

OPERATING MANUAL

Double eccentric
flanged butterfly valve

Part No. 4493 4493SQ 4493SA



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1. INTENDED USE

Product Number 4493, 4493SA eccentric butterfly valves are intended for potable water supply systems, sanitary sewage systems and (if approved by the manufacturer) industrial media systems. Each valve can be installed in overground and underground pipelines as an integral in-line part of the piping. The butterfly valves are used to shut off and regulate the flow of the medium using a part-turn gearbox, electric actuator or a multi-turn actuator unit with a part-turn gearbox. They are recommended as shut-off valves for open or closed position. Additionally they can be used as flow control valves for opening angle range 15°÷90°. The selected actuator unit must ensure a stable closure actuation angle within 0° - 90° and the correct operating torque value, see Table 1.

2. TECHNICAL DESCRIPTION

- Production and acceptance according to EN 1074-2 (*Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Isolating valves*) and EN 12266-1 (*Industrial valves. Testing of valves*).
- 100% of each valve is leak tested.
- 4493, 4493SA butterfly valves are tight in both directions.
- The temperature range of the valve application is from 0°C to 70°C (they can be used in other temperatures as agreed with the manufacturer).
- Nominal pressure ratings: 1.0 MPa; 1.6 MPa.
- Nominal diameter range offered: DN200÷ DN2000 [mm].
- Hydraulic performance: maximum liquid medium flow rate: PS10 max. 3[m/s]; PS16 max. 4[m/s];
- Minimum driving torques necessary to operate the valve (*without actuator element*) are given below:

DN [mm]	ISO 5211	Torque value on valve shaft required for closing or opening (Nm)	
		1,0 [MPa]	1,6 [MPa]
Δp		1,0 [MPa]	1,6 [MPa]
200	F10	430	970
250	F10	500	1,100
300	F10	860	1,200
350	F14	1,300	1,891
400	F14	1,400	2,400
450	F14	2,300	3,300
500	F16	2,600	3,800
600	F16	3,700	6,300
700	F25	5,500	8,700
800	F25	7,600	11,300
900	F25	9,600	14,400
1000	F25	14,500	20,200
1200	F30	22,900	37,200
1400	F35	42,500	67,800
1600	F40	54,600	118,400
1800	F40	135,000	202,500
2000	F48	150,000	225,000

Table 1. Driving torque

- The minimum valve switch-over time (to close or open) dependent on the DN size (nominal diameter) is listed in Table 2:

DN (mm)	Switch-over time (s)
40÷350	10
400÷600	16
700÷800	40
900÷1200	50

Table 2. Minimum valve switch-over time

The valve switch-over time is the minimum time to close or open the valve connected to a pump which delivers a medium. The time values listed in Table 2 are calculated with the following formula:

$$T = \frac{L \cdot V}{g \cdot h \cdot (k - 1)} \cdot \sqrt{k}$$

T → switch-over time (s)

L → piping length (m)

g → 9.81(m/s²),

h → nominal pressure in metres of sweet water column

V → flow rate (m/s)

k → shock wave pressure rise factor, calculated in relation to the nominal pressure (1-1.25)

The listed time values from Table 2 are calculated for: $L=500(m)$, $V=4(m/s)$, $k=1.25$. If the closing time is shorter, it is mandatory to install water hammer dampers (and standard safety valves are unfit for this application).

- Valve control mode: the standard version of the valve has the clockwise closing sense of rotation. The closing sense of rotation can be opposite on special order. The standard valve version control is operated with a self-retarding worm gearbox. It is possible to control the valves with electric actuators. The following is the standard for the version with electric actuator:
 - Product 4493SQ: applies to DN200 - DN400; control is carried out by the SQ electromechanical part-turn actuator from AUMA,
 - Product 4493SA: applies to DN500 - DN2000; the control is carried out by the SA electromechanical multi-turn actuator and a GS part-turn gearbox from AUMA.
- Connection flanges are manufactured in accordance with EN 1092-2 (*Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN. Cast iron flanges*) and in sizes suitable for nominal pressure ratings.
- The installation (face to face) length and its tolerance are per EN 558 (*Industrial valves. Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems. Valves with PN and class marking*); Series 14.
- Butterfly valves with a soft seal (4493, 4493SQ, 4493SA) in diameters DN200 ÷ DN2000 have a double-seated cover (*disk*). The valve pivot shafts are held by the necks, mounted on additional bearing sleeves. The pivot shafts are sealed by the packing gland assembly, comprising an arrangement of o-rings. The butterfly valve is closed with a cast iron disc fitted with an elastomer seal. One of the shafts is used to control the valves. The second shaft is enclosed and is used to evenly distribute the moments acting on the butterfly valve disk. In the case of underground installations, the valve must have a part-turn gearbox connected to the fixed housing Product Number 9025. Such a configured valve can be controlled with: T key - Product Number 9015,
 - Stand with opening indicator - Product Number 9113,
 - Stand for actuator - Product Number 9114.
 - Stand for actuator - Product Number 9114 + additional equipment (*electromechanical actuator*)

For more information on installation of valves in underground pipework, see point 5.2. *Installation instructions*).

The following figures (*fig.1*) show the position of the eccentrics for double eccentric butterfly valves.

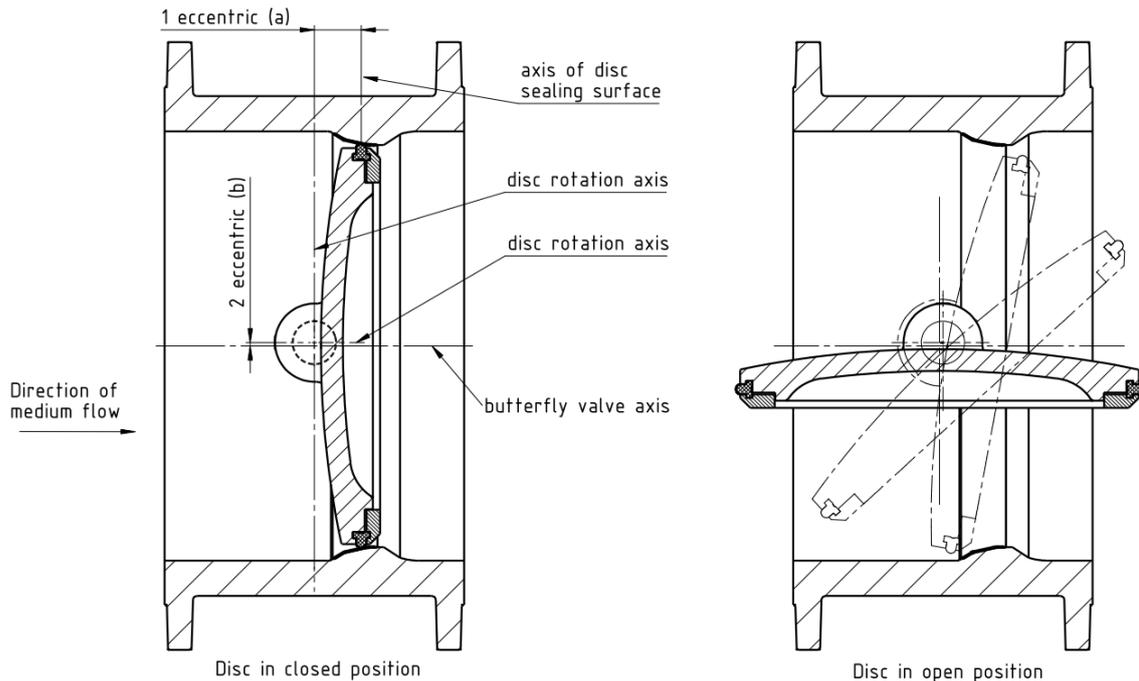


Fig. 1. Disk positions depending on the butterfly valve opening angle.

The first eccentric (a) causes the disc rotation axis to be outside of the sealing surface axis. Such construction ensures full sealing around the entire circumference between the body welded seat and the rubber sealing ring. The second eccentric (b) is an offset of the butterfly valve disc axis in relation to the butterfly valve axis (body axis).

It serves to minimise the compressive stress of the sealing ring when the butterfly valve is opened.

- The valve without a gearbox forms an assembly that can be adapted to various control devices (gearboxes, actuators). **To ensure proper leak-tightness of the valve, an operator can only be installed by an authorized service of Fabryka Armatur JAFAR.** The operator must ensure a stable closure actuation angle within:
 - 0 - 90° for the fully open and fully closed motion;
 - 15° - 90° for flow control (damping);

and the proper operating torque (see Table 1). Long-term operation of the valve with an operator as a flow damping valve may cause wear of the sealing insert and result in leaks through the closed valve.

3. PRODUCT IDENTIFICATION

The valve marking meets the following standards: EN 19 (*Industrial valves. Marking of metallic valves*), EN 1074-1 (*Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Part 1: General requirements*). The permanent identification markings are on the front and back walls of the body chamber and on the cylindrical closure plate. The marking contains the following data:



- manufacturer's trade mark,
- arrow; direction of the recommended media flow,

- identification sticker,
- nominal diameter,
- nominal pressure,
- body material type,

- closure plate material type,
- nominal diameter;

The location on the valve specified in the documentation features the identification stickers (nameplates) which contains the following data (*Fig.2*):

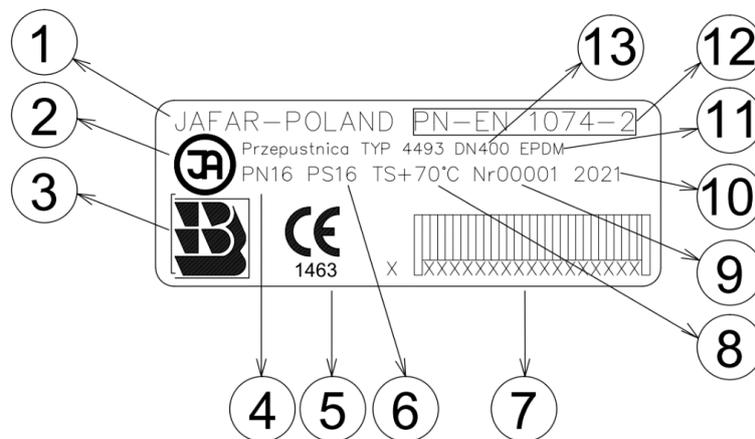
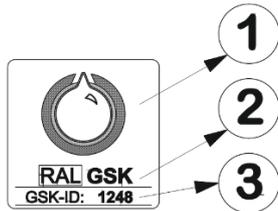


Fig.2 Plate identifying the valve

1. Manufacturer's company and country of origin.
2. Manufacturer's company logo.
3. Polish construction mark (for the full range of diameter values).
4. Alphanumerical reference designation for the combination of mechanical properties and sizing of the mating piping ends (PN).
5. CE marking
6. Maximum permitted pressure (PS).
7. Barcode.
8. Maximum / minimum permissible temperature (TS).
9. Production serial no. in the calendar year.
10. Year of manufacture of the product.
11. Sealing material specification (where the operating temperature shall not exceed 70°C for EPDM).
12. Reference standard the product is compliant with.
13. Nominal diameter (DN).

Butterfly valves with anti-corrosion protection in accordance with GSK RAL certificate have an appropriate label (*this applies to valves in the range DN200 - DN1200*) (Fig. 3):



1. GSK logo.
2. Certificate title.
3. Certificate reference number.

Fig. 3 The sticker specifying the RAL mark of the GSK company

Additionally, each valve has a sticker with information on how to contact the JAFAR service (Fig. 4).



Fig. 4 Sticker specifying contact with JAFAR service

A sticker identifying part-turn gearboxes Type JFR IP68 (GRAY) is used for standard valves:



Fig. 5. Plate identifying JFR gearboxes

1. Manufacturer's company logo.
2. Shaft size used for the gearbox unit.
3. A constant ratio of the number of sprockets between the worm screw crescent and the worm screw shaft of the gearbox.
4. Conversion ratio of the maximum output torque from the gearbox to the input torque. This value may increase to 20% during operation.
5. Maximum input torque which can be used to operate a valve using, for example, a drive wheel.
6. Maximum gearbox torque that can be transmitted to the valve shaft.
7. Accessory type.
8. Gearbox type JFR IP68
9. Production serial no. in the calendar year.
10. Year of manufacture of the product.

4. STORAGE AND TRANSPORT

The products are packed on EURO pallets (1200x800) or in dedicated packaging. The valves should be stored in clean rooms, free from bacteriological and chemical contamination, at temperatures from -20°C to 70°C. The paint coating and rubber elements must be protected against long-term exposure to UV radiation. The stored valves are protected against mechanical damage.

Do not compress any rubber parts. The valve flap should be left in an intermediate position - so that the flap does not exceed the installation length of the valve (*this position is shown in Figs. 6 and 7*). Secure the products against shifting during shipping and handling. Heavy valves (DN500 and larger) shall be handled with dedicated eye bolts; valve sizes from DN200 to DN400 shall be handled on slings and secured from rotating. Do not handle by the lever, the gearbox handwheel, or the operator/gearbox housing.

Table 3 below lists the transport holes on the flange projections for the range DN500 - DN900 - Fig. 3. For DN1000 and DN1200, the transport holes are located on the cylindrical surface of the body (*between the connection flanges to the pipeline*) - Fig. 4.

	DN500	DN600	DN700	DN800	DN900	DN1000	DN1200
PN10	4x ϕ 28	4x ϕ 31	4x ϕ 31	4x ϕ 34	4x ϕ 34	4xM27	4xM36
PN16	4x ϕ 34	4x ϕ 37	4x ϕ 37		4x ϕ 41		

Table 3. Sizes of transport holes



Fig. 6. Butterfly valve part no. 4493SA DN800



Fig.7. Butterfly valve part no. 4493 DN1200

5. INSTALLATION

5.1. GENERAL REQUIREMENTS

Flanged butterfly valves: TYPE 4493, TYPE 4493SQ and TYPE 4493SA can be installed in underground or overground pipelines on horizontal or vertical installations. The listed products are suitable for joining with the flanged ends of pipelines with the size equal to that of the valve flanges. The valves are bi-directional tight. The valves are to be installed in the pipeline so that the flow direction of the medium is in accordance with the flow direction indicated on the body. This is due to the increased service life of the sealing elements and the reliability of operation in such a configuration. At the moment of valve opening the stream coming out through the slit in the lower part of the body has the maximum speed, which consequently results in tearing off the embedded contamination (this applies to the situation when solid contaminants get with the medium and they settle at the bottom of the pipeline and in the body of the butterfly valve). It is possible to mount the valve in the opposite direction to the arrow on the body, bearing in mind the increased wear and tear of the sealing elements compared to the standard configuration described above.

When installing eccentric butterfly valves downstream of the control valves (e.g. Product Number 6800) and shut-off valves (e.g. needle, ball or poppet valves), a minimum distance of $10 \times DN$ of the valve must be kept between them.

Due to the non-uniformity of the speed and pressure fields near piping elbows and tees, it is recommended to maintain a straight piping run at least $3 \times DN$ long between the valve outer flange face and the piping bend or tee (see picture below). The manufacturer allows for a distance less than $3 \times DN$, but this may result in noisy operation and faster wear of the butterfly valve.

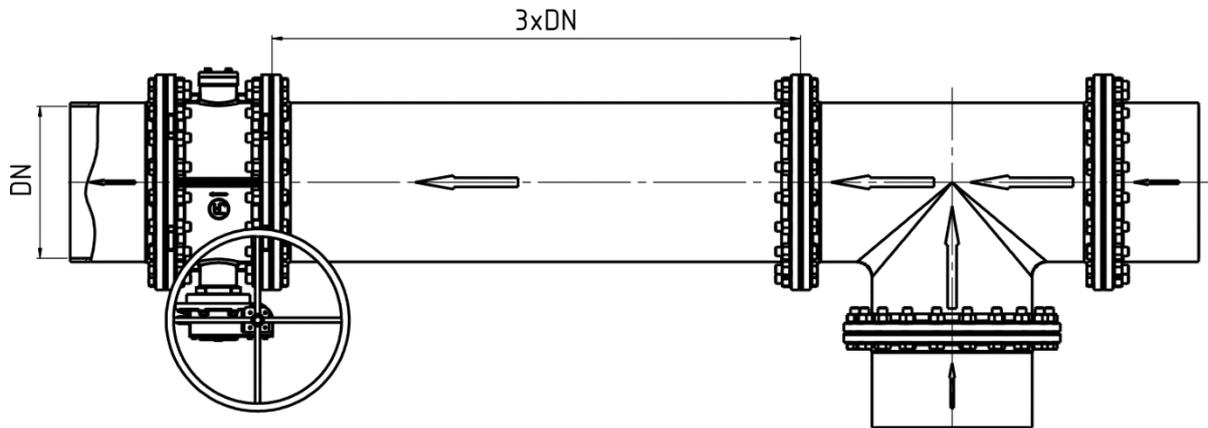


Fig. 8. Recommended distances from the piping bends

The general rule is not to install the valve near any bend or tee or any piping bends (elbows / tees), especially with the valve on the high-pressure side of the piping (in the pump to valve to piping curve system). The normal flow deflection over a piping bend will be aggravated by the low-pressure area of the valve (where a risk of flow interruption exists). Installation directly behind pumps, behind elbows or tees is not permitted due to the possibility of cavitation on the flap surface, vibration or disc oscillation and faster wear of bearings and sealing elements. The dimensions of the valve must also be taken into account in the technical design so that the valve can be operated freely.

The butterfly valve can be installed in any orientation and in either direction of flow, provided that the butterfly valve closure pivot shafts are aligned horizontally. Correct installation of the valve on vertical and horizontal pipelines is given below - Fig. 9. The permissible deviation from the horizontal location of the shafts in relation to the horizontal axis of the pipeline is from 2 to 5 degrees.

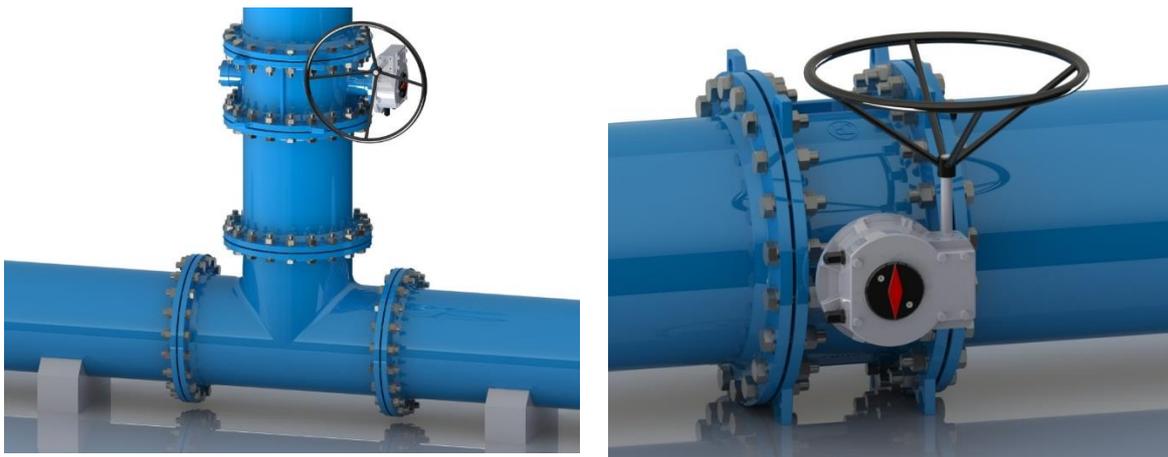


Fig. 9. Orientation of the valve closure pivot shaft relative to the piping plane shown for Product Number 4493 DN500

a) Vertical piping

b) Horizontal pipeline

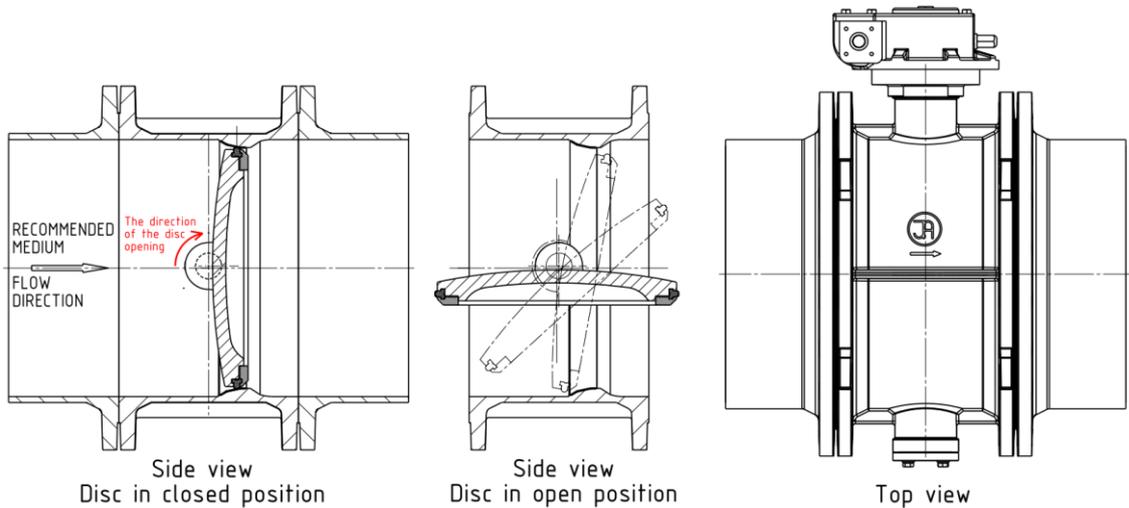


Fig.10 The movement of the valve flap in the standard version

The above Fig.10 shows the standard version of eccentric butterfly valves with the JFR GRAY gearbox. The standard movement that opens the flap is clockwise. In contrast, the permanently marked arrow on the valve flap pivots shows the movement that closes the flap (counter clockwise). This is the optimal movement that increases the service life of the valve components. Irrespective of the requirement for a straight piping run at least $3 \times DN$ long between the valve outer flange face and the piping bend (alternatively, the designed valve can be replaced with one of a higher pressure rating), to minimise the localised flow acceleration and interruption by the piping bend. The valve shall be installed with the centreline of the valve closure pivot shaft perpendicular to the vertical line of the piping bend so that the valve closure drive shaft centreline is aligned with the piping bend plane. While the valve is being closed or opened, the medium is at its maximum flow rate and entrains the contamination settled in the neighbouring part of the pipeline. The valve installation shown in Fig. 10 additionally extends the service life and operating reliability even with media loaded with contaminants which by their weight tend to settle down in the piping. A consequence of this is that the deposits can be entrained from the upstream of the valve by the maximum possible flow passing the bottom part of the valve closure during the opening operation (Fig. 11). Apart from normal flow deflection by the piping bend, the liquid flow applies a high strain in the low-pressure valve area. This in turn causes the valve to operate with difficulties.

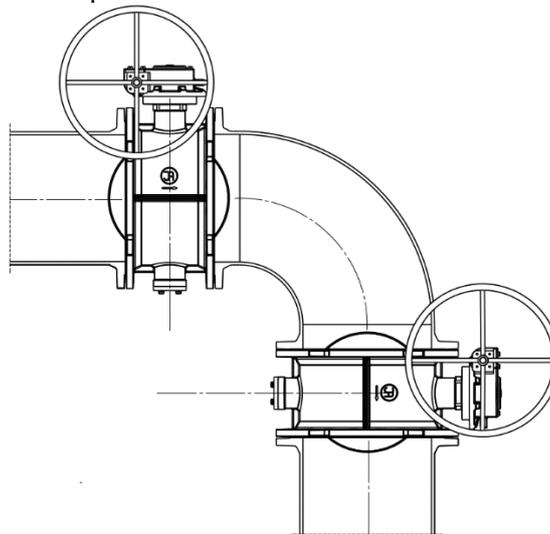


Fig. 11. Correct valve flap orientation

When designing the installation, consider that the horizontal orientation of the valve closure pivot shafts is the best for operating performance and reliability:

1. the weight of the pivot shafts and the closure rests on both bearings;
2. the load at the bearing of the face end of the shaft is decreased,
3. valve life is increased, particularly when the liquid contains solids the particles of which tend to settle at the bottom of the pipe.

5.2. INSTALLATION INSTRUCTIONS

Before installation, the condition of the internal surfaces of the butterfly valve and the surfaces to which the seals working with the pipeline will be fitted should be checked and, if necessary, thoroughly washed with water. When mounting butterfly valves between pipeline flanges, first remove any preservatives which may have been used to protect the surfaces during transport, clean thoroughly the side surfaces of the butterfly valve to which the seal is to be mounted, install previously prepared seals and fasten the whole assembly with appropriately long bolts or pins connecting two adjacent flanges. For proper installation, the flange thickness for the selected DN of the pipeline must be taken into account. When opening the butterfly valve flap it extends beyond the installation length, therefore it is necessary to remember about free space in the pipeline for proper operation of the flap by using the appropriate fittings e.g. cast iron stub pipe, assembly insert. The minimum distance from the valve flange to the end of the gasket dimension is given in the following Table 4 and Fig. 12:

DN	DN200	DN250	DN300	DN350	DN400	DN450	DN500	DN600	DN700
x [mm]	0	0	8	24	33	48	63	93	124
DN	DN800	DN900	DN1000	DN1100	DN1200	DN1400	DN1600	DN1800	DN2000
x [mm]	154	184	214	199	274	334	394	454	514

Table 4. Dimension "x"

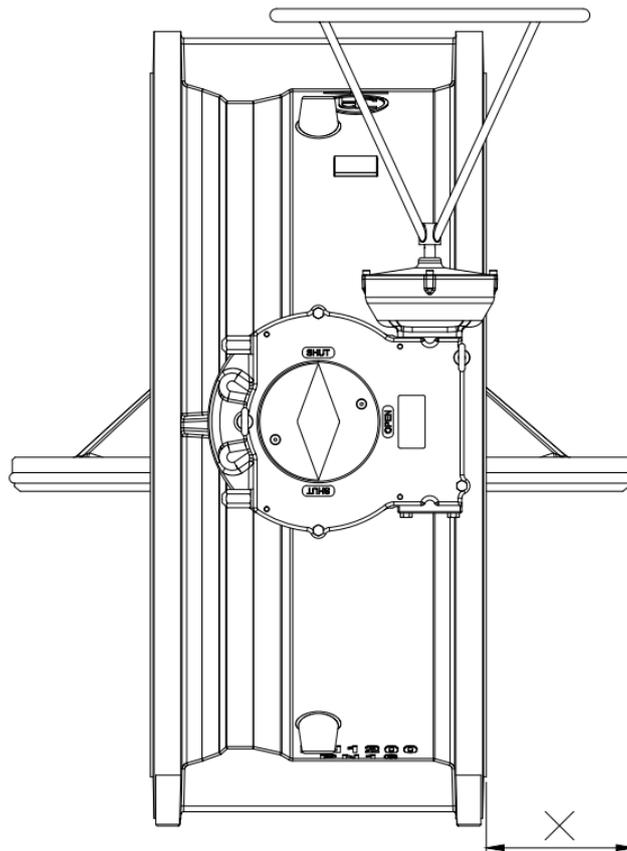


Fig. 12. Preview drawing of a fully open valve 4493 DN1200 PN10

Tighten the connection flange bolts crosswise to ensure a proper seal pressure. Start from the bolt holes near the valve pivot shaft. The tightening torque of the bolt nuts is specified in the standard PN-63/M-82056. During mounting, it is necessary to consider making bases or supports for butterfly valves, which must be adapted to the size and weight of the valve in order to avoid transferring the load into the pipeline. Installed fittings are an integral part of the pipeline.

As standard, the manufacturer offers fittings for dry chambers and directly for installation in the ground. The IP68 protection class (part turn gearbox) does not define the exact operating ranges of the products, such as: immersion depth (a value is specified; at least 1m), the pressure value acting on the product and the valve immersion time. The fittings may be used in chambers (tanks) only after prior agreement between the customer and Fabryka Armatur Jafar. - special realization. As stated in point 2, the control is carried out by a T- key, stands or an electromechanical actuators including fixed casing Product Number 9025. When mounted in the ground, the manufacturer recommends the use of a street box Product Number 9501 mounted on a base plate Product Number 9521 or an equivalent product ensuring rigid foundation of the box. More information on the use of street boxes for underground installations is described in the "Operating Manual for PE-HD street boxes Product Number 95xx".

In case of installing butterfly valve housings in chambers, it is forbidden to transfer the weight of the housing to the valve gearbox. It is absolutely necessary to use stabilizers or other relieving elements, which are mounted to the walls of chambers. Exceeding the limit moments given in Table 4 in point 6 may result in mechanical damage to the JFR GRAY part-turn gearbox.

Note that the completed installation must not expose the valve to bending or tensile stress from loading with the unsupported pipeline sections. Install the product properly aligned with the piping centreline and with proper parallelism and flatness of the mating connection flanges, with prevention of hydraulic shock, and with due compensation of the pipeline dimensional changes from temperature and pressure. A valve assembled and adjusted by the manufacturer is ready for installation in the system. Any dismantling of the valve components (e.g. the shaft, the closure panel, or sleeves) may result in loss of seal.

The requirements for correct quality of the mating flanges have to be satisfied, that is flatness and parallelism, during the installation process. During the installation process, do not leave any installation tools, bolts, nuts, or welding wire inside of the piping or they can stop in the sealing seat of the butterfly valve or on the flap (disc). This may lead to damage of the seat during closing of the valve and loss of seal across the valve. The outer diameter of the flat seals installed the pipeline and butterfly valve flange faces must be equal to or higher than the outer diameter of the face. It must never less than the outer diameter of the face. Place the flat seals aligned with the centreline of the flap sealing ring (the outer diameter of the flat seal must be equal to the nominal diameter of the piping). The tightness is ensured by an elastomeric seal in the disc groove, attached with a clamping ring to the valve flap.

The manufacturing tolerance of the valves and their components are large enough to ensure full interchangeability. The user carries out the installation of the valve in the pipeline on his or her own accord.

Use proper intrinsically safe tools and avoid all actions which may lead to fire during all repair and maintenance work.

Before attempting to install the valve, check the technical and commercial documents delivered with the product to verify that your media and pipeline operating parameters comply with the manufacturer's declaration. If the butterfly valve is installed at the end of piping, mount a steel or cast-iron stub pipe on the free end of the butterfly valve to guard the disc during opening.

Any change in the operating conditions must be consulted with the valve manufacturer beforehand.

Before attempting to assemble the valve, remove the main bore plugs, check the inner surfaces of the valve and thoroughly flush with water, if necessary. When installing butterfly valves between the pipeline flanges, first remove all transport preservation from the surfaces, thoroughly clean the flange faces, install the seals, and screw down with screws long enough to tighten the adjacent flanges of the pipeline together. The valve and piping flange holes must be aligned.

Having completed the installation, perform a pressure test at a maximum test pressure equal to 1.5 times the nominal pressure in the fully open or 1.1 times the nominal pressure in fully closed position.

Caution! If the product has mechanical damage, do not install it in the pipeline.

The pipe inner diameter shall be equal to the nominal diameter (DN) of the valve plus the tolerance for the deviations provided for by the foundry industry for the given pipe I.D.

If the valve is installed with an operator or an operator and gearbox unit, check the electrical wiring and fire-proof protection features (also during coupling and adjustment of the operator) for conformity with the respective operating manuals from the operator drive unit manufacturer.

6. OPERATION

The valve shall be operated in accordance with all relevant requirements for stop valves.

To ensure full operational efficiency, carry out a technical inspection and maintenance at least once a year as follows:

- Operate the valve from the fully open position to the fully closed position, or vice versa.
- If the valve operation is difficult, i.e. the valve reaches the maximum driving torque before either of its limit positions, repeat the full operation three times (by opening and closing the valve repeatedly).
- Check the tightness of all connections and seals with the valve closed.

If all the actions above have been completed with a good result, visually inspect the corrosion protection. If the paint coat is damaged, rebuild it with the paint kits available from JAFAR.

Exceeding the operating limits of the valve may result in damage that will not covered by the warranty or the statutory warranty granted by the manufacturer. When controlling butterfly valves 4493 fitted with a JFR part-turn gearboxes, the torque limits given in Table 5 below must be strictly adhered to:

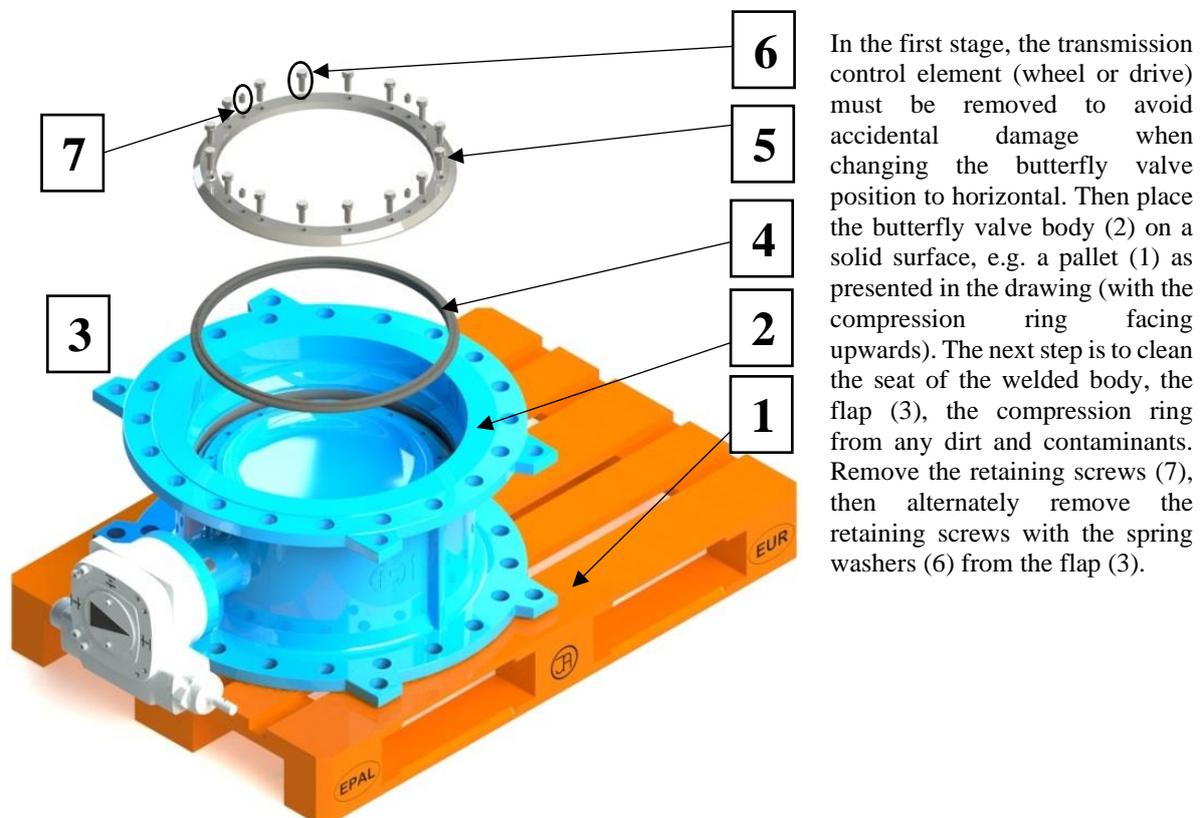
DN	200	250	300	350	400	500	600	700	800	900	1000	1200
M_{maks} [Nm]	46	46	109	175	175	197	134	123	123	151	151	153
Number of turns	10	10	9	10	10	14	55	93	93	117	117	218

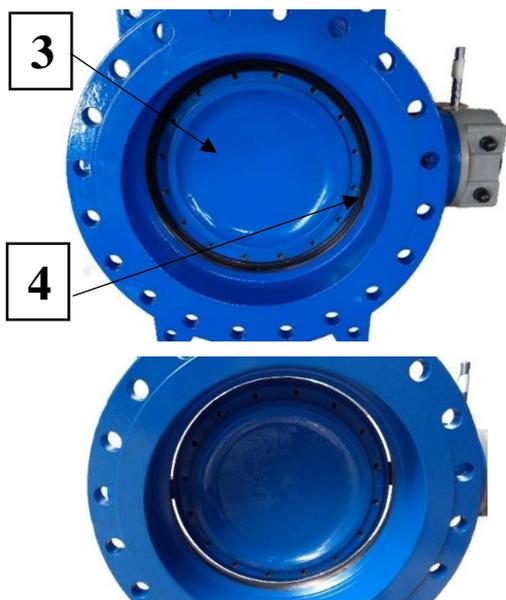
Table 5. Maximum torque on the gearbox shaft and the total number of rotations to the open-close position.

Replacing the seal in the flap.

In order to replace the sealing ring of the flap, it is recommended to remove the butterfly valve from the pipeline, while observing the relevant health and safety regulations.

Before replacing the seal (4), the product must be fully closed. This will make it easier to dismantle the compression ring (5).





Remove the compression ring (5). Open the flap (3) with the seal (4) so that the seal is completely relieved. Carefully clean the flap where the seal is installed. In addition, the welded seat and the compression ring must be cleaned. The flap seal should be lubricated with a grease approved for contact with drinking water and certified by the National Institute of Hygiene (PZH). Install the seal in the place provided for it in the flap, then install the compression ring starting from the initial centring of the ring with the screws (7). Tighten the screws and washers alternately to the torque listed in the table below. Tighten screws (7) in the butterfly valve flap.

Butterfly valve DN	Screw thread	Screw tightening torque
DN200 – DN250	M8	20 Nm
DN300 – DN350	M10	35 Nm
DN400 – DN1200	M12	60 Nm

4. SAFETY

All installation and operation tasks related to the product shall be only be done by qualified professionals with sufficient training and experience to assess the current situation and identify and avoid hazards. Failure to follow this warning or this Operating Manual may cause death, severe bodily injury or substantial property damage.

Fabryka Armatur Jafar S.A. shall not be liable for any accidents or emergencies related to incorrect installation or operation of the product. Note that the valve installation could be pressurized or contain various type of stray gas or aggressive liquids. If the installation is operated explosion hazard zones, ATEX requirements may apply; this will require suitably trained professionals (according to ATEX requirements). Do not use tools which may generate electrostatic discharge in the ATEX zone.

Do not use the product without thorough knowledge and understanding of this Operating Manual. Follow the general health and safety rules. Keep this Operating Manual throughout the service life of the product to ensure a safe operation of the latter.

5. WARRANTY

The product assembled, installed and operated in conformity with this Operating Manual and the data sheet is covered by a guarantee from the manufacturer. The warranty terms, conditions and period are given on the website <http://www.jafar-valves.com/en/obsługa-gwarancyjna-i-pogwarancyjna>. The tab can only be accessed after creating an account in *Customer area* and then logging in.

The manufacturer may provide this product with custom materials and modifications on order. The final selection of the product which meets the optimum criteria for the installation project in question is made by the installation designer, who should consider this Operating Manual along with other data and information of significance for the correct operation of the product.

Failure to comply with the guidelines and instructions in this Operation and Maintenance Manual releases the manufacturer from all obligations, liability and warranty. Due to constant development of our company, we reserve the right to introduce modifications and structural alterations to the product presented in this document.