

<b>FAP</b> <b>WAKMET</b> 48-348 Bodzanów 75	OPERATING AND MAINTENANCE MANUAL NR QT-2/101 straight, angle and slanted stop valves	Issue: 4 Page: 1 Pages: 12 Date: 2020-12-03
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# OPERATING AND MAINTENANCE MANUAL

## **stop valves** **straight, angular and oblique**

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## 1. GENERAL INFORMATION

This "Operation and Maintenance Manual" applies to all, manufactured by FAP Wakmet, straight, angle and angular globe valves, with nominal pressure PN2,5 PN6, PN10, PN16, PN25, PN40, 63, 100 and 160 bar and nominal diameter DN10-300.

Valve design, production and testing are performed in accordance with the Quality Assurance System according to ISO 9001:2000 and the European Pressure Directive No. 2014/68/EU.

Proper installation, use and repair will ensure proper functioning of the valves. The manufacturer will not assume any liability if the instructions in this document are not followed.

Straight, angle and angled globe valves can only be operated within the range of permissible temperatures and pressures.

The use of valves outside the permissible range of parameters can cause serious damage to them.

The descriptions and instructions in this document apply to standard products, but are also applicable to variant products.

The instructions in this document do not take into account:

- any events that may occur during installation, use and repair,
- local regulations; the user must ensure that these regulations are strictly followed by everyone, including the personnel performing the installation.

The fittings must be operated by properly trained personnel. Improper use of valves (fittings) can have a significant impact on the entire system such as leakage of refrigerant, restriction in system operation, etc.

This manual complies with the requirements of Directive 2014/68/EU.

## 2. TECHNICAL DESCRIPTION

Stop valves are used to cut off and open the flow of the working medium and are not used for flow control. They are designed for two-position operation. This means that they should operate in the fully open, or fully closed position.

Stop valves are made with an elevated wheel and stem. The pipe connections of the valves are adapted for connection on the installation.

The hull and cover are made of carbon, or alloy, or austenitic steels. The seat is welded to the hull.

The material of the seat and plug is compatible with the required operating pressure and temperature. The connection between the body and the cover is protected against leakage by an asbestos-free seal. The stem (spindle) relative to the cover is sealed with asbestos-free sealing rings.

The valve is opened and closed manually or by means of an electromechanical actuator. Closing the valve is done by turning the wheel clockwise.

The electromechanical actuator closes the valve with a specific torque (the setting torque is specified in the instructions). The valve is opened by a road switch.

The design of the valves has been subjected to an analysis of the risks posed by the effects of all internal factors, external factors, handling, unintended actions, and impacts on the human environment.

## 3. APPLICATION

Standard globe valves are designed for water, steam and other non-flammable, non-aggressive

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chemical media and can operate in temperature ranges from -20°C to 450°C (or -20°C to 560°C - depending on material design)

Pressure and temperature relationships for individual types of globe valves are specified in the respective data sheets.

*NOTE: For valves with a rubber seal, the temperature of the medium must not exceed 120°C (393K), and with a Teflon seal up to 200°C (473K).*

*Application to other media, parameters involves a change in materials to ensure safe use and requires agreement with FAP WAKMET.*

*Do not use the above fittings contrary to the guidelines of this manual.*

*Any deviation from this can risk loss of health and even life.*

#### 4. TRANSPORTATION AND STORAGE OF FITTINGS

The valves are delivered in the "closed" state and are ready for use. The inlet and outlet are protected by caps. Appropriate safety measures should be taken to protect the fittings from damage during transportation.

Heavy fittings should be transported using ropes hooked behind the cover arms or the top flange. The weight of the armature is given in the data sheets. Fittings must never be hooked by a wheel or actuator. After delivery to the site and before installation, fittings should be checked for damage during transport.

Fittings should be stored in such a way that their subsequent use is not affected. It should be protected from the harmful effects of moisture, dust, corrosion, etc. Storage of fittings can be carried out in dry places and protected from the harmful effects of precipitation and the effects of chemical substances or gases.

Fittings should always be stored in the closed position.

Store fittings so as not to destroy their locking system, do not manipulate the drive knobs or wheel.

Valves stored for more than 4 months, before installation, should be visually inspected paying special attention to:

- Preservation of interior surfaces,
- The quality of the paint coating,
- blanking controls,
- checks on other security features,
- Inspection documents attached to the fittings;

Using the recommendations listed above, fittings can be stored for up to 12 months. If the storage period exceeds 1 year - fittings should be deconserved, pressure tested, and then preserved again.

#### 5. PREPARATION FOR INSTALLATION ON THE PLANT

Before proceeding with the installation of fittings:

- carry out identification of fittings with documentation,
- carry out a check on the connections of fittings whether they correspond to the assumed dimensions,
- carry out an examination of the completeness of fittings and the required technical documentation, acceptance protocols, quality certificates, etc,
- Decontaminate the surfaces and connections that are subject to welding,
- Remove safety features and caps,
- check that the faces are undamaged and metallic clean - free of paint and corrosion,

- Check the inside of the valve and pipeline to make sure it is free of any impurities.

## 6. INSTALLATION ON THE PLANT

Proper installation has a major impact on the functioning of the valves. Installation work must be carried out by qualified personnel who are familiar with the application and purpose of the valves. Installation work must be carried out under supervision, observing health and safety regulations.

Fittings before installation on the system are not subject to disassembly.


Valves can be installed in any position, but the position with the stem facing up is recommended.

The stem threads must not be painted.

The valves should be positioned between the ends of the pipeline so as to maintain the direction of flow as marked on the body.

Installation of flanged fittings should be carried out so that the holes on the flanges and counter-flanges are located opposite each other. The required gasket must be inserted between the flanges, paying special attention to ensure that the gasket between the flanges is properly centered. When attaching fittings to the pipeline, all bolt holes located on the flange must be used. Installation of screws must be carried out with the principle of screwing in two opposite screws. Tighten the bolts crosswise with the appropriate torque, as described in Table 1

**Table No. 1** Tightening torque of mounting screws [Nm].

Size thread	Hexagon 	Strength classes of bolts					
		5,6	5,8	6,8	8,8	10,9	12,9
M5	8	2,8	3,7	4,5	6,0	8,5	10
M6	10	4,8	6,4	7,7	10	14	17
M8	13	12	16	19	25	35	41
M10	17	23	31	37	49	69	83
M12	19	40	54	65	86	120	145
M14	22	64	86	105	135	190	230
M16	24	98	130	155	210	295	355
M18	27	135	180	215	290	405	485
M20	30	190	255	305	410	580	690
M22	34	260	345	415	550	780	930
M24	36	330	440	530	710	1000	1200
M27	41	490	650	780	1050	1500	1800
M30	46	660	880	1050	1450	2000	2400
M33	50	900	1200	1450	1900	2700	3250

The bolts, nuts and washers used for fastening must be made of suitable and certified materials, with the required strength class.

Welded connections may be made only by qualified personnel, using appropriate equipment. The responsibility for this and for any necessary heat treatment rests with the owner (user) of the pipeline. The valve, when welded to the pipeline, should be open. During welding, special care should be taken not to contaminate the valve and the pipeline.

The fittings must not be installed in a way that will cause axial stresses and torques in the pipeline.

When cleaning the installation before operation, protect the sealing rings from dirt. The agent used to clean the installation must not be aggressive to the valve's contents. It is recommended to use, on the installation, before the stop valves, sediment traps.

In the case of fixtures equipped with an electromechanical actuator, the installation of this actuator can be carried out by an electrical worker who has sufficient authorization and adequate knowledge of electromechanical actuators.

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## 7. PREPARATION FOR TRIAL START-UP

Before the test commissioning, carry out functional tests of the valves. Open and close. Check all connections and gland sealing, eliminate inadequacies.

Check the attachment and support of the valve.

Carry out the necessary inspection of the given cut and pipeline. Carry out control moments and start-up tests taking into account user instructions. Carry out commissioning tests with neutral medium. Open the valve during filling. After filling, vent the system. During the test, check the tightness of the body, the seals of the cover and the body, the tightness of the stuffing box, inter-flange connections and welded joints. If there are leaks, tighten the connecting bolts of the cover flange connections. Tighten the gland bolts if there are leaks in the gland chamber. After completion of commissioning tests, drain the installation and prepare it for operation.

## 8. OPERATION AND MAINTENANCE

During operation, the valve should be inspected. The frequency of inspection should be carried out every 100 opening-closing cycles or at least every 4 months. The inspection is subject to the tightness of the inter-flange connections, the tightness between the body and the cover and the tightness of the gland chamber.

In case of leakage, if possible, tighten the gland bolts or the connecting bolts of the hull and the cover. When it is impossible to tighten the sealing system due to the gland leaning against the cover it is necessary to add sealant. This should be done by unscrewing the nuts, lifting the gland, topping up the package (on request, FAP WAKMET will provide a repair package), lowering the gland and re-tightening the gland nuts.

Before doing any work on the fitting, or before removing it from the pipeline, make sure that there is no pressure and the fitting is cooled down.

If the medium is toxic or flammable, the fittings must be drained and then flushed or blown out.

Valves from FAP WAKMET are designed to minimize maintenance. However, to ensure their long and reliable operation and reduce repair costs, they should be checked regularly, especially those that are rarely used and those that are difficult to access.

The user of the installation is responsible for establishing regular inspections, the frequency of which depends on the operating conditions of the fittings.

The proper functioning of fittings can be prolonged by:

- Regular lubrication of the stem,
- Tightening the valve gland or replacing the sealing pack,
- Opening and closing the valve at least twice a year,
- Replacing the flat seal in a timely manner,

Each time the valve is disassembled and assembled, replace the flat gasket and gland pack. If it is necessary to replace components, use parts recommended by the manufacturer.

The valve should be checked for leaks before being put on the system.

## 9. DETAILED DESCRIPTION OF THE CONSTRUCTION

Straight, angle and angled globe valves, by design, are generally divided into:

- stop valves without relief (fig.no1, 2, 3)
- relief valves (Figure 4)

A separate group is made up of valves with a control plug, in which a structurally different plug is used (fig. no. 5) and valves adapted for drive (fig. no. 6)

Due to the multiplicity of design options for globe valves, and thus the large number of dimensional parameters, these quantities (detailed in the drawings) are not cited in this manual, but are contained

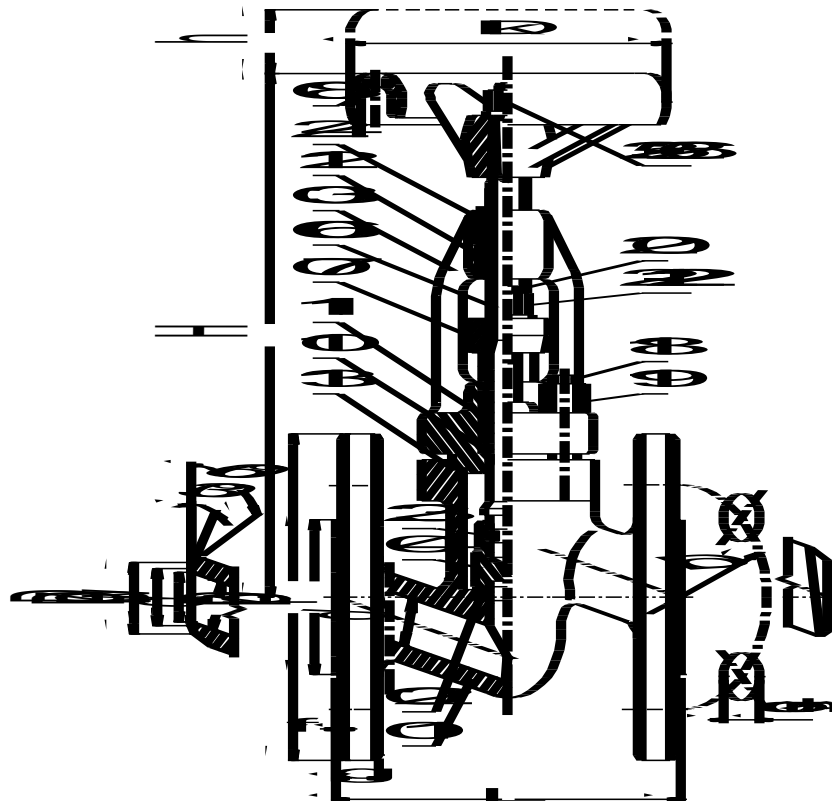
in the relevant data sheets.

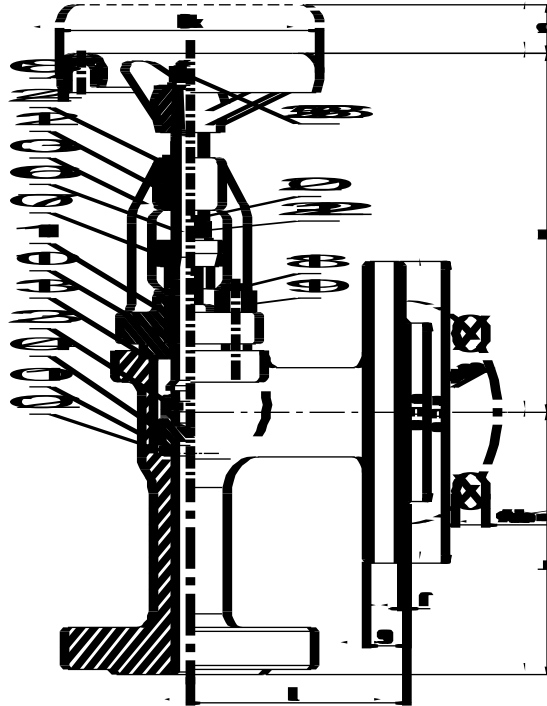
According to Figure 1, the basic element of the valve is the hull [1]. It has a seat made of austenitic or stellite surfacing [2]. The next element that interacts with the seat is a plug [4] with an austenitic or stellite surfacing [5].

The entire throat system is closed from the top with a cover [3]. This cover is made of carbon steel or cast steel. This system is sealed by a flat gasket [13].

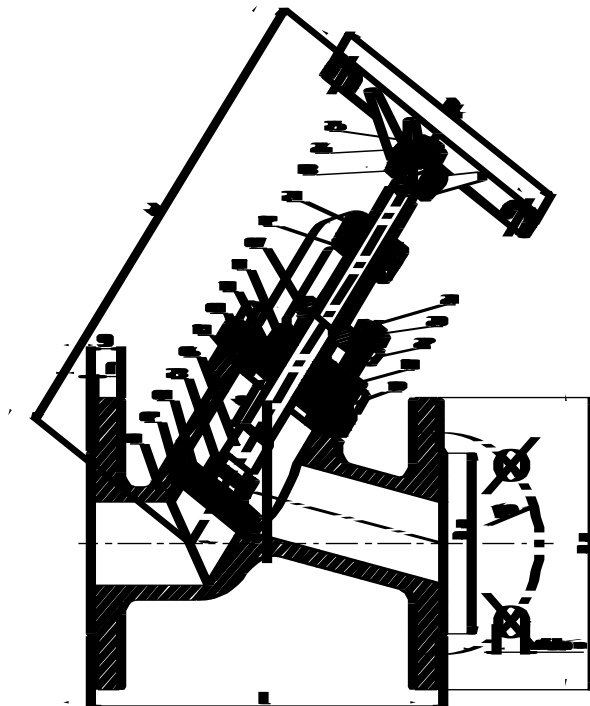
**Figure 1.**

Valve  
prohibitive  
straightforward  
relieves

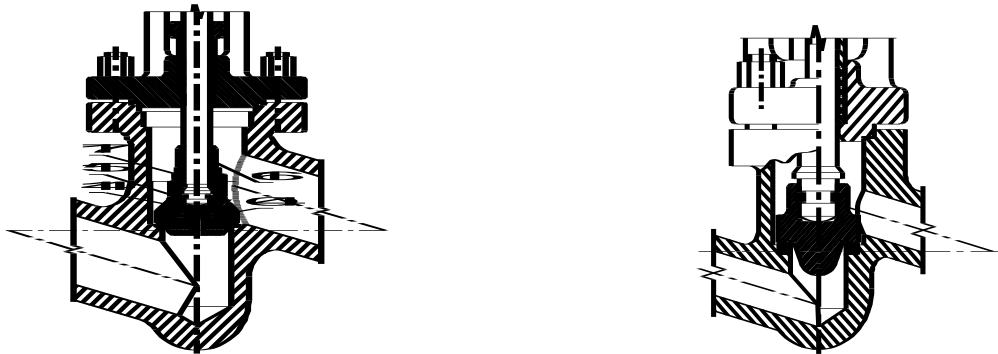




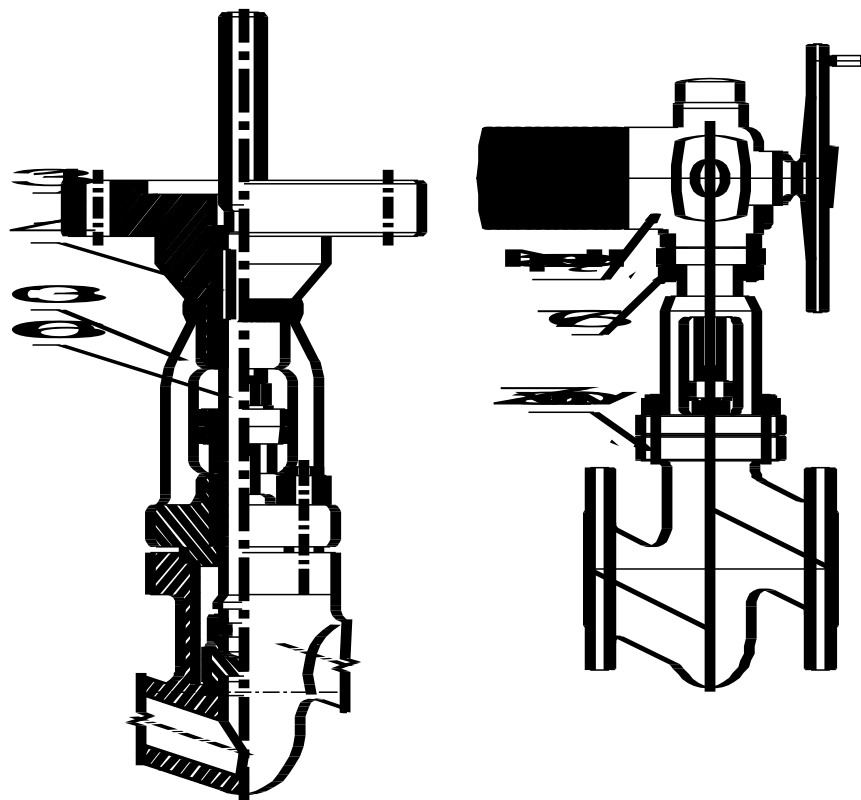
**Fig. No. 2.** Angular stop valve without relief



**Fig. No. 3.** slanted stop valve without relief



**Fig. No. 4.** Stop valve with relief **Fig. No. 5.** Stop valve with control plug



**Fig. No. 6.** straight barrier valve adapted under drive / with drive

The basic component of the cover subassembly is the stuffing box, in which graphite segments [10] are used to seal the stem [6], supported from below by an insert [11]. The entire gland is closed by a gland [7]. A cover screw [12] is placed in the head of the cover [3]. A handwheel [8] is used to close the valve.

In the case of larger passages, in order to ensure proper operation of the valve due to the forces acting on the containment body, a plug with strain relief was introduced into the valve design (fig.no.4).

The basic components of the plug [4] with strain relief are the strain relief plug [14], the stem clamp [15], the plug screw [16] and the lock washer [17].

The system works as follows: with the plug closed and the pressure directed at the plug, lifting the plug in such a case is practically impossible without relief and risks twisting the stem (spindle). The use of a pressure-relieving plug [14] and lifting it up the spindle through the clamp [15] equalizes the pressures upstream and downstream of the plug, which in turn allows the large plug to be lifted



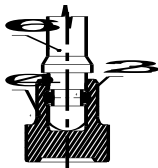
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freely. A screw [16] and washer [17] are used to mechanically secure the assembly against self-unscrewing.

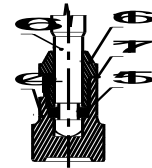
## 10.DETAILED DISASSEMBLY AND ASSEMBLY

### ❖ DEMONSTRATION

1. Fix the valve (immobilize).
2. Remove the handwheel [08]. Loosen the nut [25] with a wrench, pull out the washer [26], then knock the handwheel out of the stem [06].
3. Disconnect the cover subassembly [03] from the fuselage [01] by unscrewing the nuts [19] from the studs [18]. In turn, you can remove the flat gasket [13] from the hull and unscrew the studs.
4. Fix the removed cover subassembly in a vise with soft jaws. Fasten by grasping the mandrel [06] on the mushroom side, taking care not to damage its surface. Now we can unscrew the mandrel from the cover subassembly by twisting the cover.
5. Fix the cover in the vise. Loosen the nuts [21], remove the washers [22], then remove the studs [20] of the choke. Now we can pull out the choke [07]. Then, using a special tool, pull out the packing [11] along with the inserts [10].
6. Remove the plug [04] from the stem [06]:



a) wire connection



) screw connection

**Fig. no. 7.** solutions for the connection of the plug to the stem

- For wire connection (fig.no.7a) :  
Bend off the protruding part of the wire [23] with a sharp screwdriver and flat-nosed pliers. Hold it in a vise and, using the principle of leverage (support on the mushroom, force applied on the mandrel), pull the wire out piece by piece with attaching.
- For a screw connection (Figure 7b)  
Bend the bend of the lock washer [17] with a sharp screwdriver and a hammer. Remove the screw [16], remove the plug, remove the bipartite ring [15] (half rings).
- For the connection to the relief plug (Figure 4):  
Bend the bend of the lock washer [17] with a sharp screwdriver and a hammer. Remove the screw [16], remove the plug holding the stem clamp [15] with your fingers, separate it by disconnecting the stem [06] from the plug [14].

### ❖ MONTAGE

1. Assemble the stem [06] with the plug [04]:
  - For the wire connection (Figure 7a):

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Fix the mushroom in a vise (the axis of the mushroom deviated from the vertical preferably at an angle of about 45°). Coat the head of the mandrel with a thin layer of high-temperature lubricant. Insert the head of the mandrel into the socket of the mushroom. Drive the wire [23] until it fills the channel, and bend the protruding part.

- For a screw connection (Figure 7b):

Apply the screw [16] and lock washer [17] to the stem. Coat the head of the mandrel with a thin layer of high-temperature lubricant. Seat the bipartite ring [15] in the groove of the mandrel. Holding the ring, slide the mandrel into the plug and screw in the screw, leaving a clearance. Fix behind the plug in a vise with special jaws. Position the lock washer correctly with respect to the plug and tighten the screw with a wrench to the ready. Bend the lock washer.

- For the connection to the relief plug (Figure 4):

Apply the screw [16] and lock washer [17] to the stem. Coat the head of the mandrel with a thin layer of high-temperature lubricant. Set the arbor clamp [15] on the strain relief plug [14] and the arbor head at the same time. Holding the clamp, slide this whole into the plug and screw in the screw leaving a clearance. Perform further steps as for the screw connection.

*NOTE: For each type of connection, pay attention to the free rotation of the pin relative to the fungus (without any resistance or jamming) after their installation.*

2. Screw the cover screw [12] into the head of the cover with a special wrench so that the face of the screw is flush with the face of the cover. On the pitch diameter of the screw thread, drill a hole at the appropriate depth, and then drive the locking pin [24] there.
3. Screw in the studs of the choke [20]. If tilt screws are used, insert the screws into the ears of the cover and drive the pins in, and swell the ends (the screw should deflect at least 90°).
4. Set the cover on a special mounting mandrel, fixed in a vise. Insert the sealing package [11] together with the inserts [10] into the gland chamber of the cover [03]. Tighten the packing - the package should be flush with the edge of the gland chamber. If it is below (2mm or more), it should be supplemented with an additional ring of graphite without tightening. Remove the cover subassembly from the mounting stud.
5. Apply a thin layer of high-temperature lubricant to the trapezoidal thread of the mandrel. Insert the stem subassembly with the plug into the cover while applying the gland [07] and possibly the gland sleeve to the stem. Screw the mandrel into the head of the cover so that it protrudes above the screw about 8-10 turns of the trapezoidal thread.
6. Put washers [22] on the choke bolts [20], screw on the nuts [21] and lightly tighten them.
7. Fix the fuselage in a vise (in the case of large flights set on stands - prisms). Screw in the studs [18] of the hull. Insert the gasket [13] into the lock.
8. Place the cover assembly on the hull so that the cover bails are in the longitudinal plane of the valve. Pay special attention that the markings cast or forged on the hull and the lid are on the same side of the valve. Screw on the nuts (alternately - crosswise), and then check that the parallelism of the flanges of the lid and the hull is maintained with a minimum gap between them of about 0.5 mm.
9. Put the wheel [08] on the stem, tap it lightly and screw on the nut [25] with the washer [26].

*NOTE: Disassembly and assembly for electromechanically operated valves:*

❖ DEMONSTRATION

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1. Fix the valve (immobilize) in the vertical position.
2. Disconnect the electromechanical actuator from the valve. Suspend the actuator. Loosen the bolts [76] (nuts in case of a different mounting). Remove the actuator from the stem [06] by turning the actuator handwheel.
3. Disconnect the cover subassembly [03] from the fuselage [01] by unscrewing the nuts [19] from the studs [18]. In turn, you can remove the flat gasket [13] from the hull and unscrew the studs.
4. Fix the removed cover subassembly in a vise with soft jaws. Fasten by gripping the mandrel [06] from the mushroom side, taking care not to damage its surface. Remove the key [41] from the key groove of the mandrel. Now we can remove the cover subassembly from the mandrel by twisting and pulling the cover.

The next disassembly steps should be carried out as for a valve with a handwheel.

#### ❖ MONTAGE

1. Assemble the stem [06] with the plug [04] - as for a valve with a handwheel.
2. Screw the studs of the choker [20] into the cover fixed in the vise. If tilt screws are used, insert the screws into the ears of the cover and drive the pins, and swell the ends (check that the screw has the possibility of deflection by at least 90°).
3. Set the cover on a special mounting mandrel, fixed in a vise. Insert the sealing package [11] together with the inserts [10] into the gland chamber of the cover [03]. Tighten the packing - the package should be flush with the edge of the gland chamber. If it is below (2mm or more), it should be supplemented with an additional ring of graphite without tightening. Remove the cover subassembly from the mounting stud.
4. Insert the stem subassembly with the plug into the cover while placing the choke [07] and possibly the choke sleeve on the stem and placing the key [41] in the key groove of the stem. Slide the mandrel so that the key enters the drive flange keyway [31].
5. Put washers [22] on the choke bolts [20], screw on the nuts [21] and lightly tighten them.
6. Fix the fuselage in a vise (in the case of large flights set on stands - prisms). Screw in the studs [18] of the hull. Insert the gasket [13] into the lock.
7. Connect the cover subassembly to the hull - as for a valve with a handwheel.
8. Fix the valve in the vertical position (large valves for prying). Suspend the drive above the valve with the connection facing the valve. While slowly lowering the drive, screw its sleeve into the stem [06] by turning the drive's handwheel. Now you can connect the valve to the drive with screws [76].
9. **After mounting the actuator to the valve, the electromechanical actuator should be set to torque closure.**

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## 11. SECURITY AND WARRANTY

This manual contains basic recommendations that must be followed during installation, operation and repair work. Fitters and operating personnel should read it and understand it well before the installation is put into operation. All personnel involved in the installation, operation, supervision and service of the fixtures should be qualified. The competence and responsibility of personnel must be clearly and unambiguously defined by the user of the installation.

Failure to follow the instructions may lead to damage and even destruction of the fixture and cause danger to personnel and the environment.

Any modification of the supplied fittings is possible only with the approval of the manufacturer.

To ensure safety, use only original spare parts.

Warranty claims will not be accepted if unsuitable replacement parts and materials are used. Claims regarding the functionality and safety of the valve will be considered only if the maximum permissible operating parameters are not exceeded (see data sheet).