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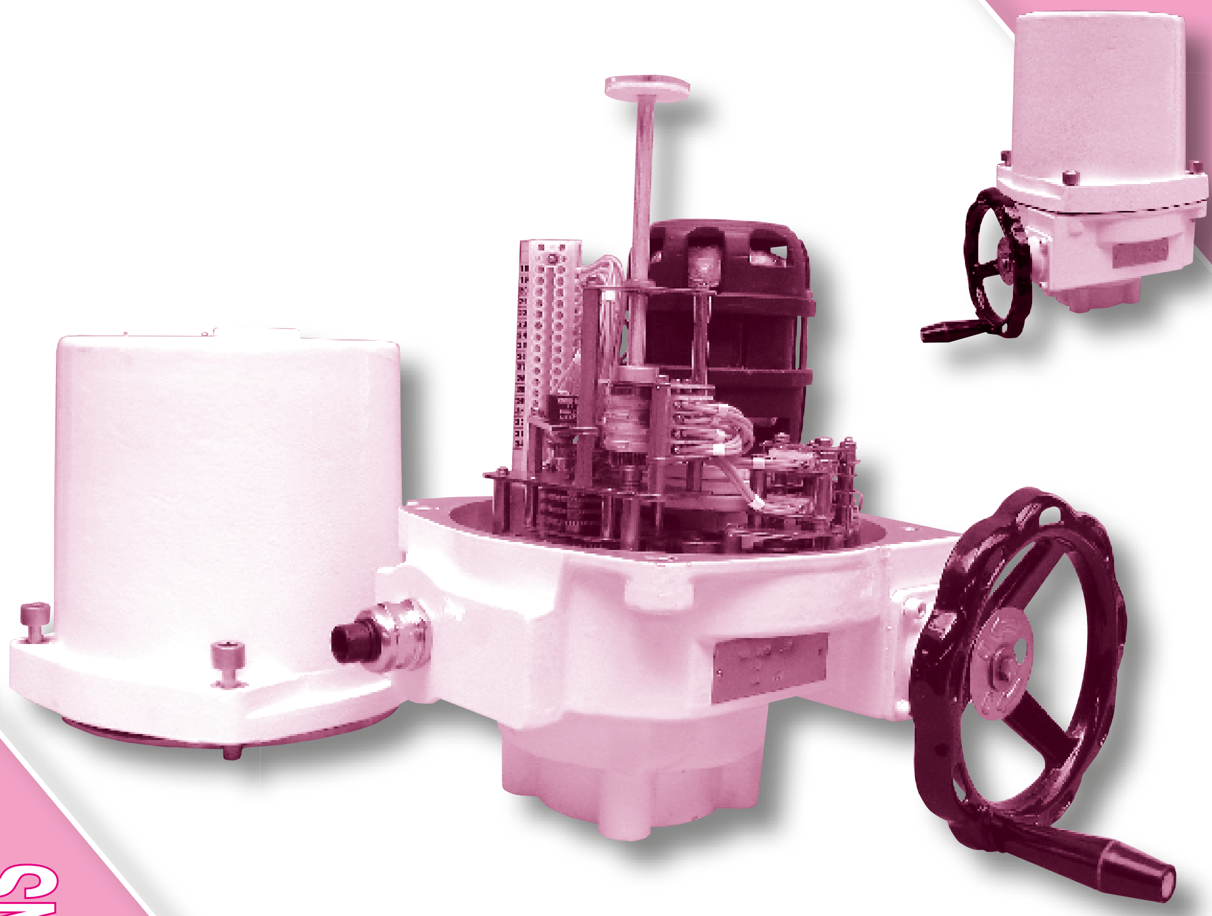


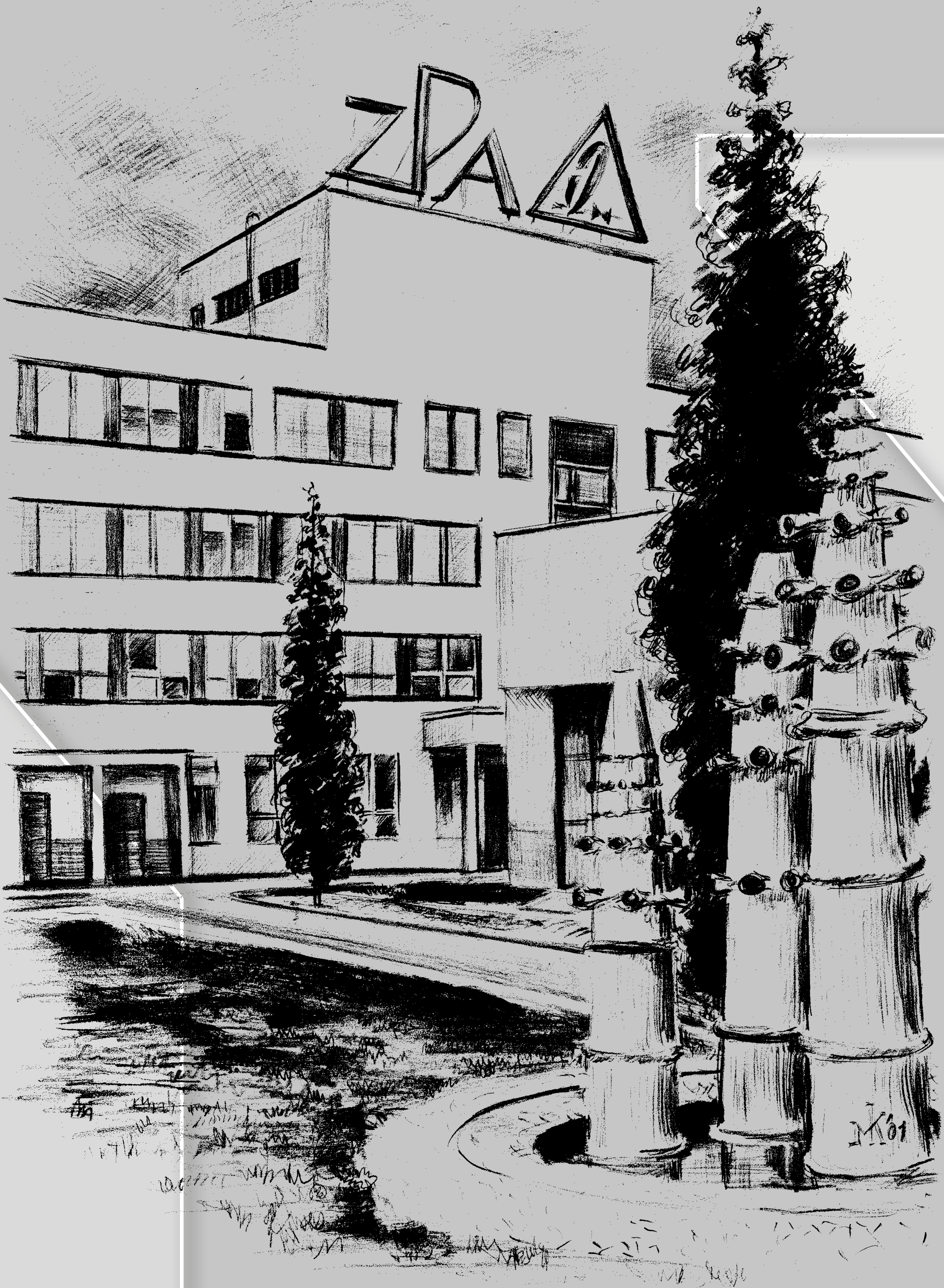
MOUNTING INSTRUCTIONS

Electric multi-revolution actuator for nuclear power plants outside containment

MODACT MOA

Type number 52 029

2/19



ZPA Pečky, a.s. is certified company in accordance with ISO 9001 as amended.

CONTENS

1. APPLICATION

Electric rotary multi-revolution actuators **MODACT MOA** are designed for remote control of special valves installed in attended areas of nuclear power plants with reactors VVER or RBMK.

2. OPERATING CONDITIONS

The actuators **MODACT MOA** must operate reliably with the following parameters of surrounding environment:

1) Nominal operation regime:

temperature	- 25 °C to + 55 °C
pressure	atmospheric
relative humidity	up to 90 %

2) Regime of “small releases”:

pressure	up to 0.17 MPa
temperature	up to 90 °C
relative humidity	steam-air mixture
period of overpressure action	up to 5 h
frequency of regime occurrence	1x in 2 years (5 cycles in actuator lifetime)
period of operation during operation cycle of 10 min duration	max. 85 s

The actuator will remain operational in the regime of “small releases” and after it.
The actuator requires no revision after the mentioned regime.

3. TECHNICAL PARAMETERS

Basic technical parameters are listed in the design table.

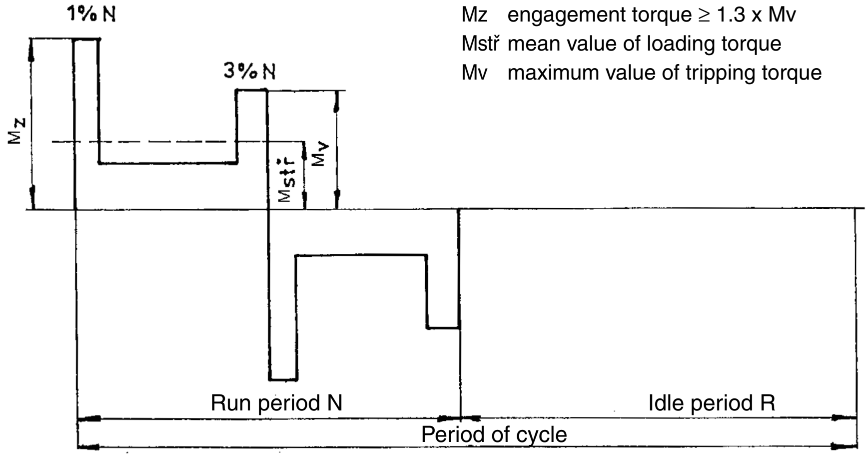
Feeding voltage of electric motor:	3 x 400 V, 50 Hz (or according to data on rating plate)
Type of protective enclosure of actuator:	IP 67
Working position:	working position is arbitrary (position with motor heading down is not recommended)

Working regime - frequency of switching

The actuators can work during short-time loading with the type of loading S2 according to ČSN EN 60 034-1, wherein the course of loading is shown in the figure. The longest working cycle (close-open-close) is 10 minutes with the ratio of run to idle time 1:3 (load factor 25 %). Average loading of the actuator during the running time is 33 % of the value of maximum tripping torque and it is called rated torque.

The actuators can also work in the regime of interrupted run with start-up S4 according to ČSN EN 60 034-1 (e.g. during gradual opening of the valve etc.). The highest number of closing in automatic regulation is 1200 cycles per hour with load factor 25 % (ratio of run to idle time 1:3). Mean value of loading torque is 33 % at most of the maximum tripping torque. The longest working cycle (N+R) is 10 minutes, load factor (N/N+R) is max. 25 %.

The highest mean value of loading torque is equal to rated torque of the actuator.



Course of working cycle

Insulation resistance

Insulation resistance between respective electric circuits and against frame must not, even under more severe working conditions, drop below 0.3 Mohm. Under dry conditions it must be min. 20 Mohm.

Electric strength of insulation

	Test voltage
Electric circuits of actuator with rated voltage up to 250 V	1500 V, 50 Hz
Position transmitter, resistance with rated voltage up to 50 V	500 V, 50 Hz
Electric motor with three-phase rated voltage 400 V (380 V)	1 800 V, 50 Hz according to ČSN EN 60034-1
Position transmitter, current CPT 1AAE	50 V DC

Noise - level of acoustic pressure A is max. 85 dB (A)
- level of acoustic power A is max. 95 dB (A)

Resistance against seismic shocks, against effect of deactivation agents, and other parameters are specified in Technical conditions TP 02-01/05.

4. DESCRIPTION

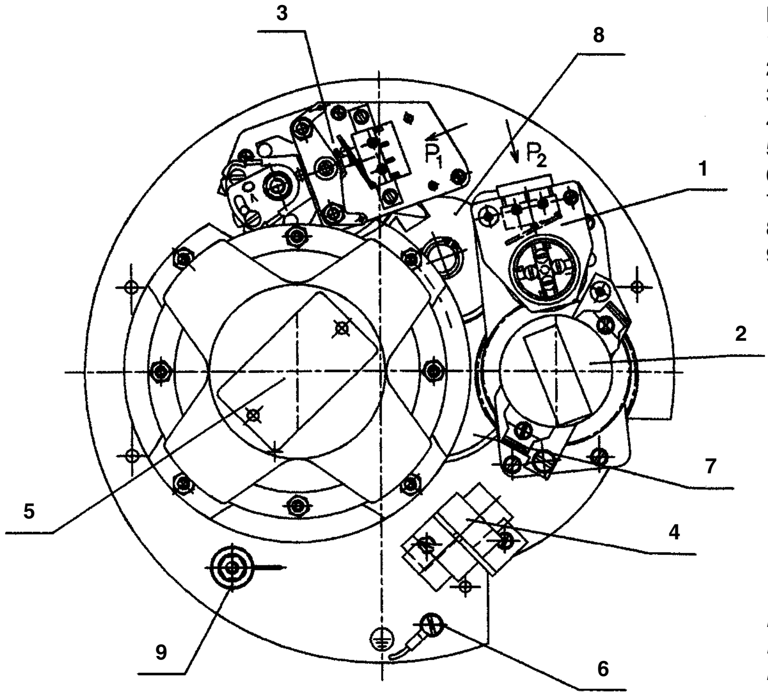
The actuators are designed for direct assembly on a valve and connection is realized by means of a flange according to ISO 5210 and a clutch according to DIN 3210, shape C or E or D.

The actuators consist of two parts:

- **Power part –** It generates and transmits torque to the output shaft of the actuator – It includes three-phase asynchronous electric motor, countershaft gearbox, epicyclic gearbox with output shaft, mechanism for manual control with hand wheel and floating worm.
- **Control part –** It ensures respective working functions of the actuator, such as torque-limit switching, position-limit switching, signalization, and remote reporting on position; it is composed of the following mechanical groups (units) installed on the control board according to Fig. no. 1 - position-limit switching and signalling unit 1, position transmitter 2, torque-limit switching unit 3, terminal board 4, and anti-condensation heater 9. The position-limit switching and signalling unit is fitted with four micro-switches, always two for each direction of rotation of the output shaft. The point of changing-over of each micro-switch can be separately adjusted within the working stroke of the actuator. The torque-limit switching unit is fitted with micro-switches – one for each direction of rotation.

The torque-limit switches are blocked against tripping at engagement torque. The resistance position transmitter is fitted with a skidding clutch providing for its adjustment with the output shaft. The anti-condensation heater 9 prevents condensation of steam under the control part cover. The position-limit switching unit and the position transmitter derive their motion from the output shaft of the actuator via the drive wheel 7. The torque-limit switching unit is driven by the “floating worm” of manual control where displacement of the worm is directly proportional to the torque on the output shaft of the actuator. This allows the electric motor to be switched off when the value of torque is reached to which the torque-limit switching unit is set.

Cable inlets are realized through two cable bushings M 25 x 1.5. The cable bushings will seal the cable diameter 9 to 16 mm.



Legend:
1 - position-limit switching and signalling unit
2 - position transmitter
3 - torque-limit switching unit
4 - terminal board
5 - electric motor
6 - internal protective terminal
7 - drive wheel
8 - change-over wheel
9 - anti-condensation heater

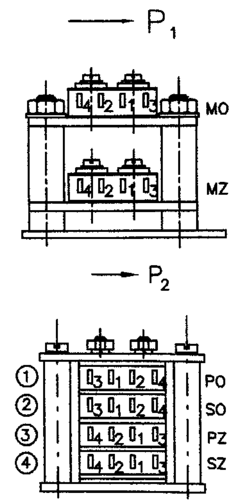
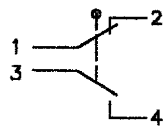


Diagram of micro-switches



Note:
Numbers in circle are identical with numbers of releasing screws of cams of the position-limit switching unit.

Fig. 1 ***- Control board***

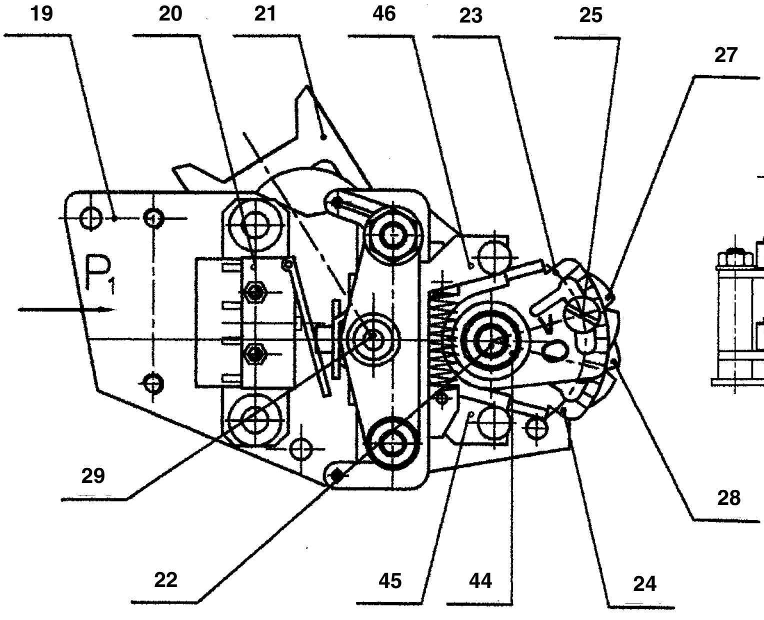
Important warning:

The micro-switches used in respective units do not allow connecting two voltages of different values or phases to contacts of the same micro-switch.

Description and function of control units

a) Torque-limit switching unit - Fig. 2 is, as an independent assembly unit, composed of basic board 19 carrying micro-switches 20 and, at the same time, forms bearings for the shaft of torque control 22 and the shaft of blocking 29.

The shaft of torque control transmits motion of the floating worm from power gearing by means of segments 23 or 24 and levers 45 or 46 to micro-switches MO or MZ. By moving round the segments against the tripping levers magnitude of tripping torque is set. For shifting the tripping torque outside the factory, segments 23, 24 are fitted with a scale on which points for setting maximum and minimum torque are individually marked with index lines on each piece of actuator. The set torque is then shown by slots in segments 27 and 28.



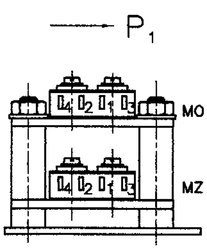
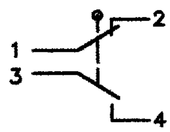


Diagram of micro-switches



Legend:
19 - basic board
20 - micro-switches MO, MZ
21 - shifter
22 - torque control shaft
23 - segment top “open”
24 - segment top “close”
25 - lock screw “open”
26 - lock screw “close”
27 - segment bottom “open”
28 - segment bottom “close”
29 – shaft of blocking
44 - lock nut
45 - tripping lever “close”
46 - tripping lever “open”

Fig. 2 - ***Torque-limit switching unit***

The numbers on this scale do not show setting of tripping torque directly. Divisions on this scale serve just for more precise dividing of the range of points of maximum and minimum tripping torque and, thus, more precise resetting of tripping torque out of the factory in case a loading bench is not at disposal. Segment 28 is intended for direction “close”, segment 27 for direction “open”.

The unit of torque control is also fitted with a blocking mechanism. After tripping of the torque-limit switch, the blocking mechanism will ensure its blocking and thus prevent its re-closing and pulsing of the actuator. Moreover, the blocking mechanism prevents tripping of the torque-limit switch after reversing the actuator run and, thus, it provides for full utilization of engagement torque of the electric motor. The blocking mechanism operates with both motion directions of the output shaft of the actuator in limit positions as well as in intermediate position for the time specified by the second complementary number of the actuator in revolutions of the output shaft after reversing its motion.

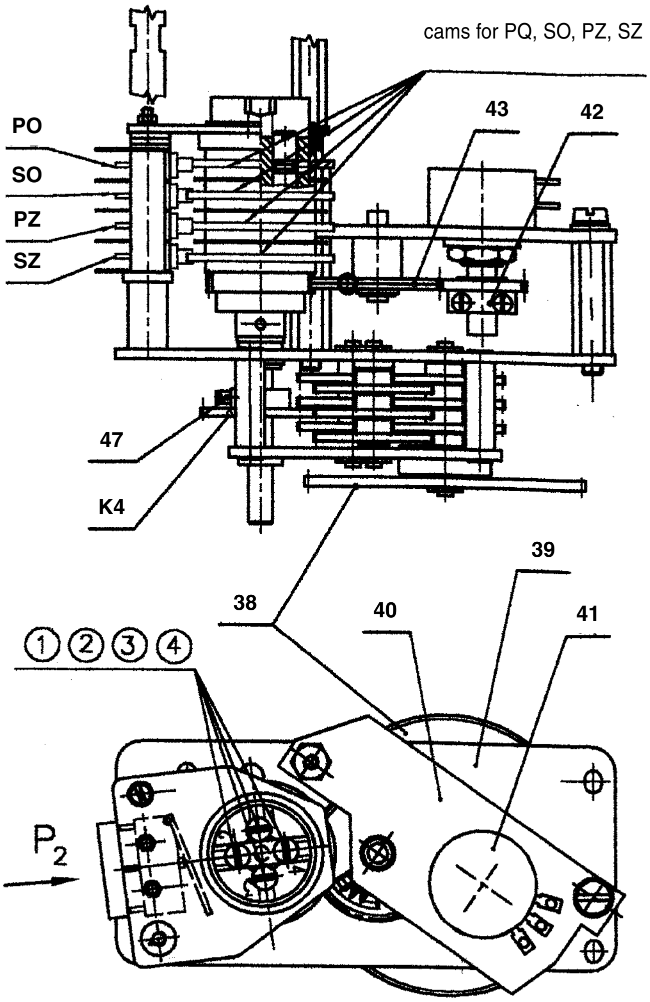
When the output shaft of the actuator is loaded with anti-torque, the shaft of the torque control 22 and also segments 23 and 24 are partially moved round; motion is thus transferred to tripping lever 45 or 46. After the torque on the output shaft of the actuator reaches a value to which the torque-limit switching unit is set, the tripping lever presses down the push-button of the particular micro-switch; the electric motor is thus disconnected from the supply mains and the actuator stops.

Procedure of setting torque-limit switching unit

In setting different tripping torque than that to which the unit was set in the factory, the procedure is as follows: release lock nut 44 (see Fig. 2) and particular lock screw -26- (for direction “close”) or 25 (for direction “open”). Then, insert a screwdriver into the slot in top segment -24- or -23- and turn the segment until the slot in segment 28 or 27 matches with particular point on the scale. This point is determined by dividing the difference between the maximum and minimum adjustable torque in Nm by the number of divisions between the mark of the maximum and minimum torque. The result shows which part of the tripping torque (in Nm) corresponds to one division of the scale; interpolation is used for determining the point on the scale which the slot in segment 28 or 27 should telly with.

The mark > on top segments 23 and 24 indicates direction in which the torque is increased or decreased, and which coloured index line on the scale indicates the point of setting maximum tripping torque and the point of setting minimum torque. The unit of torque control must never be set so that the slot in the bottom segment would fall beyond the range demarcated by the coloured index lines on the scale.

After setting the tripping torque, lock screw 26 or 25 and lock nut 44 are retightened.

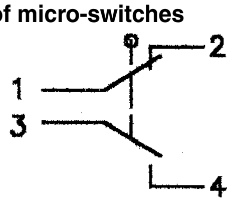


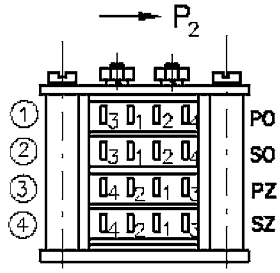
Legend:
PO - position-limit micro-switch „open”
SO - signalling micro-switch „open”
PZ - position-limit micro-switch „close”
SZ - signalling micro-switch „close”

① - screw for cam of micro-switch PO
② - screw for cam of micro-switch SO
③ - screw for cam of micro-switch PZ
④ - screw for cam of micro-switch SZ

38 - gear (drive) wheel
39 - supporting plate of unit
40 - supporting plate of transmitter
41 - resistance position transmitter
42 – pinion with friction clutch
43 - sprung drive wheel of transmitter
47 - lock screw of shifting wheel
K4 - shifting wheel

Diagram of micro-switches





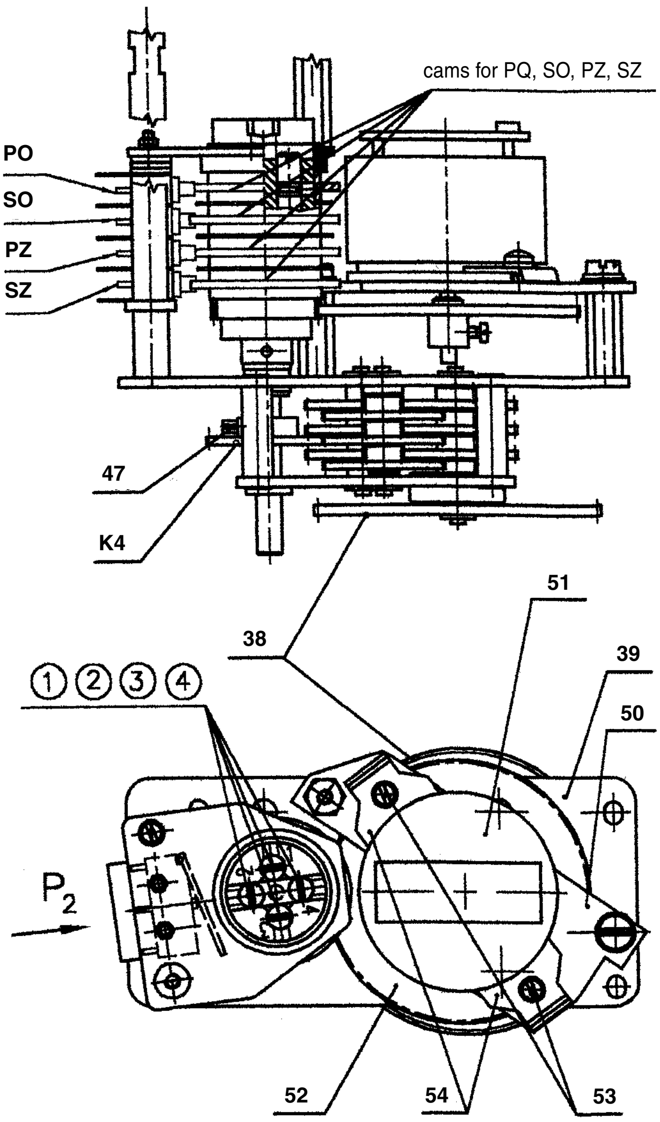
Note:
Numbers in circle are identical with numbers of releasing screws of cams of the position-limit switching unit.

Fig. 3 - ***Position-limit switching and signalling unit with resistance transmitter***

Tripping torque must not be set to higher values than those corresponding to respective type designations in Table no. 1.

b) Position-limit switching and signalling unit - Figs. 3 and 4 – provides for tripping of the position-limit switching units PO or PZ after the set number of revolutions of the output shaft has been reached and, by means of signalling switches SO and SZ, sending electric signal for signalization of position of the output shaft of the actuator. The unit drive is realized by gearwheel -38- from the output shaft via the multi-speed gearbox to cams controlling micro-switches PO, PZ, SO, SZ. The moment of closing of the signalling switches can be chosen at any point of the working stroke of the actuator except for a narrow range around the limit positions (the signalling switch must close before the position-limit switching unit when the output shaft is still in motion).

The signalling and position-limit switching unit is designed as an independent assembly unit. It is assembled on the supporting plate 39 under which the gearings arranged according to the kinematic diagram Fig. 5 are fitted. The gearing is assembled so that the shifting wheel K4 can be shifted to various levels (I, II, III, IV, V,) after releasing lock screw 47. Shifting of wheel K4 changes the range of setting of the position-limit switching and signalling units according to working stroke of the actuator – see the tables below.



Legend:
PO - position-limit micro-switch „open"
SO - signalling micro-switch „open"
PZ - position-limit micro-switch „close"
SZ - signalling micro-switch „close"

① - screw for cam of micro-switch PO
② - screw for cam of micro-switch SO
③ - screw for cam of micro-switch PZ
④ - screw for cam of micro-switch SZ

38 - gear (drive) wheel
39 - supporting plate of unit
50 - supporting plat of current transmitter
51 - current position transmitter CPT 1AAE
52 - drive wheel of transmitter CPT 1AAE
53 - lock screw
54 - shim plate
K4 - shifting wheel

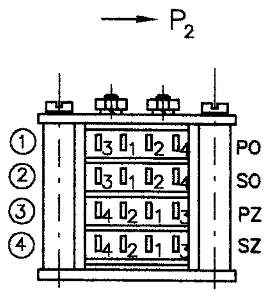
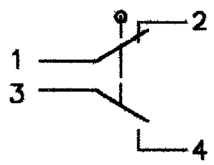
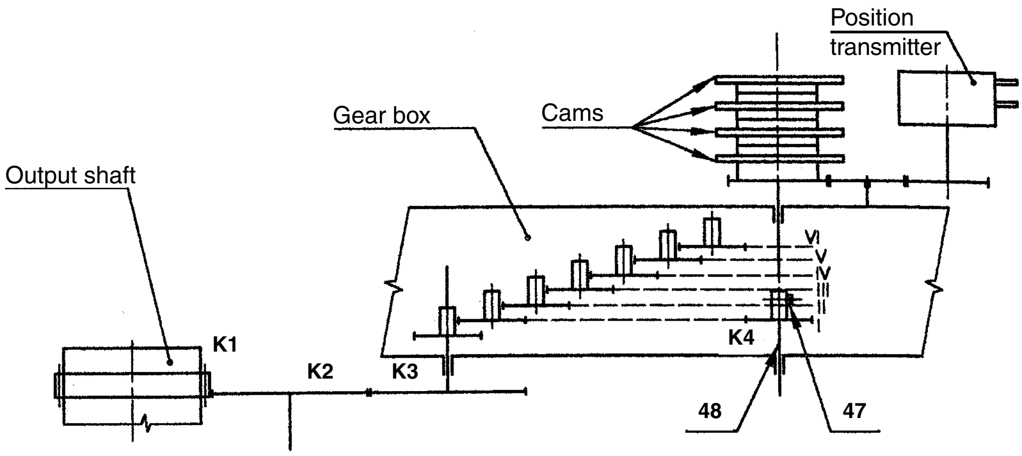


Diagram of micro-switches



Note:
Numbers in circle are identical with numbers of releasing screws of cams of the position-limit switching unit.

Fig. 4 - ***Position-limit switching and signalling unit with current transmitter***



Legend:
K1 - gear wheel of output shaft
K2 - intermediate wheel
K3 - drive wheel
K4 - shifting wheel
47 - lock screw of shifting wheel
48- shaft of cams

*Fig. 5 - **Kinematic diagram of gearings***

Range of setting of working stroke (for resistance position transmitter)

Working stroke of actuator (rev.)	1.5-2.6	2.6-5.2	5.2-10	10-19.5	19.5-38.1
Gear stage of unit	I	II	III	IV	V

Range of setting of working stroke (for current transmitter CPT)

Working stroke of actuator (rev.)	1.5-2.6	2.6-5.2	5.2-10	10-19.5	19.5-38.1
Gear stage of unit	I	II	III	IV	V

Setting of position-limit switching and signalling unit

Before setting the position-limit switching and signalling unit, the assembly of the position indicator (Fig.6) should be removed by loosening the screws 66 to allow for access to the screws of cams 1, 2, 3, 4. After setting the unit, the indicator assembly is re-screwed and adjusted according to point d.

If it is necessary to change the range of setting the position-limit switching and signalling units, and the position transmitter, position of the shifting wheel K4 should be changed. After shifting, the lock screw 47 should be properly retightened and secured.

Layout of cams and micro-switches of the position-limit switching and signalling unit is shown in Figs. 3 and 4. Shoulders of cams control the micro-switches PO, PZ, SO and SZ .

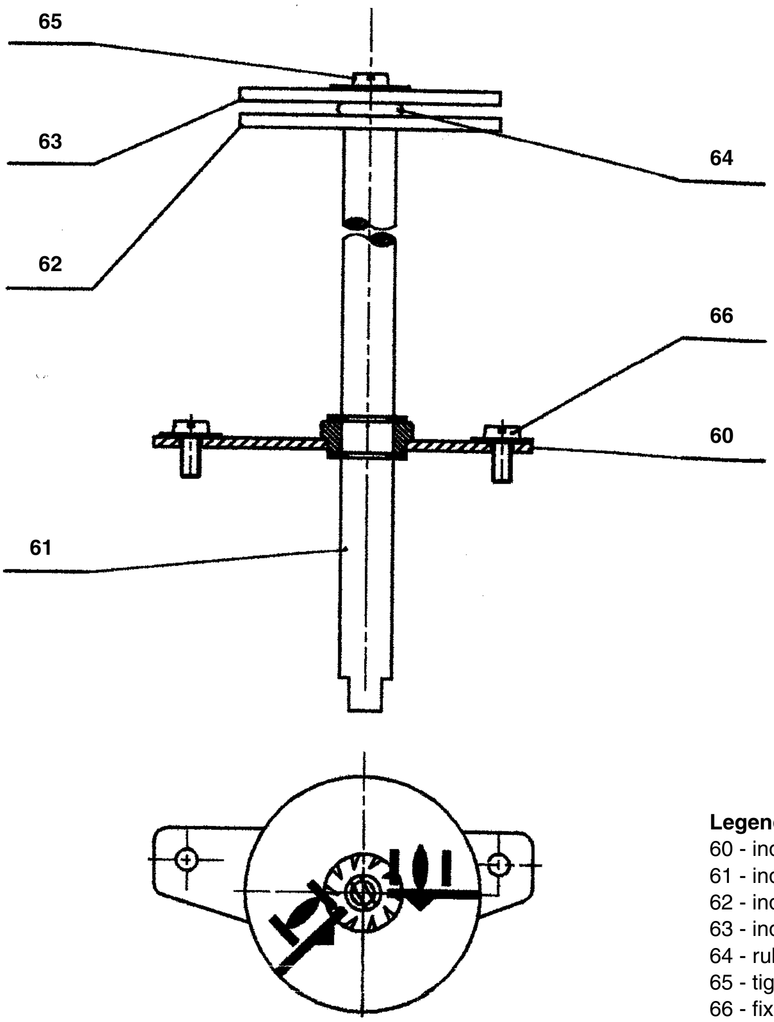
In setting of the position-limit switching units the procedure is as follows: first, set the output shaft to its limit position in which the set micro-switch should trip. Then, release the cam of the micro-switch (PO, PZ, SO, SZ) by particular releasing screw (1, 2, 3, 4). Releasing is carried out by rotating the releasing screw counter-clockwise. The releasing screw is rotated just to release the cam - further rotation of the releasing screw would result in retightening the cam.

Numbers of particular releasing screws (1, 2, 3, 4) are given on the shaft of cams of the position-limit switching unit (Fig. 3 and 4). After releasing, rotate the cam in the direction opposite to motion of the output shaft of the actuator during setting the position „close" or „open" until the micro-switch changes over. In this position, secure the cam by tightening the releasing screw (in the clockwise direction).

The signalling switch must be set so that it changes over before the particular position limit or torque-limit switch or at the same time with it.

Warning

After each manipulation with the lock screws in the control part of the actuator, these screws should be secured against releasing through vibration by a drop of quick-drying varnish. In case these screws were already secured with varnish, the rests of old varnish should be removed during adjustment and the area under them properly degreased.



Legend:
60 - indicator holder
61 - indicator shaft
62 - indicator bottom „close”
63 - indicator top „open”
64 - rubber ring
65 - tightening screw
66 - fixing screws

*Fig. 6 – **Indicator assembly***

c) Position transmitters

Resistance position transmitter 1x100 ohm

First, suitable gearing stage from the output shaft of the actuator to the transmitter shaft should be set according to required working stroke of the actuator (see tables).

Setting is carried out by means of shifting wheel K4 in the gearbox of the position-limit switching and signalling unit according to point b).

The resistance transmitter has the rated value of resistance signal 100 ohm. The transmitter shaft sticks out on one side. Pushed on the shaft end is the pinion with the friction clutch pos. 42 which can skid on the shaft in both limit positions of the transmitter, which can be utilized in adjustment.

Setting of resistance transmitter

Due to multi-speed gear ratio of the position-limit switching and signalling unit, the sliding contact of the potentiometer does not move in the whole range of the resistance travel but just in its certain part.

In setting the position-limit switching and signalling unit to the limit positions „open” and „close” according to point b), certain setting of the resistance transmitter is automatically made by skidding of the friction clutch pos. 42 in the limit position of the transmitter.

This automatic setting can be changed as required by the following procedure:

Decisive aspect in setting is whether in the position „close” resistance should be low (lower limit of the resistance travel) or high (upper limit of the resistance travel). If low resistance is chosen for the position “close”, terminals 30, 31 must be connected on the terminal board; for high resistance, terminals 31, 32 should be connected. In setting the resistance transmitter, loosen the screw and bolt for the position indicator holding the transmitter supporting plate pos. 40 (Fig. 3) two revolutions of the hand wheel before the position “close” and shift the transmitter wheel out from engagement. Then, set the transmitter by rotating the shaft to the lowest value of resistance (less than 4 ohm), bring it back to engagement, and retighten the bolt and screw.

Finally set the minimum resistance value of the transmitter by rotating the hand wheel to the position "close". On starting the actuator or rotating the hand wheel to "open", resistance will begin increasing until the value of resistance is reached which corresponds to the limit position "open" (max. 96 ohm).

In case that high resistance is required in the position “close”, connect the terminals 31, 32 and set the transmitter to the highest value of resistance (more than 96 ohm) two revolutions of the hand wheel before the position "close" following the above mentioned procedure. On starting the actuator or rotating the hand wheel to "open", resistance will begin decreasing until the value of resistance is reached which corresponds to the limit position "open" (max. 4 ohm). The transmitter is now adjusted.

Current position transmitter CPT 1AAE

The transmitter housing must be earthed (to neutral conductor, earthing conductor or electric earth of the measuring circuit) and the measuring circuit (double conductor) must also be earthed (usually to electric earth of the linked-up regulator).

Voltage is measured on terminals 31, 32; current is measured between the terminal and disconnected core of the feeding cable.

The transmitter is galvanically isolated, consequently several transmitters can be connected to a single source. The connection of the transmitter is realized by two conductors transferring the unified signal 4 – 20 mA with feeding voltage 18 – 25 V DC and resistance load within the range of 0 to 500 ohm. Feeding voltage is also supplied by these conductors. The output is fitted with diode against changing polarity and the transmitter is thus protected against majority of possible damages. It can be permanently damaged by connection to voltage higher than 30 V DC.

Adjustment of current position transmitter CPT 1AAE

First, set appropriate gear stage from the output shaft of the actuator on the transmitter shaft according to required working stroke of the actuator (see table).

Setting is carried out by means of shifting wheel K4 in the gearbox of the position-limit switching and signalling unit according to point b). After setting appropriate gear stage, adjust the current transmitter according to the following procedure:

Warning!

Without previous check of the feeding voltage, the transmitter CPT 1AAE must not be connected. Outlets of the transmitter must not be connected in the actuator with the actuator frame nor earth, not even incidentally.

1) Before checking the feeding voltage, disconnect the transmitter from the supply source. Measure voltage on the actuator terminals to which the transmitter is connected; this is best accomplished using a digital voltmeter of output resistance at least 1 Mohm. The voltage must fall within the range of 18 - 25 V DC; in no case may it be higher than 30 V (the transmitter would be destroyed). Then, connect the transmitter by connecting the positive pole of the source to the positive pole of the transmitter, i.e. to the red/black conductor + which is connected to terminal 32. The negative pole of the transmitter (black conductor) is connected to terminal 31.
2) Temporarily, connect a milli-ammeter, best a digital one of accuracy at least 0.5 % in series with the transmitter. Shift the output shaft to the position “close”. The value of signal must decrease. If this is not the case, rotate the output shaft in the direction “close” until the signal begins decreasing and the output shaft reaches the position “close”.

Then, loosen lock screws 53 of the transmitter shim plates 54 so that the whole transmitter can be rotated. By rotating the whole transmitter, set current 4 mA and retighten the lock screws of the shim plates. Then, shift the output shaft of the actuator to the position “open”. Using the resistance trimmer on the transmitter face (closer to edge) set current to 20 mA. The trimmer has 12 revolutions but no stop, therefore it cannot be damaged.

If the correction 20 mA has been considerable, repeat adjustment to 4 mA and 20 mA once again. Then, disconnect the connected milli-ammeter. The screw secured with a drop of varnish closer to the centre must not be rotated. Retighten properly the screws securing the shim plates of the transmitter and secure them with varnish against releasing.

After completing the adjustment, check voltage on the transmitter terminals with a voltmeter. It must fall within the range of 9 – 16 V with current 20 mA.

Note:

The characteristics of the transmitter has two branches - descending with respect to position „Z” or ascending with respect to position „Z”. The characteristics is selected by moving-round the transmitter body.

d) Position indicator

The local position indicator serves for orientational determination of position of the output shaft. It is connected in a detachable mechanical way to pillars of the position-limit switching and signalling unit and dragged by the groove in the shaft of cams of this unit. In adjustment of the cams of the position-limit switching and signalling unit, the complete assembly of the indicator (Fig. 6) should be dismounted by loosening the fixing screws pos. 66.

Adjustment of position indicator

First, set the position-limit switching and signalling unit according to point b). After setting this unit, fix the indicator assembly, and adjust the indicator according to the following procedure:

First, set the output shaft of the actuator to the position “close” and detect position of the mark “close” in the sight hole of the fitted cover with respect to the mark on the sight hole. Remove the cover and set the mark “close” of the bottom indicator pos. 62 to this point according to Fig. 6 after loosening the screw pos. 65. After re-fitting the cover, check accuracy of setting the marks against each other and, if necessary, correct the position. Then, move the output shaft of the actuator to the position “open” and detect position of the mark “open” with respect to the mark on the sight hole. Remove the cover and set the mark “open” of the top indicator pos. 63 to this point and retighten the screw pos. 65. Care should be paid not to change the already set position of the bottom indicator “close”. After fitting the cover, check once again accuracy of setting the marks against each other and, if necessary, correct the position. The indicator is now set for both limit positions.

Manual control

The output shaft of the actuator can be shifted also manually by means of the hand wheel. By rotating the hand wheel in the clockwise direction, the valve closes (left thread in the valve is assumed).

5. PACKING AND STORING

The actuators are packed together with the valve to which they are to be fitted. The way of packing the complete with the valve must be specified in the technical conditions for the valves with the fitted actuator.

The actuators are transported from the manufacturer of actuators to completion at the manufacturer of valves in our country using sheltered vehicles or transport boxes. In this case, the actuators are transported unpacked. In case of direct delivery of actuators to the nuclear power plant (JE) packing is made according to Annex no. 7 to TP 07-02/05.

In case of deliveries of actuators to foreign customers, the actuators must be packed. Type of packing and its design must be adapted to conditions of transport and distance to the place of destination.

After receiving the actuators from the manufacturer, the customer should check whether they have not been damaged during transportation. Check should be made whether data on the rating plates of the actuator agree with the order and with the accompanying documentation. Possible discrepancies, defects and damages should be immediately reported to the supplier. In this case, the actuator cannot be put into operation.

If the unpacked actuator is not mounted immediately, it must be stored in a dust-free room with temperature ranging between -25°C and +50 °C and relative humidity up to 80 %; the room should be free of caustic gases and vapours and protected against harmful climatic effects. If actuators have been stored for a period longer than 4 years it is necessary, before putting it into operation, to replace the lubricant. Any manipulation at temperatures below -25 °C is prohibited. The actuators must not be stored in the open area or in rooms not protected against rain, snow and frost. Surplus conserving grease should be removed just before putting the actuator into operation. When unpacked actuators are to be stored for a period longer than 3 months, it is recommended to insert a sachet with silicagel or another suitable desiccant under the actuator cover.

6. CHECKING OF INSTRUMENT FUNCTION AND ITS COMMISSIONING

Before commencing the assembly, inspect the actuator once again for possible damage during storage. Functionality of the electric motor can be verified by connecting it to the supply mains via a switch and short-time starting. It is sufficient to verify whether the electric motor starts running and the output shaft moves round. The actuators must be located so that easy access is provided to the wheel of manual control and to the control board. It is also necessary to verify once again whether location corresponds to provisions of par. “Working conditions”. If different way of assembly is required by local conditions agreement with the manufacturer is necessary.

7. ATTACHMENT TO VALVE

The actuator is fitted onto the valve so that the output shaft snaps reliably into the valve clutch; the actuator is connected with the valve by four screws. By rotating the hand wheel check correct connection of the actuator with the valve. Remove the actuator cover and carry out electric connection of the actuator according to the internal and external wiring diagram.

8. ADJUSTMENT OF ELECTRIC ACTUATOR WITH VALVE

After fitting the actuator onto the valve and verifying mechanical connection, setting and adjustment takes place.

1) Shift the actuator manually into intermediate position.
2) Connect the actuator to the supply mains and, by short starting in the middle of the working stroke, verify correct direction of rotation of the output shaft. When viewing into the control box the output shaft rotates in the clockwise direction during motion in the direction “close”.
3) Shift the actuator electrically into the vicinity of the position “close”; remaining shifting into the position “close” is carried out by means of the hand wheel. In this position “close” set the position-limit switching unit (micro-switch PZ) according to point 4b, resistance or current transmitter according to point 4c, and position indicator according to point 4d.
4) Shift the output shaft into the position in which the signalling switch SZ should change over. Adjust the switch SZ according to point 4b.
5) Shift the output shaft of the actuator by a required number of revolutions and set the switch of the position PO “open” according to point 4b, resistance transmitter according to point 4c, and position indicator according to point 4d. Setting of the position and signalling switches and the position transmitter should be verified several times.
6) Shift the output shaft to the position in which the signalling switch SO should change over. Adjust the switch SO according to point 4b.

Warning:

When assembling the valve to the piping, the valve should be set into intermediate position using the hand wheel of the actuator. Short starting of the electric motor is used for checking whether the actuator rotates in the correct direction. If this is not the case, two phase conductors of the electric motor feeding should be interchanged.

9. OPERATION AND MAINTENANCE

Operation of rotary actuators results from process conditions and is usually limited to passing-on impulses to respective functional tasks. In case of the electric current black-out, the controlled unit is shifted using the hand wheel. If the actuator is connected in the automatic circuit it is recommended to install in the circuit components for manual remote control that would provide for controlling the actuator even in case of the automatics failure.

The operator should pay attention to carrying out prescribed maintenance, the actuator being protected from harmful influence of the surroundings and atmospheric effects which are not stated in the paragraph “Working conditions”. Another duty is to ensure that excessive heating of the actuator surface does not occur, rating values are not exceeded and excessive vibrations of the actuator are prevented.

Maintenance

Once in two years, it is necessary to lightly smear the gearing teeth in the gearbox, the bearings in which these gearings are seated, and the gearwheels of the transmitter drive.

Lubrication is made using the lubricating grease CIATIM 201. To increase resistance against corrosion, all springs and metal strips in the control part are also smeared with the lubricating grease.

Within half a year at the latest after putting the actuator into operation and then at least once a year, retighten the screws connecting the valve with the actuator. The screws are to be tightened in a cross-wise manner.

10. FAILURES AND THEIR REMOVAL

1) The actuator is in its limit position and does not start; the motor hums.

Make a check for possible interrupted phase. If the valve is wedged and cannot be moved using the hand wheel or motor, dismount the actuator and release the closure mechanically.

2) If, after starting the actuator from the limit position of the output shaft of the actuator, it stops spontaneously it is necessary to ensure that the slot in the change-over wheel (Fig. 1) stops in the limit position of the output shaft of the actuator (after tripping of the torque-limit switch) before it runs on the shifter 21 Fig. 2. This is achieved by suitable

moving-round the actuator output shaft when connecting the actuator with the valve or by suitable moving-round the change-over wheel with respect to the output shaft. To allow for this, the change-over wheel is fitted with additional two holes.

Cleaning - general inspection

The electric actuators should be kept clean and attention should be paid to prevent their clogging with dirt and dust. Cleaning should be carried out regularly and as often as required by operation conditions. Occasionally, it is necessary to make sure that all connecting and earthing terminals are properly tightened in order to prevent their heating during operation. The general inspection of the actuator is recommended once in 4 operating years unless otherwise specified in the revision regulations of electric devices.

Table 1 – Basic technical parameters and characteristics of actuator, type MODACT MOA for shut-off vales installed in attended areas of nuclear power plants with reactors VVER or RBMK

Size of connecting flange	ACTUATOR										
	Type designation	Type number		Range of setting torque tripping	Range of setting output revolutions (of stroke)	Speed of output shaft resetting	Gear ratio output shaft / electric motor	Gear ratio output shaft / hand wheel	Max. force on had wheel	Min. guaranteed M_{close} at $U=80\% \ U_{nom}$	Weight of actuator incl. electric motor
		Basic	Comple-mentary	[Nm]	[rev.]	[min^{-1}]			[N] 1)	[Nm] 3)	[kg]
F10 (F07)	MOA 30-9	52 029.	x x 1 x	10÷30	1.5÷38	9	1:155	1:93	4	30	17
	MOA 30-15	52 029.	x x 2 x			15	1:91				
	MOA 30-25	52 029.	x x 3 x			25	1:54				
	MOA 30-40	52 029.	x x 4 x			40	1:34				

1) The table shows one force from pair of forces acting at diameter of the hand wheel.
2) The cables are connected through a gland bushing.
3) The value recommended by the manufacturer to be set as maximum is 1.3x higher for engagement torque than the closing value at voltage reduced by 20 %.

ELECTRIC MOTOR										
Type designation	Output [kW]	Speed of electric motor [min^{-1}]	Rated current [A]	Angagement current [A]	Efficiency [%]	Power factor [cos φ]	Ratio of engagement / rated torque	Ratio of engagement / rated current	Engage-ment torque [Nm]	Weight of electric motor [kg]
EAMXR63L04A	0.02	1440	0.20	0.54	29	0.50	4.0	2.7	0.53	2.15
EAMXR63L04	0.09	1385	0.44	1.40	56	0.59	3.2	3.2	1.98	3.5
EAMXR63N04L	0.12	1390	0.45	1.26	58	0.67	1.8	2.8	1.48	3.3
EAMXR63N04	0.18	1370	0.66	2.24	62	0.70	2.0	3.4	2.50	3.9

Meaning of complementary numbers in the actuator type number:

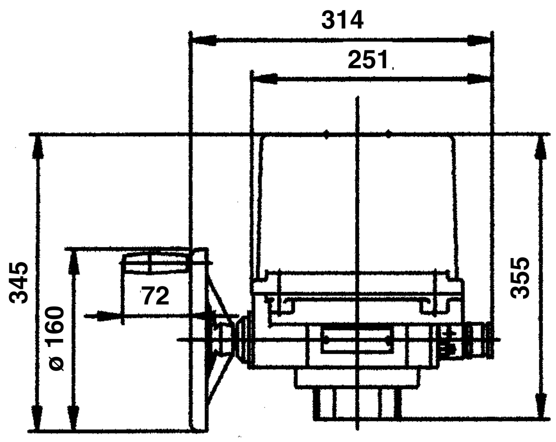
- the first complementary number means the way of mechanical connection:
  - 1xxx – connection F07, shape C
  - 2xxx – connection F07, shape D
  - 3xxx – connection F07, shape E
  - 4xxx – connection F10, shape C
  - 5xxx – connection F10, shape D
  - 6xxx – connection F10, shape E

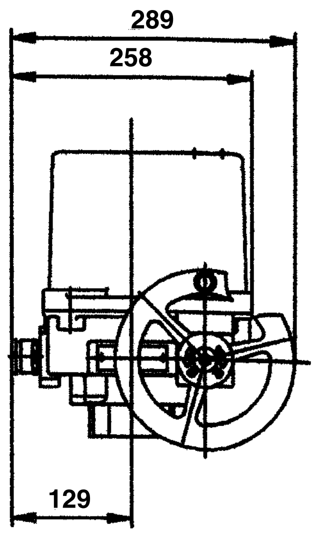
- the second complementary number means the required time of torque blocking:
  - x0xx – time of blocking between 1.5 and 3 revolutions of output shaft after reversing
  - x1xx – time of blocking between 0.75 and 1.5 revolutions of output shaft after reversing
  - x2xx – time of blocking between 0.4 and 0.75 revolutions of output shaft after reversing

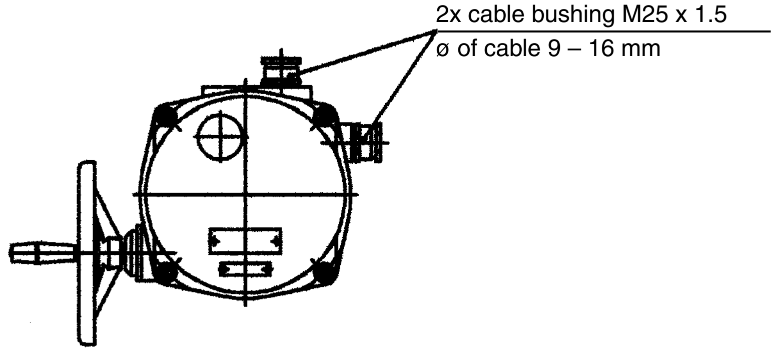
- the third complementary number means resetting speed – see the table.

- the fourth complementary number means possible use of position transmitter:
  - xxx0 – without position transmitter
  - xxx1 – resistance transmitter 1 x 100 ohm
  - xxx2 – current transmitter CPT 1AAE
  - xxx3 – current transmitter CPT 1AAE with feeding source

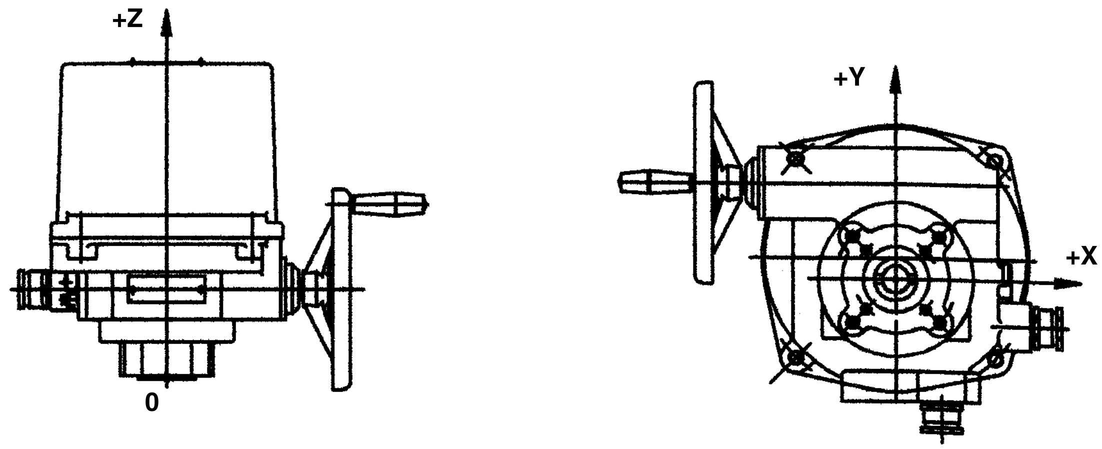
Dimensional sketch of actuator **MODACT MOA**, Type No. 52 029







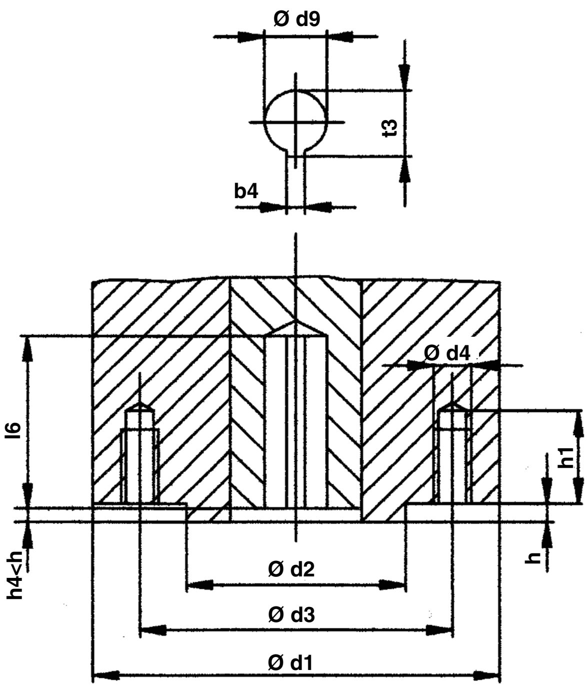
Centre of mass of actuator **MODACT MOA**, Type No. 52 029



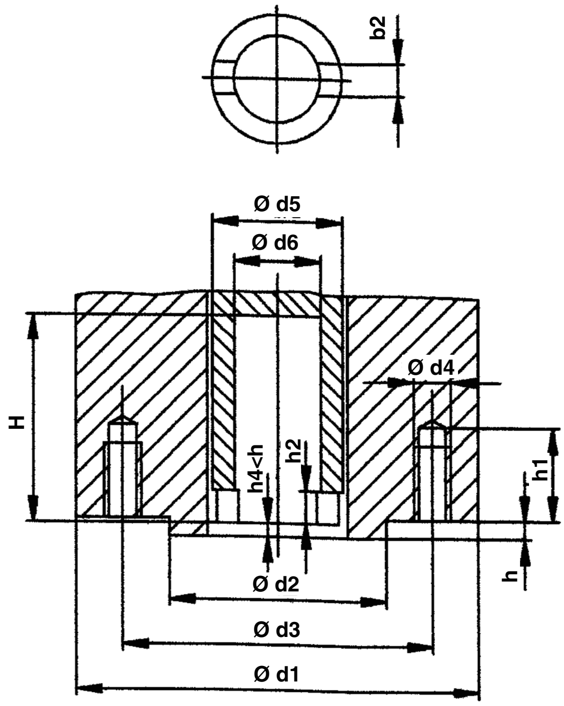
Type number	Coordinates of centre of mass			Actuator weight (kg)
	x (mm)	y (mm)	z (mm)	
52 029	-7.5	+22	+148	17

Mechanical connecting dimensions of actuator **MODACT MOA,** Type No. 52 029

SHAPE E



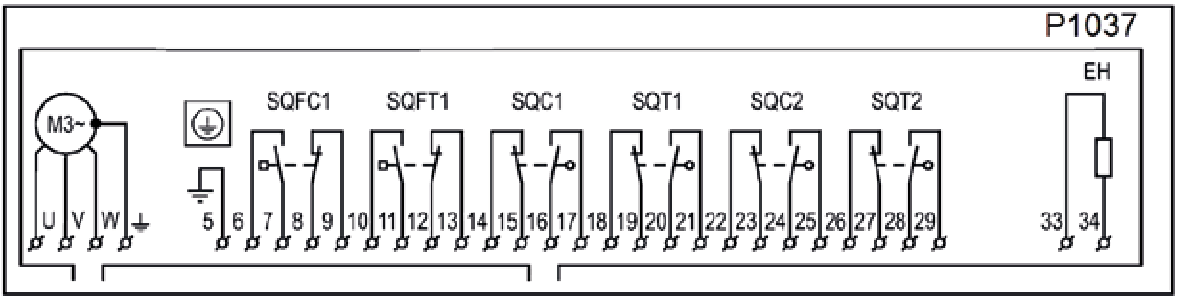
SHAPE C



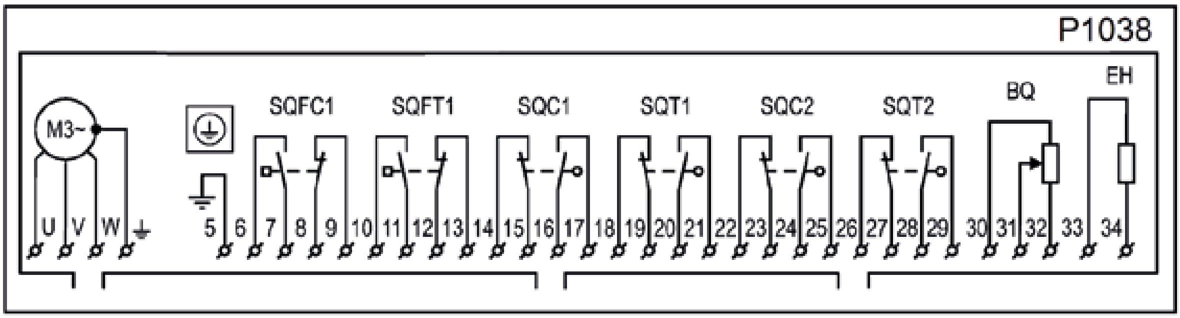
Flange size	Common data for both shapes							Data for shape C					Data for shape E			
	ø d1	ø d2f8	ø d3	ø d4	Number of threaded holes	h1	h	ø d5	h2	H	b2H11	ø d6	ø d9H8	l6 min	t3	b4Js9
F 07	125	55	70	M8	4	16	3	40	10	125	14	28	16	40	18.1	5
F 10	125	70	102	M10	4	20	3	40	10	125	14	28	20	55	22.5	6

Diagrams of internal electric wiring of actuators **MODACT MOA**, Type No. 52 029

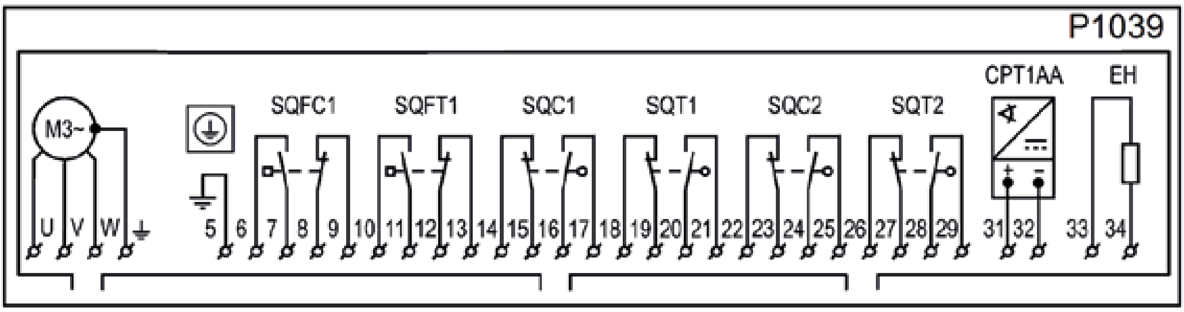
Position transmitter – no



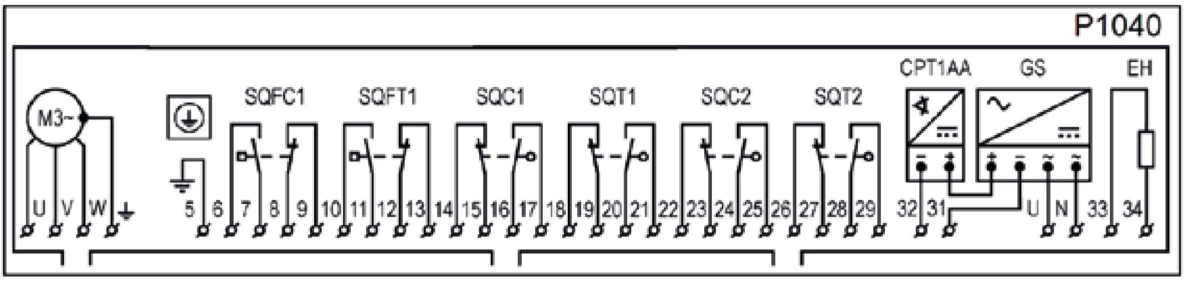
Position transmitter – resistance 100 ohm



Position transmitter – current 4 – 20 mA or without transmitter



Position transmitter – current 4 – 20 mA with feeding source



LEGEND:

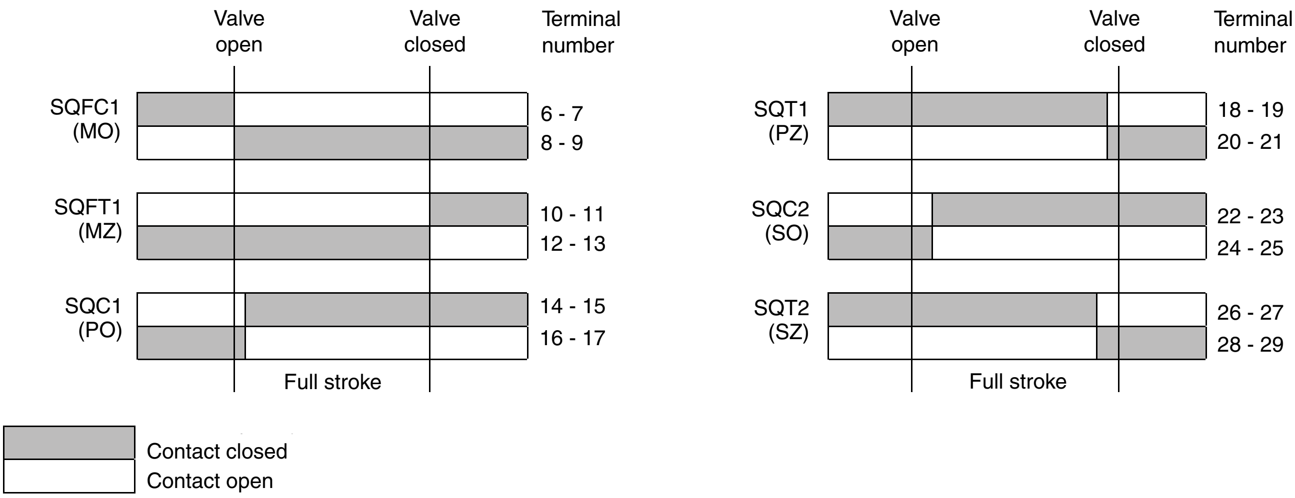
SQFC1 (MO) – torque-limit switch „open“
SQFT1 (MZ) – torque-limit switch „close“
SQC1 (PO) – position-limit switch „open“
SQT1 (PZ) – position-limit switch „close“
SQC2 (SO) – position signalling switch „open“
SQT2 (SZ) – position signalling switch „close“

BQ) – resistance transmitter 100 ohm
CPT1AA – current transmitter CPT 1AAE
GS – feeding source for CPT1AAE
M3 – three-phase motor
EH – heating resistance

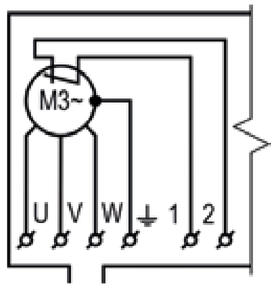
The micro-switches can be used as single-circuit only. Two voltages of different magnitudes or phases must not be connected to contacts of the same micro-switch. The contacts of micro-switches are drawn in the intermediate position.

In the version with current transmitter, the user should ensure connection of two-wire circuit of the current transmitter to electric earth of the linked-up regulator, computer, etc. Connection must be realized just in one point in any part of the circuit outside the electric actuator.

Operation diagram of torque, position and signalling switches



Electromotors can have built-in thermocontacts, which are brought on terminals 1 and 2. This built-in thermal protection together with driving system will disconnect electromotor from power supply, if winding temperature of electromotor exceeds the temperature +155 °C.



Thermocontacts diagram

List of spare parts for actuators **MODACT MOA,** Type No. 52 029

Spare part name	Order number	Use
Sealing ring 24x20 PN 029280.2	2327311500	Packing of hand wheel shaft
Sealing ring 40x2 PN 029281.2	2327311032	Packing of indicator sight hole
Sealing ring 50x2 PN 029281.2	2327311028	Packing of hand wheel flange
Sealing ring 50x40 PN 029280.2	2327311007	Packing of output shaft
Sealing ring 210x3 PN 029281.2	2327311401	Packing of cover
Micro-switch FK4T7Y1UL	2337441071	Torque-, position-limit and signalling micro-switches

SURVEY OF PRODUCED ACTUATORS

KP MINI, KP MIDI
Electric rotary (90°) actuators (up to 30 Nm)

MODACT MOK, MOKED, MOKP Ex, MOKPED Ex
Electric rotary (90°) actuators for ball valves and flaps

MODACT MOKA
Electric rotary (90°) actuators for nuclear power stations application outside containment

MODACT MON, MOP, MONJ, MONED, MOPED, MONEDJ
Electric rotary multi-turn actuators

MODACT MO EEx, MOED EEx
Explosion proof electric multi-turn actuators

MODACT MOA
Electric multi-turn actuators for nuclear power stations application outside containment

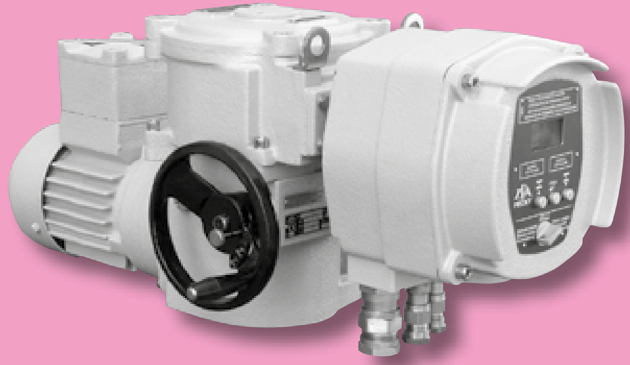
MODACT MOA OC
Electric multi-turn actuators for nuclear power stations application inside containment

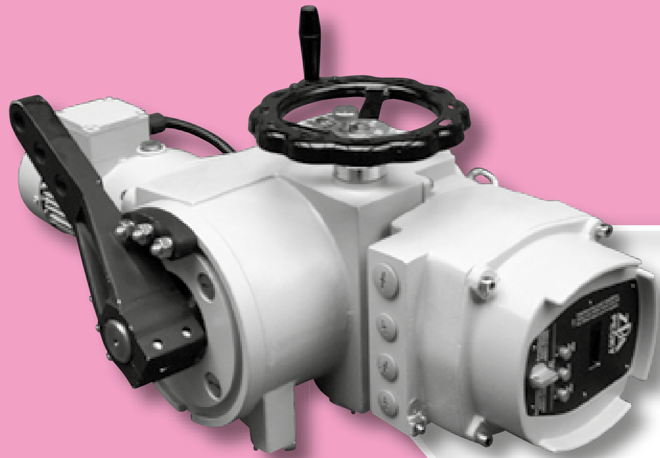
MODACT MPR Variant
Electric rotary (160°) lever actuators with a variable output speed

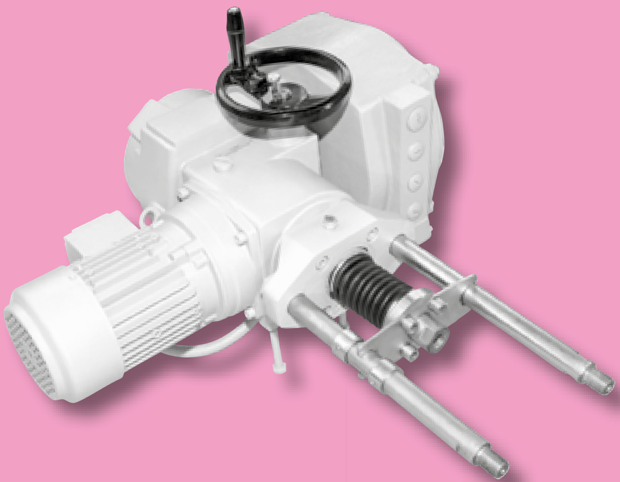
MODACT MPS, MPSP, MPSED, MPSPED
Electric rotary (160°) lever actuators with a constant output speed

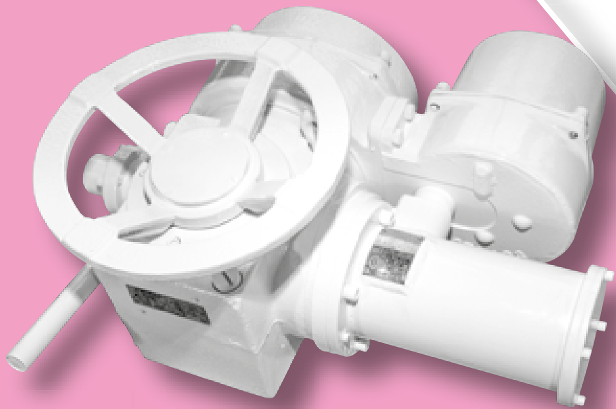
MODACT MTN, MTP, MTNED, MTPED
Electric linear thrust actuators with a constant output speed

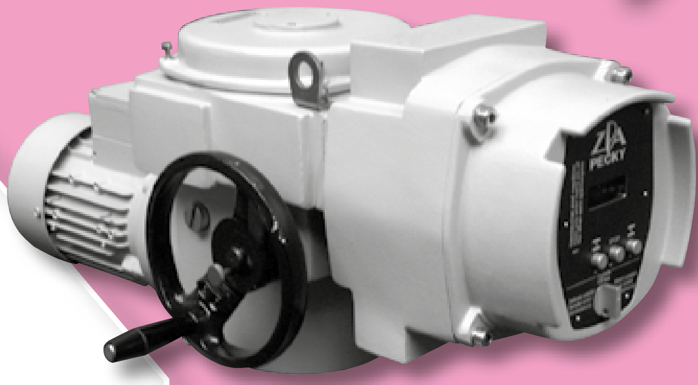
Deliveries of assembled actuator + valve (or MASTERGEAR gearbox) combinations

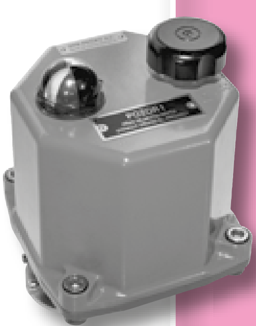


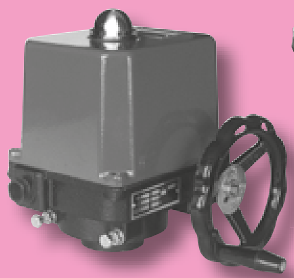


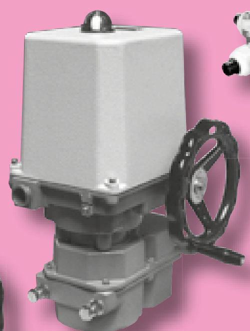












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