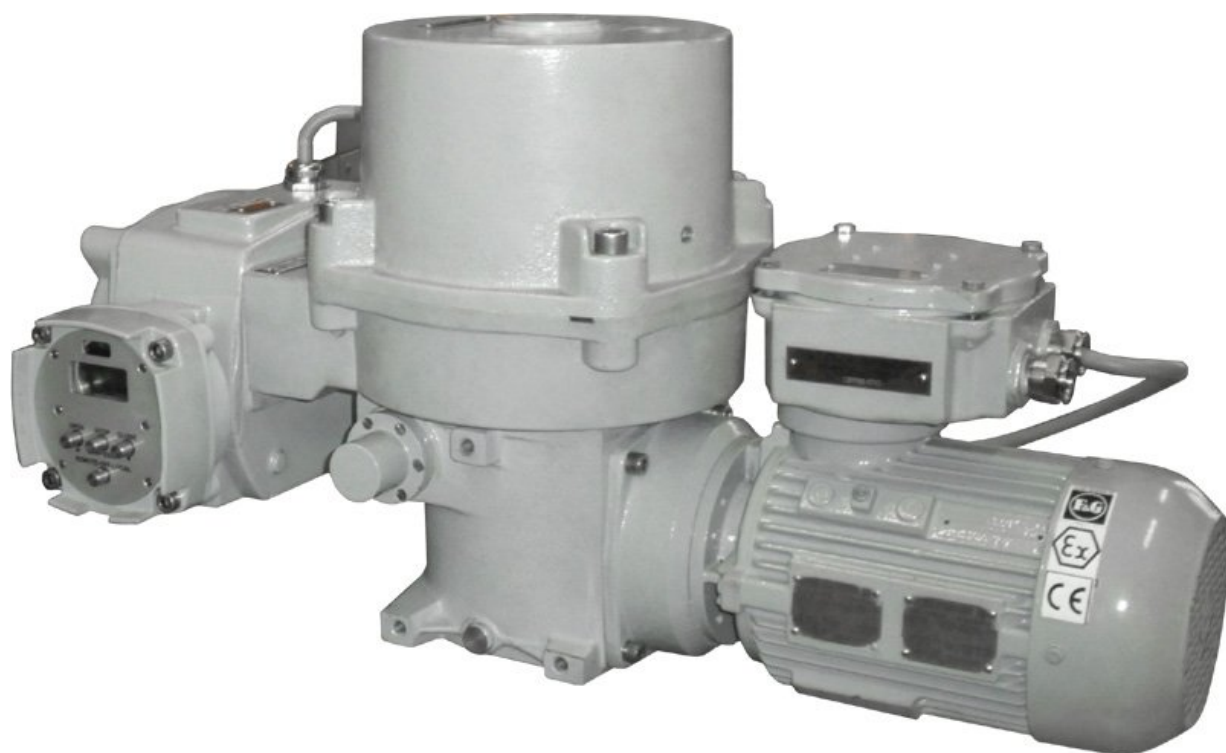




CE 1026

# ***INSTALLATION, SERVICE AND MAINTENANCE INSTRUCTIONS***



***Explosion-proof electric multi-turn actuators  
MO 3-Ex, MO 3.4-Ex, MO 3.5-Ex, MO 4-Ex,  
MO 5-Ex***

## TEST CERTIFICATE

EXPLOSION-PROOF ELECTRIC MULTI – TURN ACTUATOR MO 3-Ex, MO 3.4-Ex, MO 3.5-Ex, MO 4 -Ex, MO 5-Ex

Type number ..... Power supply .....V .....Hz

Serial number ..... Rated torque ..... Nm

Production year ..... Switching-off torque ..... Nm

Wiring diagram ..... Operating speed ..... min<sup>-1</sup>





..... Adjusted number of revolutions.....

..... Transmitter (potentiometer) .....

Warranty period ..... months Output signal.....

Serial number of electric motor .....

Serial number of transmitter .....

Explosion-proof version:  II 2 G Ex db eb IIC T5 a T4 Gb +  II 2 D Ex tb IIIC T135°C Db (platí pre MO 3-Ex, MO 3.4-Ex, MO 3.5-Ex, MO 5-Ex) resp.  II 2 G Ex db eb IIB T5 a T4 Gb +  II 2 D Ex tb IIIC T135°C Db (platí pre MO 4-Ex )

Final report No.: FTZÚ 12 ATEX 0137X , FTZÚ 12 ATEX 0138X , FTZÚ 14 ATEX 0058X , FTZÚ 16 ATEX 0074X

Design and type tests are in accordance with the following standards:

EN/IEC 60 079-0 – Electrical apparatus for explosive gas atmospheres – Part 0: **General requirement**

EN/IEC 60 079-1 – Electrical apparatus for explosive gas atmospheres – Part 1: **Flameproof enclosures “d”**

EN/IEC 60 079-7 – Explosive atmospheres Part 7: **Equipment protection by increased safety “e”**

EN/IEC 60079-31: Explosive atmospheres – Part 31: **Equipment dust inition protection by enclosure „t“**

Tests made by ..... Packed by .....

Date ..... Signature and stamp .....

## COMPLETENESS CERTIFICATE

Used valve .....

Assembled by: Firm .....

Name .....

Warranty period ..... months

Date ..... Signature and stamp .....

## INSTALLATION CERTIFICATE

Location.....

Installed by: Firm.....

Name .....

Warranty period ..... months

Date ..... Signature and stamp.....

Please read these instructions carefully before mounting and operating the actuator!

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Edition: 02/2019

The right of changes reserved!

Ev. Nr.: 74 1145 62

The Installation, Service and Maintenance Instructions are drawn up according to requirements of EC Executive Nr. 89/392/EEC "Uniform requirements for machines and devices from the point of view of safety and health care", to save life and health of users and to avoid material damages and exposure environment to danger.

## 1. General data

### 1.1 Purpose and applications

Explosion-proof electric multi-turn actuators (hereinafter **EA**) types **MO 3-Ex, MO 3.4-Ex, MO 3.5-Ex, MO 4-Ex, MO 5-Ex** (hereinafter MO-Ex) types are high-powered electric-mechanical products, designed for direct installations onto controlled devices (regulating bodies -valves, etc.). They can be equipped with means of measuring and control of technological processes where an unified analogue direct current or voltage signal is an information bearer on their input and/or output. They can be used in heating, energy, gas, air-conditioning and other technological systems, which they are suitable for, regarding their features. They are connected with controlled devices with a flange and coupling shape according to ISO 5210 or in accordance with GOST R 55510-2013.



1. It is prohibited to use EA as lifting device!
2. The option of switching EA via semi conductive trigger switches must be consulted with the actuator manufacturer.
3. Switching of actuator by a semiconductor switches have to be consulted with producer.

### 1.2 Safety instructions



EA of MO types are reserved technical devices with higher rate of danger, with possibility of installation in areas specially danger regarding casualties caused by electric current.

#### **Product characteristics from risk point of view**

EA are according to directive LVD 2014/35/EU and standard EN 61010-1:2010/A1:2019/AC:2019-04 assigned for installation category II (overvoltage category).

In order to demonstrate the compliance with the requirements of the European Council directive on machinery 2006/42/EC, European Parliament and Council Directive 2014/34/EU on equipment and protective systems intended for use in potentially explosive environment (designated as Directive ATEX 100a), directive of the Council 2014/35/EU on LVD and Council Directive 2014/30/EU on EMC, the electric actuators are subject to certification by authorized certification facilities.

The product meets the essential safety requirements according to EN 60204-1 and is in compliance with EN 55011/A1 within valid edition.

#### **Product influence to environment**

**Electromagnetic compatibility (EMC):** the product complies with the requirements of the Directive 2014/30/EU of the European Parliament and of the Council on the approximation of the laws the Member States relating to the electromagnetic compatibility and with the requirements of standards as well EN IEC 61000-6-3:2021, EN IEC 61000-6-2:2019, EN 61000-3-3:2013/A1:2019/A2:2021 and EN IEC 61000-3-2:2019/A1:2021.

**Vibrations caused by the product:** product influence is negligible.

**Noise produced by the product:** The maximum allowable noise level (A) of the product measured in a place of operation is 78 dB (A) (valid for MO 3-Ex-MO 3.5-Ex) or 85 dB (A) (valid for MO 5-Ex).

**Environment hazard:** the product involves a mineral oil fill harmful for water species that is capable to generate long-time lasting adverse effects in water environment. When handling and operating the product don't allow oil to escape in environment. An increased care must be given when the product is operated near to water sources.



### 1.3 Instructions for stuff training

#### Requirements for professional qualification of people performing installation, service and maintenance



The electrical connection of the actuator can only be carried out by a person in accordance with legislative requirements of the given country, depending on the required areas of location/use. Service can be performed only by workers professionally qualified and trained by the producer or contracted service centre.

Electric actuators MO-Ex are made in explosion-proof version:

 **II 2 G** Ex db eb IIC T5 a T4 Gb +  **II 2 D** Ex tb IIIC T135°C Db (platí MO 3-Ex, MO 3.4-Ex, MO 3.5-Ex, MO 5-Ex) resp.

 **II 2 G** Ex db eb IIB T5 a T4 Gb + II  **II 2 D** 2G Ex tb IIIC T135 °C Db, (platí pre MO 4-Ex )

pursuant to:

EN/IEC 60079-0: Explosive atmospheres – Part 0 : Equipment general requirements – General requirements

EN/IEC 60079-1: Explosive atmospheres – Part 1 : Equipment protection by flameproof enclosures “d”

EN/IEC 60079-7: Explosive atmospheres - Part 7: Equipment protection by increased safety “e”.

EN/IEC 60079-31: Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure „t“, within valid edition.

#### Electric parts EA are proposed:

- as devices of the group **II** for others threatened areas (excluding mines)
- of the category **2** with demanding requirements for safety
- for use max. in zone 1,2,21,22
- for atmospheres **G** (gases, vapors or mists ) or **D** (combustible conductive dusts)
- topressure range from 0.8 to 1.1 bar.

#### Design version is :

- flameproof enclosures “**d**”, increased safety “**e**” or level dust ignition protection by enclosure “**tb**”
- with explosion protection group **IIC** or **IIIC**
- and temperature class T4 resp. T5 (max. permissible surface temperature +135°C).

Zones for installation of explosion-proof electric actuators and conditions for equipment installation are defined in the following standards:

EN/IEC 60079-10: Electrical apparatus for explosive gas atmospheres  
Part 10: Classification of hazardous areas

EN/IEC 60079-14: Electrical apparatus for explosive gas atmospheres  
Part 14: Electrical installations in hazardous areas

Non-electric parts of electric actuators are designed, engineered, manufactured, tested and identified in compliance with the requirements for safety of machinery according to the following standards:

EN 1127-1: Explosive atmospheres – Explosion prevention and protection  
Part 1: Basic concepts and methodology

EN 13463-1: Non – electrical equipment potentially explosive atmospheres  
Part 1 : Basic method and requirements

EN 13463-5: Non – electrical equipment potentially explosive atmospheres  
Part 5: Protection by constructional safety “c”

**Equipment identification** consists of the following characters:

**Ex** - electric equipment complies with standard EN/IEC 60 079-0. and related standards for the corresponding types of explosion protection.

**d** - identification of the explosion **protection type** - "flameproof enclosure" according to EN/IEC 60 079-1.

**e** - identification of the explosion **protection type** – „increased safety" according to EN/IEC 60 079-7.

**tb** - identification of dust ignition protection by enclosure „t“ according to EN/IEC 60 079-31.

**II or III** - identification of the class of non-explosive electric device according to the standard EN/IEC 60 079-0.

**C** - identification of the **sub-class II** resp. **III** of non-explosive electric devices according to the standard EN/IEC 60 079-0.

**T4,T5,T100°C resp. T135°**- identification of the **temperature class** of non-explosive electric device class II or III according to the EN/IEC 60 079-0.

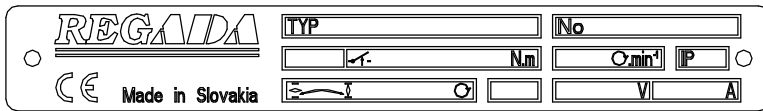
**Gb** - (EPL Gb) identification of the equipment designated for explosive gaseous atmospheres, with "high" level of protection, which is not a source of initiation in standard operation or in case of expected failures.

**Db** - (EPL Db) - identification of the equipment designated for explosive dust atmospheres, having a “high” level of protection, which is not a source of ignition in normal operation or during expected malfunctions.

### 1.4 Data specified on electric actuator

Nameplate:

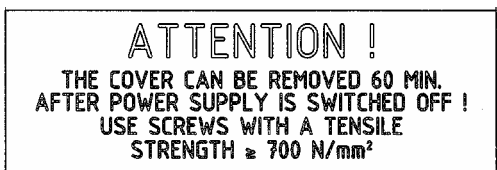
Warning plate:



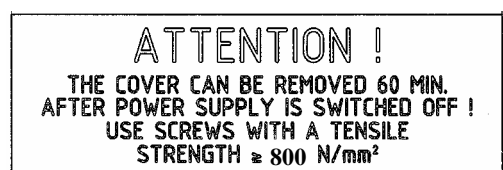
Nameplate contains the basic data concerning identification, performance and electricity: indication of producer, type, serial number, max. load torque and switching-off torque, operating speed, protection code, revolutions, supply voltage and current.

Warning label:

- with identification of the waiting time and requirements for strength of screws

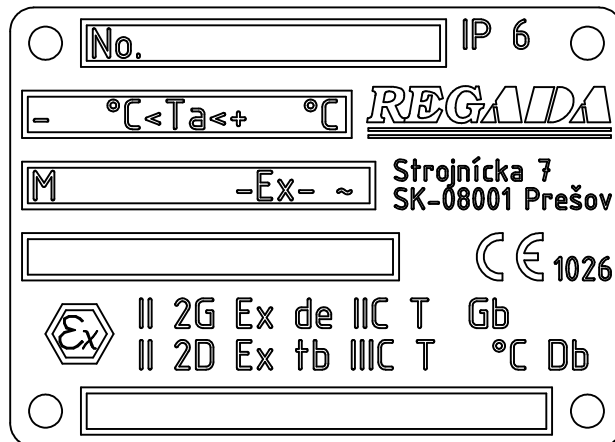


MO 3.X-Ex



MO 4-Ex, MO 5-Ex

**Non-explosive label:** identifying the manufacturer, certificate number, type identification, version identification, serial number and version for ambient temperature -20°C to +60°C or -50°C to +40°C C (valid for MO 3.X-Ex and MO 5-Ex) or -60°C to +40°C resp. -50°C to +40°C resp. -20°C to +60°C resp. -60°C to +60°C.(valid for MO 4-Ex).



### Graphic symbols on electric actuator

The graphic symbols used on electric actuator substitute the text messages. Some of them are in accordance with EN ISO 7010, ISO 7000 and IEC 60417 within valid edition.

	Dangerous voltage	(EN ISO 7010-W012)
	CAUTION!	(EN ISO 7010-W001)
	Stroke of the electric actuator	
	Switching-off torque	
	Manual control	(0096 ISO 7000)
	Protection terminal	(5019 IEC 60417)

## 1.5 Terminology

**Potentially explosive environment** - an environment where explosive atmosphere can occur.

**Explosive gas atmosphere** - a mixture of flammable substances (in form of gases, vapors or mist) with air under atmospheric conditions, which upon initiation enables the propagation of the combustion in unconsumed mixture.

**Maximum surface temperature** - maximum temperature occurring during operation in most adverse conditions (but within accepted tolerance limits) at any part of the surface of the electric device, that could result in ignition of the surrounding atmosphere.

**Enclosure** - all walls, doors, covers, cable glands, shafts, rods, draw bars, etc., that contribute to the level of protection against explosion or to the level of protection (IP) of the electric device.

**Flameproof enclosure "d"** - type of protection wherein the parts capable of igniting an explosive atmosphere are located within the enclosure, in case of explosion of an explosive mixture within the enclosure, such enclosure will withstand the pressure of the explosion and prevent the propagation of explosion to the surrounding atmosphere.

**Increased safety "e"** - type of protection applied to electrical apparatus in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks in normal service or under specified abnormal conditions.

**Dust ignition protection by enclosure "t"** - type of protection for explosive dust atmospheres where electrical equipment is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures.

**Combustible dust** - finely divided solid particles, 500 µm or less in nominal size, which may be suspended in air, may settle out of the atmosphere under their own weight, may burn or glow in air, and may form explosive mixtures with air at atmospheric pressure and normal temperatures.

**Conductive dust** - combustible dust with electrical resistivity equal to or less than  $10^3 \Omega \cdot m$ .

**Combustible flyings** - solid particles, including fibres, greater than 500 µm in nominal size which may be suspended in air and could settle out of the atmosphere under their own weight.

## 1.6 Warning for safety use

- Products are assigned for operation in environment consist of gas, steam and vapours, with temperature range from  $-20^{\circ}\text{C}$  up to  $+60^{\circ}\text{C}$ ; and special version for ultra low temperatures from  $-50^{\circ}\text{C}$  up to  $+40^{\circ}\text{C}$  (valid for MO 3.X-Ex and MO 5-Ex) or  $-60^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$  resp.  $-50^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$  resp.  $-20^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$  resp.  $-60^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$ .(valid for MO 4-Ex). to pressure range from 0.8 to 1.1 bar. EA can be installed at areas specified max. as zone 1,2,21,22.



It matters about following products:

It matters about following products are designated for environment:

- group II
  - the category 2
  - for type of the atmospheres **G** or **D**
  - subgroup **C**
  - temperature class **T4** resp. **T5**.
- Products are designed according to standards for electrical and non-electrical devices assigned for areas with danger of explosion:
    - for electric parts: EN/IEC 60079-0, EN/IEC 60079-1 and EN/IEC 60079-7 and EN/IEC 60079-31
    - for non-electric parts: EN 1127-1, EN 13463-1 and EN 13463-5.
  - The maximum surface temperature of the actuator for given group **T4** is not allowed to exceed  $+135^{\circ}\text{C}$  and for given group **T5** is not allowed to exceed  $+100^{\circ}\text{C}$ .
  - If the actuator is placed on device which regulate medium with higher temperature than  $+55^{\circ}\text{C}$ , protect the actuator by additional construction in order to maintain ambient temperature max.  $+55^{\circ}\text{C}$  and also to stop temperature transmitting through junction component!
  - Cable glands blinds are assigned only for transport and storage period, i.e. for period till the actuator is builded into operation with danger of explosion, than blinds must be replace by connecting cable.
  - If any of the cable glands are not used to install a cable, it must be replaced with certified Ex plug of the approved type, secured with Loctite 243 adhesive.
  - Temperature on entry cables is max.  $90^{\circ}\text{C}$ .
  - ATTENTION: THE COVER CAN BE REMOVED 60 MIN. AFTER POWER SUPPLY IS SWITCHED OFF! USE SCREWS WITH A TENSILE STRENGTH  $\geq 700 \text{ N/mm}^2$  (MO 3.X-Ex) resp.  $\geq 800 \text{ N/mm}^2$  (MO 4-Ex a MO 5-Ex).**

9. After reassembling the cover of control box and the cover of terminal box please proceed according to warning in section 5.3 Maintenance to assure inexplosiveness.
10. **WARNING – POTENTIAL ELECTROSTATIC CHARGING HAZARD.**  
During operation of EA it must be prevented any process with intensive formation of electrostatic charge stronger than manual friction of his surface.

#### Product protection

EA MO-Ex does not have own short-circuit protection, therefore there must be included suitable protective device into the supply power (circuit breaker, or fuse), which serves at the same time as main switch. For protection, we recommend to use a fuse type "T" or a contactor type "C".

**Type of equipment from a connection point of view:** The equipment is designed for permanent connection.

### 1.7 Warranty conditions

The supplier is responsible for completeness of the delivery and guarantees these specifications of the product which are stated in the Contract.

The supplier is not responsible for any deterioration of parameters caused by the customer during storage, unauthorised installation or improper operation.

### 1.8 Under-guarantee and after-guarantee service

Our customers are provided with professional service of our firm in installation, operation, service, maintenance, revision and help in troubleshooting for all our products.

Under-guarantee service is performed by the service department of the production plant, or by a contracted service centre according to a written claim.

In case of occurring of any fault please let us know it and state:

- type code
- serial number
- ambient parameters (temperature, humidity...)
- duty cycle including frequency of switching
- type of switching-off (position or thrust)
- set switching-off thrust
- type of fault - description of claimed fault
- it is recommended to place also Installation certificate.

It is recommended to have **after-guarantee service** performed by the service department of the production plant, or by a contracted service centre, with national laws.

#### 1.8.1 Lifetime of actuators

The lifetime of an electric actuator (EA) is at least 6 years.

EA used for closing mode (closing valves) comply with the requirements for at least **15,000 working cycles** (cycle C – O – C at 30 revolutions per operating stroke:for multi-turn EA)

EA used for regulating/modulating operation (control valves) comply with the below stated numbers of **operating hours** at the total number of 1 million start-ups:

Switching frequency				
max. 1,200 [h <sup>-1</sup> ]	1,000 [h <sup>-1</sup> ]	500 [h <sup>-1</sup> ]	250 [h <sup>-1</sup> ]	125 [h <sup>-1</sup> ]
Minimal lifetime expectancy – number of operating hours				
850	1,000	2,000	4,000	8,000

Time of **net operation** is min. 200 hours, max. 2,000 hours.

**Lifetime at operating hours** depends on loading and switching frequency.

**Note:** High switching frequency does not ensure better regulation. Setting of regulation parameters should be therefore made



## 1.9 Operation conditions

### 1.9.1 Product location and operation position

- Electric actuators may be installed and operated in enclosed locations of industrial facilities with no temperature and moisture regulation, protected from direct climatic effects (such as direct sunlight). Moreover, special "marine" versions may be used in waste water treatment applications, water management, selected chemical applications, tropical environments and coastal areas.
- Electric actuators must be placed with access to the manual control wheel, to the cover of control box, to control box, to bushings.
- Installation and operation of actuators is possible in either position, while motor axis is in horizontal position; variance of motor axis from horizontal plane can be  $\pm 15^\circ$ . Common position is the one with vertical position of exit part axis and control box above.

#### Warning:



When the EA is installed in open air, it must be sheltered lightly to protect it against direct effects of atmosphere.

In applications placed in an ambient of a relative moisture above 80%, in external ambient under shed, it is necessary to change the preset thermostat temperature  $+25^\circ\text{C}$  to  $+70^\circ\text{C}$  by a PC and program to prevent switching off the heating resistor.

### 1.9.2 Working environment

According to valid standard IEC 60 721-2-1, there are delivered these versions of electric actuators:

- 1) Version „temperate“ for type climate temperate
- 2) Version „cold“ - for type climate cold
- 3) Version „tropical“ for type climate tropical and dry
- 4) Version „marine“ for type climate marine.

In accordance with IEC 60 364-1, IEC 60 364-5-51 and IEC 60 364-5-55 within valid edition the EA have to resist external effects and operate reliably:

In conditions of external environment marked as:

- warm mild to very hot dry with temperature in range  $-20^\circ\text{C}$  to  $+60^\circ\text{C}$  ..... AA 6+AA 7\*
- cold, warm mild to hot dry with temperatures  $-50^\circ\text{C}$  to  $40^\circ\text{C}$ ..... AA 8\*
- with relative humidity 10 to 100 %, including the condensation of up to 0,029 kg water content per 1 kg of dry air at  $27^\circ\text{C}$ , at above stated temperature..... AB 6+AB 7\*
- with relative humidity 15 to 100 %, including the condensation of up to 0,036 kg water content per 1 kg of dry air, at above stated temperature..... AB 8\*
- with elevation up to 2000 m, with barometric pressure range from 86 kPa up to 108 kPa ..... AC 1\*
- with exposure to intensive water jets (IPx6) ..... AD 6\*
- with strong dustiness – with a possibility of influences of inflammable, non-conducted and non-explosive dust; the middle layer of dust; the dust drop more than 350 but not more than 1000 mg/m<sup>2</sup> per day (products with protection enclosure of IP 6x) ..... AE 6\*
- expose to corroding or pollute chemical substances during producing or using of these substances); at places where is handled with small quantity of chemical products and these can accidentally get in contact with an electric device ..... AF 3\*
- with permanent exposure of big amount of corroding or contaminated chemical and salt fog in execution for sea environment, fog sewage water disposal plant and some chemical plant ..... AF 4\*
- with a possibility of influences of mechanical stress:
  - medium sinusoid vibrations with frequency in range from 10 up to 150 Hz, with shift amplitude of 0,15 mm for  $f < f_p$  and acceleration amplitude 19,6 m/s<sup>2</sup> for  $f > f_p$  (transition frequency  $f_p$  is from 57 up to 62Hz) ..... AH 2\*
  - medium impacts, shocks and vibrations ..... AG 2\*
- with serious danger of plants and mould growing..... AK 2\*
- with serious danger of animal occurrence (insects, birds, small animals).....AL 2\*
- with detrimental influence of radiation:
  - of stray current with intensity of magnetic field (direct or alternate, of mains frequency) up to 400A.m<sup>-1</sup> ..... AM2-2\*
  - of sun radiation with intensity  $> 500$  and  $\leq 700\text{W/m}^2$  ..... AN 2\*
- with effects of medium seismic activity with acceleration  $> 300\text{ Gal}$   $\leq 600\text{ Gal}$  ..... AP 3\*

- with direct endanger by storm .....AQ 3\*
- with quick air movement and strong wind ..... AR 3 , AS 3\*
- stand on a conductive bottom) ..... BC 3\*
- with a danger of inflammable gases and vapours explosion - for Ex of version .....BE 3N2\*
- fire risks ..... BE 2\*

\* Marking in accordance with IEC 60364-1, IEC 60 364-5-51 and IEC 60 364-5-55 within valid edition

### 1.9.3 Power supply and duty cycle

#### Power supply:

#### Supply voltage :

electric motor .....3x400 V AC  $\pm 10\%$ ; or 3x380 V AC  $\pm 10\%$ ;  
 control ..... 230 V AC resp. 220 V AC  $\pm 10\%$   
 power supply frequency ..... 50 Hz or 60\* Hz  $\pm 2\%$  or 50 Hz  $\pm 2\%$  (MO 4-Ex и MO 5-Ex)

\* For 60Hz frequency is operating speed increased by 1, 2 multiple.

Duty cycle (according to EN/IEC 60034-1 within valid edition):

**EA MO-Ex** designed for remote control are designed for :

- short-time operation **S2-15 min**
- intermitted operation **S4-25%, 6 up to 90 cycles per hour**

**EA MO-Ex** designed for **automatic regulation** via analogue signals are designed for :

- intermitted operation **S4-25%, 90 up to 1200 cycles per hour, up to 100Nm**  
**90 up to 600 cycles per hour, 101Nm up to 700Nm**

### 1.10 Packing, transport, storing and unpacking

Surfaces without surface treatment are treated by conservation preparation MOGUL LV 2-3 before packaging .

Conservation is not necessary if the following storage conditions are complied with:

- Storage temperature: -10 to +50 °C
- Relative air humidity max.80 %
- Electric actuators and their accessories must be stored in dry, well ventilated covered spaces, protected against impurities, dust, soil humidity (by placement to racks, or on palletes), chemicals and foreign interventions
- There shall be no corrosive gases present in the storage areas.

The of EA are delivered in solid packages guaranteeing resistance in accordance with EN/IEC 60 654.

Package is a box. Products in boxes is possible to load on the pallets (pallet is returnable). On the outer side of the package is stated:

- manufacturer label,
- name and type of product,
- number of pieces,
- other data – notices and stickers.

The forwarder is obliged to secure packed products, loaded on transportation means, against self-motion; if open transportation means are used, to secure their protection against atmospheric precipitations and splashing water. Displacement and securing of products in transportation means must provide their stable position, exclude the possibility of their inter-collision and their collision with the vehicle walls.

Transportation can be executed by heatless and non hermetic spaces of transportation vehicles with influences within the range:

- temperature: -25° C up to +70°C (a strange version -50 ° C up to +45 ° C)
- humidity: 5 up to 100 %, with max. water content 0.029 kg/kg of dry air
- barometric pressure 86 up to 108 kPa

**After receiving EA check whether during transport or storage the actuator was not damaged. Compare also whether the parameters on their nameplates are in accordance with accompanying documentation or the Contract. If any discrepancy or fault occur inform immediately your supplier.**

*If the actuators and accessories are not immediately installed, they have to be stored in dry, well-ventilated sheltered rooms, protected against dirt, dust, soil humidity (with placing onto shelves or onto*

*pallets), chemical impacts and encroachment, at ambient temperature from -10°C up to +50 °C and relative humidity max. 80 %, in special version at temperature –50°C do +40°C.*

- It is forbidden to store EA outside or in areas not prevented against direct impact of climate.
- Strains of the surface finishing should be promptly removed if any – it can prevent the product against corrosion damages.
- While storing more than one year it is necessary to check lubrication filling before the actuator is put into operation.
- The EA installed but not operated are to be protected the same way as when storing (e.g. with a wrapping).
- After it is mounted onto a valve in free and wet areas or in areas where temperature is changing it is necessary to connect the space heater – to prevent the actuator against corrosion resulted from water condensed in the control part.
- Remove odd conservation grease as late as before putting into operation.

### ***1.11 Assessment of the product and packaging and removal of contamination***

The product and its package are made of recycling materials. Do not throw the single parts of the package and of the product after their life but sort them according to instructions in corresponding executives or regulations of environment protection, and allow their recycling.

The product and its packing are not a source of any environment pollution or contamination and do not contain any dangerous waste.

## 2. Description, function and specifications

### 2.1 Description and function

EA MO-Ex are of compact construction with several connected modules. They are composed of two functionally different main parts consisting of following modules (Fig.1,1a):

- |                      |            |  |
|----------------------|------------|--|
| Power part -         | Module M1  | – electric motor   |
|                      | Module M11 | – countershaft transmission with rotating bief   |
|                      | Module M3  | – power transmission with manual control (MO 3-Ex, MO 4-Ex, MO 5-Ex) and power transmission with manual control and with additional gear box (MO 3.4-Ex and MO 3.5-Ex) |
| Control part -       | Module M4  | - control box  |
| Electric connection- | Module M5  | - terminal box   |
| Manual control -     | Module M6  | - manual control   |

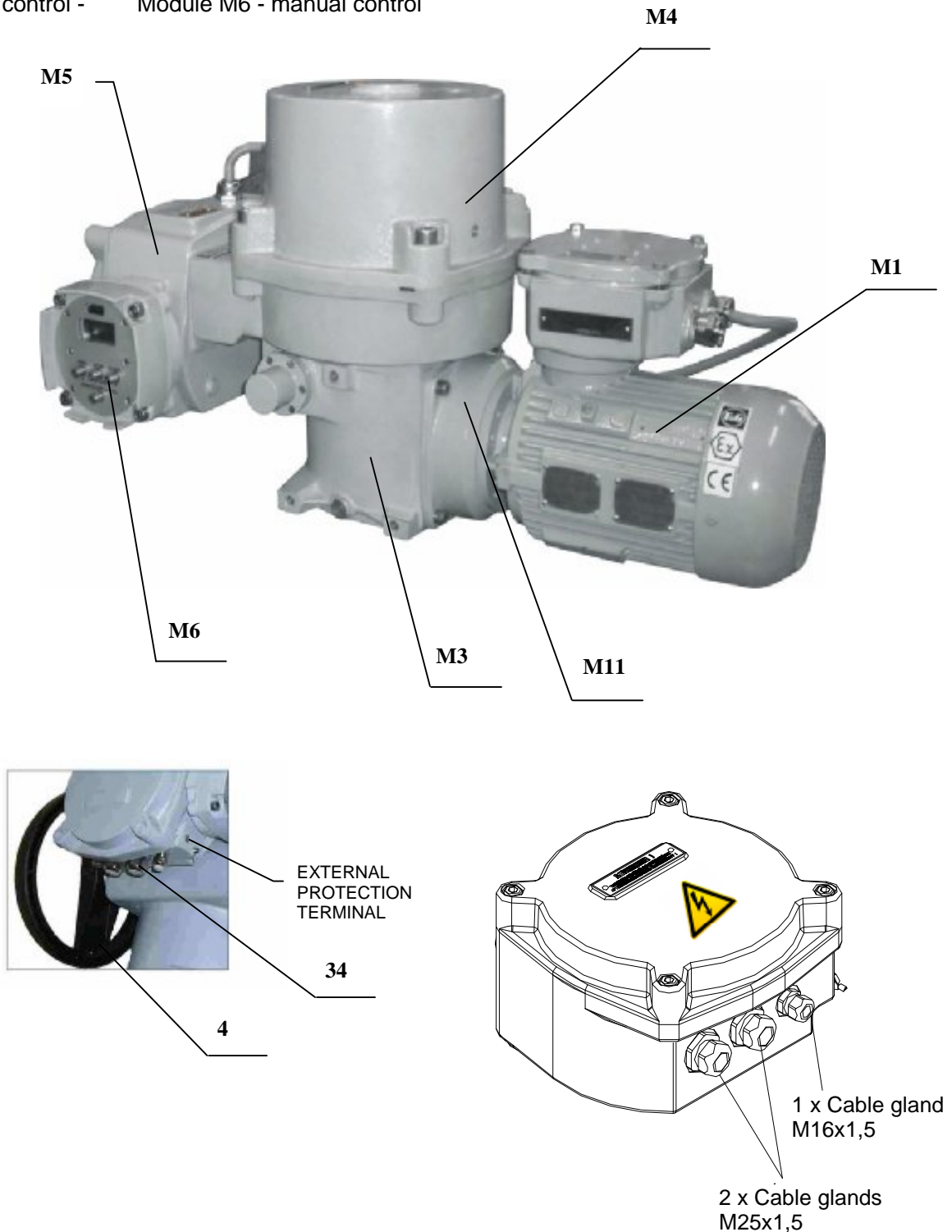


Fig. 1 – MO 3.X-Ex, MO 4-Ex

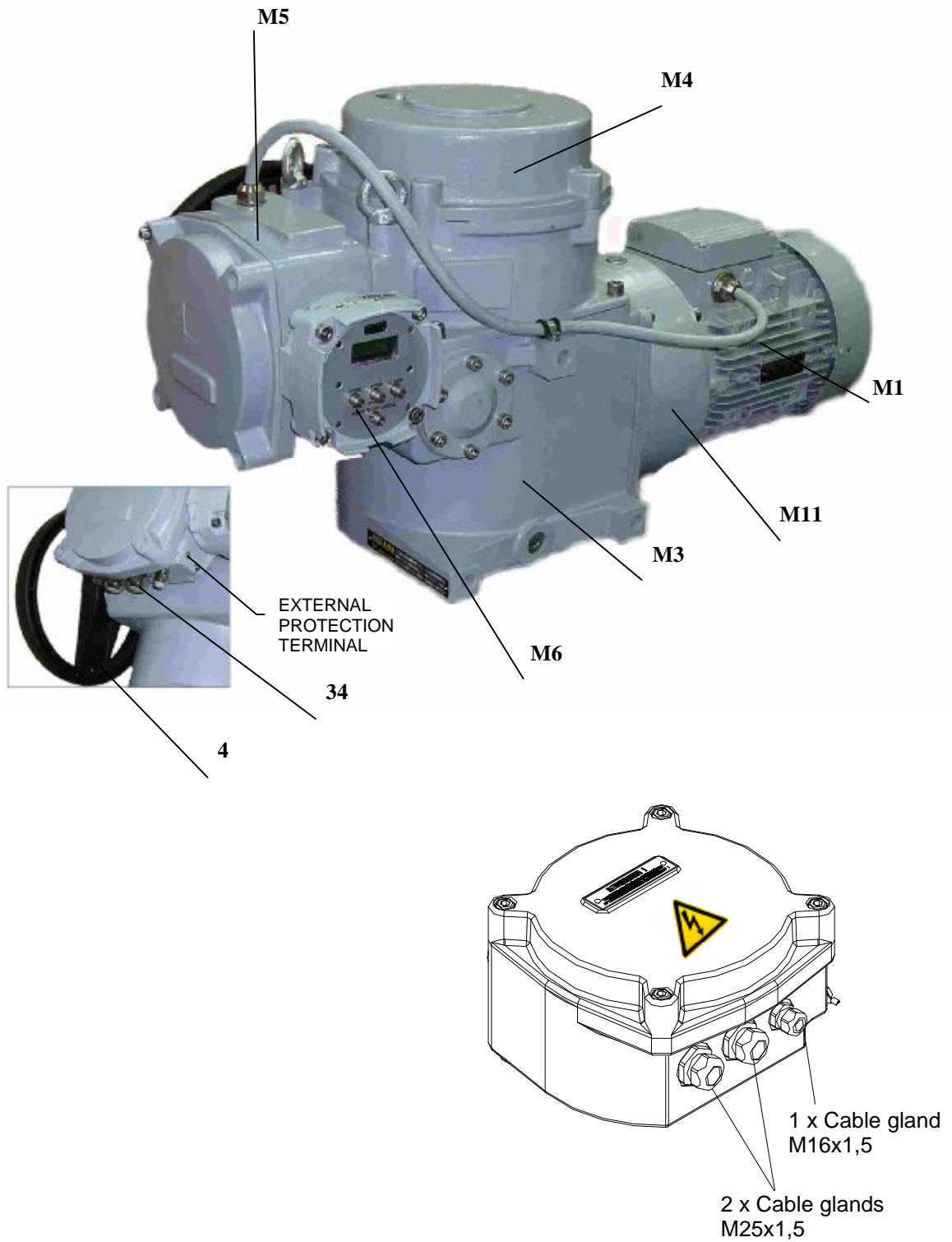


Fig. 1a – MO 5-Ex

**Power part**

**Module M 1 – electric motor**

3-phase explosion-proof electric motor (M1) is in make Ex de IIC T4 and T5 Gb resp. Ex de IIB T4 a T5 Gb - what is flameproof enclosures “d”, increased safety “e”.

**Module M11 – countershaft transmission with rotary hold** Ex c IIC T4 and T5 Gb resp. Ex c IIB T4 a T5 Gb

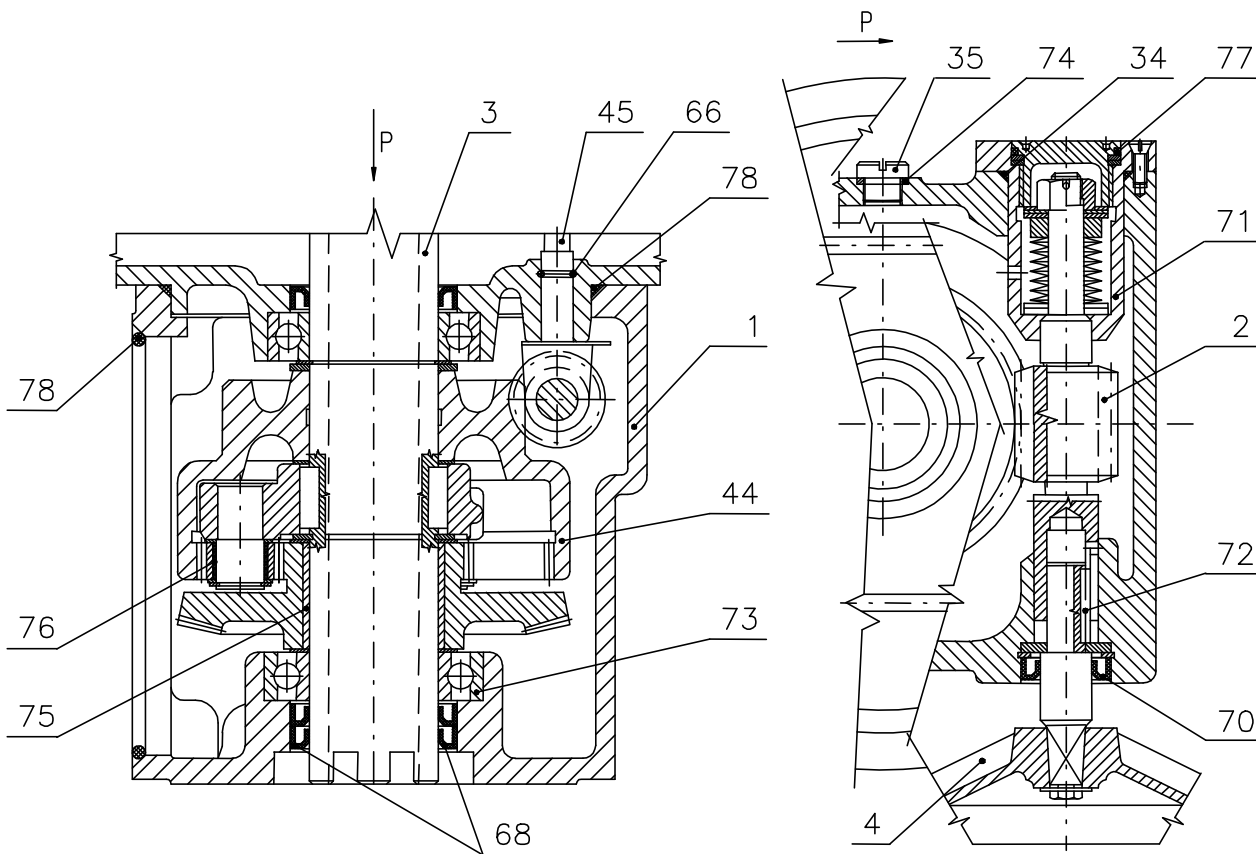
Countershaft transmission performs reduction of revolutions of electric - motor to specified transmission value. Countershaft transmission consists of one to three pairs of spur meshing toothed wheels and is terminated by bevel pinion, which meshes into bevel gear of transmission from module M3.

Rotary hold substitutes motor mechanic brake and allows manual control of EA.

**Module M3 – force transmission with manual control (Fig. 2)** Ex c IIC T4 and T5 Gb resp.

Ex c IIB T4 a T5 Gb

The set is stored in box (1). Gears are centrally positioned on output shaft (3) and creates independent assembly unit. Wheel rim (44) with inner gearing provides transfer between electric motor pinion and output shaft. In upper part is located the worm (2) for torque sensing and manual control, which is used for positioning of controlled equipment during electric power breakdown. Positioning is executed manually by hand wheel (4). The worm is suspended and a thrust created by output shaft torque axially shifts the worm against spring tension. The worm movement is transferred by the fork with pin through a shaft (45) joined to control box. Movement of the worm is proportional to the load torque. The fork meshes into circumferential notch, allowing rotary motion of manual wheel, therefore manual control in every operating status. On the box (1), (across to manual wheel) are three bosses with threaded openings allowing assembly of electric actuator on the wall, or supporting construction.



**Fig. 2**

### Control part

Module M4 – control box (Fig. 1,1a), Ex db IIC T4 a T5 Gb is in upper part of electric actuator and forms individual function unit. The top part is formed by the cover with opening and monitoring window of position indicator.

The bottom part of control box closes the box of force transmission and forms carrying part of control plate (1) (Fig.3,-3c).

- position unit (2) (Fig.3,3a,3c).
- signalling unit with gear unit and with position indicator (3) (obr.3,3a,3c)
- torque unit (4) (Fig.3,3a,3c) with torque disk (5) (obr.3,3a,3c)
- transmitter unit (6) with electronic position transmitter (7) active (8) (according to EA specification) (Fig. 3,3a, 3c)
- heating resistor (9) with thermal switch (10) (Fig. 3,3a, 3c)
- electrical connections by means of terminals (11) (Fig.3b,c), situated within terminal box (M5) (Fig. 1,1a) and cable glands (34) (Fig. 1,1a),
- local electric control module (M6) (Fig. 1, 1a) (according to EA specification) is situated in terminal box

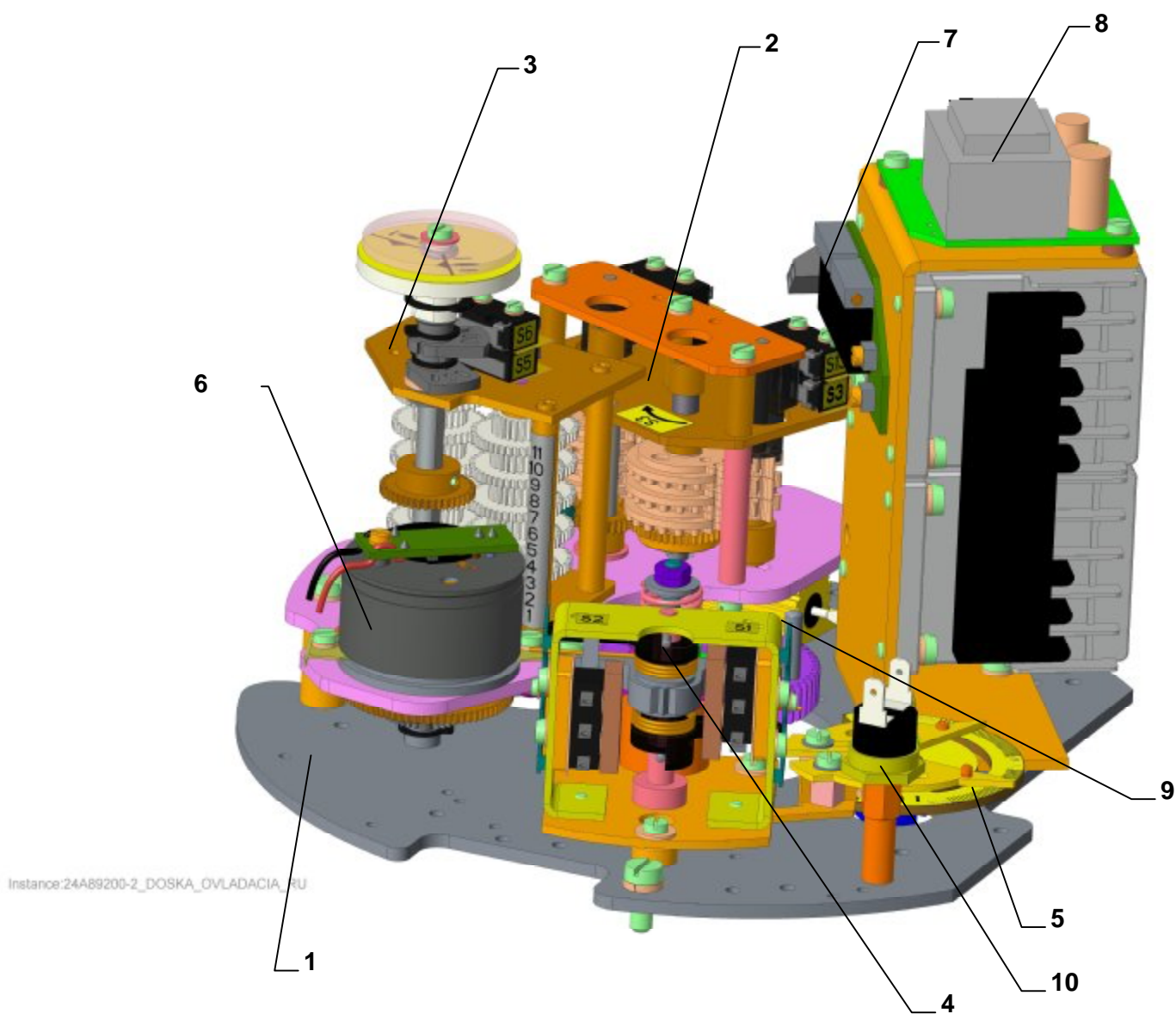


Fig. 3 – MO 3-Ex – MO 3.5-Ex

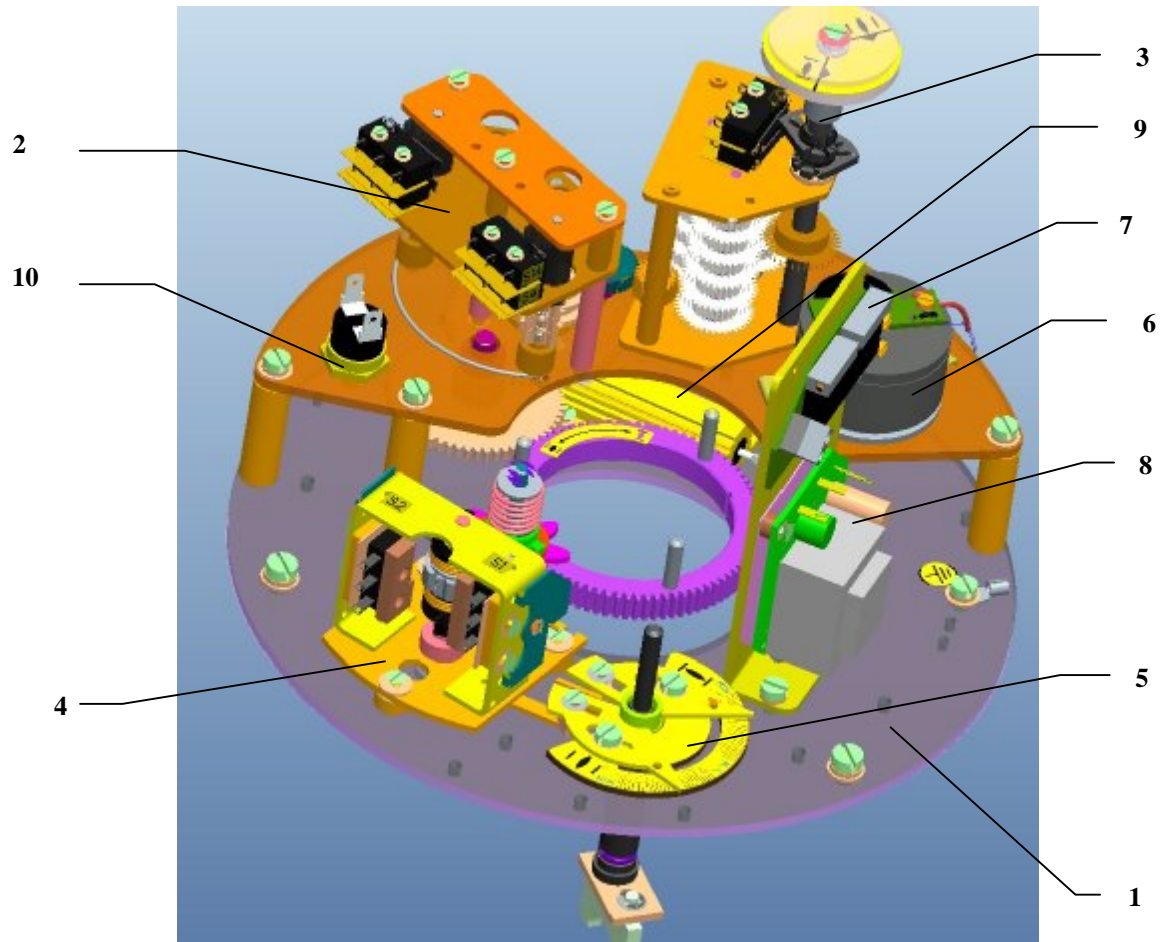


Fig. 3a – MO 4-Ex

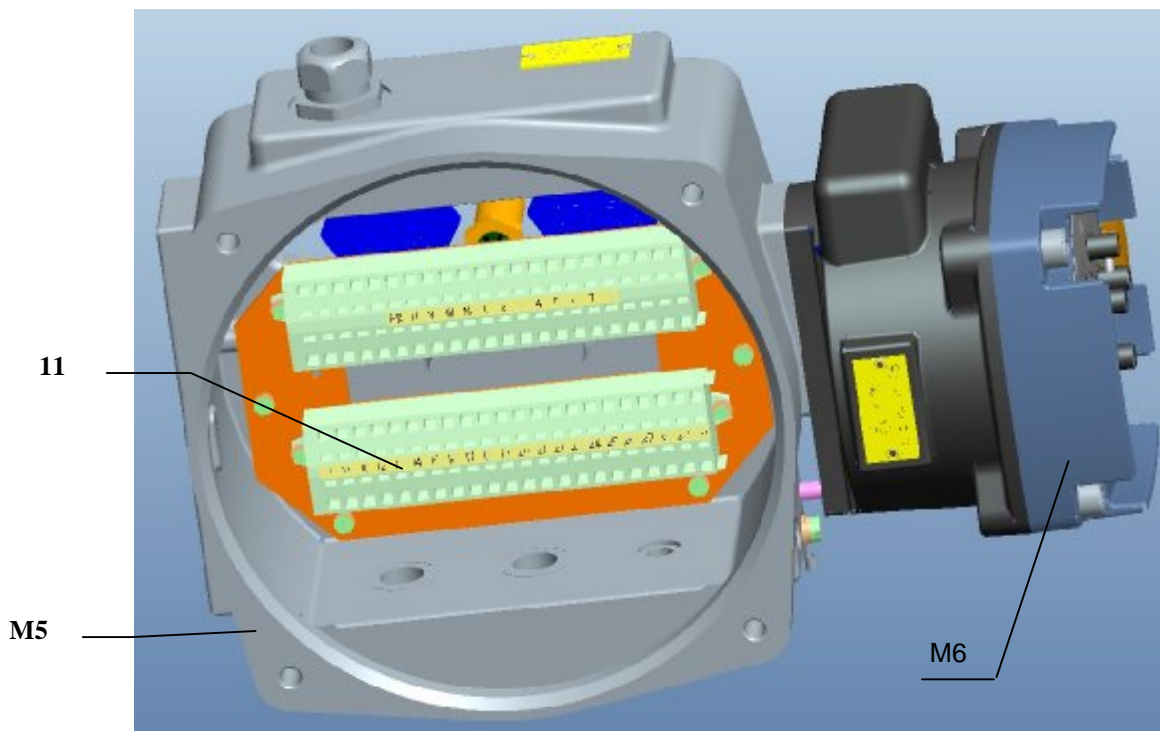


Fig. 3b – MO 4-Ex



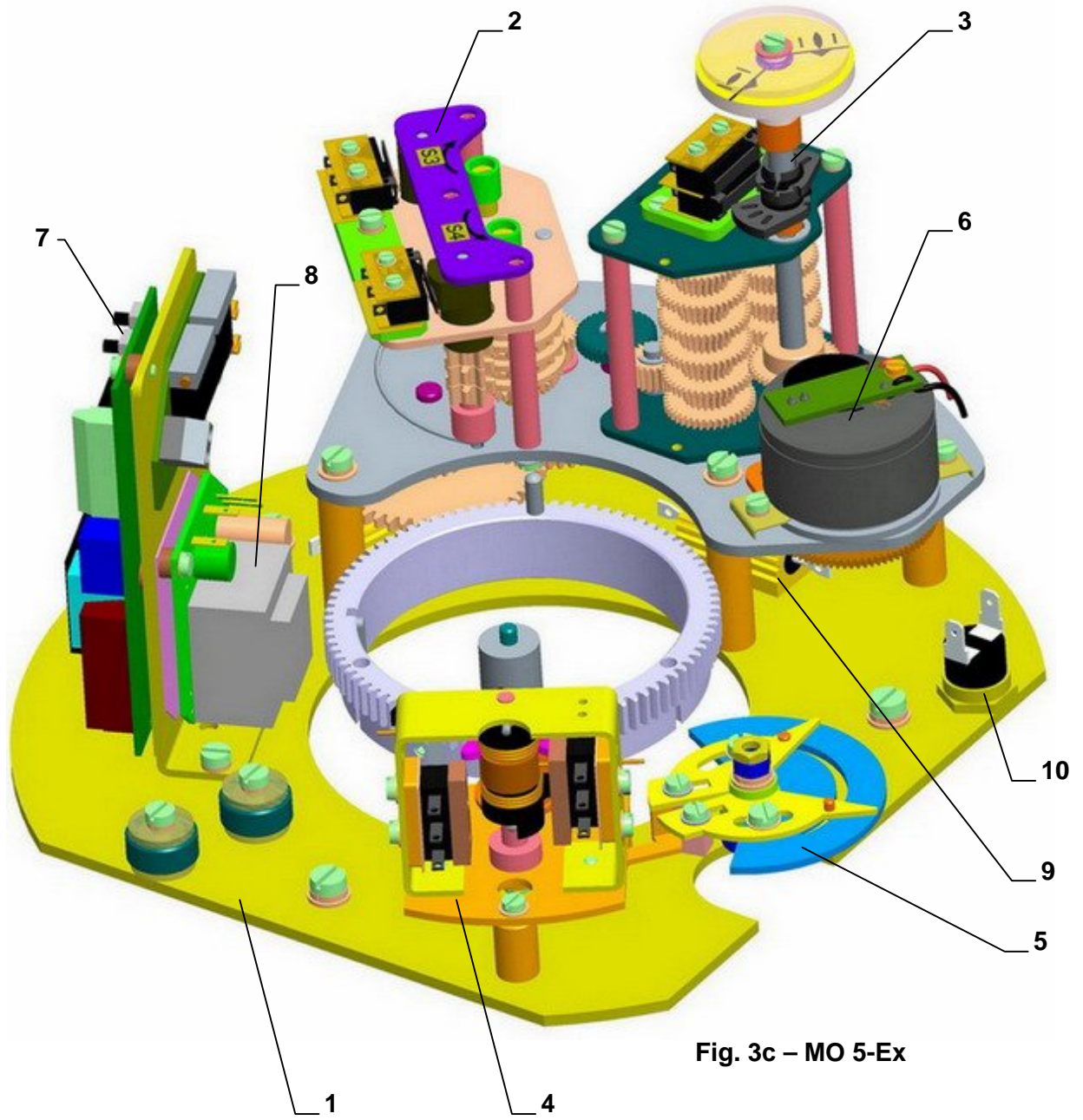


Fig. 3c – MO 5-Ex

The M5 terminal box module (fig. 1, 1a) enables electrical connection through terminal boards (11), (fig. 3b), located in the space of the terminal box (M5) and cable glands (34) (fig. 1, 1a).

The M6 local control module (fig. 1, 1a, 3b) (according to EA specification) is located on the terminal board and connected to the control board.

### **Position unit (2, Fig. 3,3a,3c)**

EA is equipped with a position step unit that provides for limiting the EA end positions with electric control by means of S3, S4 position switches. The drive for the position unit is derived from EA output shaft by means of idle gears.

### **Signalling unit with gear unit and with position indicator (3, Fig. 3,3a,3c)**

Signalling unit provides for closing S5, S6 position switches before the end positions. The drive for the signalling unit is derived from EA output shaft by means of a gear unit on which an appropriate working revolutions range is to be set by an adjustable gear wheel. The immediate position is indicated by the position indicator.

### **Transmitter unit (6, (Fig. 3,3a, 3c) with electronic position transmitter (7) active (8) (according to EA specification)**

EA can involve also a position transmitter and output signal of which depends on the customer's specification. This transmitter provides for continuous transfer of output member position information, eventually, in the variant with regulator as a feedback for controller.

### **Heating resistor with thermal switch (9,10, Fig. 3,3a,3c)**

The EA is equipped with a space heater (9) with an external thermal switch (10) (Fig. 3,3a,3c) with a total output according to ch. 2.2. to prevent the condensation of water vapor and for the correct function of the built-in electric control parts of the ES in case of low working temperatures of the EA.

## 2.2 Basic specifications

### Basic EA specifications:

Operating speed [ $\text{min}^{-1}$ ], operating stroke [rev.], switching-off torque [Nm], and electric motor parameters are given in Table 1 to 1c.

Table Nr.1

Type/type number	Operating speed $\pm 10\%$	Operating stroke <sup>8)</sup>	Switching-off torque <sup>5) 6)</sup> $\pm 15\%$	Weight	Electric motor <sup>1)</sup>				
					Supply voltage	Nominal			
						Power	Revolutions	Current <sup>7)</sup>	
	[ $\text{min}^{-1}$ ]	[rev]	[Nm]	[kg]	[V] $\pm 10\%$	[W]	[1/min]	[A]	
1	2	3	6	7	8	9	10	11	12
MO 3-Ex type number 100	16	1-3/2,5-685	26 - 40	cca 26,5 - 34,5	Three-phase	Y / $\Delta$ ; 380 / 220; 50 Hz Y / $\Delta$ ; 400 / 230; 50 Hz	250	1370	0,69
			60 - 90						
			80 - 130						
			100 - 150						
	25		26 - 40				250	1370	0,69
			60 - 90						
			80 - 130						
			100 - 150						
	40		26 - 40				250	1370	0,69
			60 - 90						
			100 - 150						
			50 - 80						
	60 - 90								
	100 - 150								
	60 - 90		750				1410	1,7	
	100 - 150								
	60 <sup>2)</sup>		26 - 40				370	1385	0,95
			40 - 63						
	63 <sup>2)</sup>		26 - 40				1100	2775	2,29
			40 - 63						
	90 <sup>2)</sup>		26 - 40				750	1410	1,7
			40 - 63						
	95 <sup>2)</sup>		50 - 80				1500	2855	3,07
			100 - 150						

continue &gt;&gt;&gt;&gt;&gt;&gt;

Table Nr.1a

Type/ type number	Operating speed ±10[%]	Operating stroke <sup>8)</sup>	Switching-off torque ±15 [%]	Weight	Electric motor <sup>1)</sup>				
					Supply voltage		Nominal		
							Power	Revolutions	Current <sup>7)</sup>
	[min <sup>-1</sup> ]	[rev]	[Nm]	[kg]		[V] ±10%	[W]	[1/min]	[A]
1	2	3	6	7	8	9	10	11	12
MO 3.4-Ex type number 107	10	1,3 - 285	200 – 300	cca 42 ± 5%	Three-phase	Y / Δ; 380 / 220; 50 Hz Y / Δ; 400 / 230; 50 Hz			
							370	1385	0,95
	16		100 – 180						
			120 – 200						
	25		200 – 300						
			90 – 150						
			120 – 200						
			200 – 300						
			750				1410	1,81	
			750				1410	1,81	
	40		120 – 200						
			200 – 300						
	63 <sup>2)</sup>		90 – 150						
			150 - 250						
120 – 200									
80 <sup>2)</sup>									
MO 3.5-Ex type number 150	25	1,5 - 185	80 – 140	cca 49 ± 5%	Three-phase	Y / Δ; 380 / 220; 50 Hz Y / Δ; 400 / 230; 50 Hz			
			200– 320						
			300 – 450						
	32		350 – 550						
			80 – 140						
			200– 320						
			300 – 450						
			350 – 530						
			1100				2775	2,29	
	40		80 – 140						
			160 - 260						
			200– 320						
1100		2775	2,29						
1500		2855	3,07						

Table Nr.1b

Type/type number	Operating speed $\pm 10\%$	Switching-off torque $\pm 10\%$	Max. load torque		Operating stroke	Weight	Electric motor <sup>1)</sup>							
			S2	S4-25%			Supply voltage		Nominal					
									Power	Revolutions	Current <sup>7)</sup>			
[min <sup>-1</sup> ]	[Nm]	[Nm]	[rev]	[kg]	[V] $\pm 10\%$	[W]	[1/min]	[A]						
1	2	3	5	6	7	8	9	10	11	12				
<b>MO 4-Ex</b> type number 165	16	150-250	90-150	60-100	1,0 - 3,0 or 2,5 - 685,0	70 - 85	Three-phase	Y / $\Delta$ ; 380 / 220; 50 Hz Y / $\Delta$ ; 400 / 230; 50 Hz	0,55	910	0,42			
	25								0,75	1420	0,65			
	32								1,10	2880	0,84			
	40								1,10	1415	1,05			
	50								1,50	2880	1,31			
	63 <sup>2)</sup>								1,50	1420	1,62			
	80 <sup>2)</sup>								2,20	2845	2,10			
	125 <sup>2) 3)</sup>								2,70	2830	2,88			
	180 <sup>2) 3)</sup>								2,70	2810				
	16								300-500	180-300	120-200	0,75	915	0,84
	25	1,10	1420	1,31										
	32	1,50	2860	1,68										
	40	2,20	1420	2,10										
	50	2,20	2880	2,62										
	63 <sup>2)</sup>	2,20	1450	2,64										
	80 <sup>2) 3)</sup>	2,70	2830	2,93										

Table Nr.1c

Type/type number	Operating speed $\pm 10\%$	Operating stroke <sup>8)</sup>	Max. load torque		Switching-off torque $\pm 10\%$	Weight	Electric motor <sup>1)</sup>				
			S2	S4-25%			Supply voltage		Nominal		
									Power	Revolutions	Current <sup>7)</sup>
[min <sup>-1</sup> ]	[rev]	[Nm]	[kg]	[V] $\pm 10\%$	[W]	[1/min]	[A]				
1	2	3	5	6	7	8	9	10	11	12	
<b>MO 5-Ex</b> type number 167	15	1,25 - 4 or 4-500	600	400	630 - 1000	93,5 103	Three-phase	Y / $\Delta$ ; 380 / 220; 50 Hz Y / $\Delta$ ; 400 / 230; 50 Hz	1,5	710	4,15
			375	250	500 - 630						
			300	200	300 - 500						
	20		600	400	630 - 1000				2,2	960	5,2
			375	250	500 - 630						
			300	200	300 - 500						
	40		600	400	630 - 1000				3	1415	6,6
			375	250	500 - 630						
			300	200	300 - 500						
	60 <sup>2) 3)</sup>		600	400	630 - 1000				4	1435	8,1
			375	250	500 - 630						
			300	200	300 - 500						
	100 <sup>2) 3)</sup>		375	250	500 - 630				5	1420	11,1
			300	200	300 - 500						
			300	200	300 - 500						

**Remarks:**

- 1) Switching elements for different type of load (also for EA) defines standard EN/IEC 60 947-4-1
- 2) Applies to ON/OFF mode
- 3) It is only valid for temperatures up to -50°C.
- 5) State the switching - off torque in your order by words. If not stated it is adjusted to the maximum rate of the corresponding range  
Starting torque is min. 1, 3 multiple of maximum switching-off torque of selected range
- 6) Max. load torque is equal to:
  - 0, 6 multiple of max. switching-off torque for operating mode S2-10min, respectively S4-25%, 6-90 cycles / hr.

- 0, 4 –multiple of max. switching-off torque for operating mode S4-25%, 90-1200 cycles / hr.
- <sup>7)</sup> Applies to voltage 3x400V AC
- <sup>8)</sup> State individual number of working revolutions in the order Otherwise, EA is set to the 6th stroke according to tab. No. 3.

### Other specifications:

**Protection enclosure of EA:** ..... IP 54 resp. IP 66 EN/IEC 60 529)

### Mechanical ruggedness:

sinusoid vibrations.....see Chapter 1.9.2

resistance by drops ..... 300 drops with acceleration of  $5 \text{ m.s}^{-2}$

**Self-locking:** .....declared in range 0% to 100% 100 % switching - of torque

Braking of EA: .....by roller bief

Output part backlash: ..... < 5 °at the load by 5% value switching of torque

### Switches:

Type **DB 6** - equipped with the silver contacts  
 250 V AC; 20mA to 2 A;  $\cos\varphi = 0.6$ ;  
 24 V DC and 48 V DC; 20mA to 1A;  $T=L/R=3\text{ms}$ ;  
 minimum switch-off voltage: 20 V

Type **DB 3**- gold-plated contacts  
 max. 250 V AC; 1mA to 0,1 (0,05)A;  
 24 V DC and 48 V DC, 1mA to 0,1 A ;  $T=L/R=3\text{ms}$

### Manual control:

By hand wheel; after releasing of locking screw even during operation of the electric motor. By rotation of hand wheel clockwise is electric actuator output shaft shifted towards „close“.

### Electric control:

- standard for **EA version MO-Ex** - on the supply voltage level
- for the EA version **MO-Ex** with external controller – by feeding of unified signal.

**Output part backlash:** ..... < 5 °at the load by 5% value switching of torque

### Heating element (E1)

Heating resistor – supply voltage: ..... max. 250 V AC;

Heating output: ..... max. 35 W/55°C (MO3-Ex-MO 3.5-Ex,MO 4-Ex)

Heating output: ..... about 2x35 W/55°C (MO5-Ex)

### Thermo-switch of heating element (F2)

Supply voltage: ..... 230 V AC, 5 A

Temperature of conduction:  $+20^\circ\text{C} \pm 3^\circ\text{C}$

Temperature of disconnection:  $+30^\circ\text{C} \pm 4^\circ\text{C}$

### Position switch adjustment

End position switches are preset to a specified revolutions number with an accuracy of  $\pm 90^\circ$  .

Additional position switches are preset to close immediately before appropriate end position switches.

### Adjustment of torque switches

Switching of torque, unless other adjustment is specified, is set up to maximum switching of torque of selected range with tolerance  $\pm 10\%$  , for repeated torque switching-off.

### Position transmitter

#### Resistive – potentiometer:

Resistance (single **B1**): ..... 100  $\Omega$ , 2000  $\Omega$

Resistance (double **B2**): ..... 2x100  $\Omega$ , 2x2000  $\Omega$

Operating life of transmitter .....  $1 \cdot 10^6$  cycles

Load capacity:..... 0.5 W up to 40°C (max. 0 W/125°C)

Maximum current of sliding contact ..... max. 35 mA

Maximum supply voltage:.....  $\sqrt{P \times R}$  V DC/AC

Potentiometer linearity error:.....  $\pm 2.5 [\%]^1$

Potentiometer hysteresis:..... max. 5  $[\%]^1$

For MO: "O" (open) .....  $\geq 93\%$ , "Z" (closed) .....  $\leq 5\%$

**Electronic positional transmitter (EPV) - converter R/I (B3)****a) 2-wire version - without built-in power supply, or with built-in power supply**

Current signal .....	4 ÷ 20 mA (DC)
Power supply voltage (at version without built-in power supply) .....	15 ÷ 30 V DC
Power supply voltage (at version with built-in power supply) .....	24 V DC ±1,5%
Load resistance .....	max. $R_L = (U_n - 9V) / 0,02A$ [Ω] ( $U_n$ - power supply voltage [V])
Load resistance (at version with built-in power supply) .....	max. $R_L = 750$ Ω
Output signal values at limit positions: .....	"O" ..... 20 mA (clamps 81,82) "Z" ..... 4 mA (clamps 81,82)
Values tolerance of output signal of EPV .....	"Z" ..... +0,2 mA "O" ..... ±0,1 mA

**b) 3-wire version - without built-in power supply, or with built-in power supply**

Current signal .....	0 ÷ 20 mA (DC)
Current signal .....	4 ÷ 20 mA (DC)
Current signal .....	0 ÷ 5 mA (DC)
Power supply voltage (at version without built-in power supply) .....	24 V DC ±1,5%
Load resistance .....	max. 3 kΩ
Temperature dependency .....	max. 0,020 mA / 10 K
Output signal values at limit positions: .....	"O" ..... 20 mA or 5 mA (clamps 81,82) "Z" ..... 0 mA or 4 mA (clamps 81,82)
Values tolerance of output signal of EPV and capacitive transmitter .....	"Z" +0,2 mA "O" ±0,1 mA
EPV linearity error: .....	±2.5 % <sup>1)</sup>
EPV hysteresis: .....	max. 5 % <sup>1)</sup>

**Capacitive (B3): non-contact, life 108 cycles****2-wire connection** with power supply or without power supply

The current signal **4 ÷ 20 mA (DC)** is acquired from the capacitive transmitter supplied from the internal or an external voltage supply source. The electronics of the transmitter is protected against eventual wrong polarity and current overloading. The entire transmitter is galvanic insulated so several transmitters can be connected to one external voltage source.

Power supply voltage (with power supply) .....	24 V DC
Power supply voltage (without power supply) .....	18 to 28 V DC
Ripple voltage .....	max. 5%
Max power input .....	0,6 W
Load resistance .....	0 to 500 Ω
Load resistance can be single side grounded.	
Influence of resistance on output current .....	0,02%/100 Ω
Influence of voltage on output current .....	0,02%/1V
Temperature dependency .....	0.5% / 10 °C
Output signal values at limit positions:	
"O" ..... 20 mA (clamps 81; 82)	
"Z" ..... 4 mA (clamps 81; 82)	
Values tolerance of output signal of capacitive transmitter	
"Z" ..... +0,2 mA	
"O" ..... ±0,1 mA	

**DCPT3M – current transmitter (B3)****- 2-wire connection** without built-in power supply or with built-in power supply

Current signal .....	4 ÷ 20 mA (DC) with optional mirroring (20 ÷ 4 mA)
Mode of operation .....	contactless, magnetic resistance
Transmitter increments without gears .....	0.352 °
Loading resistor: .....	0 through 500 Ω
Operating stroke .....	35 to 100% of the rated stroke at the gear ratio
Non-linearity .....	max. ±1 %
Non-linearity - geared .....	max. ±2.5 %
Power supply voltage for version without power source .....	15 through 28 V DC, max. 42 mA
Power supply voltage for version with built-in power source .....	24 V DC
Max. voltage deviation .....	±5%

Operating temperature .....	-25 to +70°C
Values tolerance of output signal :	
"Z" .....	+0,2 mA
"O" .....	±0,1 mA
Linearity deviation: .....	±2.5 %1)
Hysteresis.....	max. 2.5 %1)
Error messages .....	by flashing LED

1) of the transmitter's nominal value related to output values with max. revolutions setting for the given stroke degree according to table 3

### 2.2.1 Mechanical connection

- By flange F10, F14 resp. F16 (ISO 5210)
- By flange  $\phi 220$  resp.  $\phi 135$  (GOST R 55510).

Main and connecting dimensions are presented in **dimensional drawings**.

### 2.2.2 Electric connection

#### a) Electric actuator

##### to terminal box type (X) :

- max. 32 terminal connectors, crosscut of connecting wire 0,08 - 2,5 mm<sup>2</sup> (MO 3-Ex, MO 3.4-Ex, MO 3.5-Ex, MO 4-Ex )
- max. 32 terminal connectors, crosscut of connecting 0,08 - 2,5 mm<sup>2</sup> (MO 5-Ex)
- wire stripping length of the wires for screwless terminals is from 8 to 9mm.
- through cable glands – 2xM25x1,5 a 1xM16x1,5 (see fig. 1, 1a).

#### b) 3~ electric-motor

**in a terminal board make without contactors:** through cable glands M20, M25 or M32 to the motor terminal board.

#### Protection terminal:

During start-up - during installation of device:



- for safety operation of the actuator use EA be unavoidable connect external and internal ground terminal. The position of the external a internal ground terminal can be seen in fig. 3d. For forcing - in wires in external ground terminal be needed use pliers HP3 for insulated eyelet (firm CEMBRE).

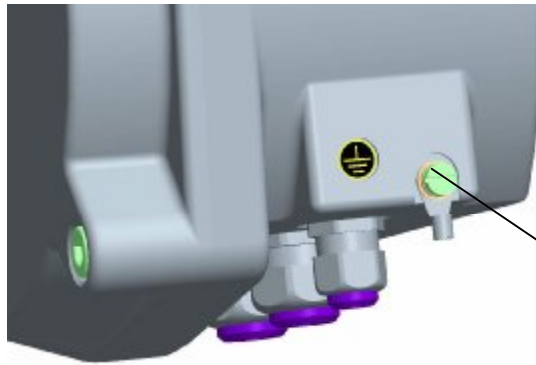
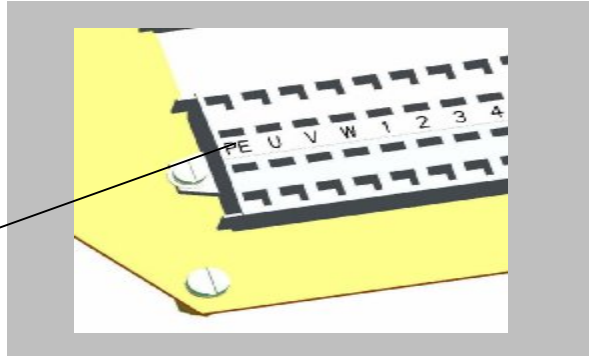
- a switch / circuit breaker must be installed on the power supply line, as close as possible to the device, easily accessible to operators and identified as the actuator isolation switch.

External and internal, are together connected and marked with the mark of protection grounding.

The electric connection should be made according to wiring diagrams pasted into the upper cover resp. terminals box of the EA.



INTERNAL  
PROTECTION  
TERMINAL



EXTERNAL  
PROTECTION  
TERMINAL

Fig.3d

--

### 3. Installation and dismantling of actuator



**Abide by safety measures!**

**Carrying out the dismantling, repair and maintenance of the live EA is prohibited. When starting to disassemble the EA, make sure that the EA is disconnected from the mains and that the "Do not turn it on, people are working" sign is displayed on the control panel.**

Notes:

Repeatedly verify whether placing of EA corresponds to part "Operating conditions". If actual conditions differ from recommended, it is necessary to consult it with manufacturer.

**Before starting of mounting the EA onto the valve:**

- Check again whether the EA was not damaged during storing.
- Check whether the adjusted operating speed angle and connecting dimensions of the actuator (see the nameplate) are in compliance with the valve parameters.
- In case of inconsonance, perform adjusting according to the part Adjustment.

#### 3.1 Installation

The actuator is set up by the manufacturer to the parameters according to label tag, with connecting dimensions according to relevant dimensional drawing and is set to mid - position.

Put on the hand wheel before assembly.

##### 3.1.1 Mechanical connection to the armature

In case that required shape of mechanical connection is designed by A-shape adapter (with flange F16, F14 or F10), resp. C-shape adapter (with flange F14) at first is necessary to fix this adapter to connecting flange of EA by the screws.

**Mechanical connection – shape of connecting element B, C, D, E (eventually B3) and gear clutch :**

- Bearing surfaces of EA connecting flange must be carefully de-greased.
- Slightly grease the shaft of armature/gearbox by acid-free grease;
- Shift EA to its terminal position „CLOSED“; shift armature into identical terminal position.
- Put EA on armature, so as output shaft reliably fits into clutch of armature.

**Warning!**

**Do not use force when you put EA on armature, otherwise the gear can be damaged!**

- Should there is the necessity to synchronize the openings in the EA flange and armature, turn the EA by hand wheel;
- Verify, whether connecting flange fits tightly to the armature / gearbox.
- Attach the flange by four bolts (with mechanical hardness min. 8G), which steadily tighten crosswise.
- At the end of mechanical connection perform **the check of proper connection with the armature**, by turning hand wheel in the „open“ direction.

**Mechanical connection – rising spindle (for shape A resp. C):**

- If the rising spindle of armature is in terminal position „open“ longer than dimension of mounting flange up to the control box cover, disassembly cover of output shaft on control box and replace it by covering pipe (not part of delivery) after assembly of electric actuator on armature.
- Seating surfaces of EA connecting flange and armature carefully de-grease.
- Slightly grease the output shaft of armature.
- Shift EA to terminal position „CLOSED“; shift armature into identical terminal position.
- Slide electric actuator by output shaft / nut on the spindle / nut of armature and turn by hand wheel counterclockwise until connecting flange of electric actuator fits to connecting flange of armature. Further procedure is identical to previous part of mechanical connection for shapes B, C, D.
- At the end of mechanical connection perform the check of proper connection of EA with the armature by tur-ning the hand control wheel wheel in the „open“ direction.

Note:

It is also possible to fix the EA on the wall construction using the three feeders located at the box external wall, opposite to the hand wheel.

### 3.1.2 Electric connection to the network, respectively control system

Consequently perform electric connection to the network, respectively to joining system.



1. *Follow instructions in the part "Requirements for specialized...!"*
2. *While laying electrical line abide by the instructions for heavy current installations. Power supply cables must be of the type approved. Minimum thermal resistance of power supply cables and wires must be +90°C.*
3. *Line wires to terminal boards, respectively to connector lead by screw cable glands.*
4. *Before putting the electric actuator into operation is necessary to connect inner and outer grounding terminal.*
5. *Leading-in cables must be attached to firm construction maximum 150 mm from cable glands!*
6. *To prevent moisture from entering the actuator around the connecting cables, the cables must be sealed with silicone material at the point of penetration through device shell.*

#### Connecting to terminal board

**Before electric connection remove the cover of electric actuator control box and check whether the type of electric current, supply voltage and frequency comply with data on electric motor type label.**

#### Electrical connections:

- Electrical connections are to be realised according to an electric plan attached in the EA casing.
- Electrical connections is to be done through two cable glands to the control box and 1 cable glands to electric motor.
- If necessary, make EA adjustment, place cover and fasten it by screws uniformly in diagonal way. Tighten cable glands firmly, only then the protection is assured.

#### Remarks:

1. *Stuffing cable glands are delivered with EA, which in case of tight mounting on supply line secure coverage up to IP 68. For required coverage is necessary to use ringlets according to actual cable diameter and required thermal resistibility.*
2. *During attachment of a cable is necessary to watch acceptable bending radius to prevent damage, respectively not acceptable deformation of sealing element of cable gland. Supply cables must be attached to firm construction maximum 150 mm from cable glands.*
3. *For connection of remote transmitters is recommended to use shielded wires.*
4. *Sealing surfaces of control part cover must be cleaned before repeated fastening.*
5. *EA reversal is secured, if time interval between switching OFF and ON of supply voltage for reverse direction of output part motion is minimum 50 ms.*
6. *Delay after turn-off, i.e. time from reaction of the switches until the motor is without voltage, can be max. 20 ms.*



*Adhere to instructions of armature manufacturers, whether turn-off in terminal positions must be executed via position, or force switches!*

**The check of el. motor connection and control drawing.** Set up the electric actuator by hand wheel to mid position. Check proper connection by pressing the pushbutton "close" (on the box of manual control, respectively on the panel of testing pushbutton box) and output shaft must turn clockwise from the view from the top view (into control box) on output shaft. If it is not so, change the sequence of electric power network phases.

**Check of torque switches (Fig.4,5).** When the actuator moves towards "close" and at torque switches connection to "torque switching-off" should be contacts of switch S2 switched over by pressing of disconnecting bell (24)(Fig.5) of relevant switch. If the connection is properly performed, the actuator must stop. When the torque switches are connected for "signalization" only, signalization on control box panel will be activated.

Analogous repeat test towards "open" by switching over of switch S1 contacts. If any of function is not correct, check the connection of switches according to wiring diagram.

**Check of position switches (Fig.6,8).** When the actuator moves towards "close" switch over contacts of switches S4 resp. S6 by pressing of disconnecting bell of relevant switch. If the connection is properly performed, the actuator must stop when contacts of switch S4 are switched over and light up when contacts of switch S6 are switched over. Analogous repeat test towards "open". By pressing disconnecting

bell of switches S3 resp. S5, the actuator must stop resp. signalize. Again, if any of the function is not correct, connection of switches should be checked according to wiring diagram.

### 3.2 *Disassembly*



***Attention!***

***Before disassembly is necessary to disconnect electric supply of electric actuator!***

***Connection and disconnection of connectors must not be performed under the voltage!***

***Secure by prescribed way protection against connection of EA to the network and thus potential electrical accident!***

- Disconnect the EA from mains.
- Disconnect the leads from the EA terminal boards and loosen the cables from cable glands. Pull out the connectors in case of the connector version.
- Loosen the fixing screws of the EA flange and disconnect the EA from the valve/gearing.
- While sending the EA to be repaired put it into a package solid enough to avoid damages of the EA during transportation.

## 4. Adjusting



**Attention!** See chapter 1.2

**Disconnect the electrical electric actuator from electrical power network!**

**Observe safety regulations!**

The EA has been factory set to the fixed operation speed (entered into the order by the customer). If you wish to have the EA readjusted to other parameters, please follow the following instructions. Make the readjustment with the EA connected both mechanically and electrically. This chapter includes the electric actuator adjustment to the parameters specified in the specification table in case that you need to change the set EA parameters. See Fig. 3,3a,3c for arrangement of the operating elements on the control board.

### 4.1 The torque unit adjustment (Fig. 4 and 5)

It is only possible to set up the switching – off torque using the torque measuring equipment and only within the particular range with application of rough adjustment (17) and soft adjustment (18), Figure 4, according to the Version Table.

It is only possible to readjust the electric actuator using the segments (17), Fig. 4, within the marked MIN - MAX limit on the torque wrench and within the particular electric actuator torque range.

To change the torque range, the springs need to be replaced in the torque drive, executable in the manufacturing concern or service station from the point of view of mounting seriousness.

**Torque unit (Fig. 4 and 5)** is composed of three functional sub-units:

- torque disk (**Fig. 4**)
- torque unit (**Fig. 5**)
- locking mechanism (82) (**Fig. 5**)

**Torque disk (Fig. 4)** is assembled on torque shaft (45) discharged from power transmission (**Fig.2**). Steer angle of torque disk is proportional to torque moment of output shaft (3) of electric actuator. Its magnitude can be adjusted by segments (17) and by shifting of backstops (18). Achieved torque moment value is from torque disk transferred on torque unit (9) by means of torque lever (42) (**Fig.5**).

Remark:

The gauge marks on the scales do not indicate direct value switching – off torque; they are used only for more detailed orientation during adjusting its magnitude within marked MIN. and MAX. disconnecting value for given make without testing device for thrust measurement.

**Torque unit (Fig.5)** consists of a carrier, on which are displaced switches S1 (20) and S2 (21). On the shaft (23) are mounted disconnecting levers (24), keeping switches pressed by spring tensions until a moment when the shaft is turned out of the mesh of torque disconnection.

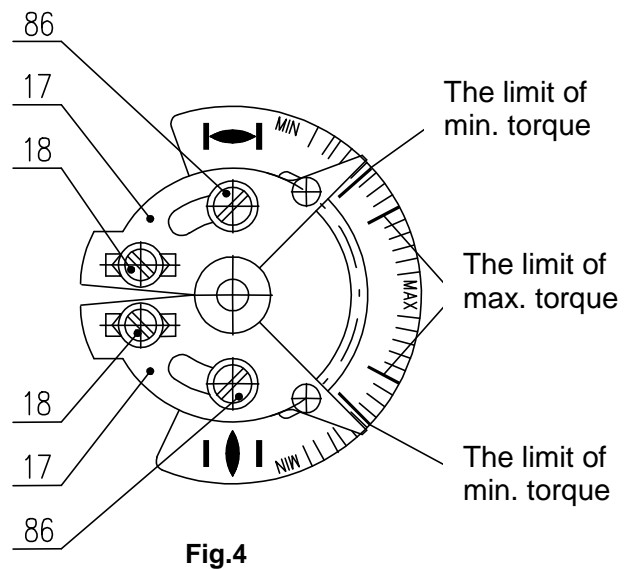


Fig.4

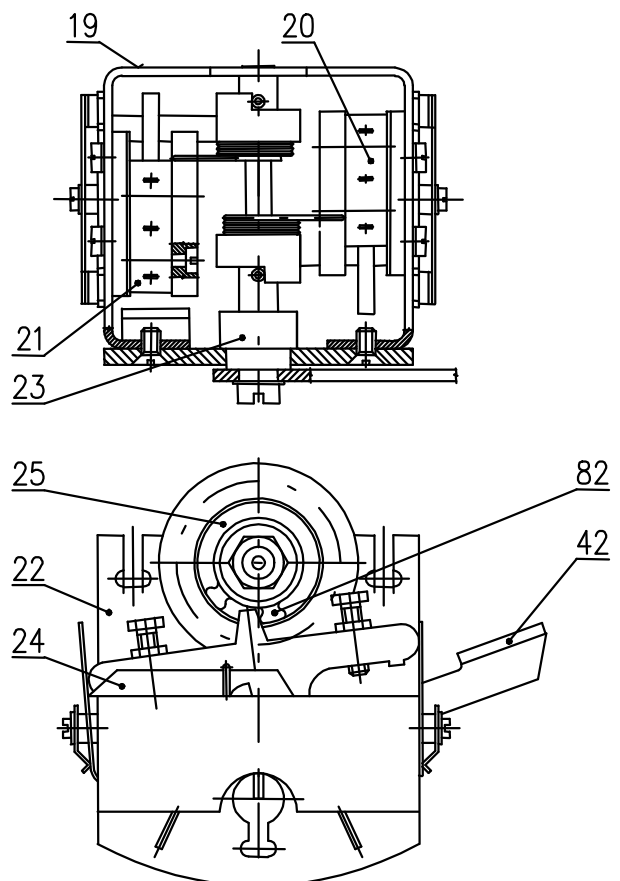


Fig.5

*Locking mechanism (82) (Fig.5)* provides locking of torque disconnection usually to 1 or 2 turns after reversing of electric actuator. After elapsing of adjusted revolution will torque unit acquire its original function.

#### Blocking adjustment:

EA operates within a working revolutions range according to Variant table. Blocking can be set to a number of revolutions given in tables 2a, 2b.

TABLE Nr. 2a					
Torque blocking speed for the version with <b>more than 5 working revolutions</b> for EA (1 pin in driving wheel)					
MO 3-Ex	MO 3.4-Ex	MO 3.5-Ex	MO 4-Ex	MO 5-Ex	Cams on pinion (25) are revolved by
<b>1,0 – 2,0</b>	-	-	<b>1,0 – 2,0</b>	<b>1,0 – 2,0</b>	90°
3,0 – 4,0	<b>1,25 – 1,7</b>	<b>0,8 – 1,1</b>	3,0 – 4,0	3,0 – 4,0	180°
5,0 – 6,0	2,1 – 2,5	1,36 – 1,7	5,0 – 6,0	5,0 – 6,0	270°
7,0 – 8,0	3,0 – 3,35	1,9 – 2,18	7,0 – 8,0	7,0 – 8,0	360°

TABLE Nr. 2b					
Torque blocking speed for the version with <b>less than 5 working revolutions</b> for ES (3 pins in driving wheel)					
MO 3-Ex	MO 3.4-Ex	MO 3.5-Ex	MO 4-Ex	MO 5-Ex	Cams on pinion (25) are revolved by
<b>0,33 – 0,66</b>	0,13 – 0,28	0,09 – 0,18	<b>0,33 – 0,66</b>	<b>0,33 – 0,66</b>	90°
1 – 1,33	<b>0,42 – 0,56</b>	<b>0,27 – 0,36</b>	1 – 1,33	1 – 1,33	180°
1,66 – 2	0,7 – 0,85	0,45 – 0,55	1,66 – 2	1,66 – 2	270°
2,33 – 2,66	0,97 – 1,12	0,63 – 0,73	2,33 – 2,66	2,33 – 2,66	360°

The torque unit blocking is set by the producer withing the range marked in bold in the following table. In case the revolutions modification is needed please contact the authorized service center. When assembling the actuator with a valve at the producer's workshop the torque unit blocking is set to the value 15% of operating revolutions. The maximum possible setting for versions over 5 operating revolutions is as follows:

MO 3-Ex - 8 rev., MO 3.4-Ex - 3,35 rev. or MO 3.5-Ex - 2.18 rev.

The maximum possible settings for versions up to 5 operating revolutions:

MO 3-Ex - 2,66 rev., MO 3.4-Ex - 1,12 rev. or MO 3.5-Ex - 0,73 rev.

## 4.2 Position switches adjustment (S3(S13),S4(S14) (Fig. 6)

EA is delivered set to a stroke corresponding to 6.° according to table 3 or to a stroke required by customer. The stroke referred on the type label of EA corresponds to the maximum stroke with the gear unit set to 11.° according to table 3. The procedure for position switches setting, adjustment a new setting is as follows (Fig. 6, 7):

- With variant having resistance transmitter, disengage the transmitter, (Fig.9)
- Having the set screw of the gear unit wheel released, move the adjustable wheel to a required stage of the range (it means to a one corresponding accurately to the particular revolutions, or to the next higher one) according to table 3 and Fig.7. When moving the adjustable wheel, take care to achieve the proper meshing with the gear wheel of the subjected stage, and then tighten the set screw back.
- Move EA to the "open" position electrically or manually. If, with electric move, EA has been switched off by S3 switch (Fig. 6), insert a screwdriver into set screw (29), press it and rotate in the arrow direction until an appropriate cam opens S3 switch. Pull the screwdriver out (see notice 1) and continue in moving EA in the „open“ position.
- In the „open“ position, insert a screwdriver into set screw (29), press it and rotate in the arrow direction until an appropriate cam closes S3 switch. Pull the screwdriver out (see notice 1).
- Move EA to the "close" position electrically or manually. If, with electric move, EA has been switched off by S4 switch (Fig. 6), insert a screwdriver into set screw (28), press it and rotate in the arrow direction until an appropriate cam opens S4 switch. Pull the screwdriver out (see notice 1) and continue in moving EA in the „open“ position.
- In the „close“ position, insert a screwdriver into set screw (28), press it and rotate in the arrow direction until an appropriate cam closes S4 switch. Pull the screwdriver out (see notice 1).

- Having position switches adjusted, You may need (depends on EA accessories) to adjust signaling switches, position transmitter, converter, position indicator and controller.

*Notice 1: in the case that the set screw remains pressed notwithstanding the screwdriver is out (it means that disengaged gear wheels don't mesh each other), turn gently the set screw against the arrow direction without pressing it until the set screw releases back to its initial position.*

*Notice 2: In the case of EA version with **tandem position switches S13, S14** those switches are adjusted after adjustment of switches S3 and S4, i.e. the switch S3 switches simultaneously with switch S13 and switch S4 switches simultaneously with switch S14.*

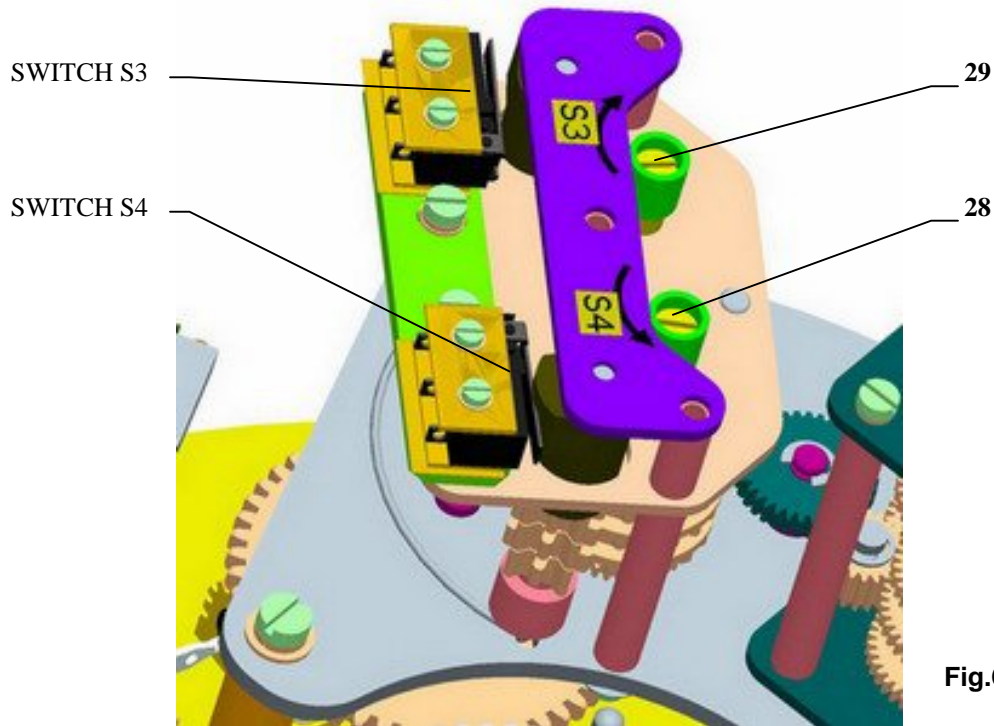
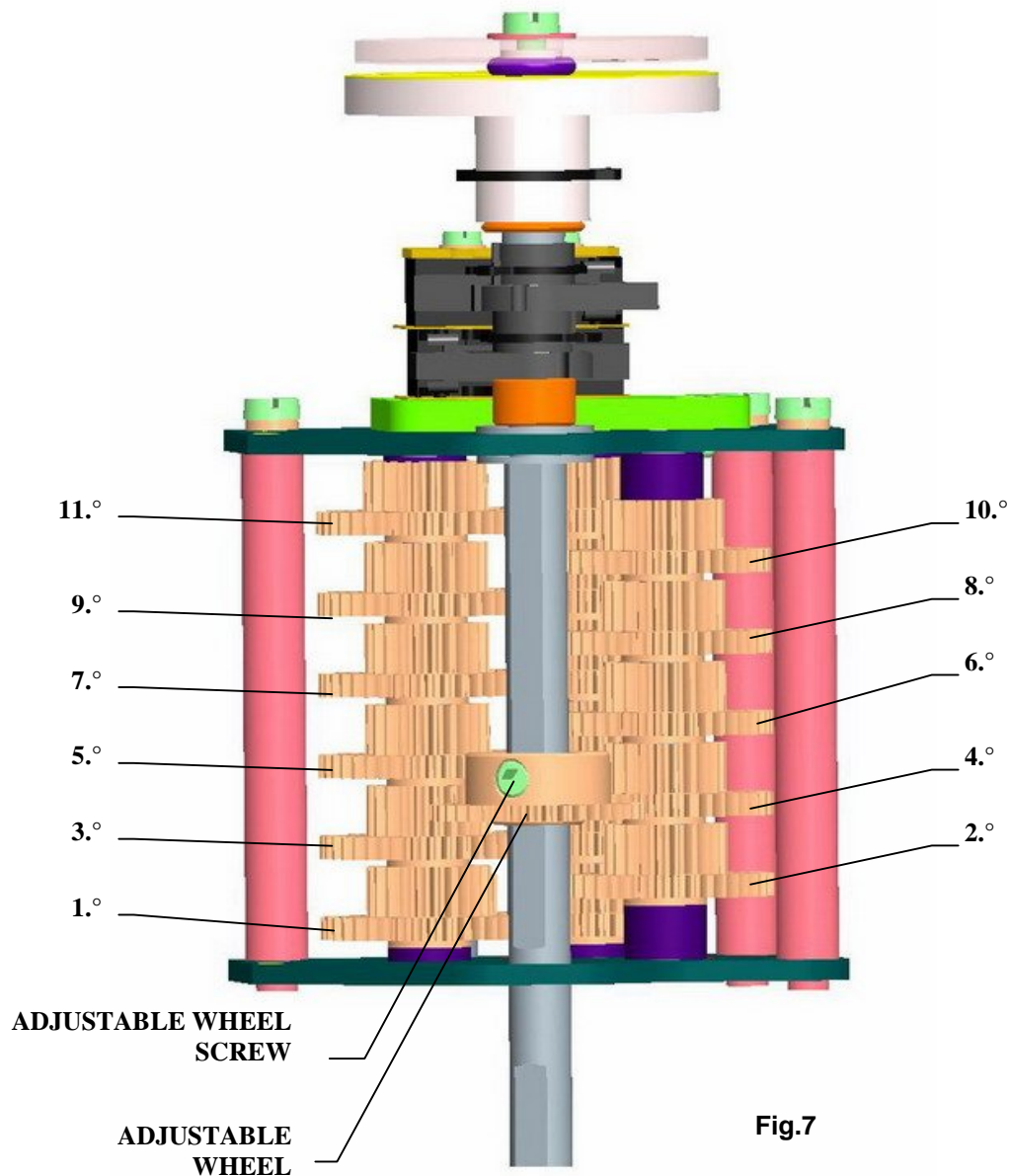


Fig.6

TABLE 3					
STROKE DEGREE	MAX. EA WORKING REVOLUTIONS (provided customer doesn't specify otherwise, EA will be set to 6° by producer)				
	MO 3-Ex	MO 3.4-Ex	MO 3.5-Ex	MO 4-Ex	MO 5-Ex
1.°	1,75	-	-	1,75	1,25
2.°	3	1,3	-	3	2,3
3.°	5,7	2,4	1,5	5,7	4
4.°	10,5	4,4	2,8	10,5	7,5
5.°	19	8	5	19	14
6.°	<b>34</b>	<b>14,5</b>	<b>9,5</b>	<b>34</b>	<b>25</b>
7.°	63	26	17	63	45
8.°	113	48	31	113	80
9.°	206	85	56	206	150
10.°	375	155	100	375	270
11.°	685	285	185	685	500



### 4.3 Signaling switches adjustment (S5,S6) (Fig. 8)

The signaling switches of EA are at producer preset to switch on about 10% before end positions provided the customer not specified otherwise. Before proceeding with signaling switches adjustment, S3, S4 end position switches must be adjusted according to the previous chapter if necessary. The procedure of signaling switches adjustment is as follows:

- Bring EA to a position in which You want S5 switch to close when EA is running in the „open" direction.
- Turn cam (31) of S5 switch (27) clockwise until S5 switch closes.
- Bring EA to a position in which You want S6 switch to close when EA is running in the "close" direction.
- Turn cam (30) of S6 switch (26) counterclockwise until S6 switch closes.

*Notice:* This signaling is capable to signalise from 50 up to 100 %..of the working stroke in both movement directions. With switch reversing function, a signaling capability from 0 up to 100 % is available.





Fig.8

#### 4.4 Position indicator adjustment (Fig.8)

The position of the output member relative to the end positions of EA stroke is indicated by a mechanical position indicator.

Before starting to adjust the position indicator, S3 and S4 position switches must be adjusted if required.

The procedure of position indicator adjustment is as follows :

- Bring EA to the „closed“ position;
- Turn the position indicator disc (32) to bring a mark identified with a symbol for the „close“ direction in coincidence with a mark on the upper cover aperture.
- Bring EA to the „opened“ position.
- Turn the upper part of the position indicator disc (32) to bring a mark identified with a symbol for the „open“ direction in coincidence with the mark on the upper cover aperture.

#### 4.5 Adjustment of resistant transmitter (Fig.9)

Function of resistance transmitter:

- remote position indicator
- remote position indicator with converter.

Before the resistant transmitter adjustment the position switches S3 and S4 have to be adjusted. Adjustment consists in setting of the resistance in the defined limit position of the EA.

Notes:

*In case that the EA is not used in the working revolutions range according to chosen degree on the competent stroke according to table 3, the resistance in the limit position "open" is proportionally reduced.*

To adjust the transmitter follow these steps:

- Loosen the fixing screws (90) of the transmitter holder and push the transmitter out of mesh.
- Connect a meter for resistance measuring to the terminals 71 and 73 of the EA **MO-Ex** terminal board.
- Put the actuator to the position "closed" (with the hand wheel, or with the local electric position control until the corresponding position switch S2 or S4 switches).
- Rotate the transmitter (91) shaft until resistance of  $\leq 5\%$  of the nominal transmitter resistance can be read on the meter in case of EA **MO-Ex** , and 3 up to 5% of the nominal transmitter resistance in case of EA **MO-Ex** with the resistant transmitter with the converter PTK1.
- In the position put the transmitter to mesh with the drive wheel and fix the fixing screws on the transmitter holder.
- Disconnect the meter from the terminal board.



Fig.9

## 4.6 Adjustment of the Electronic Position Transmitter (EPV) - the Resistive Transmitter (Potentiometer) with the Converter PTK 1

### 4.6.1 EPV – the 2-wire version (Fig. 10,10a)

The position transmitter with the converter PTK1 is in the plant adjusted to have the output current signal on the terminals 81-82 as follows:

- in the position "open" ..... 20 mA
- in the position "closed" ..... 4 mA

#### Adjustment of the EPV in electric actuators MO-Ex

If the transmitter requires a new adjustment follow these steps:

- Put the actuator to the position "closed" and switch the power supply off.
- Adjust the resistive transmitter according to the previous chapter. The resistance is to be metered on the terminals X-Y (Fig. 10,10a). The used transmitter resistance is 100 Ω.
- Switch the converter's power supply on.
- Turn the adjusting trimmer ZERO to adjust the output current signal rate measured on the terminals 81-82 to 4mA.
- Set the actuator to the position "open".
- Turn the adjusting trimmer GAIN to adjust the output current signal rate measured on the terminals 81-82 to 20mA.
- Check the output signal of the converter in the both limit positions, and repeat the procedure if needed.

#### Note:

The output signal of 4-20mA can be adjusted at the range from 75 up to 100% of the rated stroke according to table Nr.3 . At values less than 75% the value 20mA is reduced proportionally.

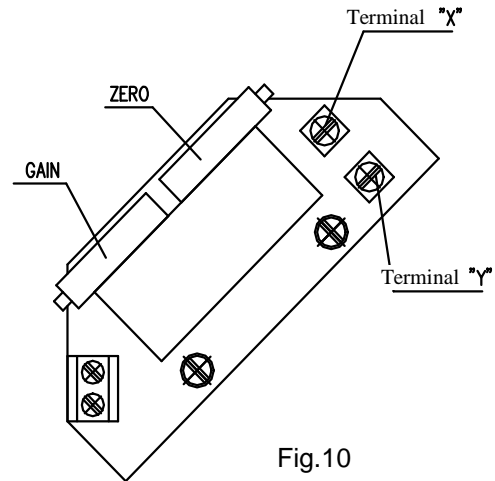


Fig.10

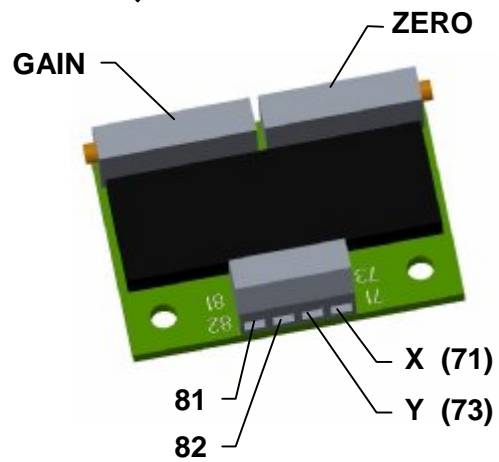


Fig.10a

**4.6.2 EPV – 3-wire version (Fig. 11,11a)**

The resistive transmitter with the converter is in the plant adjusted to have the output current signal metered on the terminals 81-82 as follows:

- in the position "open" ..... 20 mA or 5 mA resp. 10V
  - in the position "closed" ..... 0 mA or 4 mA resp 0V,
- according to the specified version of the converter.

If the transmitter requires a new adjustment follow these steps:

- Put the actuator to the position "closed" and switch the power supply off.
- Adjust the resistive transmitter according to the previous chapter. The resistance is to be metered on the terminals X-Y (Fig. 11,11a). The used transmitter resistance is 2000 W or 100 Ω.
- Switch the converter's power supply on.
- Turn the adjusting trimmer ZERO to adjust the output current signal rate measured on the terminals 81-82 to 0 mA or 4mA.
- Set the actuator to the position "open".
- Turn the adjusting trimmer GAIN to adjust the output current signal rate measured on the terminals 81-82 to 20mA or 5 mA.
- Check the output signal of the converter in the both limit positions, and repeat the procedure if needed.

Note:

The output signal of (0-20mA, 4-20mA or 0-5mA - according to the specification) can be adjusted at the range from 85 up to 100% of the rated stroke according to table Nr.3. At values less than 85% the value of the output signal is reduced proportionally.

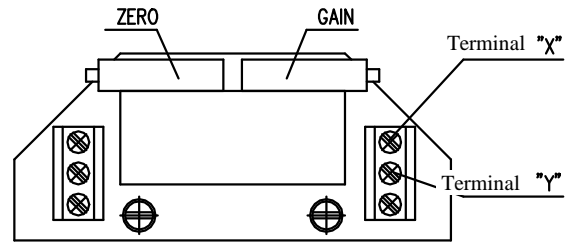


Fig. 11

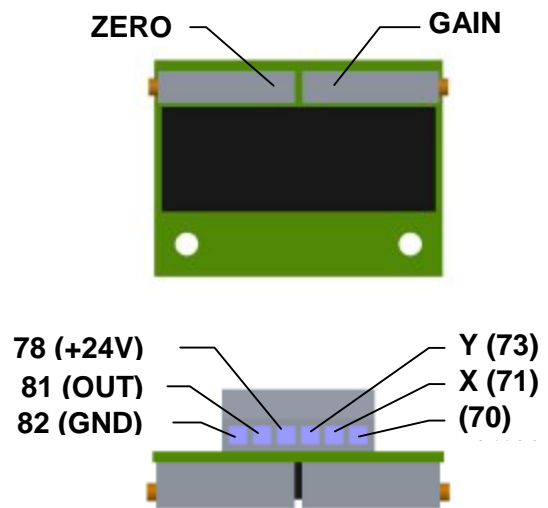


Fig.11a

#### 4.7 Adjustment of Capacitive Transmitter CPT1/A (Fig.12)

The chapter describes adjustment of the capacitive transmitter to the specified parameters (standard values of output signals) in case they are reset. The capacitive transmitter (95) serves as a position transmitter of electric actuators with unified output signal of 4÷20 mA.

The capacitive transmitter CPT1/A is adjusted by the producer to the fixed Operating angle according to the order and wired according to the wiring diagrams placed into the cover. Check the power supply of the user after connecting to terminal of the terminal board before the transmitter is electrically checked. Adjustment of the capacitive transmitter can be performed when the position switches are adjusted.

The following versions of electric actuators with built capacitive transmitters can be specified:

**A) The version without any power supply**

**B) The version with a power supply**

##### A.) Adjustment of the Capacitive Transmitter without any Power Supply

Before connecting check external power supply. The measured voltage should be in range from 18 up to 28 V DC.



*The voltage of the power supply **must not be in any case higher than 30 V DC**. The transmitter can be irreversibly damaged!*

While checking or adjusting the output signal of 4÷20 mA follow these steps:

- Connect a mA meter of precision class 0,5 and loading resistance lower than 500 Ω serially with the transmitter (pole “-”; terminal 82).  
Put the actuator to the position “CLOSED”, the signal value should decrease. In the case that the value of the signal increases, release the fixation screws (96) and turn the transmitter until the value starts to decrease.
- Check the signal value for the position “CLOSED” (4 mA).
- Tune the signal with loosening the fixing screws (96) and turning the trimmer (95) until the required value of 4 mA is reached. Tighten the fixing screws.
- Put the actuator to the position “OPEN”, the signal value should raise.
- Check the signal value for the position “OPEN” (20 mA).
- Tune the signal with turning the trimmer (97) until the required value of 20 mA is reached.
- Check the signal value for the position “CLOSED” and then for the position “OPEN”.
- Repeat the procedure until the change from 4 to 20 mA is reached with deviation less then 0,5 %.
- Disconnect the meter and lock the screws with a varnish.

##### B.) Adjustment of the Capacitive Transmitter with the Power Supply

While checking or adjusting the output signal of 4÷20 mA follow these steps:

- Check the power supply: 230 V AC ±10% on the terminals 1,61.
- Connect a mA meter of precision class 0,5 and loading resistance lower than 500 Ω on the terminals 81, 82.
- Follow the procedure described in the previous chapter A.

##### Note:

*The trimmer (97)(Fig.12) can be used to adjust the output signal of the capacitive transmitter to any value of operating revolutions in range from ca 50% up to 100% of the max. value of the operating revolutions on the competent degree according to table Nr.3.*

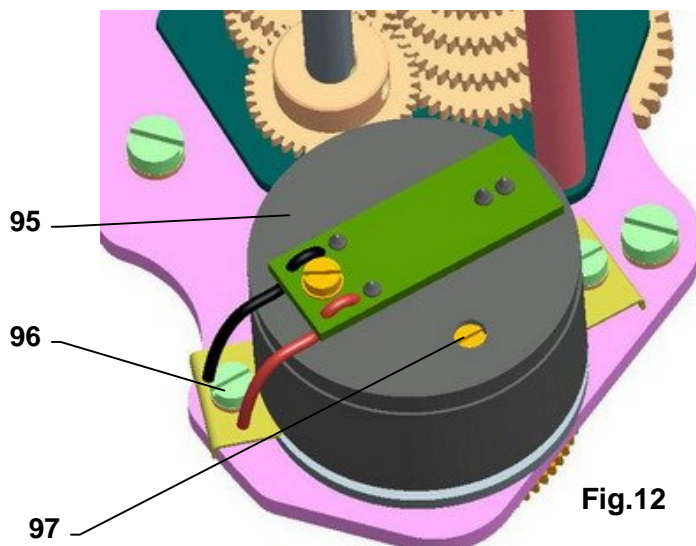


Fig.12

## 4.8 Adjustment of the DCPT3M transmitter

Before the transmitter DCPT3M (**Fig.13**) adjustment the position switches S3 and S4 have to be adjusted. Adjustment consists in setting of the output signal value in the limit positions of the actuator.

By default (unless determined otherwise by the customer), the manufacturer aligns the DCPT3M transmitter so that output signal value 4mA is set for the limit position "closed" and 20 mA for the position "opened". By default the characteristics of the output signal is set to 20-4 mA (descending).

Notes 1: -this type of transmitter enables the assignment 4 mA / 20 mA of the output signal value to any limit position of the actuator.

2:-the transmitter is adjustable within the range of 35 to 100% of the full stroke specified in the nameplate.

### 4.8.1 Setting of limit positions

If limit positions require re-adjustment, proceed as follows:

#### Adjustment of the "4 mA" position:

- Turn on the power supply voltage to DCPT3M
- Reset the actuator to the limit position that you want to assign 4 mA signal value to and press (for about 2 seconds) the pushbutton "4", until LED flashes

#### Adjustment of the "20 mA" position:

- Turn on the power supply voltage to DCPT3M
- Reset the actuator to the limit position that you want to assign 20 mA signal value to and press (for about 2 seconds) the pushbutton "20", until LED flashes

Notes 1: Transmitter error code may result when the first limit position is saved (2x LED flash). The error code is erased by saving of the second limit position, provided that the saved limit positions are within 35 to 100% of the rated stroke specified in the nameplate.

If necessary, please change the characteristic of the output signal from descending to ascending or vice versa, according to the following chapter.

### 4.8.2 Setting of the ascending/descending characteristic of the output signal

When the characteristic of the transmitter output signal is changed, the set limit positions "4 mA" and "20 mA" are maintained, however the operating range (stroke of DCPT3M) between these two positions is changed to the complement of the original operating range.

When the DCPT3M transmitter is set so that output signal value 4mA is set for the limit position "closed" and 20 mA for the position "opened", the characteristic must be set to **20-4 mA (descending)**.

When the DCPT3M transmitter is set so that output signal value 20 mA is set for the limit position "closed" and 4 mA for the position "opened", the characteristic must be set to **4-20 mA (ascending)**.

If you need to toggle the characteristic of the transmitter output signal 4-20 mA (ascending), or 20-4 mA (descending), please proceed as follows:

- Turn on the power supply voltage to DCPT3M
- For **4-20 mA (ascending characteristic)** press the pushbutton "20" and subsequently "4" and hold both buttons pressed until LED flashes.
- For **20-4 mA (descending characteristic)** press the pushbutton "4" and subsequently "20" and hold both buttons pressed until LED flashes.

### 4.8.3 Calibration MENU

The calibration menu enables setting of default parameters and calibration of current values 4 and 20 mA (fine tuning of the value of the output current signals 4 and 20 mA in the limit positions).

#### Adjustment of default parameters:

- Turn off the power supply to the transmitter power supply source.
- Press and hold the "4" and "20" adjustment pushbuttons.
- Turn on the power supply to the transmitter power supply source.
- Hold both pushbuttons until the first and on to the second flash of LED.

Caution: By saving the default parameters the calibration of the transmitter is overwritten and therefore the transmitter must be re-calibrated.

#### How to access the calibration MENU:

- Turn off the power supply to the transmitter power supply source.
- Press and hold the "4" and "20" adjustment pushbuttons.
- Turn on the power supply to the transmitter power supply source.
- Hold both pushbuttons until the first flash of LED and then release them.

#### Toggleing between 4 and 20 mA in the calibration mode:

- For 4 mA press the pushbutton "20" and subsequently "4" and hold both buttons pressed until LED flashes.
- For 20 mA press the pushbutton "4" and subsequently "20" and hold both buttons pressed until LED flashes.

#### Setting of 4/20 mA current values in the calibration MENU:

- To reduce the current value, press "20". By holding the button depressed, auto repeat is activated to continuously reduce the value of the output current and when the button is released, the actual value is saved.
- To increase the current value, press "4". By holding the button depressed, auto repeat is activated to continuously increase the value of the output current and when the button is released, the actual value is saved.

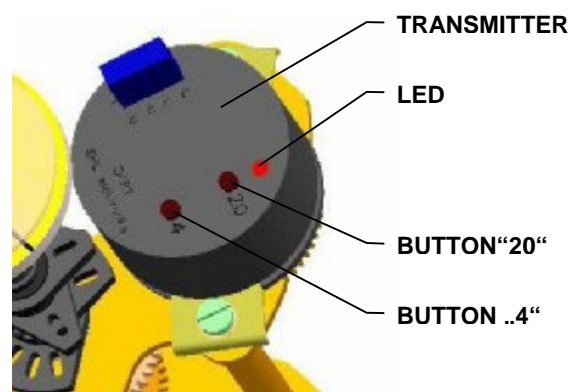


Fig.13

### 4.8.4 Transmitter error messages

Error is indicated by flashing LED. The number of repeated LED flashes indicates the error code as per table 6.

TABLE 6	
Number of LED flashes	Error
1x	Transmitter position outside operating range
2x	Incorrectly set operating range for the transmitter angle of rotation
3x	Tolerance level of magnetic field outside permitted range
4x	Incorrect parameters in EEPROM
5x	Incorrect parameters in RAM

## 5. Service and Maintenance

### 5.1 Service



1. In general it is supposed that the EA is serviced by a qualified person as required in the Chapter 1!
2. After the EA is put into operation it is necessary to check whether during manipulation its surface finishing was not damaged – the damages should be eliminated to prevent the surface against deterioration caused by corrosion!

- Electric actuator requires only inconsiderable operation. The assumption for reliable operation is proper putting into operation.
- The operation of these EA comes out of operating conditions and usually consists of information processing for consequential securing of required function. EA can be controlled either remotely by electricians, or manually on their assembly position. Manual control is executed via hand wheel.
- The operators must take care for performing of prescribed maintenance and for protection of EA during operation against harmful ambient effects and atmospheric exposure, which exceeds the scope of acceptable effects described in part „Working conditions“.
- It is necessary to prevent excessive heating of the surface of EA, exceeding of type label values and excessive vibration of EA.
- It is necessary to prevent excessive heating of the surface of EA, exceeding of type label values and excessive vibration of EA.
- Operation beyond the switching – off torque limits is not allowed. Torque switches set to maximum switching-off torque values check the critical overload of the actuator

#### Manual control:

- If the manual control is needed (adjustment, function checking, failures etc.) the staff can reset the regulated member using the handwheel. While rotating the handwheel clockwise the output element moves in the direction “CLOSING”.
- Before manual control must be realized locking screw (Fig.15). Fasten locking screw after finishing of manual control.

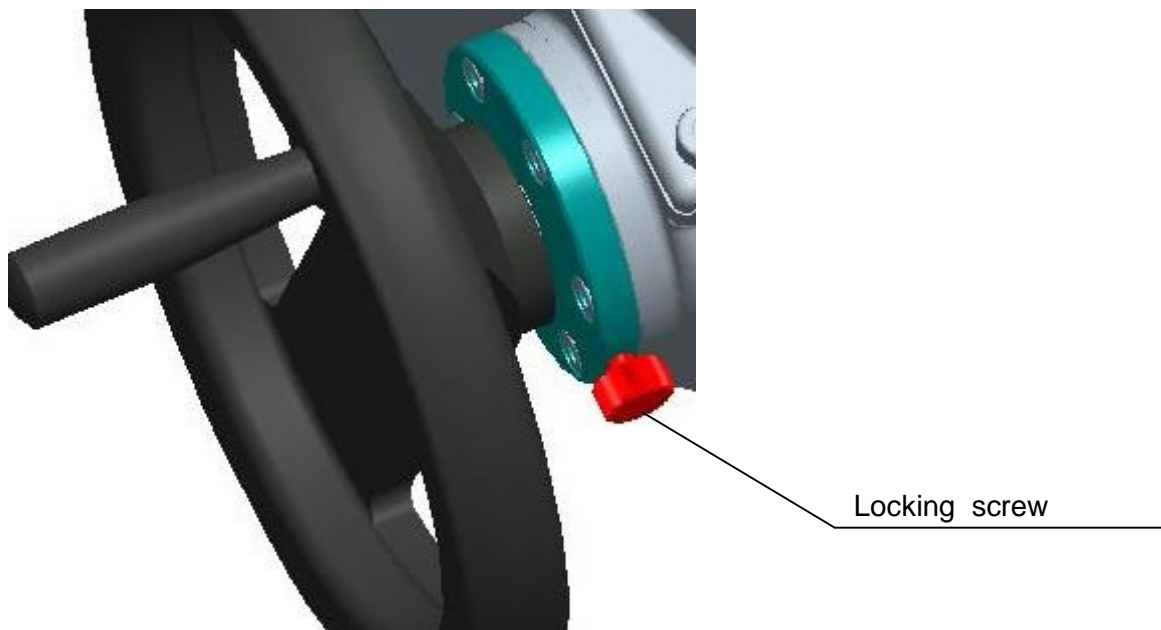


Fig.14



## 5.2 Maintenance - extent and periodicity

All screws and nuts affecting tightness and protection (IP) must be tighten during the inspection and maintenance. The internal between two preventive inspections is four years.

In case of damage or after 6 years of the actuator's operation the replacement of cover seals and oil filling seals must be done.

The grease in the supplied actuators is designed for the lifetime of the product.

It is not necessary to change the grease during the operation of the actuator.

In case there is no leakage in the transmission box caused by damaged seal the oil filling is permanent. The change of oil filling shall be done after 6 years of the actuator's operation.

The oil level check must be carried out once in a 3 months interval. Oil capacity is 1,6 l (1,5 kg) (MO 3.X-Ex), 2,5 l (MO 4-Ex) and 6 l (MO 5-Ex).

### Lubrication:

- the gearbox: in versions with temperatures  $-25^{\circ}\text{C}$  till  $+60^{\circ}\text{C}$  - Madit PP-80 (Slovnaft)
  - in versions with temperatures  $-50^{\circ}\text{C}$  till  $+40^{\circ}\text{C}$  - Avia SYNTOGEAR PE 68
  - in versions with temperatures  $-60^{\circ}\text{C}$  till  $+60^{\circ}\text{C}$  - RENOLIN UNISYN CLP 68
- gears of transmission unit and drive mechanism on the control board:
  - in versions with temperatures  $-25^{\circ}\text{C}$  till  $+60^{\circ}\text{C}$  - grease  $\mu$  HF 401/0, resp. GLEITMO585
  - in versions with temperatures  $-50^{\circ}\text{C}$  till  $+40^{\circ}\text{C}$  - ISOFLEX TOPAS AK 50
  - in versions for climate with temperatures  $-60^{\circ}\text{C}$  till  $+60^{\circ}\text{C}$  grease DISCOR R-EP 000.



**Lubrication of the valve stem is independent on maintenance of the EA!**

After every potential flooding of the product check, whether there is no water inside. After eventual water penetration, dry the product before repeated putting into operation and replace damaged sealings, resp. other parts of EA. identically check also tightness of cable bushings and replace them, if they are damaged.

- Every six months it is recommended to perform one check move in frame of adjusted operation stroke to verify reliability of functioning with setting back to the original position.
- If the audit rules do not determine else the inspection of EA is performed ones a year and tightening of all connecting and grounded screws have to be checked to avoid overheating.
- After 6 months from putting of EA into operation and once a year it is recommended to check tightening of fixing screws between the EA and the valve. (Tighten the screws with the cross system.)
  - While connecting and disconnecting of the EA check the tightness of cable glands – those with damaged sealings should be replaced by new ones of the approved type!
  - Keep the EA clean and take care about removing impurities and dust. The cleaning has to be performed regularly according to the operation possibilities and requirements.



### 5.3 Maintenance to assure inexplosiveness



- A an hour before removing of the actuator cover it is needed to switch power supply off. The given period is required to assure cooling of the electric motor and the space heater below the admissible temperature value of the temperature class T4 (+135 °C) resp. T5 (+100 °C).
- The fixing screws of the upper cover have to be always in full numbers, i.e. 4 pcs, with flexible washers and tightly fastened.
- The actuators with damaged closing surfaces, e.g. scratches, rifts, etc. have to be immediately put out of operation.
- While connecting and disconnecting of the EA check the sealing rings of the cable glands – damaged and worn sealing should be replaced by original rings!
- Keep the EA clean and take care about removing impurities and dust. The cleaning has to be performed regularly according to the operation possibilities and requirements.
- Reparation of EA (basically the parts the resisting closures consist with, have substantial influence on safety) is allowed perform only by producer, witch according to certificated documentation and by performing of required tests (inclusive of static pressure test of resisting clouser parts guarantee the fulfil required standardes and rules for this products.

#### Slots manufacturing of fixed cover- MO 3-Ex-MO 3.5-Ex

##### Gap of flameproof enclosure are between:

1. cover and control box
2. bushing body and bushing (single phase version)
3. control box and bushing body (single phase version)
4. inter - flange and bushing body (single phase version)
5. control box and screw
- 6., 7. control box and insert Ex
- 8.,10. insert Ex a output shaft
9. cover and aperture
- 11.,12. cover and insert Ex
- 13., 14., 15. control box and bushing
16. cover and inter - flange (single phase version)
17. control box and shaft

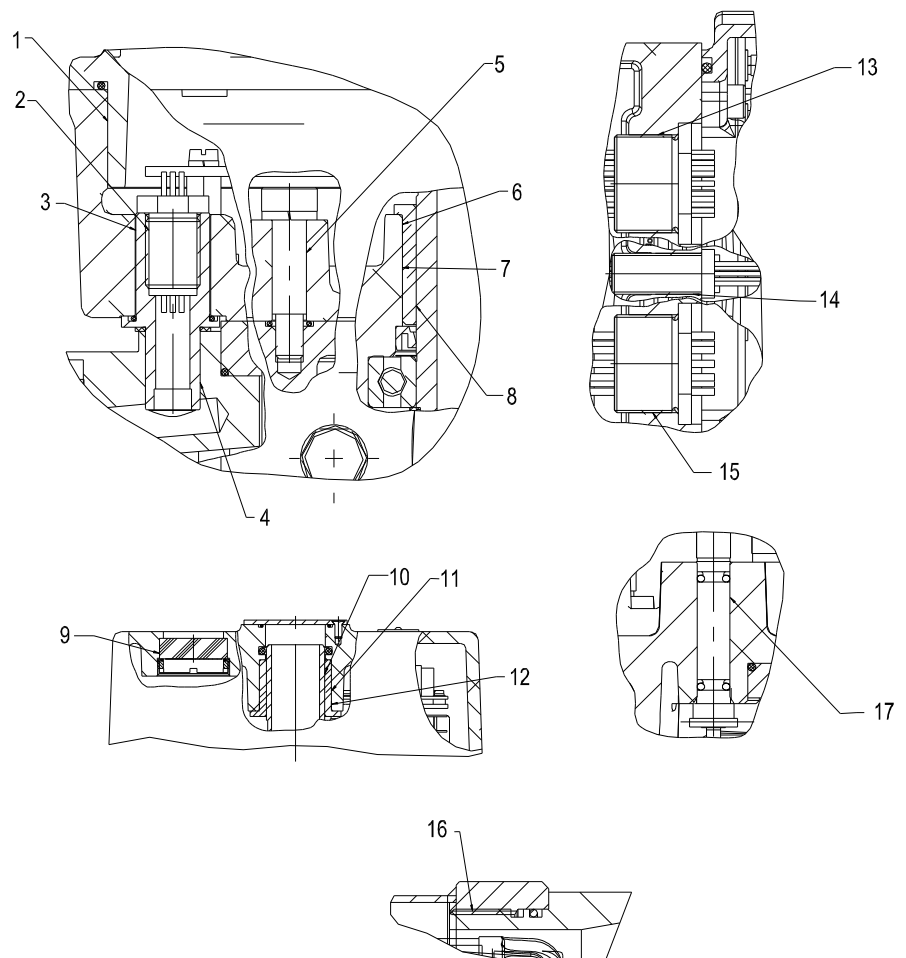


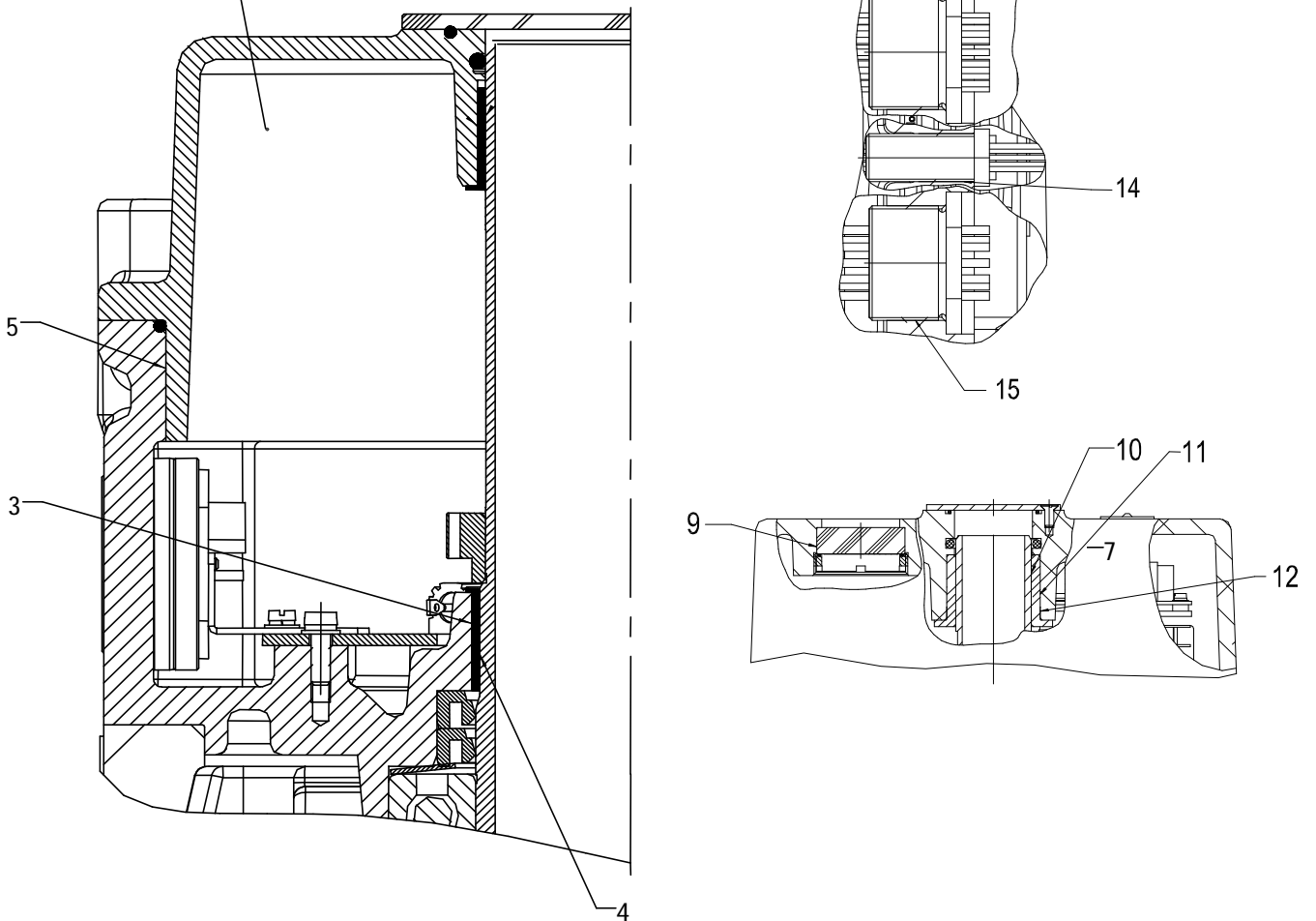
Fig.15

**Slots manufacturing of fixed cover - MO 4-Ex**

Gap of flameproof enclosure are between: (fig.16) :

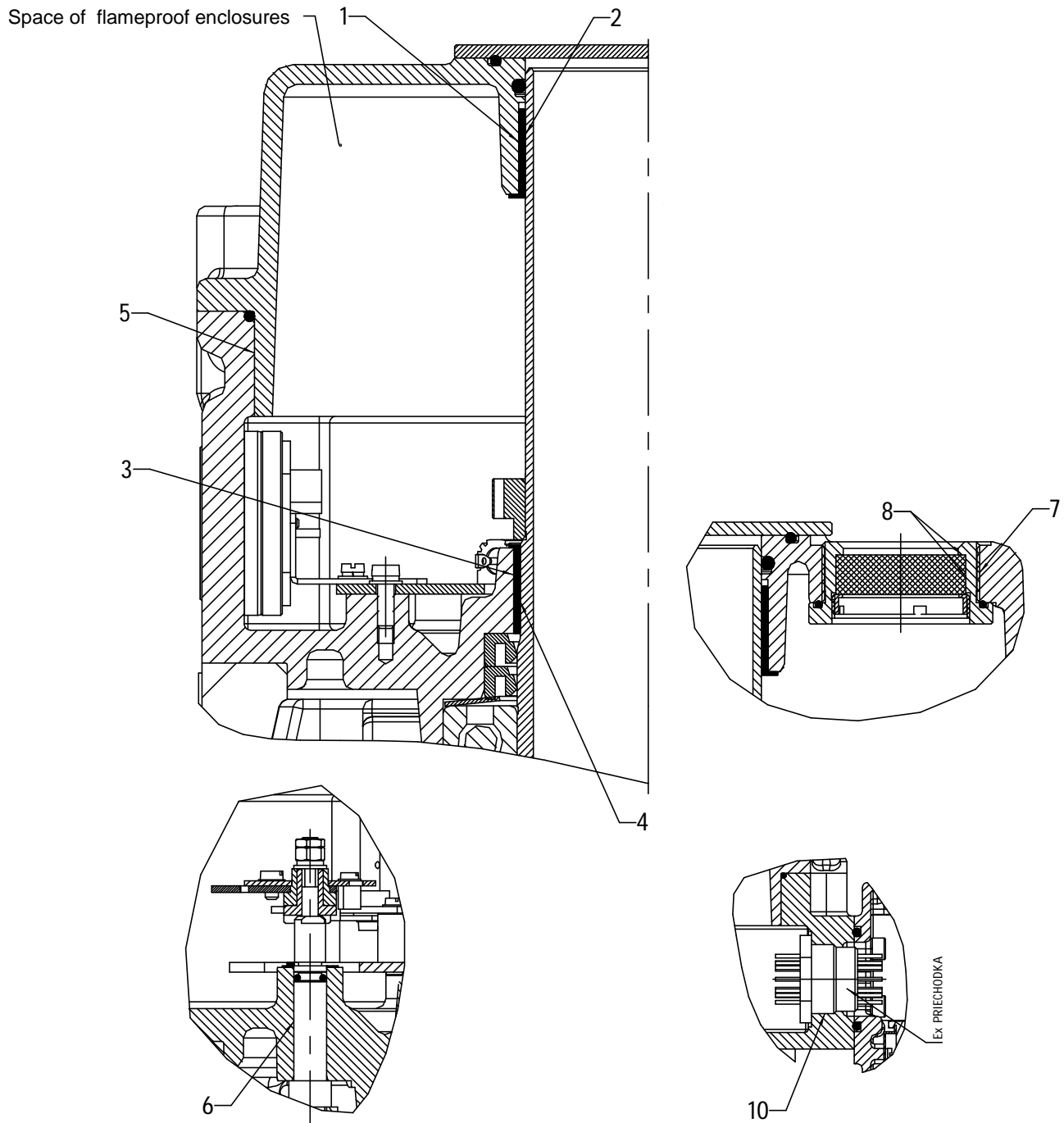
- 3. between the control box and the shaft housing of control box
- 4. cover of control box and control box
- 9. cover and aperture
- 10. insert Ex a output shaft
- 11.,12. . cover and insert Ex
- 13., 14., 15. control box and bushing.

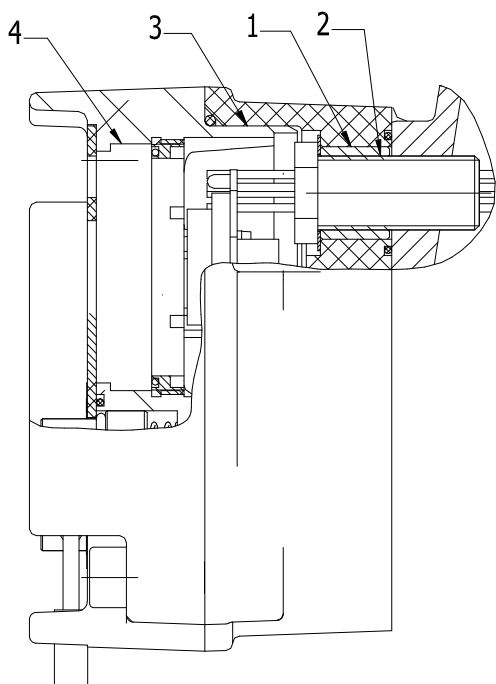
Space of flameproof enclosures



**Gap of flameproof enclosure MO 5-Ex are between:**

- cover of control box Ex and sheath of shaft and cover of control box
- sheath of shaft cover control box and output shaft
- control box and sheath of shaft control box
- sheath of shaft control box and output shaft
- cover of control box and control unit
- control box and shaft of disengaging torque
- cover of control box and indicator body
- indicator body and window
- control box and indicator body
- control box and Ex-bushing



**Gap of flameproof enclosure of local control EA M\*\* \*-Ex:are between:**

1. Bushing tube – rear cover of local control
2. Threaded joint – Bushing and bushing tube
3. Front cover and rear cover
4. Aperture and front cover.

Enclosure joint surfaces are designed according to the requirements of table 2 and 3, EN 60079-1,

To seal the gaps against entry of fluids and dust, O-rings are used from the outside except for the gap of flameproof enclosure.

**Caution:**

After disassembly and re-assembly of control box cover (see gap of flameproof enclosure 1 in chapter 5.3) and terminal box cover, the sealing O-ring must be replaced according following table:

O-Ring	Dimension	Standard	PNm	Materiál	Producer
Cover and control box MO 3-Ex-MO 3.5-Ex	202,79x3,53	AS 568B/B S 1806	62 732 156	NBR	TRELLEBORG SEALING SOLUTIONS
Cover and control box MO 4-Ex	220x3	STN 02 9281.9	62 732 123	MVQ	Rubena Náchod
	220x3	STN 9281.9	62 732 123	MVQ	Commerse PK
Cover and control box MO 5-Ex	240x3	STN 02 9281.9	62 732 008	MVQ	Rubena Náchod
Terminal box cover MO X.X-Ex	190x3	STN 02 9281.9	62 732 009	MVQ	Rubena Náchod
Local control MO X.X-Ex	105x3	STN 02 9281.9	62 732 390	MVQ	Rubena Náchod

**5.4 Troubleshooting**

- In case of a mains failure the EA stands in the position where it was before the failure occurred. If needed the EA can be reset using the manual control (with the handwheel). When necessary EA can be manually operated (handwheel), at doing this, pay attention to keep the movement of the EA output part within the range of the set stroke so as to avoid losing the adjustment of the limit position switches or position transmitter or regulator. After supply voltage recovery EA is prepared for operation.
- In case of a failure of a part of the EA the part can be replaced by a new one. The exchange is to be committed by the producer or a contracted service firm.
- In case of an EA failure, which cannot be eliminated directly in operation, follow instructions for under-guaranty and after-guaranty service.

*Note: If the EA has to be dismantled follow the procedure of the Chapter "Dismantling"*



*The EA can be dismantled to be repair purpose by qualified and trainer persons only! The training can be performed by the producer or by a contracted service firm.*

## 6. Accessories and spare parts

### 6.1 Accessories

The EA is delivered with the **handwheel and cable glands**.

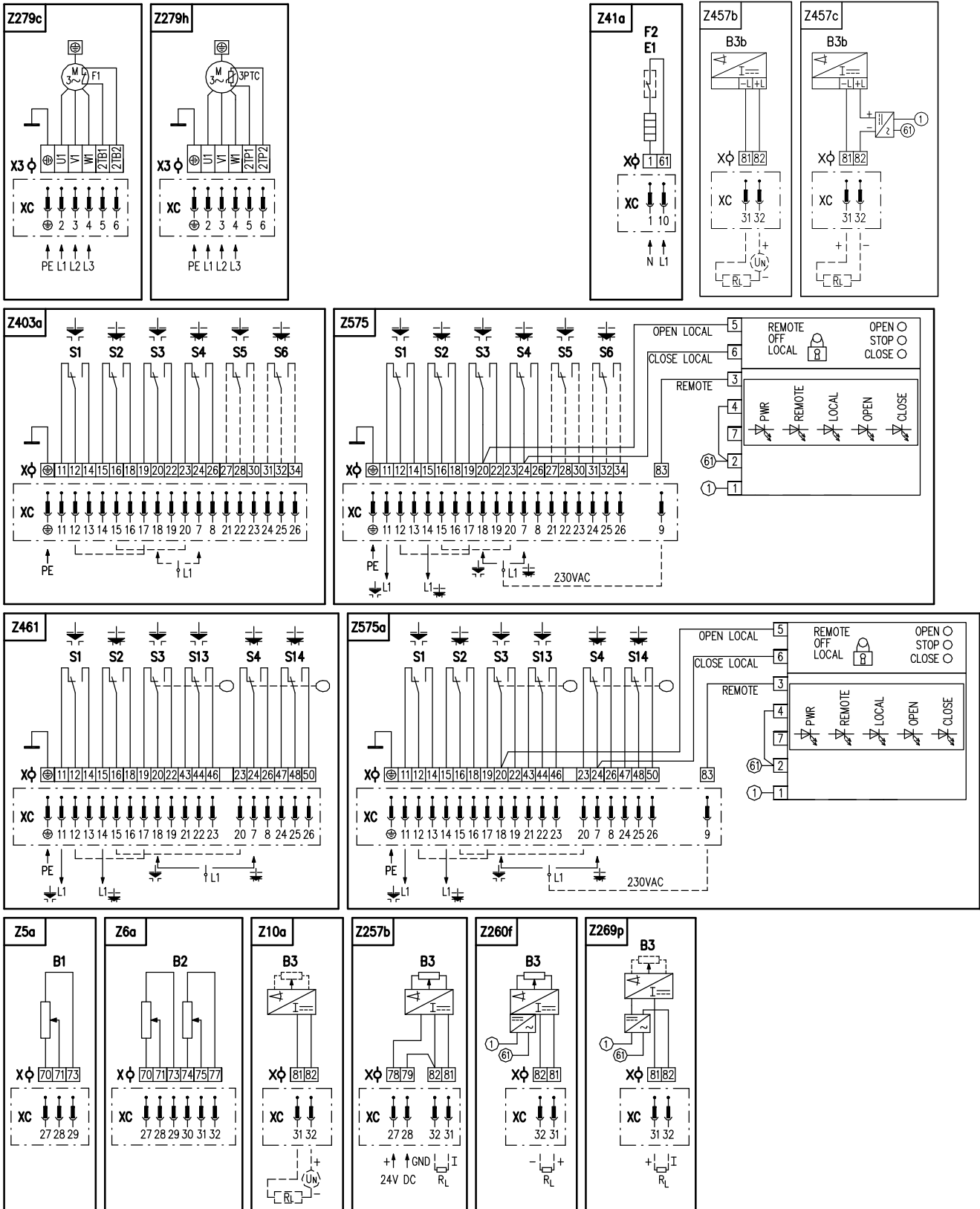
### 6.2 Spare part list

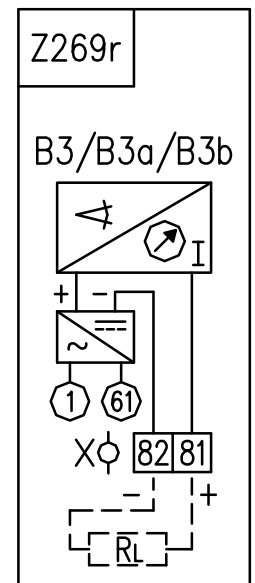
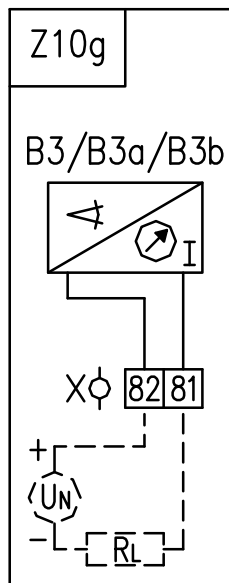
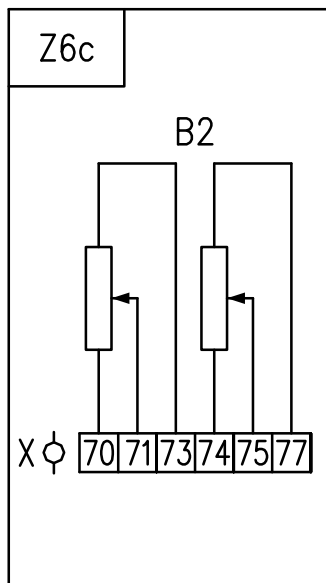
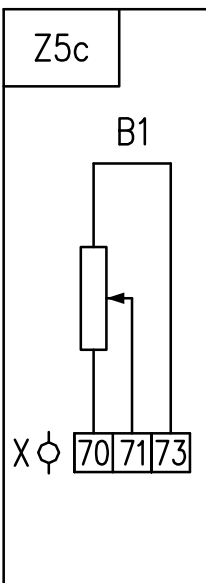
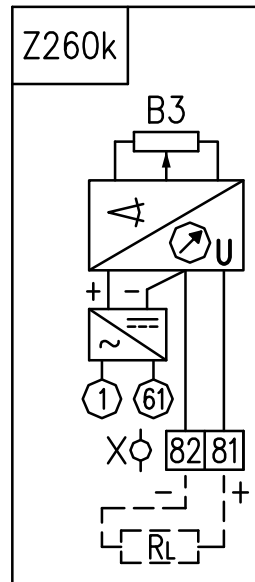
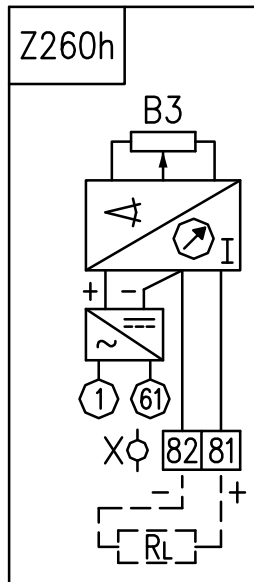
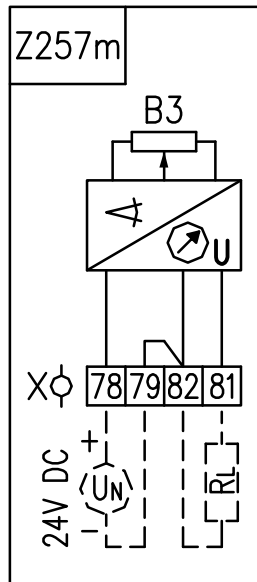
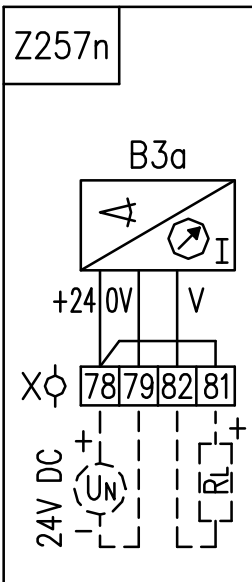
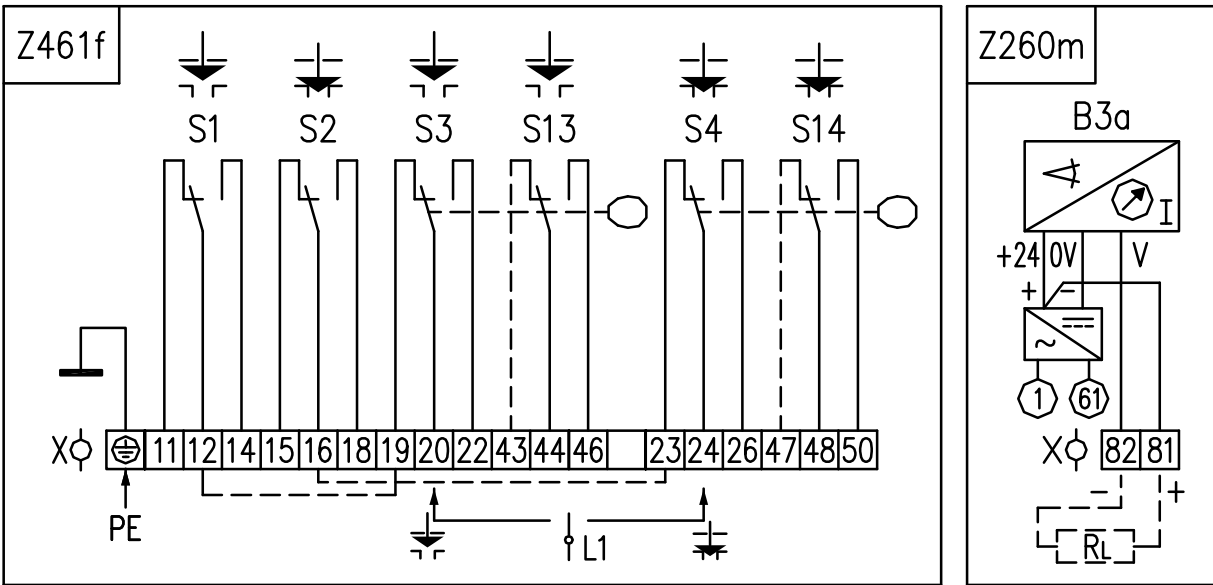
<b>Table 5 Spare part</b>			
<b>Spare part</b>	<b>Order Nr.</b>	<b>Position</b>	<b>Figure</b>
Electric motor; 4KTC 71 A-4 (CD71M1-4);0,25kW, Δ/Y 230V/400V (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; AVM071MK04;0,25kB (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; 4KTC 71 B- 4(CD71M2-4);0,37kW, Δ/Y 230V/400V (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; AVM071M04;0,37kB (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; 4KTC 80 B- 6(CD80M2-6);0,55kW, Δ/Y 230V/400V (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; AVM090LK06;0,55kB (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; 4KTC 80 B-4 (CD80M2-4);0,75kW, Δ/Y 230V/400V (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; AVM080M04;0,75kB (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; CD80M1-2 X (4KTC 80 B-2);1,1kW,Δ/Y 230V/400V (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; AVM080M02;1,1κ kW (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; 4KTC 90S-2 (CD80M2-2 X);1,5kW (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; AVM090LK02; 1,5kB (MO 3-Ex-MO 3.5-Ex)	63 592 xxx	M1	1
Electric motor; CD 90L-2X; 0,27kB (MO 4-Ex)	63 592 xxx	M1	1
Electric motor 4KTC 112 M-4; 4 kW; (CD 112M-4) ;Δ/Y 230V/400V AC (MO 5-Ex)	63 592 xxx	M1	1
Electric motor 4KTC 100 LB-4; 3 kW; (CD 100L2-4) ;Δ/Y 230V/400V AC (MO 5-Ex)	63 592 xxx	M1	1
Electric motor 4KTC 112 M-6; 2,2 kW; (CD 112M-6) ;Δ/Y 230V/400V AC (MO 5-Ex)	63 592 xxx	M1	1
Electric motor 4KTC 112 M-8; 1,5 kW; (CD 112M-8) ;Δ/Y 230V/400V AC (MO 5-Ex)	63 592 xxx	M1	1
Electric motor 4KTC 112 M-4; 5 kW; (CD 112M-4X) ;Δ/Y 230V/400V AC(MO 5-Ex)	63 592 xxx	M1	1
Micro-switch CHERRY DB6G-B1BA	64 051 219 + 64 051 415	20,21	5
Micro-switch CHERRY DB6G-A1LB	64 051 466	26,27	6,8
Resistive transmitter 1x100Ω	64 051 812	92	9
Resistive transmitter 1x2000Ω	64 051 827	92	9
Resistive transmitter 2x100Ω	64 051 814	92	9
Resistive transmitter 2x2000Ω	64 051 825	92	9
Converter	According to	-	10,11
Casing KU 40x30	63249037	75	2
Casing KU 14x12	63243150	76	2
Ringlet 10 x 6	62732022	66	2
Sealing ring 16 x 28 x 7	62735044	70	2
Sealing ring 40 x 52 x 7	62735043	68	2
Ringlet 32 x 2	62731097	77, 34	2
Ringlet 110 x 3	62732128	-	1
Ringlet 130 x 3	62732095	78	2
O- Ringlet 202,79 x 3,53	62 732 156	-	-
O- Ringlet 190 x 3	62 732 009	-	-
O- Ringlet 105 x 3	62 732 390	-	-
Sealing	04 A05 199	-	1
Cable glands M16x1,5 (for temperatures from -20°C up to +60°C )	63 456 586	34	1
Cable glands M25x1,5 (for temperatures from -20°C up to +60°C )	63 456 582	34	1
Cable glands M16x1,5 (for temperatures from -50°C up to +40°C )	63 456 086	34	1
Cable glands M25x1,5 (for temperatures from -50°C up to +40°C )	63 456 087	34	1
Cable glands M20x1,5	63 456 596	34	1
Cable glands M25x1,5	63 456 597	34	1

**Warning:** By supplying spare parts, the manufacturer is not responsible for damages caused by their disassembly and assembly. Installation, replacement of spare parts must be performed by authorized, qualified personnel.

## 7. Enclosures

### 7.1 Wiring diagrams







**Legend:**


Z279c.....	wiring diagram of 3-phase electric motor with led out thermal protection		
Z279h .....	wiring diagram of 3-phase electric motor with led out thermal protection - PTC		
Z403a .....	wiring diagram of torque and position switches		
Z575 .....	wiring diagram of torque and position switches with local control		
Z461, Z461f ...	wiring diagram of torque and position switches with tandem position switches		
Z575a .....	wiring diagram of torque and position switches with tandem position switches and local control		
Z5a,Z5c .....	wiring diagram of single resistive transmitter		
Z6a,Z6c .....	wiring diagram of double resistive transmitter		
Z10a .....	wiring diagram of resistive with current converter or capacitive transmitter – 2-wire without power supply		
Z10g .....	wiring diagram of electronic position transmitter or capacitive transmitter or current transmitter DCPT 3M – 2-wire without power supply		
Z269r .....	wiring diagram of electronic position transmitter or capacitive transmitter or current transmitter DCPT 3M – 2-wire with power supply, 4-20mA		
Z41a .....	wiring diagram of space heater and space heater's thermal switch		
Z257b .....	wiring diagram of electronic position transmitter with current converter, 3-wire without power supply		
Z257m .....	wiring diagram of electronic position transmitter, 3-wire without power supply, 0-10V		
Z257n.....	wiring diagram of capacitive transmitter, 3-wire without power supply, 0-5mA		
Z260f,Z260h ...	wiring diagram of electronic position transmitter, 3-wire with power supply		
Z260k.....	wiring diagram of electronic position transmitter, 3-wire with power supply, 0-10V		
Z260m .....	wiring diagram of capacitive transmitter, 3-wire with power supply, 0-5mA		
Z269p ... ..	wiring diagram of resistive transmitter with current converter or capacitive transmitter – 2-wire with power supply		
Z457b .....	wiring diagram of transmitter DCPT3M without power supply		
Z457c.....	wiring diagram of transmitter DCPT3M with power supply		
B1 .....	resistive transmitter (potentiometer) single	R <sub>L</sub> .....	loading resistor
B2 .....	resistive transmitter (potentiometer) double	S1 .....	torque switch "open"
B3 .....	capacitive transmitter or resistive with current converter	S2 .....	torque switch "closed"
B3b.....	DCPT3M transmitter	S3 .....	position switch "open"
E1 .....	space heater	S4 .....	position switch "closed"
F1 .....	motor's thermal protection – termokontakt	S5 .....	additional position switch "open"
PTC.....	motor's thermal protection - PTC	S6 .....	additional position switch "closed"
F2 .....	space heater's thermal switch	S13.....	tandem position switch "open"
I/U .....	input / output current (voltage) signals	S14.....	tandem position switch "closed "
KM1, KM2 ...	reverse contactor	X .....	terminal board
M .....	electric motor	X3 .....	electric motor's terminal board

**Note 1:**

The torque tripping is equipped with a mechanical interlocking mechanism.

**Switch operation chart**

Switch	terminals	Open		close	
				operating stroke	
S1	11 (M2) - 12				
	12 - 14				
S2	15 (M3) - 16				
	16 - 18				
S3	19 - 20				
	20 - 22				
S4	23 - 24				
	24 - 26				
S5	27 - 28				
	28 - 30				
S6	31 - 32				
	32 - 34				
S13	43 - 44				
	44 - 46				
S14	47 - 48				
	48 - 50				

 Closed contact

 Opened contact

*Remark 1:* The S1, S2 torque switches trip when the set up tripping torque is achieved doesn't matter in which point of the working stroke, it doesn't apply for the set up range of interlocking during EA reversal from any position

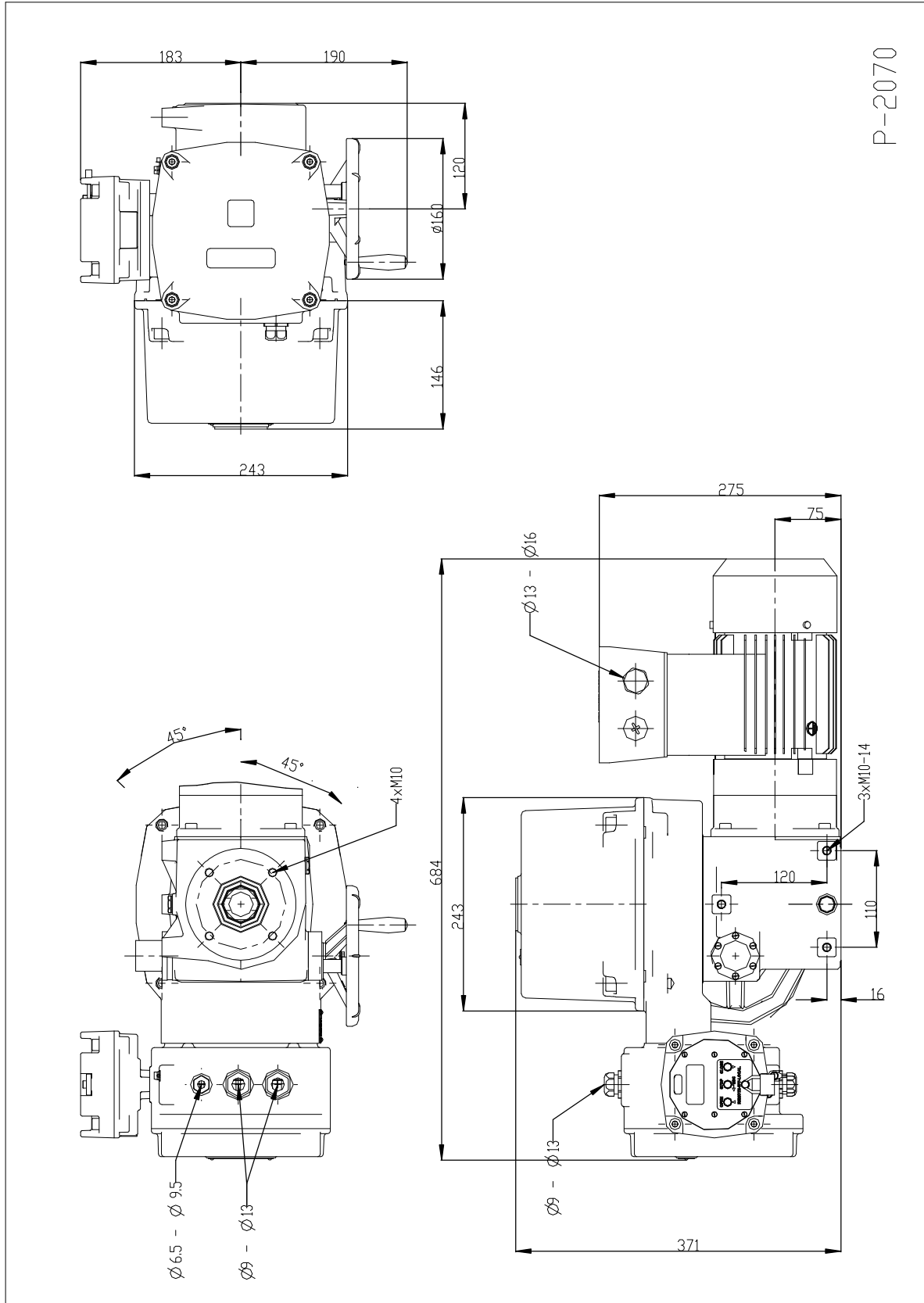
*Remark 2:* The S5, S6 signaling switches are settable within the range from the end position up to a position corresponding to the 50% of the working stroke. If a larger range for signaling purposes is necessary, the reversal function of the switches is available.

*Remark 3:* Tandem position switches S13, S14 are switched by one cam together with position switches S3, S4.

## 7.2 Dimension drawings and mechanic connections

Note: For these types of EA in all versions are valid dimensions marked \*.

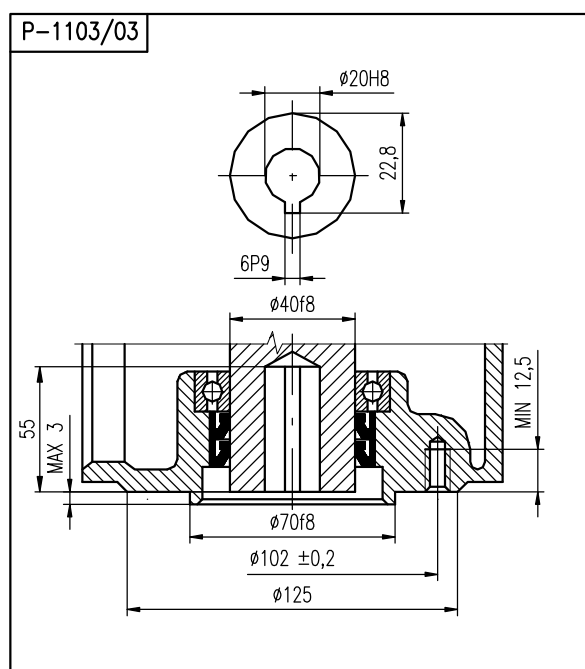
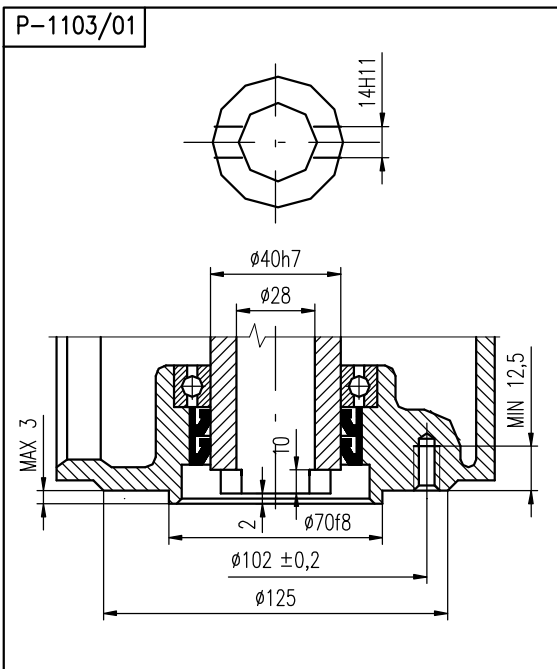
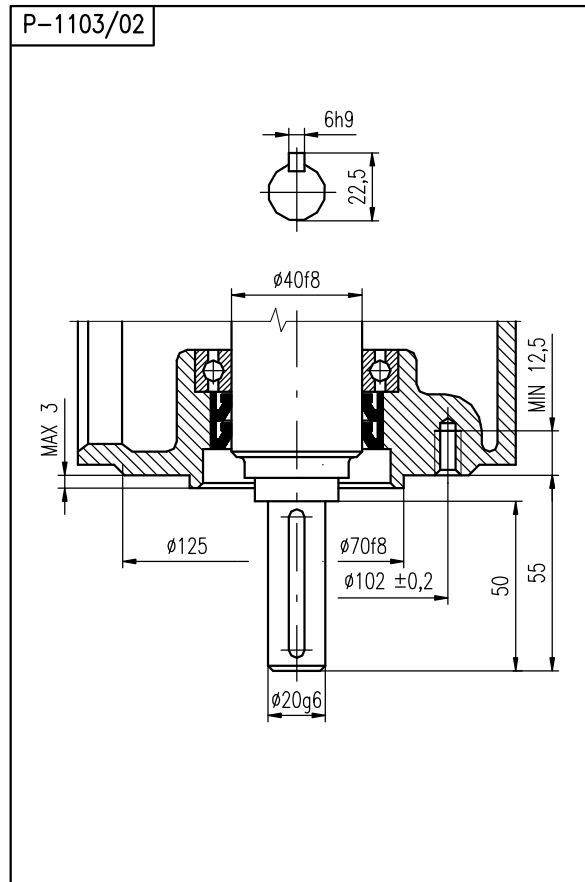
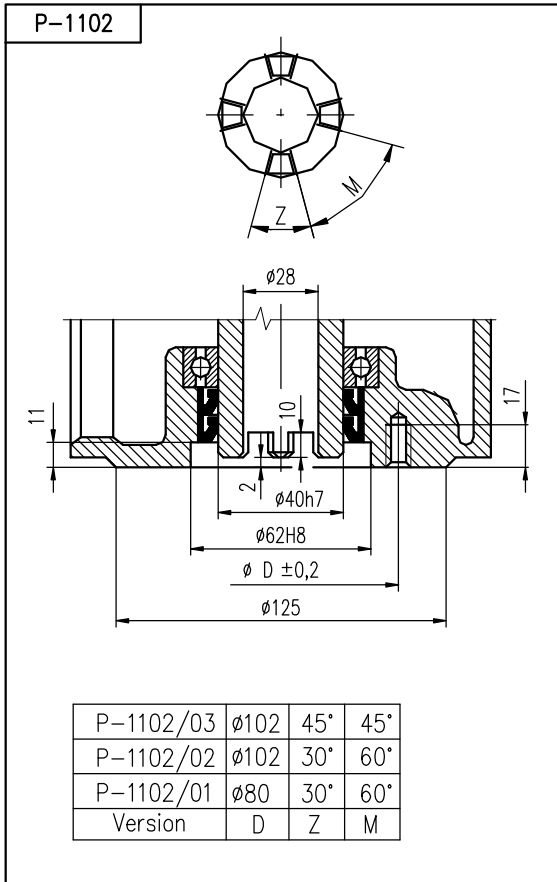
### 7.2.1 Dimension drawings for EA MO 3 - Ex



**Mechanic connections for EA MO 3-Ex without connect adapter**

4 x tooth

F10 – shape D



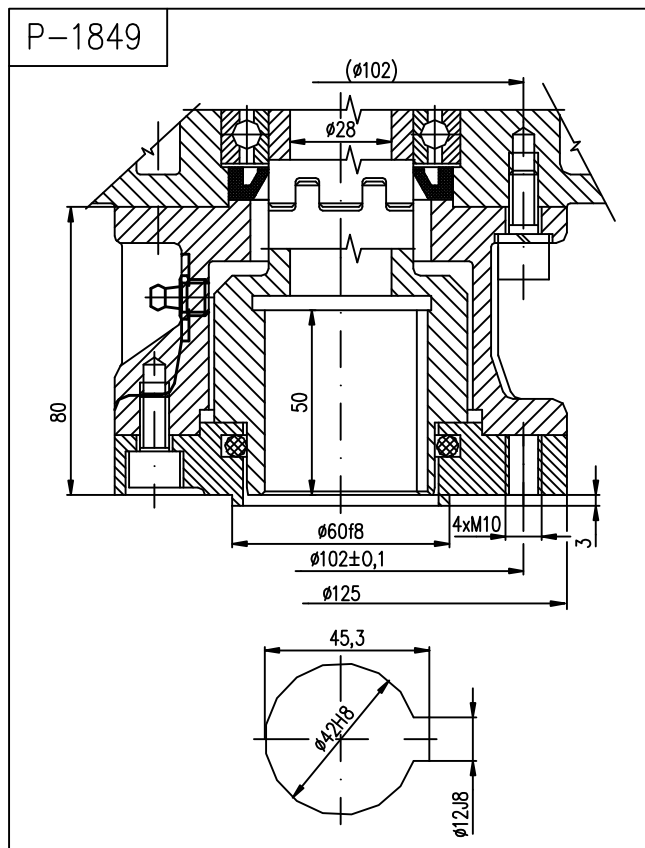
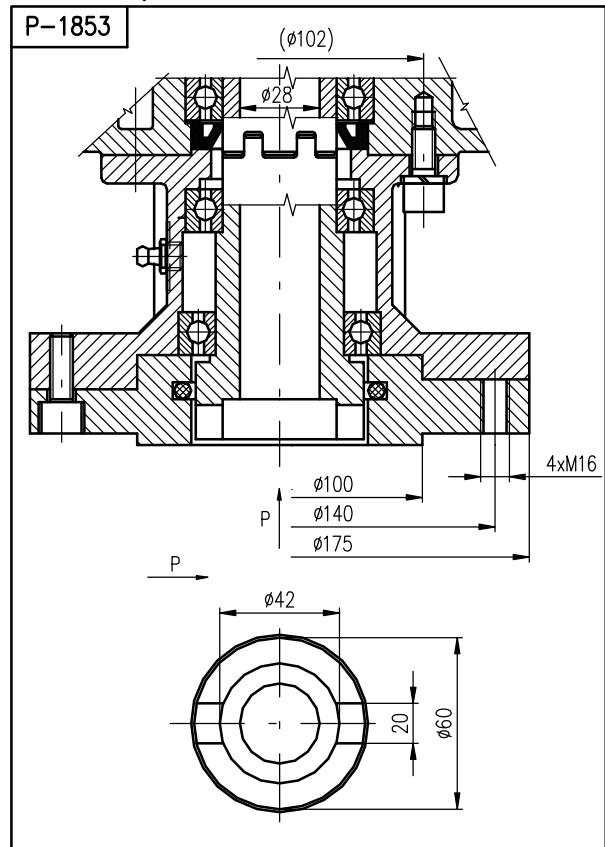
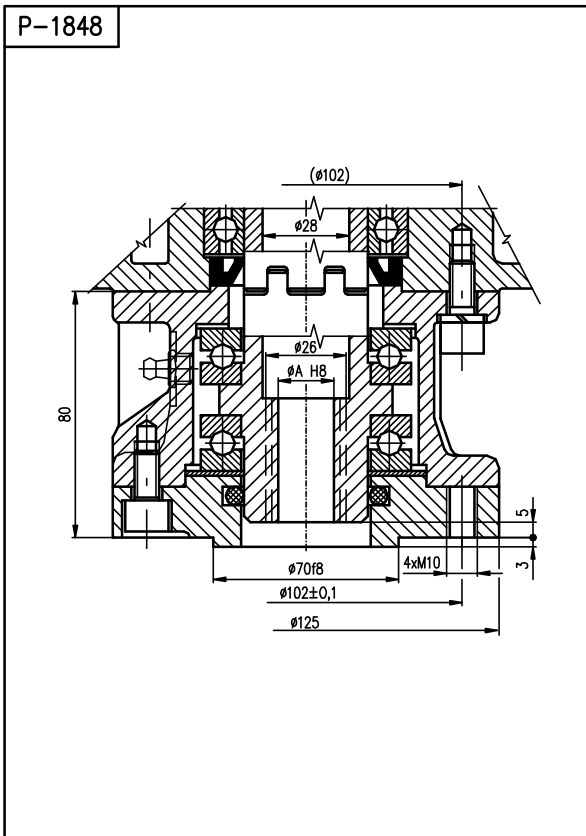
F10 – shape C

F10 – shape E; ISO 5210

**Mechanic connections for EA MO 3-Ex with connect adapter**

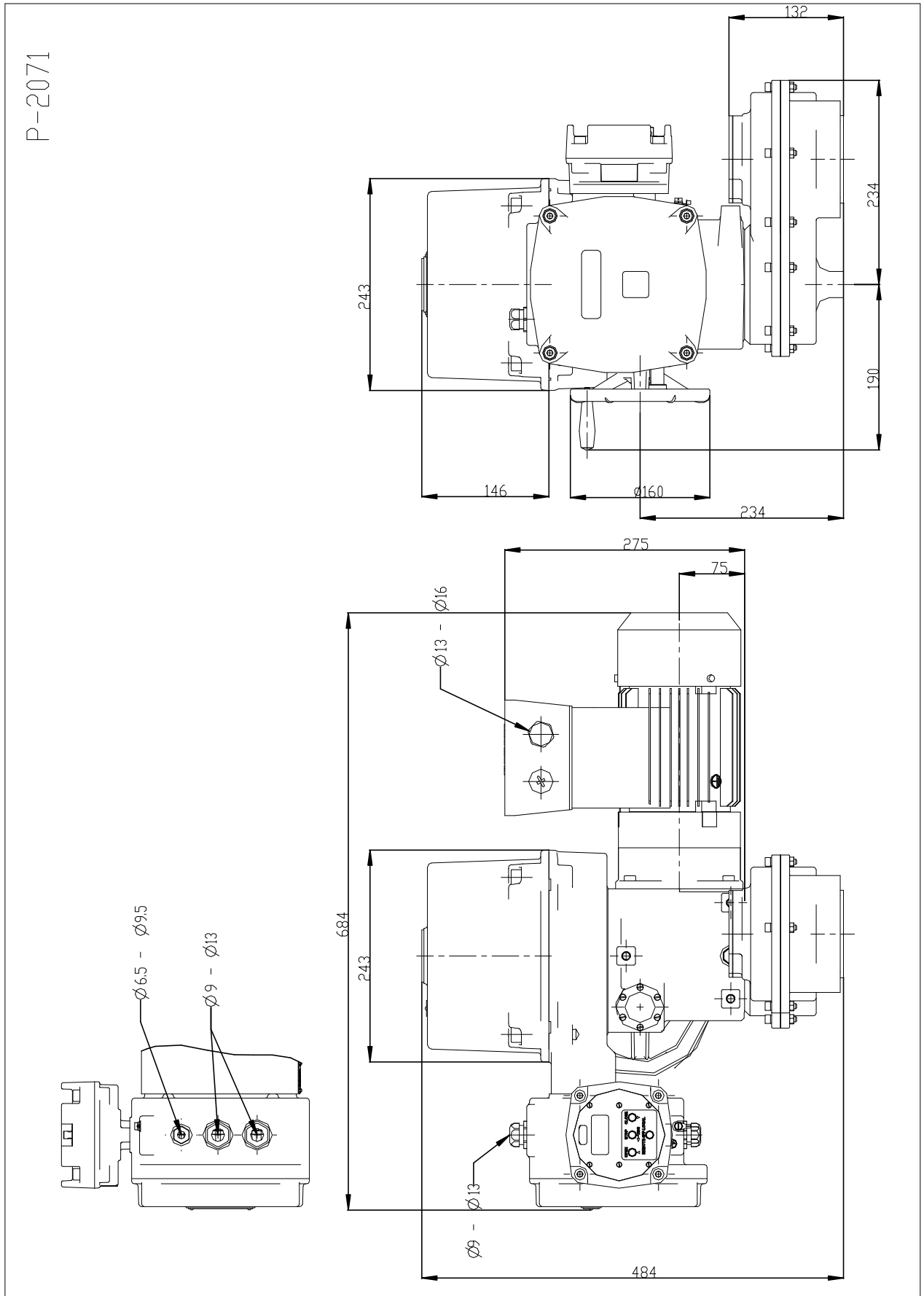
F10 – shape A

F14 – shape C



F10 – shape B1; ISO 5210

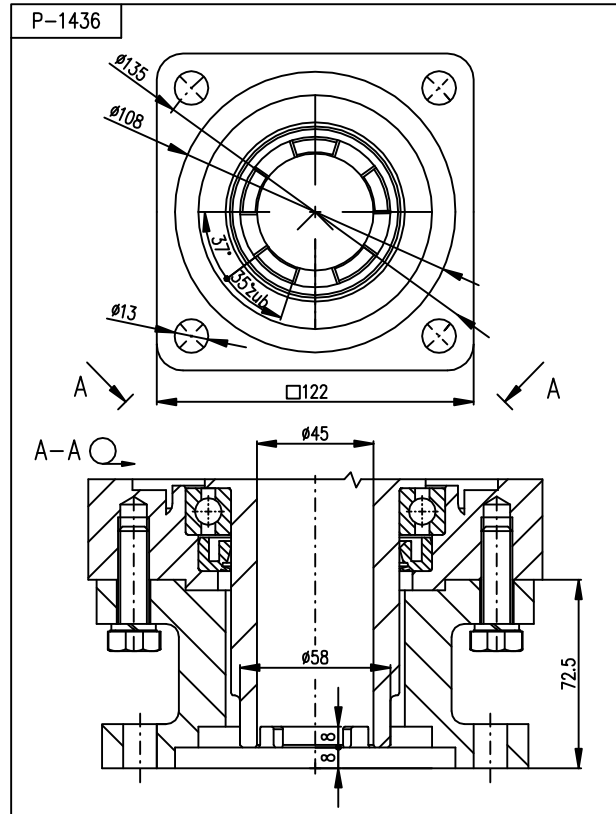
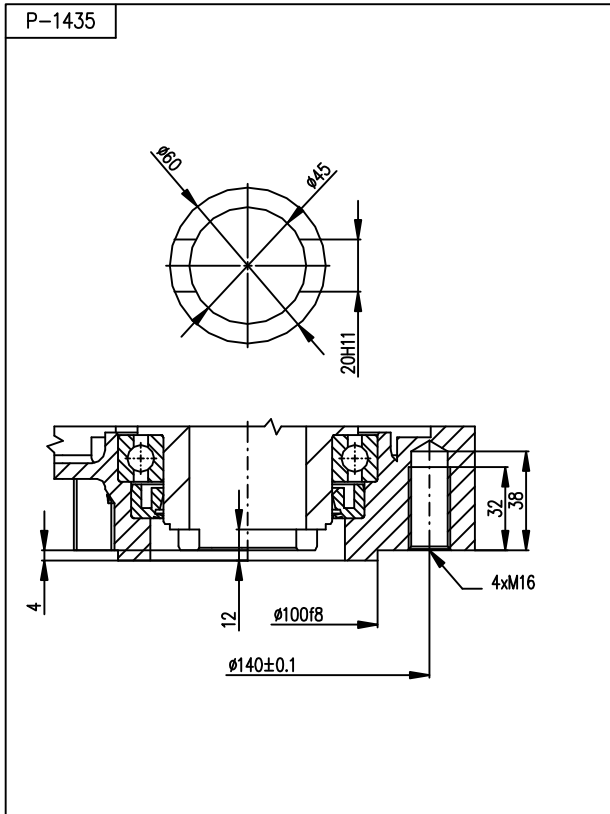
7.2.2 Dimension drawings for EA MO 3.4-Ex



**Mechanic connections for EA MO 3.4 –Ex without connect adapter**

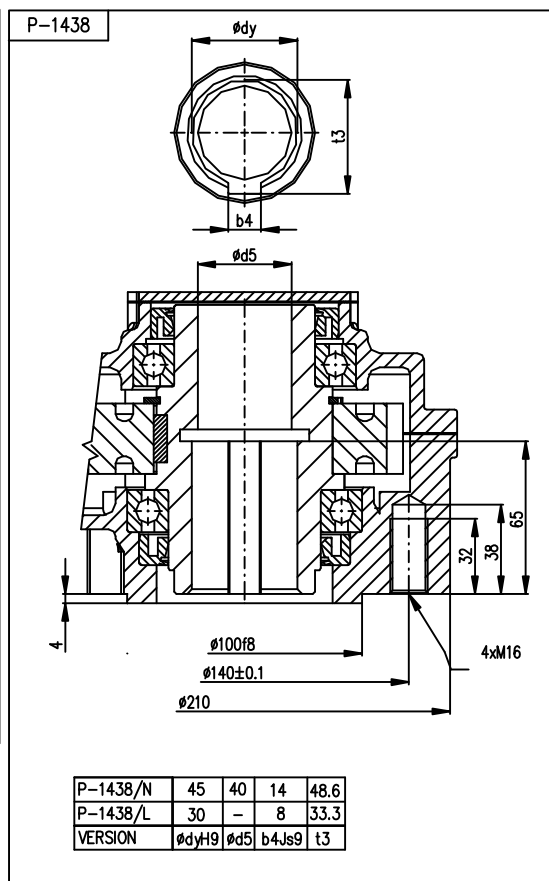
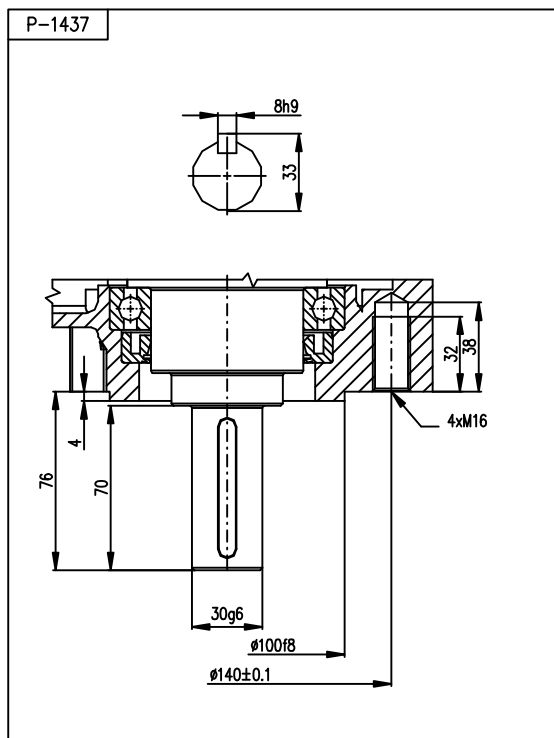
shape C

5 tooth 35°/37° ; GOST R 555 10

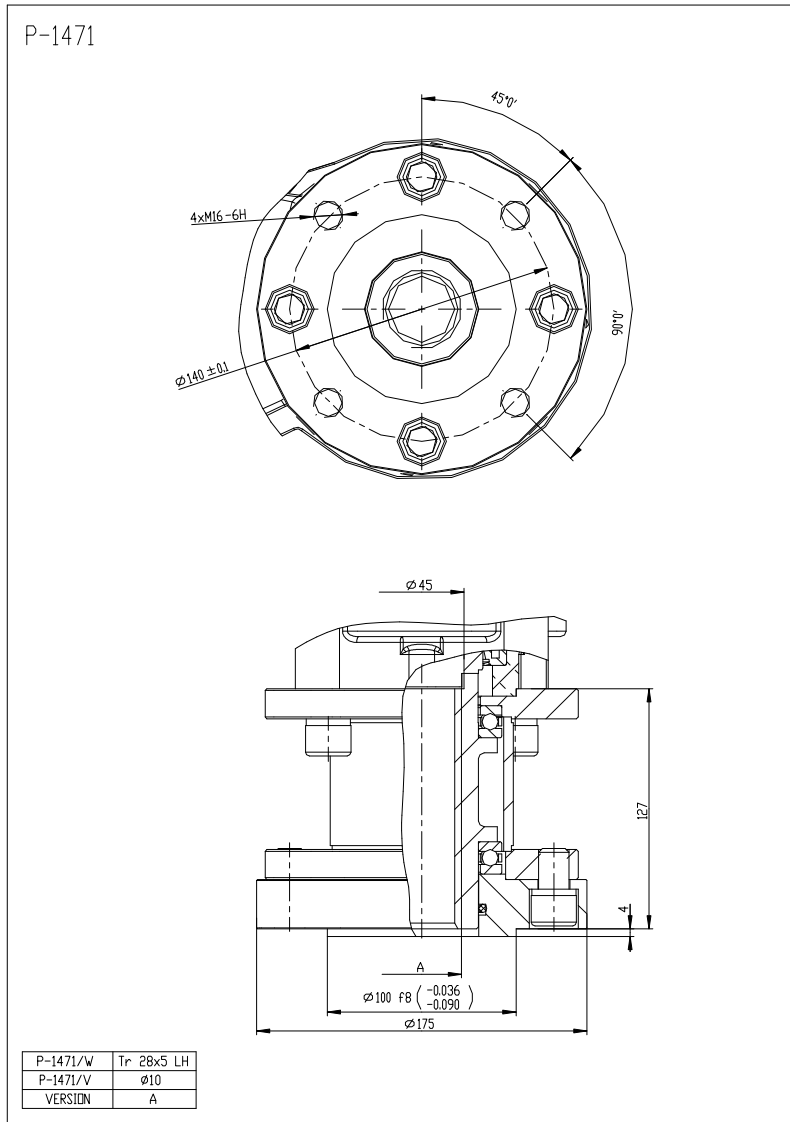


shape D

shape B2; B3; ISO 5210

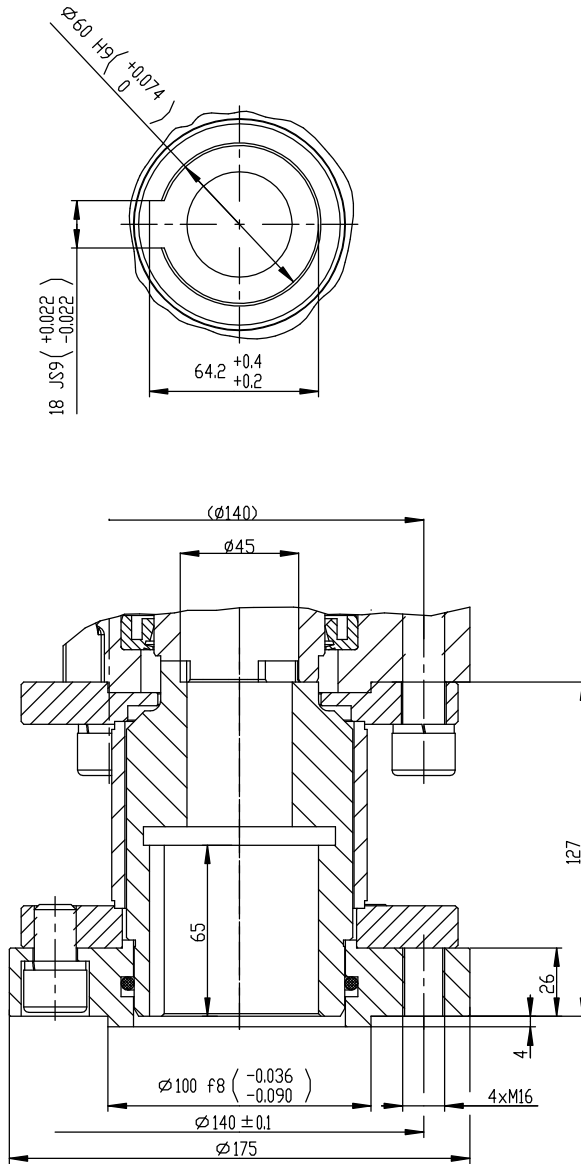


## Mechanic connections for EA MO 3.4-Ex with connect adapter

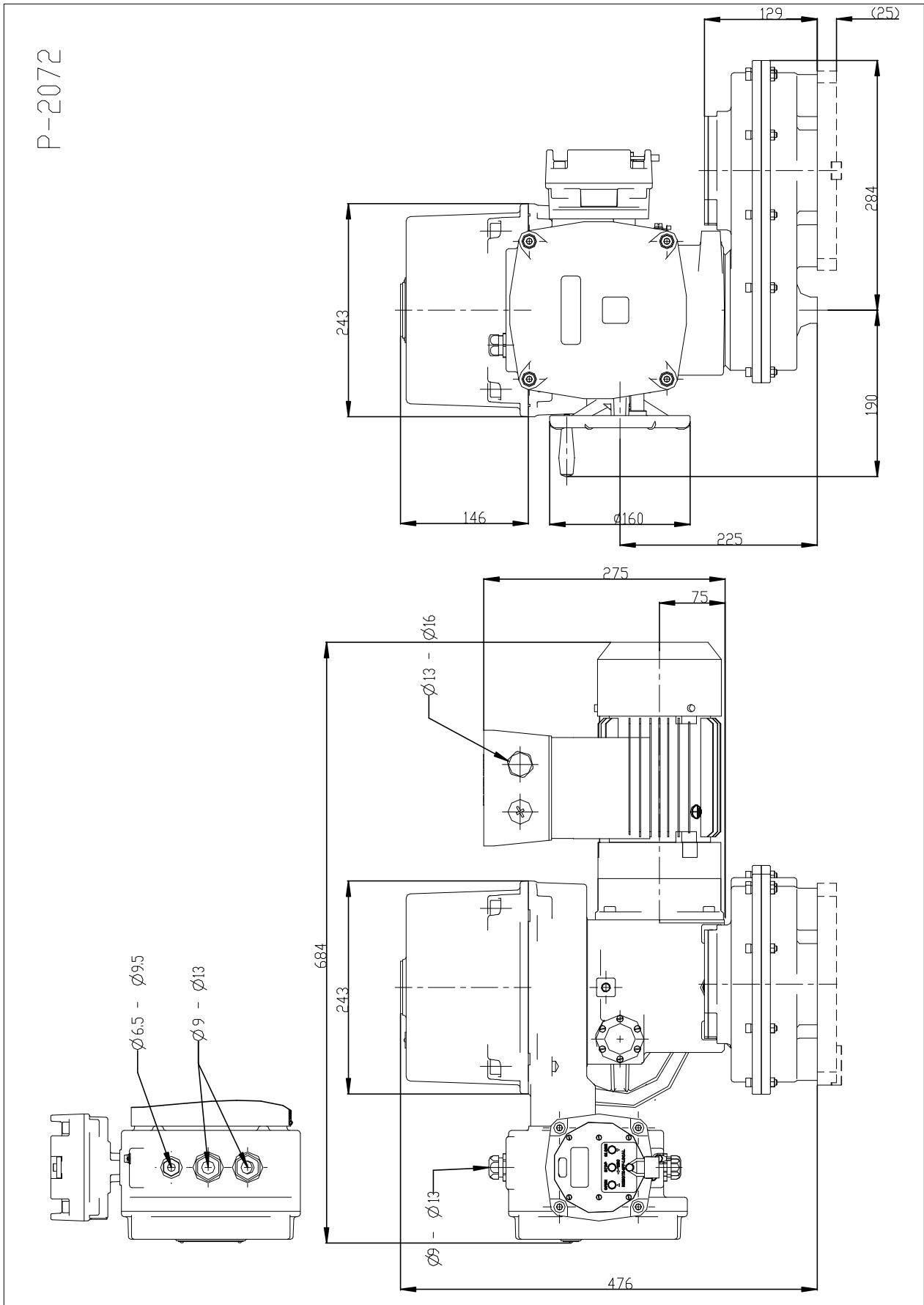




P-1463



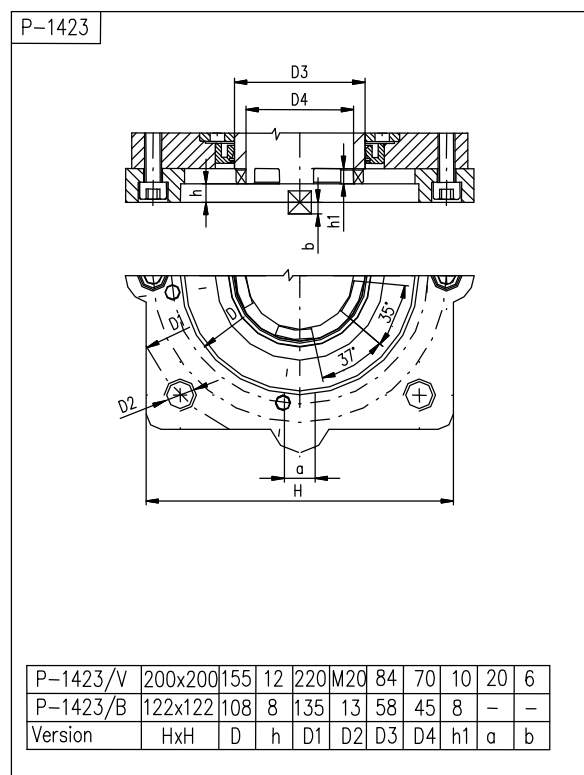
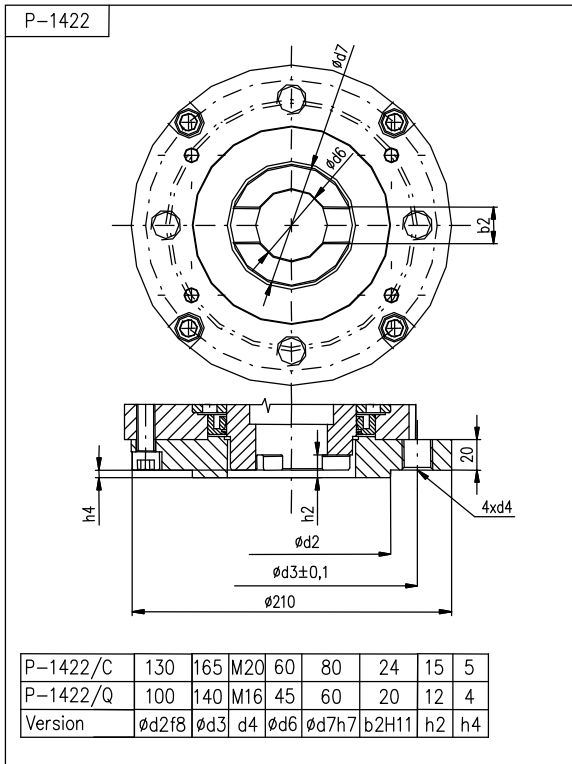
7.2.3 Dimension drawings for EA MO 3.5-Ex



**Mechanic connections EA MO 3.5-Ex without connect adapter**

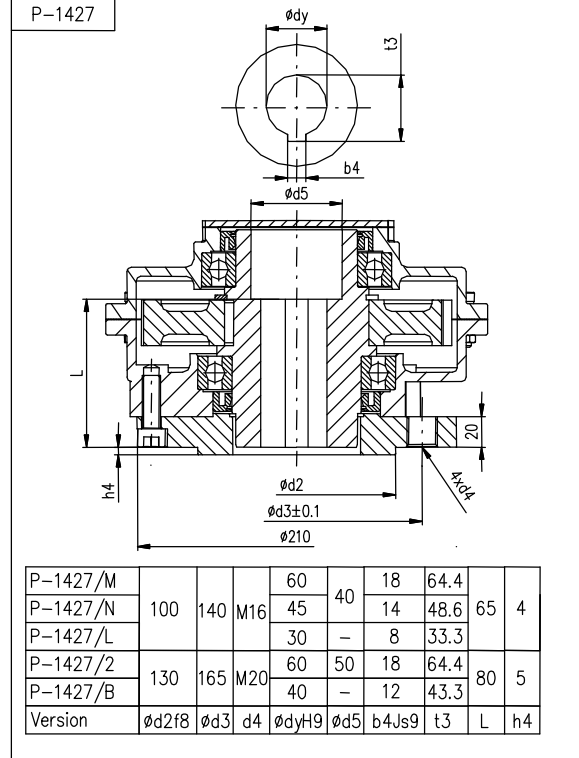
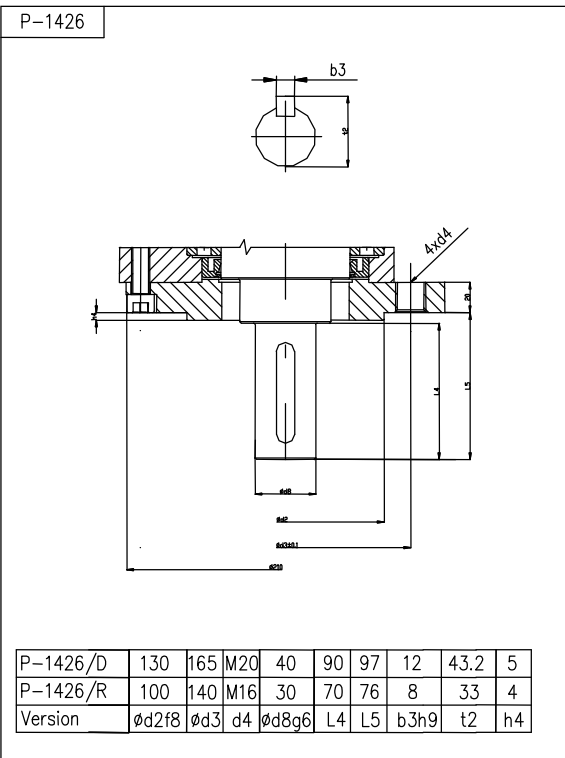
shape C

shape 5 tooth 35°/37°; GOST R 555 10



shape D

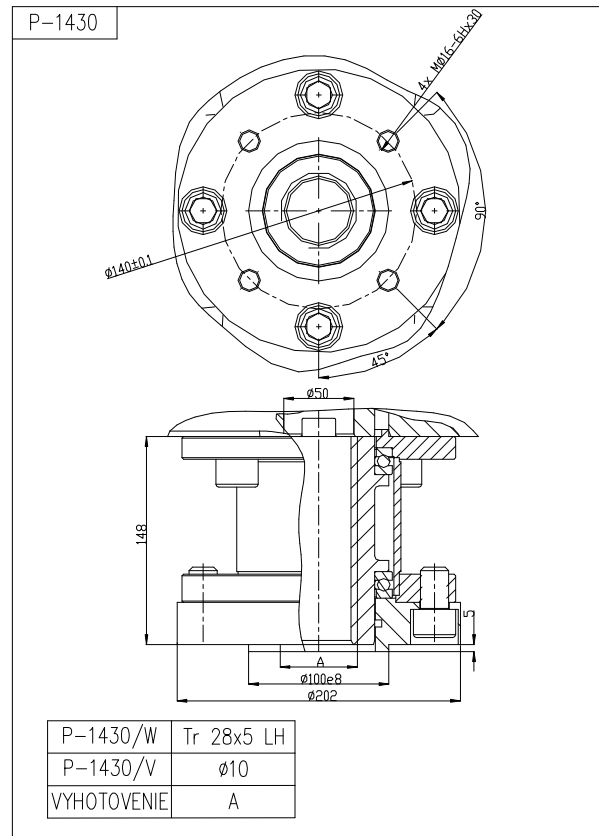
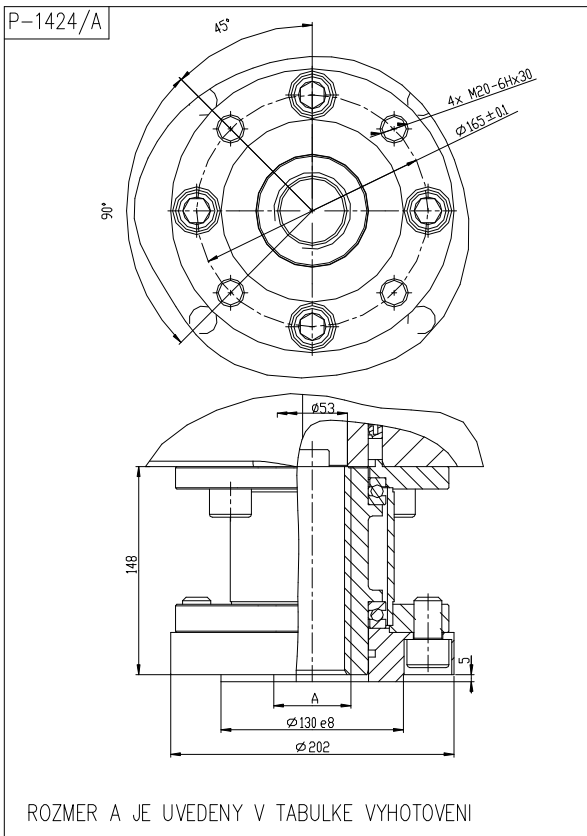
shape B1; B2, B3; ISO 5210



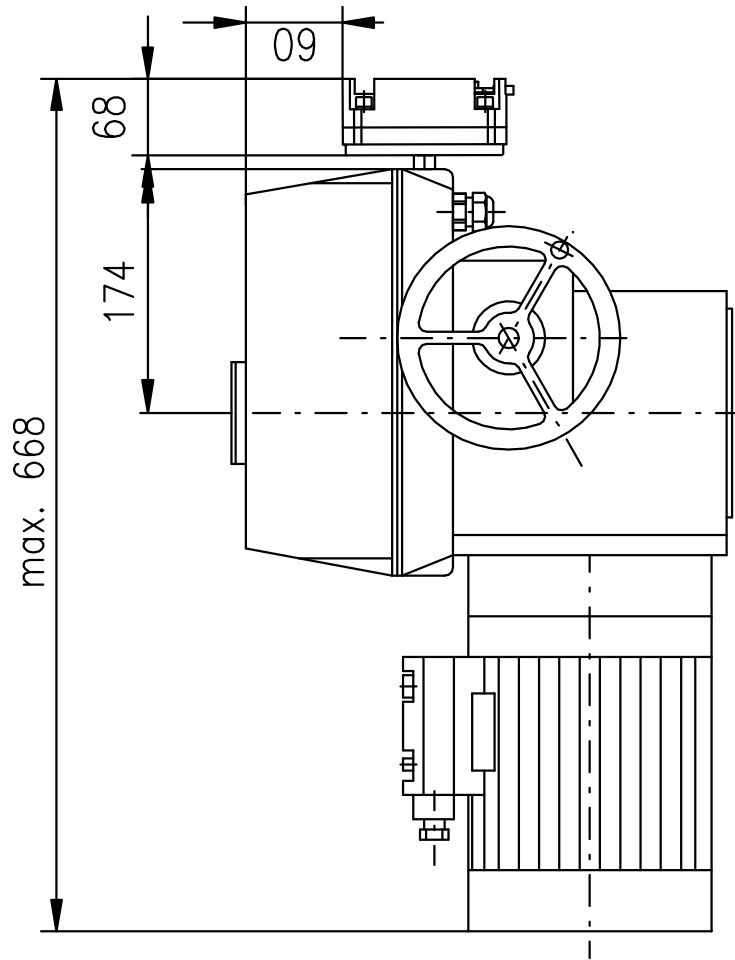
**Mechanic connections for EA MO 3.5-Ex with connect adapter**

F16 – shape A; ISO 5210

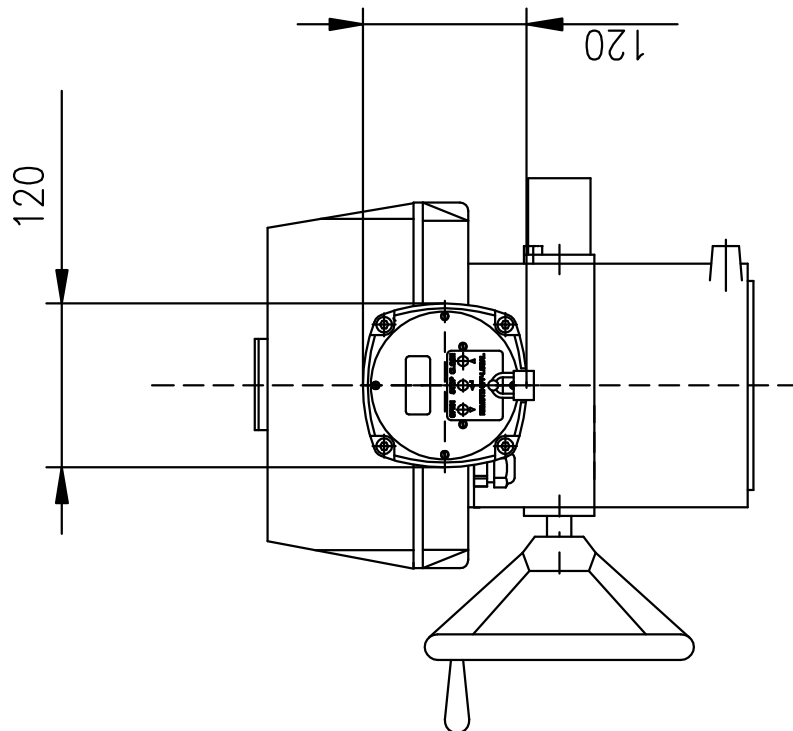
F14 – shape A; ISO 5210



EA MO 3-Ex, MO 3.4-Ex, MO 3.5-Ex with local control

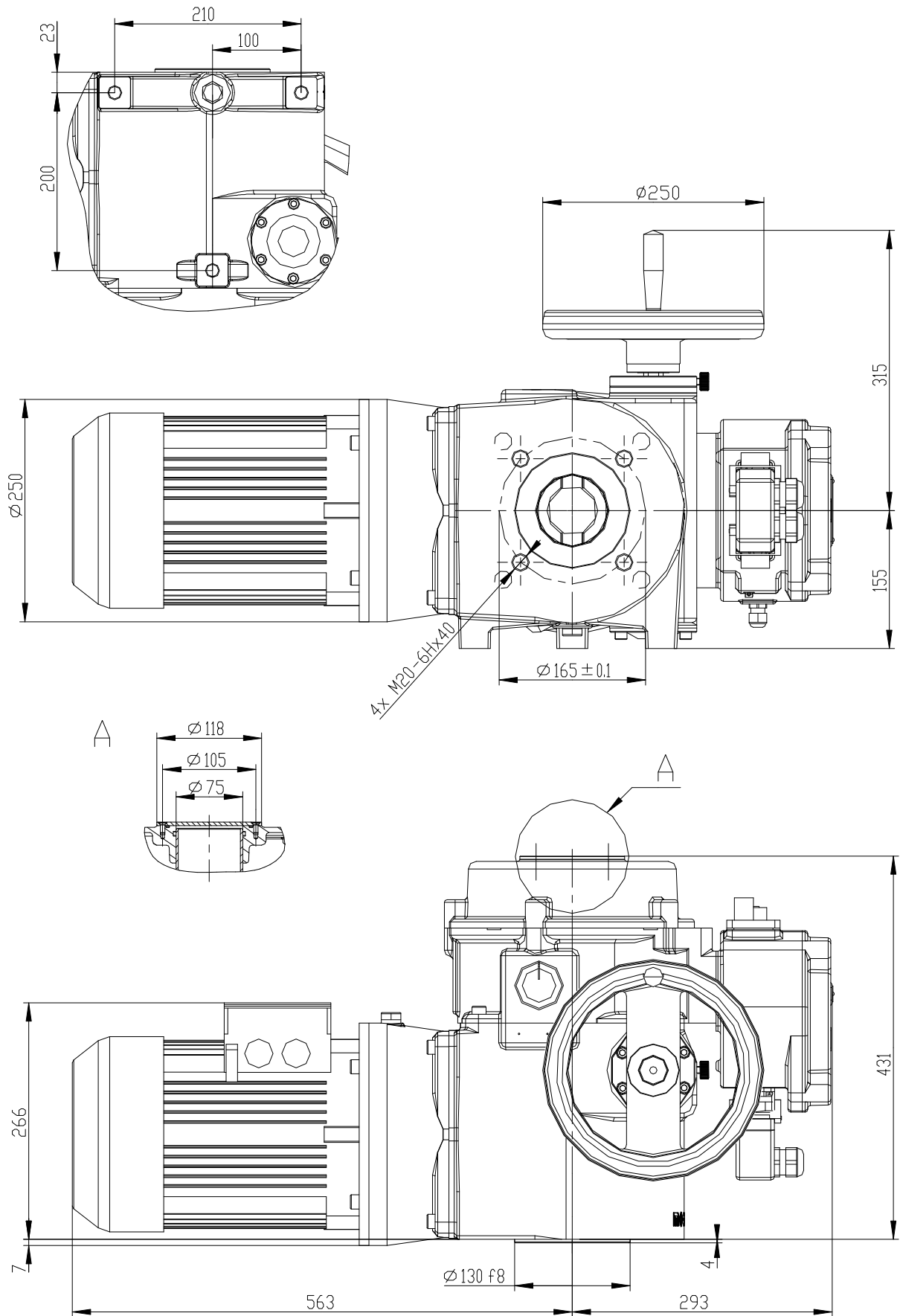


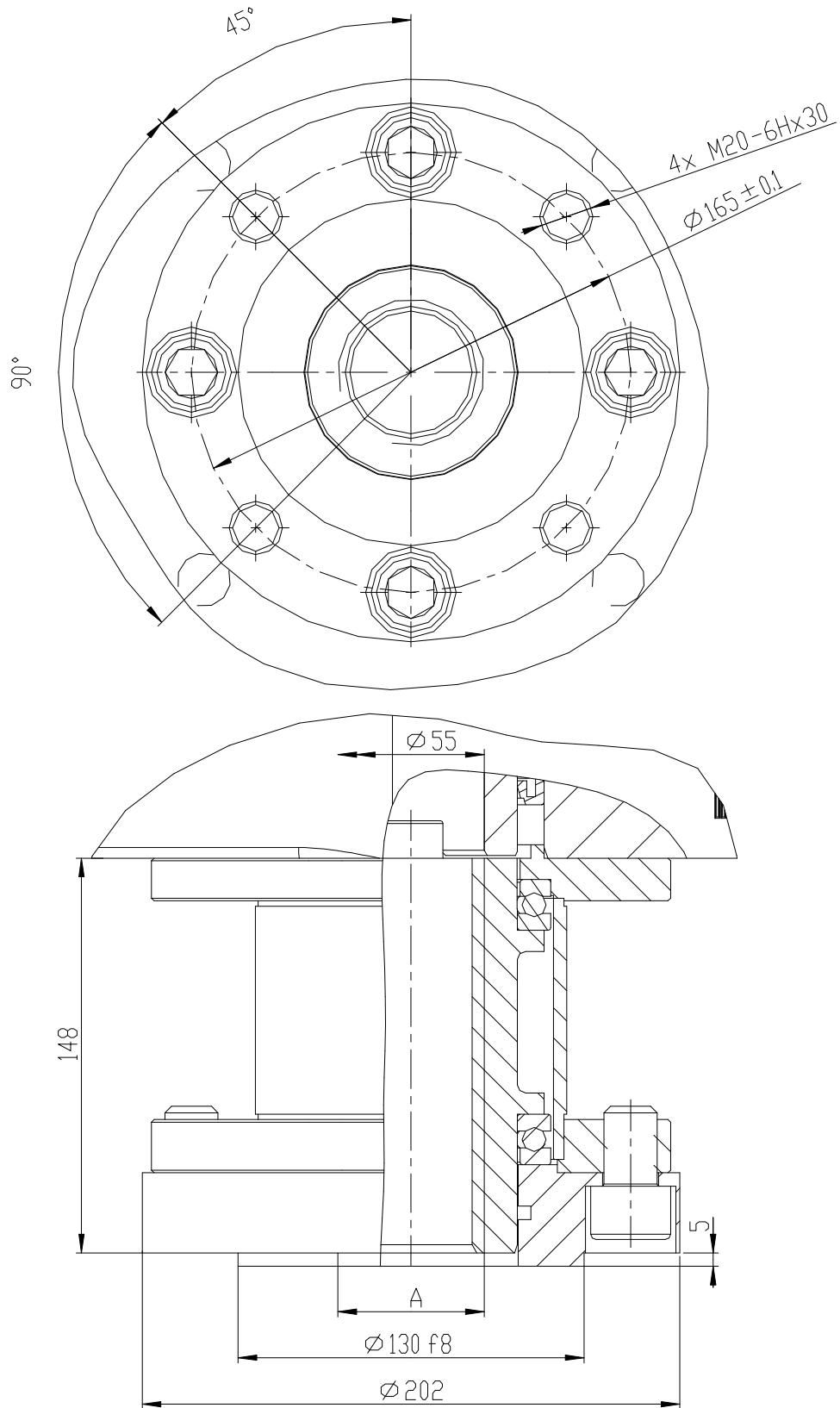
P-2069



**7.2.4 Dimension drawings for EA MO 5 - Ex**

P-1424	EA	MO 5 –Ex Connections ISO 5210, F16
P-1424/A	EA	MO 5-Ex ISO 5210, shape A
P-1424/B	EA	MO 5-Ex ISO 5210, shape B3
P-1424/C	EA	MO 5-Ex, shape C
P-1424/D	EA	MO 5 –Ex shape D
P-1425	EA	MO 5 –Ex Connections GOST R 555 10φ220/4xM20
P-1425/1	EA	MO5-Ex shape five toot 35°/37°

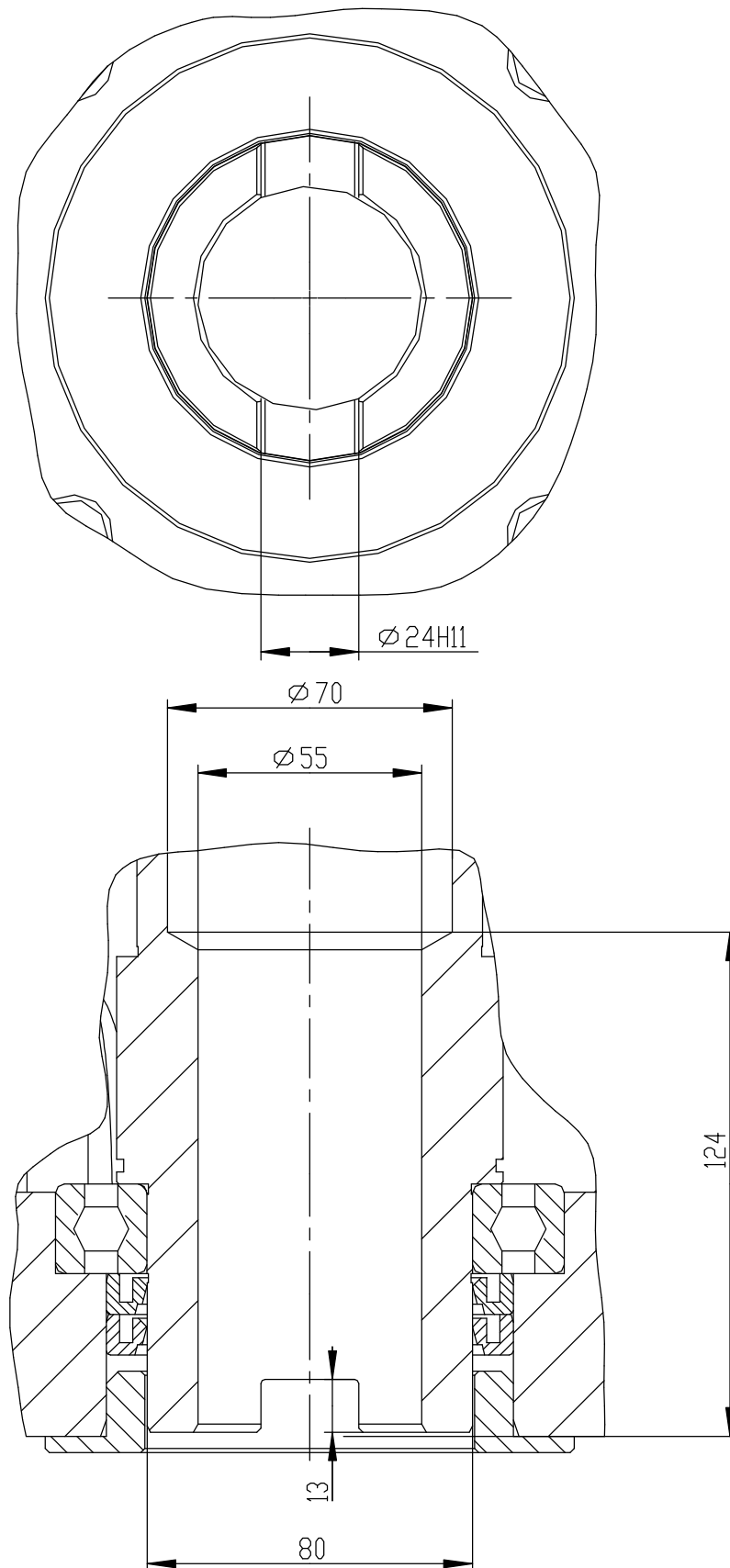




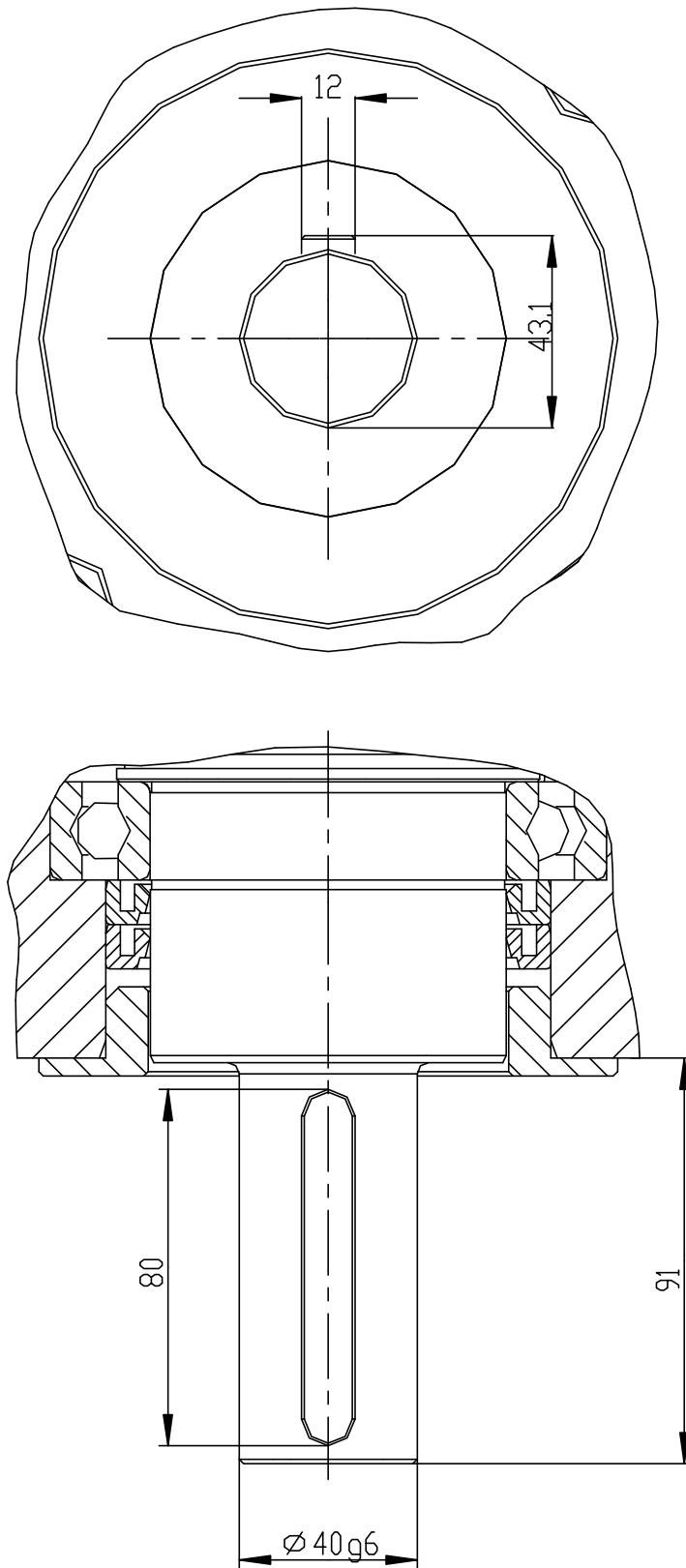
Dimension A is in table of version

P-1424/A

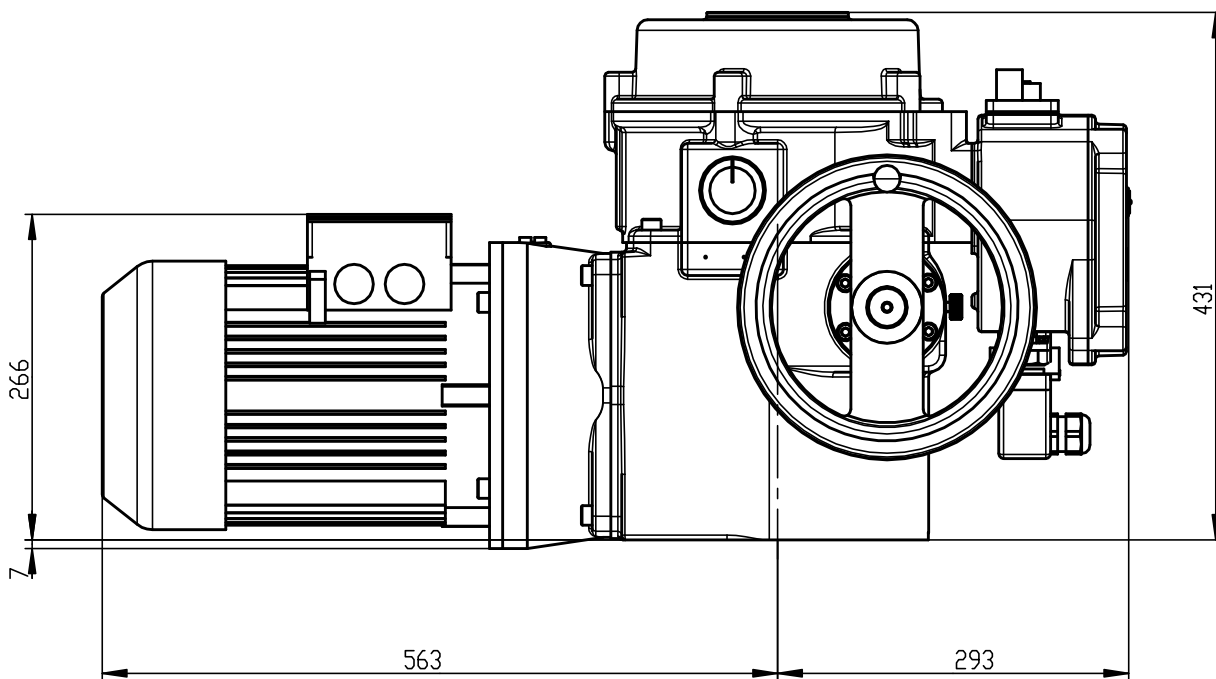
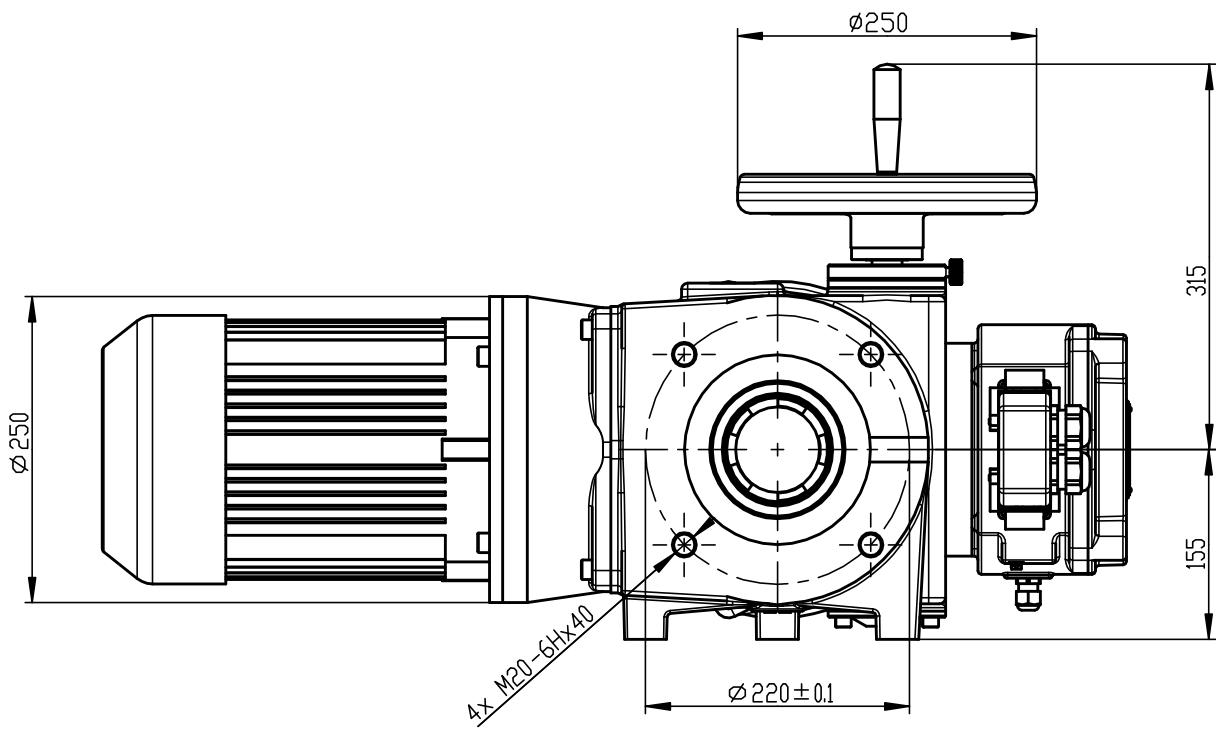




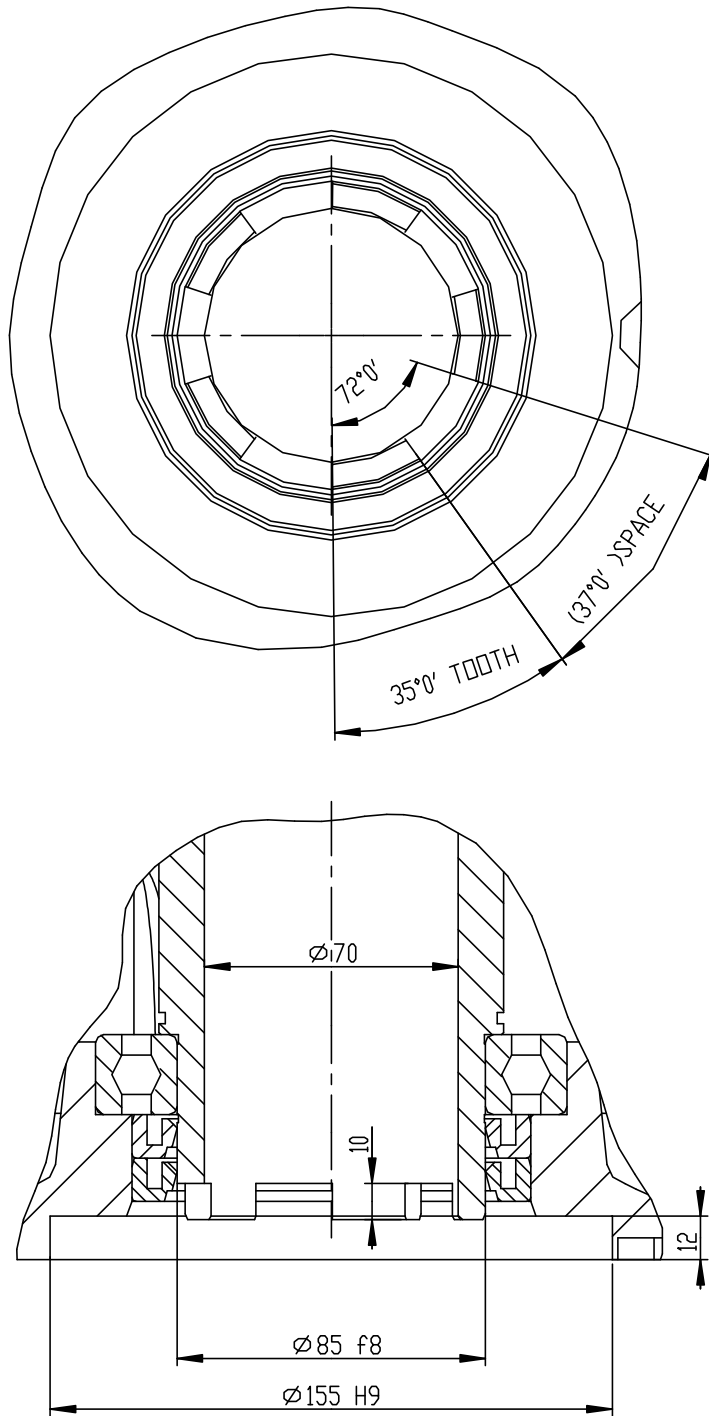
P-1424/C



P-1424/D

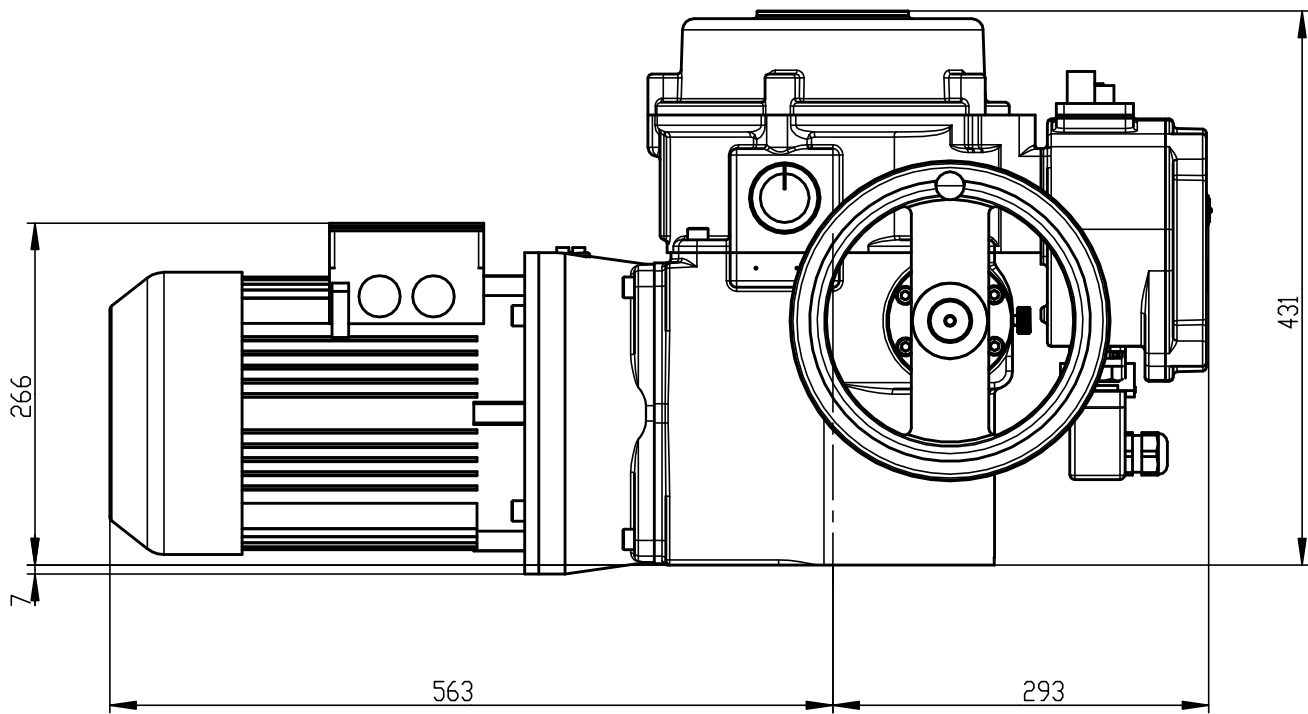
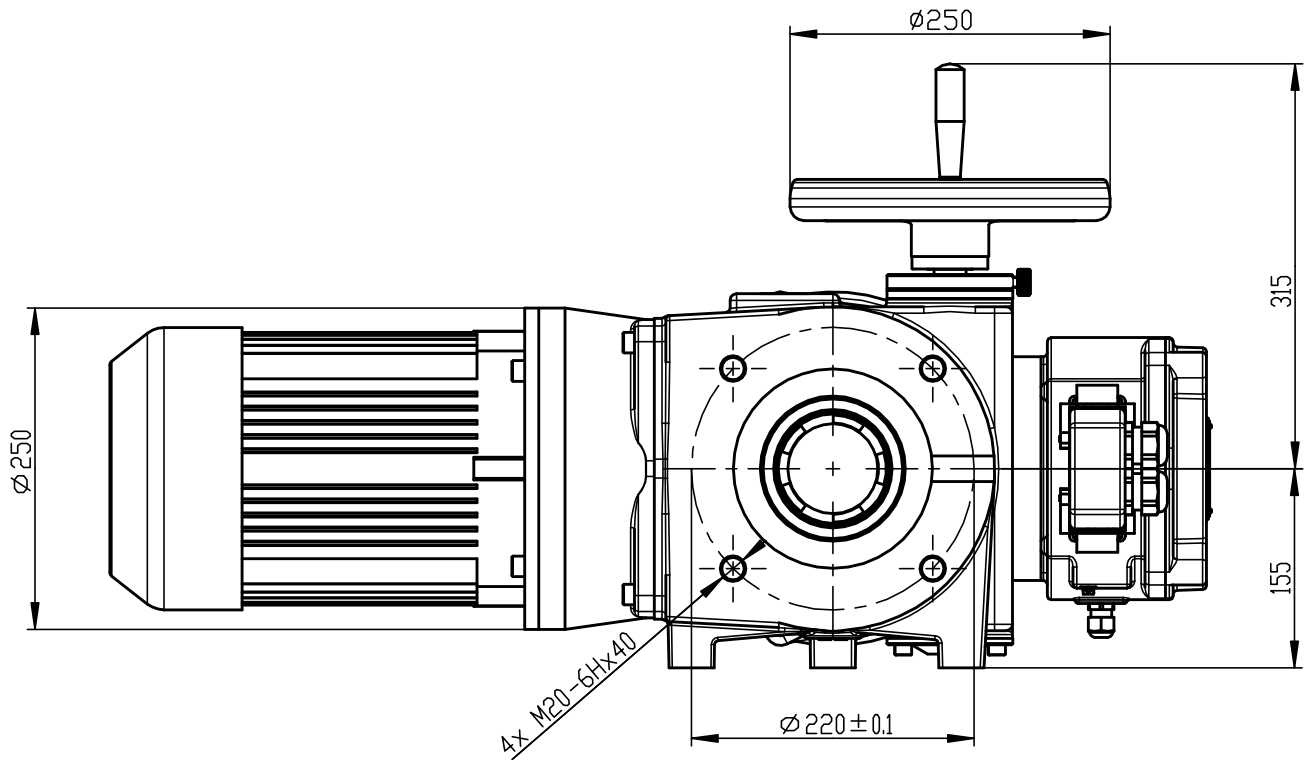


P-1425



P-1425

Dimensional connection drawings according to GOST R 555 10



**7.3 Guarantee service check report**

<b>Service center:</b>	
<b>Date of repair:</b>	<b>Guarantee repair no.:</b>
<b>User of actuator:</b>	<b>Claim applied by:</b>
<b>Actuator type number:</b>	<b>Actuator production number:</b>
<b>Product claim fault:</b>	<b>Detected product fault:</b>
<b>Used spare parts:</b>	
<b>Remarks:</b>	
<b>Issued on a day:</b>	<b>Signature:</b>

**7.4 Post guarantee service check report**

<b>Service center:</b>	
<b>Date of repair:</b>	
<b>User of actuator:</b>	<b>Actuator operating place :</b>
<b>Actuator type number:</b>	<b>Actuator production number:</b>
<b>Detected product fault:</b>	
<b>Used spare parts:</b>	
<b>Remarks:</b>	
<b>Issued on a day:</b>	<b>Signature:</b>

## **7.5 Commercial representation**

### ***Slovak Republic:***

**Regada, s.r.o.,**  
Strojnícka 7,  
080 01 Prešov  
Tel.: +421 (0)51 7480 460,  
Fax: +421 (0)51 7732 096,  
E-mail: [regada@regada.sk](mailto:regada@regada.sk)

### ***Czech republic:***

**REGADA Česká s.r.o. (Ltd.)** – exclusive representation REGADA, s.r.o. (Ltd.) for sale of electric actuators

**Regada Česká, s.r.o.**

Kopaninská 109  
252 25 Ořech  
PRAHA – západ  
Tel.: +420 257 961 302  
Fax: +420 257 961 301