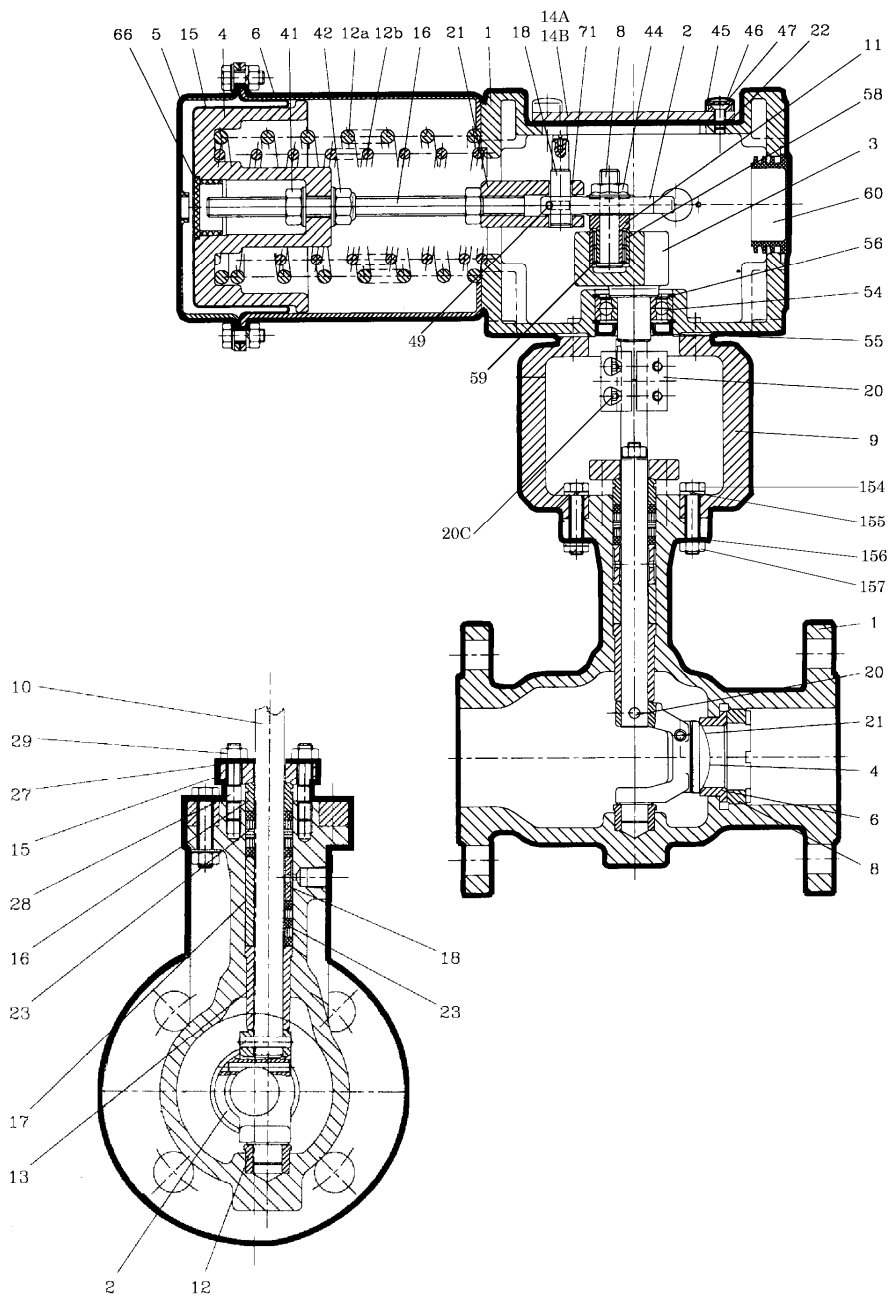


Fig. 1 Valve and actuator cross-section

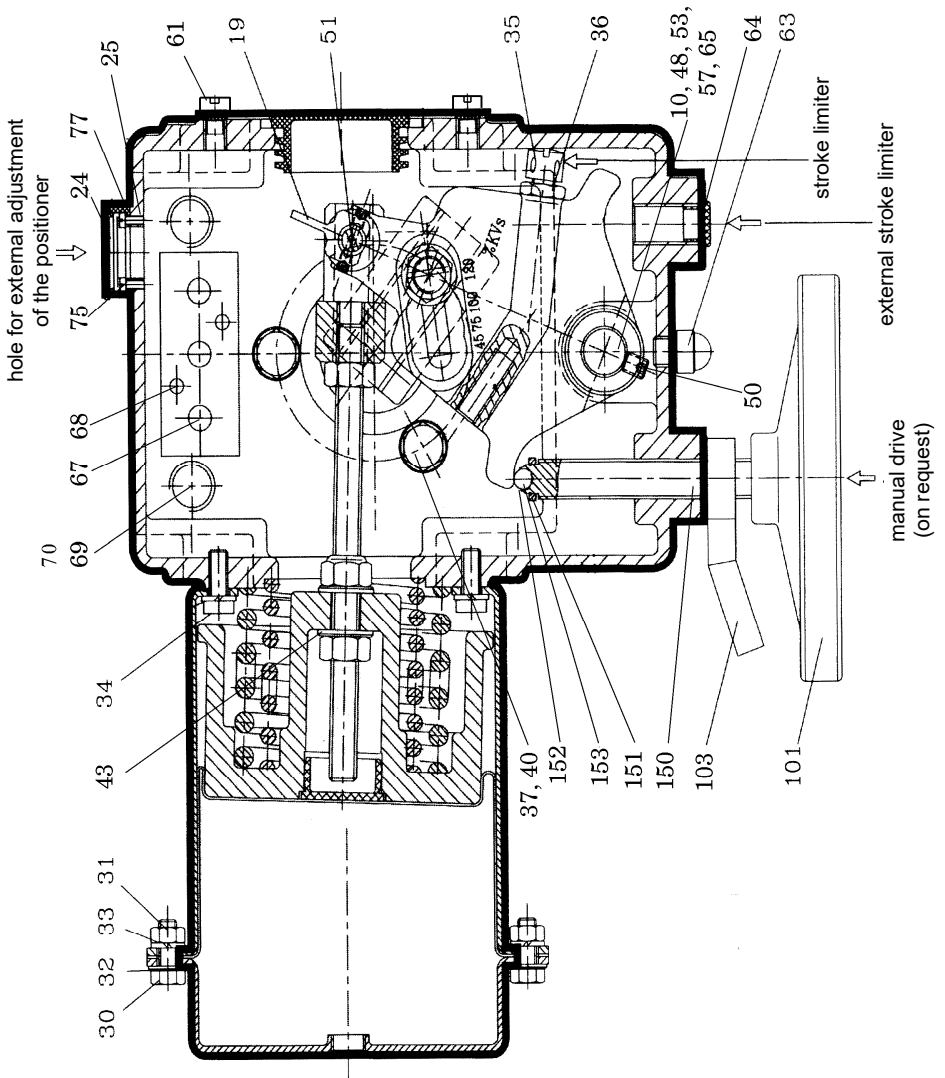
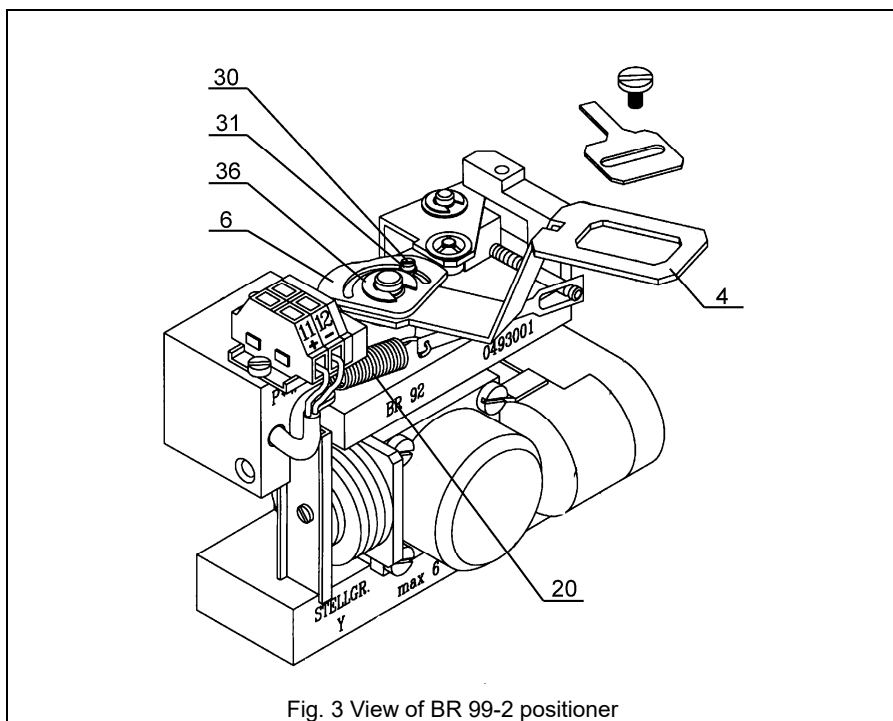


Fig. 2 Actuator cross-section



#### 14.2 Positioner part designation and name.

<b>Figure number</b>	<b>Part name</b>	<b>Number of parts</b>
4	Lever	1
6	Cam	1
20	Spring	1
30	Screw	1
31	Washer	1
36	Spring ring	1

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

### 13.1. Design requirements

The valves type "BR33" with pneumatic rotary actuators type 99 have been 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

The valves "BR33" with pneumatic rotary actuators type 99 made with marking (Ex) can be used for operation 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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Manufacturer & Distributor:

ZAKŁADY AUTOMATYKI „POLNA” SA

ul. Obozowa 23 37 - 700 Przemyśl

Phone: (16) 678-66-01; Fax: (16) 678-65-24, 678-37-10

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