

Installation, Operation & Maintenance Manual

Knife Gate Valve TYPE C



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0 - Introduction

The type C knife gate is a unidirectional wafer valve designed for industrial bulk handling service applications (i.e. powdered and granular products). The special design of the body allows for easy passage of the fluid and makes it ideal for use as a silo outlet valve.

The knife gate valve complies with the following European directives:

- **2006/42/EC (Machinery Directive)**
- **2014/68/EU (Pressure Equipment Directive)**
- **2014/34/EU (ATEX)**

It is the user's liability to clearly inform the maximum working conditions (PS, TS), medium (gas or liquid) and dangerousness group (1 or 2) and if the fluid is unstable to properly classify the valve according to the PED directive.

AKO Armaturen offers, supplies and certifies valves according to the information received from the customer. The customer is liable to make sure this information is accurate and according to specific working conditions requirements where the valve will be installed.



The knife gate valves may also comply with the directive regarding equipment and protective systems for their use in explosive atmospheres. In these cases, the logotype (see below) shall appear on the identification label of the valve. This label shows the exact classification of the zone where the valve can be used. The user will be liable for its use in any other zone.

This directive only applies in the following atmospheric conditions:

$$0,8 \text{ bar} \leq P \leq 1,2 \text{ bar}$$
$$-20^{\circ} \text{ C} < T < 60^{\circ} \text{ C}$$

Any increase in temperature due to frictional warmth is negligible, since the relative speed of the moving parts is extremely low.

The risk analysis associated to this directive does not take into account the fluid that goes through the valve, even when such fluid produces an explosive atmosphere. The user must take into account the risks that the fluid generates, such as:

- Heating of the valve surface
- Generation of electrostatic charges caused by displacement of the fluid.
- Shock waves caused by the installation (water hammer), internal crashes generated by the pellets or the risks due to foreign bodies susceptible of being present in the installation.

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1 - Handling

The knife gate valves are packed according to the appropriate transport standards. If you receive the packing damaged, please inform the transport company in writing and contact AKO Armaturen.



When handling a knife gate valve please pay attention to the following points:

- **Do NOT attach lifting gear to the valve actuators or gate guards.**
They are not designed to bear the weight, and could easily be damaged.
- **Do NOT lift the valve by the valve bore.**
This can cause damage to the seating surfaces and seals.
- Check that selected lifting gear is rated to carry the weight of the valve.

The knife gate valve can be handled using eyebolts, soft straps or slings:

- **Eyebolts:**
Make sure the eyebolts have the same thread as the bolt holes and they are all well secured. Ideally when using lifting gear to move a knife gate valve, it should be supported by two or more eyebolts screwed into the tapped fixing holes in the valve body.
- **Soft straps:**
make sure the eyebolts have the same thread as the bolt holes and they are all well secured. Ideally when using lifting gear to move a knife gate valve, it should be supported by two or more eyebolts screwed into the tapped fixing holes in the valve body.

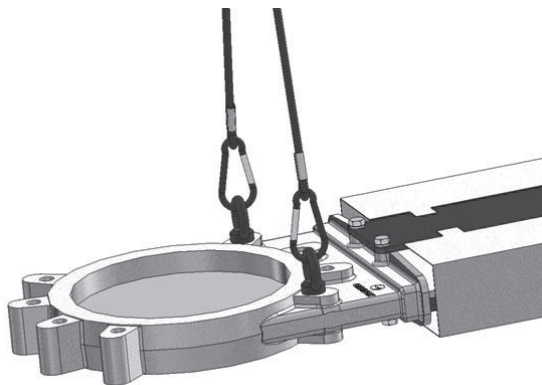


Fig. 1: Handling with eyebolts

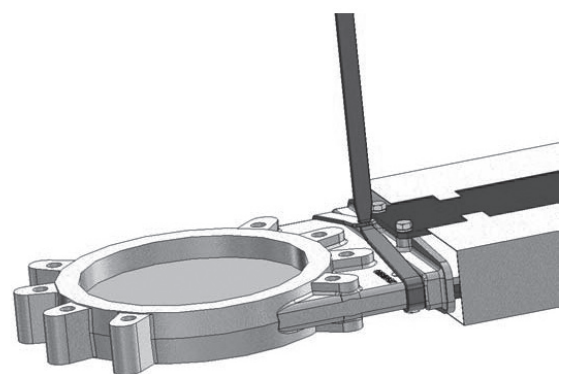


Fig. 2: Handling with eyebolts

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Pneumatic actuated knife gate valves

(Non-standard valves shall be checked case by case)

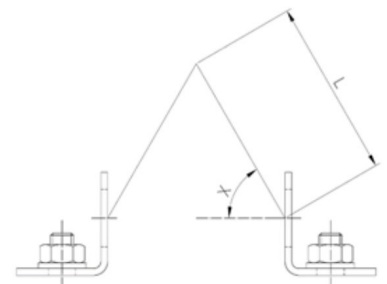
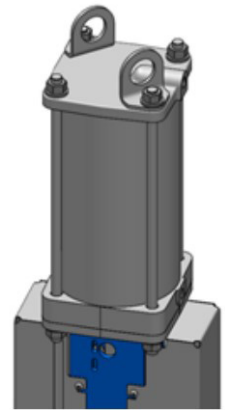
Pneumatic valves (with Ø125 cylinder and above) are supplied with 2 lifting lugs for a safe handling of the valve for vertical movements.



Lifting lugs are not machined so they could have sharp corners; soft straps or slings are forbidden to be used with these lifting lugs.

Below table shows the maximum weight of valve + pneumatic cylinder that 2 lifting lugs can hold depending on lifting chain angle (X):

Cylinder	With 2 lifting lugs: max. weight valve + cylinder (kg)			
	L: minimum lifting chain length			
	X: 60°		X: 75°	
	kg	Lmin (mm)	kg	Lmin (mm)
125	170	130	310	220
160	270	170	500	280
200	390	220	710	380
250	740	300	1335	500
300	1140	360	2030	600
350	1615	440	2835	720
400	2105	500	3660	830



- For horizontal movement, the valve shall be lifted mainly from the body and the yoke. See above instructions for further instructions.
- Cylinder's lifting lugs can only be used during horizontal movement of the valve to help balance the valve given the weight is hold at the body lifting point (center of gravity is approx. centered on the body).
- The knife gate valve can be lowered from vertical to horizontal position when it is hanging from the cylinder's lifting lugs.

Opposit table shows approximate weight of standard pneumatic knife gate valves (kg):

DN (mm)	Cylinder	kg
50	Ø 100	9
65		10
80		11
100		14
125	Ø 125	20
150		25
200	Ø 160	44
250		67
300		82
350	Ø 250	135
400		165
450		220
500		280
600	Ø 300	330

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2 - Installation

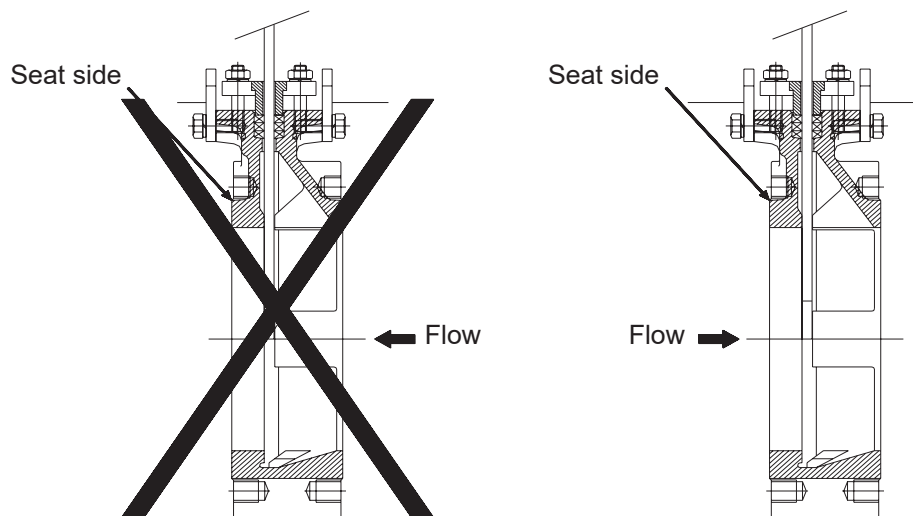


In order to avoid personal injury or damage to property when handling and installing the valve, it is important to observe the following warnings:

- It is the User's responsibility to verify compatibility of valve parts materials with the internal fluid.
- Qualified and trained personnel must carry out the handling and maintenance of the valve.
- Use suitable Individual Protection Equipment (IPE) (gloves, safety footwear...).
- Disconnect all lines affecting the valve and put up a notice notifying that work is being carried out on the valve.
- Isolate the valve completely from the process.
- Release process pressure.
- Drain the fluid from the valve.

Before installation, inspect the valve body and components for any damage that may have occurred during shipping or storage. Make sure the internal cavities within the valve body are clean. Inspect the pipeline and mating flanges, making sure the pipe is free of foreign material and that the flanges are clean.

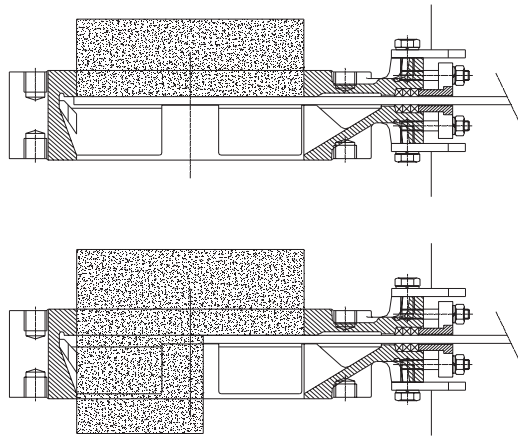
The knife gate valve is designed for solid-loaded fluids. It is normally installed to back pressure to avoid product accumulation in the valve body. The inlet side is always on the seat side (see diagram).



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For use at the outlet of a silo or hopper, the valve should be mounted in the following manner:



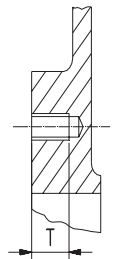
Installation and the correct orientation with respect to the direction of the flow is the responsibility of the user.

For the valve to operate correctly, it is essential to keep the gate guides clean. Depending on the process, this is done by injecting water or air into the valve body. To allow this, the valve body has two flush ports (10). The cleaning fluid must be supplied constantly and delivered at a pressure of 1 Kg/cm² above line pressure.

Special care should be taken to maintain the correct distance between the flanges and to ensure that they are parallel to the valve body. Incorrect alignment of the valve can cause deformations, which can lead to difficulties in operation.

The following table shows recommended torque values for the valve fixing bolts and the maximum depth (T) of blind tapped holes:

DN (mm)	T (mm)	PN10 (EN 1092-1/2)	CL150 (ASME B16.5 / B16.47 Serie A)	Torque (Nm) ⁽¹⁾	Torque (Nm) ⁽²⁾
50 - 65	8	M16	5/8" - 11 UNC	35	70
80	9	M16	5/8" - 11 UNC	35	70
100	11	M16	5/8" - 11 UNC	35	70
125	11	M16	3/4" - 10 UNC	35	70
150 - 200	14	M20	3/4" - 10 UNC	70	140
250 - 300	18	M20	7/8" - 9 UNC	70	140
350	22	M20	1" - 8 UNC	70	140
400	21	M24	1" - 8 UNC	120	235
450 - 500	22	M24	1 1/8" - 7 UNC	120	235
600	24	M27	1 1/4" - 7 UNC	175	350



Select the recommended torque based on bolt size for other flange drilling patterns.

Make sure that cross-pattern tightening sequence is always followed.

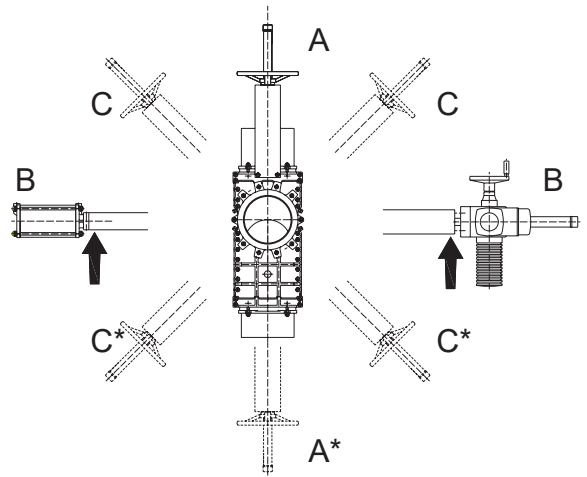
(1) GJL-250 body material. According to EN 1092-2

(2) other body materials. According to EN 1092-1

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The knife gate valve can be mounted in any position with regard to the pipe. However, it is advisable to place it vertically in horizontal pipeline (A) if the installation allows it. (Please consult the technical department).

With larger diameters (> 300 mm), heavy actuators (pneumatic, electric, etc.), or with the valve installed horizontally (B) or at an angle (C) on a horizontal pipeline, the installation will require the construction of suitable supports. (See the following diagram and consult the technical department).



** For these positions please consult technical department.



The following instructions must be followed if the knife gate valve is mounted in an ATEX zone:

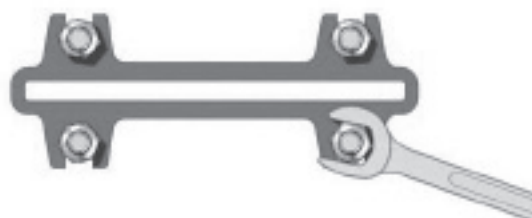
- During installation and maintenance operations, use hand tools (non -electric) which do not generate any potential ignition source such as sparks.
- Personnel shall have a Working Authorization for explosive classified areas.
- Check continuity between the body of the valve and the pipe (test in accordance with EN 12266-2 Standard, annex B, points B.2.2.2. and B.2.3.1).
- This check must be done every time the valve has been removed from the line, serviced, and put back to the line.
- The knife gate valve, included hand operated valves, must be always earthed, i.e., the electrical resistance to earth must be < 106 Ω. The integration of the slide knife in the electrically conducting circuit should be checked regularly as required by the operation instruction.

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Once the valve is installed, test that the flanges have been fastened correctly and that all electrical and/or pneumatic connections have been properly made.

First, operate the valve with no flow in the pipeline. Then test operation and valve seal with flow. It should be noted that the packing material might settle in shipping/storage, which can cause minor leakage. This can be solved by tightening the gland follower (5) during installation. The nuts shall be tightened gradually and crosswise until the leakage stops (see the next figure). Check that there is no metal contact between the glandfollower (5) and the gate (2).



If the glandfollower nuts are overtorqued, the force needed to operate the valve will increase, the valve function will be affected and the box packing lifetime will be shortened.

The opposite table shows the recommended maximum torques for the glandfollower nuts.

DN	Drehmoment (Nm)
50 - 200	15
250 - 300	25
350 - 600	30

Once performance has been tested, the valve can be put into operation.

Approximate weight of the handwheel-operated valve (rising stem):

DN	50	65	80	100	125	150	200	250	300	350	400	450	500	600
Kg	7	8	9	11	15	18	30	44	58	96	124	168	192	245

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3 - Actuators

3.1.- Handwheel

To open the valve turn the handwheel (12) anticlockwise. To close turn the handwheel clockwise.

3.2.- Lever

To operate the valve with this device, first loosen the locking clamp located on the top of the yoke (9). Then either open or close the valve by moving the lever in the desired direction. Finally, fix the position of the lever with the locking clamp.

3.3.- Pneumatic

Valves are usually supplied with a double acting pneumatic actuator although, upon request, we can supply single-acting actuators. In either case the feed pressure can vary between 3,5 and 10 bar. However, the size of the actuator for each valve has been designed for a feed pressure of 6 bar.

It is essential for a good maintenance of the cylinder that air should be well dried, filtered and lubricated. Air quality shall fulfil the following requirements:

- ISO 8573-1 Grade 5:4:3 for regular process (ON / OFF services).
- ISO 8573-1 Grade 5:3:3 for regular process at low temperature (-20° C).
- ISO 8573-1 Grade 3:4:3 for cylinders with positioners.
- ISO 8573-1 Grade 3:3:3 for cylinders with positioners at low temperature (-20° C)

It is recommended to actuate the cylinder 3-4 times before the start up, once it is installed in the pipeline.

3.4.- Electric Actuator

Depending on the type or make of the electric actuator, specific instructions (i.e. a manufacturer's manual) will be supplied.



The operation of automated valves is limited only with fitted gate covers to fulfil 2006/42/EC (machinery Directive).



- Allowed actuator for ATEX zones: pneumatic, hydraulic and electric motor. Hand operated and bare shaft valves are out of the scope of this Directive, but for installation and maintenance same requirements for explosive areas valves shall apply.
- Make sure these actuators are ATEX marked according to the requested zone.
- Maximum travel speed of the gate must be equal or below 1 m/s.

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4 - Maintenance

The valve must not undergo any modifications without a previous agreement with AKO Armaturen. AKO Armaturen shall not be liable for any damages that may arise due to the use of non original parts or components.



To avoid personal injury or damage to property from the release of process fluid:

- Those in charge of handling and maintenance of the valve must be qualified and trained in valve operations.
- Use appropriate personal protection equipment (gloves, safety shoes, etc).
- Shut off all operating lines to the valve and place a warning sign.
- Isolate the valve completely from the process.
- Release process pressure.
- Drain the process fluid from the valve.

The only maintenance required is to change the gland packing (4) or the seal (3) if the knife gate valve is a resilient seated type.

The life of these elements will depend on the working conditions of the knife gate valve such as: pressure, temperature, abrasion, chemical action, number of operations, etc.

4.1 - Replacement of the gland packing (4)

1. Depressurise the circuit and place the valve in close position.
2. Remove the gate guards (for automatically actuated valves only).
3. Release the spindle or stem (7) from the gate (2). (Photo 1)
4. Loosen the screws of the yoke (9) and remove it (without loosing the actuator).
5. Loosen the nuts of the gland follower (5) and remove it. (Photo 2)
6. Remove the old packing rings (4) and clean the stuffing box.
7. Insert the new packing rings (4), making sure that the ring joints alternate (the first on one side of the gate, the next on the other and so on). (Photo 3)
8. Once the necessary packing rings (4) have been inserted, proceed with a steady initial tightening of the gland follower (5). (Photo 2)
9. Place the yoke (9) (with the actuator) and screw it.
10. Fix the stem (7) to the gate (2). (Photo 1)
11. Remount the gate guards.
12. Carry out some operations with a loaded circuit and then re-tighten the gland follower (5) to prevent leakage.



Photo 1



Photo 2



Photo 3

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4.2 - Replacement of the seal (3)

(only applicable to resilient seated valves)

1. Remove the valve from the pipeline.
2. Remove the gate guards (for automatically actuated valves only).
3. Release the spindle or stem (7) from the gate (2). (Photo 1)
4. Loosen the screws of the yoke (9) and remove it (without losing the actuator).
5. Loosen the nuts of the gland follower (5) and remove it. (Photo 2)
6. Remove the old packing (4) and the gate (2) and clean the stuffing box.
7. Remove the seal retainer ring (6) which support the seals (3).
8. Remove the worn seal (3) and clean the seal housing.
9. Once the new seal (3) is cut according to size, insert it into the seat housing (making sure that the union of the seal is at the top). (Photo 4 and 5)

If the valve has PTFE seal (3), follow the point 4.3.

Seal length

DN	50	65	80	100	125	150	200	250	300	350	400	450	500	600
L (mm)	240	290	340	410	485	565	720	880	1040	1200	1355	1510	1670	1970

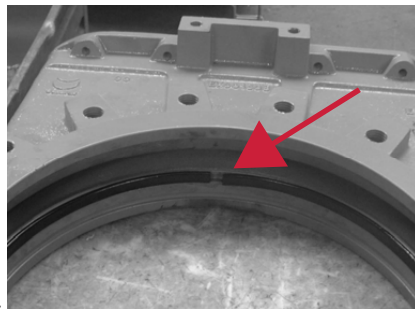


Photo 4

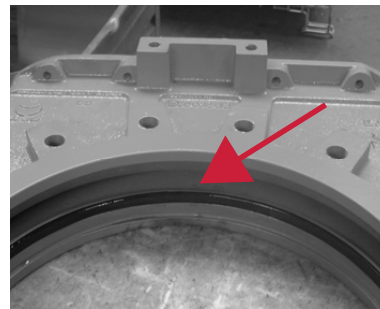


Photo 5

10. Insert the seal retainer ring (6) by hammering gently around the edge. (Photo 6 and 7)



Photo 6



Photo 7


11. Remount the gate (2).
12. Once the necessary packing rings (4) have been inserted, proceed with a steady initial tightening of the gland follower (5). (Photo 2)
Following the steps of point 4.1.

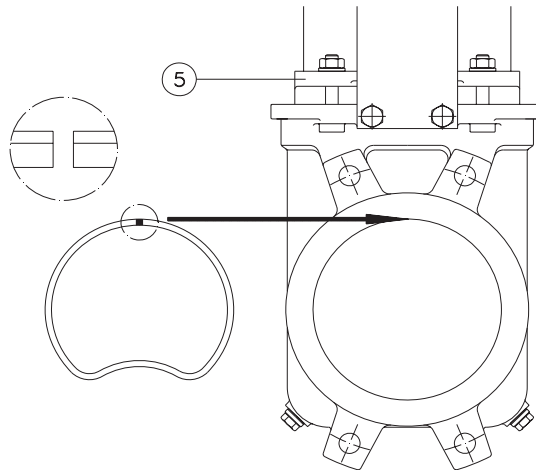
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4.3 - Replacement of the PTFE seal (3)

Follow the same procedure as point 4.2 but with following notes:

1. To obtain a tighter shut off in stainless steel valves, the machined housing of the seat is sealed with plastic glue. This is not necessary in cast iron valves. With the seal in this position:

2. Make a circle; joining the ends and making a heart-shaped form (see the following diagram).
3. Insert both ends of the seal in the upper side of the machined housing of the seat (adjacent to the gland follower (5)), and pushing the arched part with a finger, insert the seal into the housing. If the diameter of the valve is small ($DN \leq 150$), a vice can be used.



4.4 - Lubrication

Twice a year, it is recommended to remove the protection cap (13) and fill up the stem protector (14) halfway with a calcium-based grease with the following characteristics:
highly water resistant, low ash content, and excellent adherence.

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Special requirements for ATEX knife gate valves:

- Make sure the valve is ATEX marked according the requested zone and it includes all anti-static devices.
- Those in charge of handling and maintenance of the valve must be qualified and trained regarding ATEX.
- During installation and maintenance operations, use hand tools (non-electric) which do not generate any potential ignition source such as sparks.
- Personnel shall have a Working Authorization for explosive classified areas.
- Periodicity of check and evaluation of valve electrical conductivity must be determined by end user according to valve working conditions. In any case, once the valve is put into operation, the packing area must be revised after the valve has been stroked 100 times or after 3 months of operation, whatever happens first. After this preliminary check, new checking periods must be determined by end user based on the results of this first check.
- Clean the valve periodically to prevent dust accumulation. Do not sweep or dump the dust. Always use a vacuum cleaner system.
- Dead end service is not allowed.
- Do not apply any new coating to the valve. Should it require new coating, please contact AKO Armaturen.
- Allowed seals: EPDM, FKM-FPM, NBR, PTFE(*), VMQ (*), GRAPHITE and METAL (no seal).
- (*) PTFE and VMQ seals have some size restrictions. Please check with Technical department
- Allowed packing: ST, stainless steel, copper and graphite.
- To keep the ATEX approval, always use original spares. Original order number is mandatory to receive the correct spares.
- Washer DIN 6798A (This washer guarantees continuity among carbon steel parts, coated in epoxy, yoke and body and stainless-steel guards for coating thicknesses up to 200 microns).
- After any maintenance it is mandatory to check that the valve is correctly earthed, included hand operated valves. Continuity between the valve body, the pipe, the gate, supports and guards must be tested (in accordance with EN 12266-2 Test F21 Annex B, B.2.2.2 and B.2.3.1). Packing shall be checked and pressurized for zero leakage.

Maximum fluid temperatures

Atmosphere	
Gas/air, steam/air, and mist/air	Dust/air
80% of minimum fluid ignition temperature, minus 10° K	2/3 of minimum dust cloud ignition temperature minus 10°K, or minimum dust layer ignition temperature minus 85 °K (for layers up 5mm)

Note: these maximum fluid temperatures apply to all categories. The differences between categories are the consideration of foreseeable malfunction cases and rare malfunctions cases

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Maximum seal and packing temperatures

Max temperature (° C)	Seal					
	EPDM	FKM-FPM	NBR	Graphite	PTFE	VMQ
	120	200	120	600	250	250

Max temperature (° C)	Packing	
	ST	Graphite
	240	600

Hinweis: Most of the times seals maximum temperature capacity is the key limitation factor when evaluating valve maximum working temperatures. In ATEX zones these temperatures must be compared to those above related to limitation of fluids temperatures.

Always consider the most restrictive as maximum valve working temperature

Replacement of the valve:

1. The same knife gate valve with exactly the same certificates must be ordered. When placing this order, it is customer liability to clearly indicate that the new ordered valve is a replacement of a certified valve.
2. It is user's liability to ensure that all requirements in the "maintenance" chapter are fulfilled.
3. Loosen the bolts that connect the actuator to the slide.
4. Loosen the bolts that connect the yoke to the body.
5. Reassemble the valve.

Replacement of the actuator:

1. The same actuator with exactly the same certificates must be ordered. When placing this order, it is customer liability to clearly indicate that the new actuator is a replacement of a certified valve.
2. It is user's liability to ensure that all requirements in the "maintenance" chapter are fulfilled.
3. Loosen the bolts that connect the actuator to the yoke.
4. Reassemble the valve.

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5 - Storage

- For long storage periods keep the valves indoors in a safe and dry place and protect it from any impact and or vibrations.
- Storing temperatures: -10° C to +40° C
- Knife gate valves must be stored in either full open or full closed position.
- For any component installed in the valves, electric motors, solenoid valves, etc, please refer to their own instructions manuals.

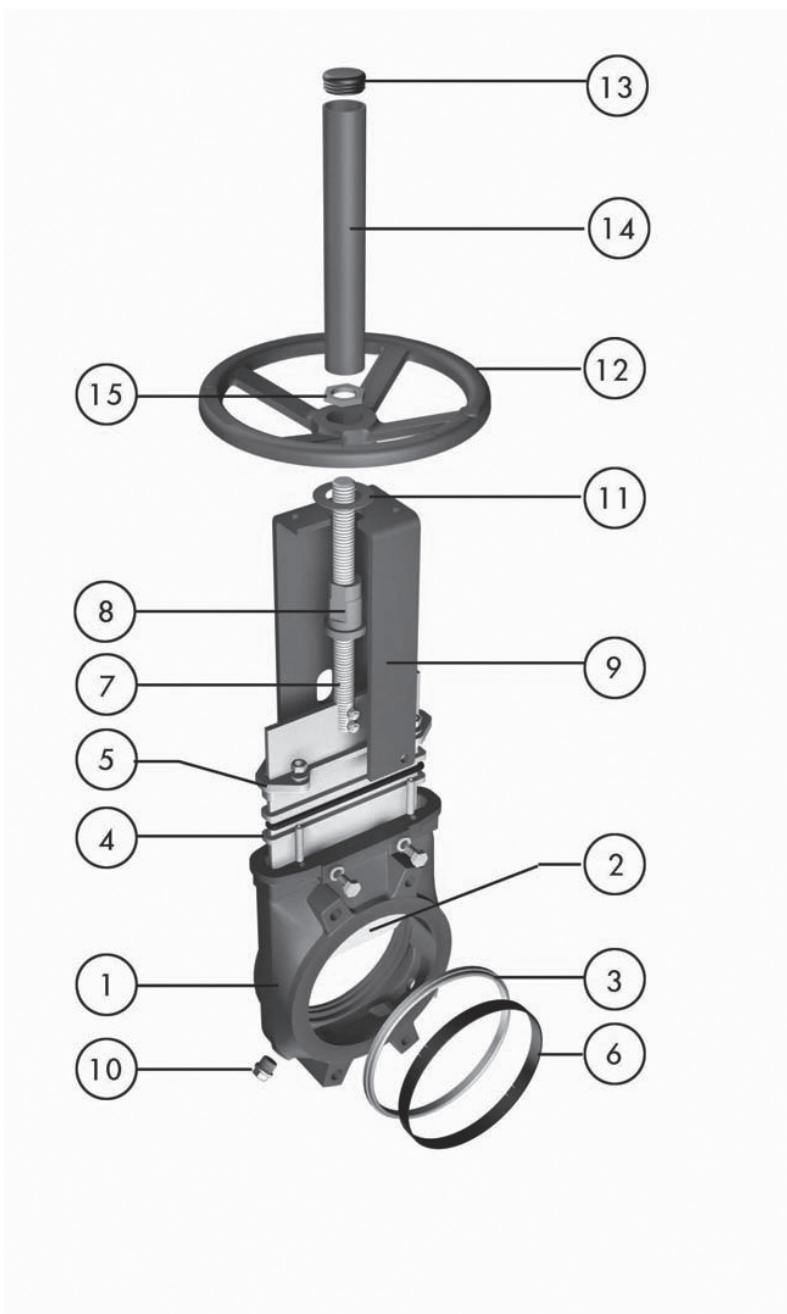
6 - Environmental considerations

- The packaging is made from environmentally friendly materials. Dispose of the packaging through the available recycling channels.
- The valve is designed and manufactured with materials that can be recycled by specialised recycling firms. Once the life of the product is expired, you have to consider a proper disposal of the product in order to prevent any negative impact on the environment and allows for the recycling of valuable commodities.
- Please follow the local environmental rules in your country for proper disposal.

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6 - Parts list & drawings



1	Body
2	Gate
3	Seal
4	Packing ring
5	Gland follower
6	Seal retainer ring
7	Stem
8	Stem nut
9	Yoke
10	Flush port / Cleaning
11	Friction washer
12	Handwheel
13	Cap
14	Stem protector
15	Nut

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