

# Operating Manual

**Installation – Commissioning – Operation – Maintenance**

## Table of contents

|  |           |
|--|-----------|
| <b>1. Preamble</b> .....   | <b>3</b>  |
| 1.1 Appendant documentation .....  | 3         |
| 1.2 Meaning of signs .....   | 3         |
| 1.3 Designation .....  | 4         |
| <b>2. Introduction</b> .....   | <b>4</b>  |
| <b>3. Application</b> .....  | <b>5</b>  |
| 3.1 Intended use .....   | 5         |
| 3.2 Non-intended use.....  | 5         |
| <b>4. Storage and transport</b> .....  | <b>5</b>  |
| 4.1 Slings options when lifting by crane. ....                                   | 6         |
| <b>5. Installation and fitting</b> .....   | <b>6</b>  |
| 5.1 Flow direction .....   | 7         |
| 5.2 Installation.....  | 8         |
| 5.3 Insulation.....  | 9         |
| 5.4 Connections.....   | 10        |
| <b>6. Commissioning and operation</b> .....                                      | <b>10</b> |
| 6.1 Prior to first commissioning.....  | 10        |
| 6.2 Warm commissioning .....   | 11        |
| 6.3 Operation.....   | 11        |
| <b>7. Maintenance</b> .....  | <b>11</b> |
| 7.1 Stuffing boxes (optional) .....  | 11        |
| 7.2 Flange or pedestal bearings (optional).....                                  | 15        |
| 7.3 Connections (optional).....  | 17        |
| 7.4 Limit switches (optional) .....  | 20        |
| 7.5 Manholes and cleaning apertures (optional) .....                             | 23        |
| 7.6 Hand levers and drives (optional).....                                       | 23        |
| 7.7 Abrasion and erosion .....   | 26        |
| <b>8. Safety guarding requirements in accordance with EN ISO 12100-1/2</b> ..... | <b>28</b> |
| 8.1 Isolating safety guarding.....   | 28        |
| 8.2 Precautions for safe access.....   | 28        |
| 8.3 Precautions for power isolation and energy dissipation .....                 | 28        |
| <b>9. Tables</b> .....   | <b>29</b> |
| 9.1 Summary of commissioning work.....   | 29        |
| 9.2 Summary of maintenance work.....   | 30        |
| 9.3 Tightening torque for screwed connections .....                              | 31        |

## 1. Preamble

This manual has been prepared for our customers' information in accordance with the best of our knowledge. It is the result of our practical experience.

Failure to observe the instructions contained in this manual will nullify our liability!

### 1.1 Appendant documentation

The following documentation forms a part of this manual:

1. The **order acceptance form** or the **delivery note** – *contains information on the operating conditions for which the butterfly valve is intended.*
2. The **drawing of the butterfly valve** – *contains information on the fitments on the butterfly valve as well as the weight and further information on installing, commissioning, operation and maintenance*
3. **Appendix 1** – *contains information on the fitments on the butterfly valve with drive and other accessories as well as the most important electrical and pneumatic data on the attachments (where applicable)*
4. **Supplementary operating manual**, or documentation – *contains further information on commissioning, operation and maintenance of the accessories included in the supply.*
5. **Appendices 2 and 3** – *are only included in this operating manual if the intended use application is to be in explosion hazard areas or the butterfly valve is to be utilised as pressurised equipment*

This documentation contains additional information which must be observed without fail during installation, commissioning, operation and maintenance.

### 1.2 Meaning of signs

|   |   |
|---|---|
|  | <p><b>Warning</b></p> <p>means that death, severe or minor bodily injury or considerable material damage can occur if the appropriate precautions are not observed.</p>   |
|  | <p><b>Caution</b></p> <p>means that material damage can occur if the appropriate precautions are not observed.</p>  |
|  | <p><b>Notice</b></p> <p>is an important piece of information on the product, its handling or the respective part of the documentation which has to be observed in particular or which contains further information.</p> |

### 1.3 Designation

The butterfly valves are provided with the identification plate shown below, mounted in the drive area. If the butterfly valves are devices under the terms of the ATEX product guidelines 94/9/EC or pressurised equipment guidelines 97/23/EC, corresponding identification is provided. The identification plate may not be removed or damaged.

|  |
|--|
|  <a href="http://www.ena-gmbh.de">www.ena-gmbh.de</a> |
| ID no.: .....  |
| Year of manufacture:.....  |

### 2. Introduction

This valve has left the factory in a faultless condition. In order to maintain it in this condition and to ensure safe operation, the information and comments given in this operating manual are to be observed.

**Warning**

The valve may only be fitted, commissioned and maintained by qualified personnel.

Qualified personnel under the terms of this operating manual are those who are familiar with the installation, commissioning and operation of butterfly valves, have been appropriately instructed by the operating company and possess qualifications appropriate to the designated activities as well as sufficient knowledge of the relevant Health and Safety at Work Regulations.

Attention is to be paid to:

- The information contained in this operating manual
- The relevant safety regulations for the construction and operation of the plant into which the valve is installed, e.g. the Health and Safety at Work Act
- The relevant operating regulations on explosion protection where equipment is built on to the valve in accordance with ATEX product guidelines 94/9/EC or the valve itself is deployed in potentially explosive areas in terms of the guidelines 1999/92/EC, e. g. the Health and Safety at Work Act
- The relevant Health and Safety at Work Act regulations
- The statutory provisions, standards and guidelines named in this operating manual are valid, where applicable, only in Germany. If the valve is being deployed in other countries, the appropriate national statutory provisions are to be complied with.

Should the information contained in this operating manual be insufficient for some situation or misunderstood in any way, we will be pleased to provide further information.

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### **3. Application**

ENA butterfly valves are devices for installation in pipelines or sewage systems in industrial applications.

They are used to shut off, regulate or restrict. Butterfly valves supplied by ENA are specially developed and produced to customers' requirements. This manual applies analogously to both circular and rectangular butterfly valves.

For applications in explosion hazard areas or use as pressurised equipment, the supplementary information in Appendix 2 is to be observed. (See section 1.1)

#### **3.1 Intended use**

Intended use is that which is in accordance with the information contained in drawings and documentation specified in section 1.1. The limit values for pressures and temperatures are to be observed in particular. For applications under special operating conditions such as explosion hazardous operation or under internal pressures in excess of 0.5 bar, the supplementary information in Appendix 2 is to be observed. (See section 1.1)

#### **3.2 Non-intended use**

The butterfly valves may only be used for the purpose for which they were intended. Any use outwith the limits of the intended applications could result in damage and safe operation can no longer be guaranteed.



#### **Warning**

Use of the butterfly valves for other than the specified design and operating conditions is a hazard and can lead to personal injury and material damage.

### **4. Storage and transport**

- Store in a well ventilated, dry place.
- Protect from rising damp by storing on a shelf or on a wooden grid.
- Cover to protect against dust and dirt.
- Treat uncoated surfaces with a suitable anti-corrosion agent.
- Transport to installation site in rigid packaging.



#### **Warning**

Incorrect transport can lead to personal injury or material damage. The relevant transport and health and safety regulations are to be observed.

#### 4.1 Slinging options when lifting by crane.

|  |   |  |                                     |
|--|---|--|-------------------------------------|
|   | <p>Possible slinging points or preferred points to use</p>                        |    | <p>Do <b>not</b> use this point</p> |
| <ul style="list-style-type: none"> <li>• Holes in the flanges</li> <li>• Sling around the housing using synthetic fibre belts</li> <li>• Valves more than 500 kg in weight are equipped with slinging points. These points are identified with this symbol.</li> </ul> |  | <ul style="list-style-type: none"> <li>• Drive</li> <li>• Hand wheels</li> <li>• Butterfly spindles</li> <li>• Other built-on attachments</li> </ul> |                                     |

**Table 1:** Slinging options

|   |   |
|---|---|
|  | <p><b>Caution</b></p> <p>When rigging the lifting tackle, it is imperative to ensure that attached components are not crushed or damaged!</p> |
|---|---|

### 5. Installation and fitting

Before installing, the following tasks or checks should be carried out:

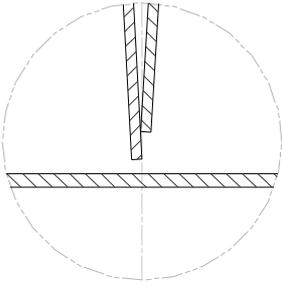
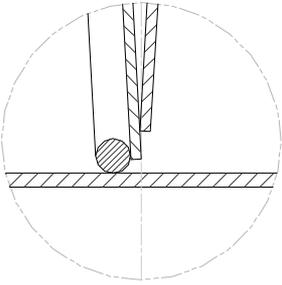
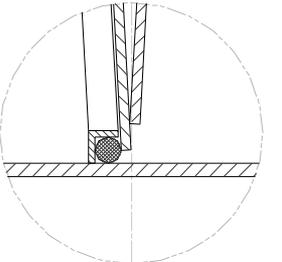
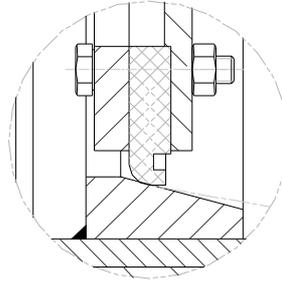
- Referring to the respective documentation (see section 1.1), check that the valve is suitable for the operating conditions
- Check the valve for free movement (manual operation)
- Check the installed dimensions and space requirements
- Determine the flow direction of the medium from the following table (see section 5.1) or the drawing

|   |  |
|---|--|
|  | <p><b>Warning</b></p> <p>Secure the valve against self-activated opening or closing during installation - crushing hazard!</p> |
|---|--|

Basically, all butterfly valves are to be installed with the spindle lying horizontally unless otherwise agreed between ENA and the purchaser. In such cases, the installed position is indicated on the drawing.

|   |  |
|---|--|
|  | <p><b>Notice</b></p> <p>The electrical connections (PG glands) must not point upwards. Install the valve accordingly or select an elbow gland for the electrical connection!</p> |
|---|--|

### 5.1 Flow direction

| Butterfly sealing   |  | Flow direction   |  |
|---|--|--|--|
| Type  | Configuration                          |  |  |
|    | Type: D<br>Swing-through butterfly     | Any.<br><br>↔  |  |
|   | Type: M<br>Metallic seal butterfly     | The lower half of the butterfly should open with the medium flow.<br><br>⇒ |  |
|  | Type: W<br>Soft seal butterfly         | The lower half of the butterfly should open with the medium flow.<br><br>⇒ |  |
|  | Type: EX<br>Double eccentric butterfly | Note the information on the drawing.                                       |  |

**Table 2:** Flow direction



**Notice**

It is imperative to take note of the information given on the corresponding drawing!

**5.2 Installation**

In principle, all fittings in the pipeline or duct must be far enough away from the valve that they do not hinder the valve from opening or closing. Particular caution is advised when installing in direct proximity to:

- pipe bends, adaptors or other shaped components.
- baffles
- compensators
- all components built into the line e.g. measurement sensors



**Notice**

Installation must be central to the pipe or duct axis: stressing the valve, e.g. due to non-parallel aligned flanges is not permitted.

Installation materials such as bolts and seals must be designed to suit the operating conditions of the valve.



**Caution**

After installation, all damage to the corrosion protection or surface protection of the valve must be made good expertly and without delay.

**5.2.1 Installation of valves with flanged connections and for sandwich mounting between flanges.**

The connecting flanges of the pipeline must be parallel and the valve must be fitted central to the axis. Seal the line by fitting seals or sealing strings. The bolts must be tightened evenly and in diagonally opposing order, as is normal for flanged connections.

**5.2.2 Installing welded connection valves.**

The connecting pipe ends must be parallel and the valve must be fitted central to the axis. The weld seam must be designed and executed to correspond with the wall thickness of the housing and the welding filler selected in accordance with the material and operating specifications.

To avoid creating stresses within the valve, take care that the heat input is kept to a minimum or is as even as possible - for example, by staggering the weld.



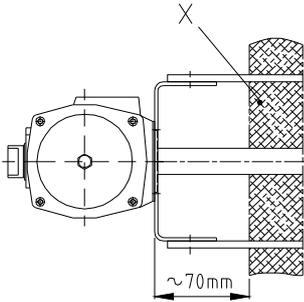
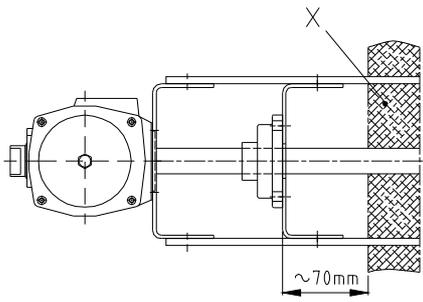
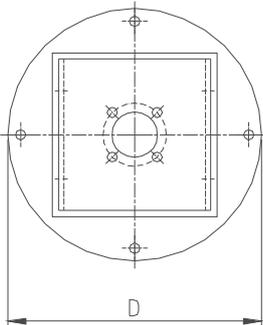
**Caution**

When welding, take care that adjacent components do not become damaged by undue heat or welding spatter.

### 5.3 Insulation

Butterfly valves should be insulated where the temperature of the medium is above 100°C in order that no radiated heat is transferred to the attached components. If insulation is not to be applied, a radiated heat shield must be fitted between the attached components and the valve.

Attached components such as flanged bearings, linkage rods, drives and other attachments must **not** be insulated. In order to ensure ample heat dissipation, the insulation (X) must be executed in accordance with the following illustration. **A minimum clearance of 70 mm** from the drive or flanged bearing mounting bracket must be maintained.

| Insulation of direct mounted drives  | Insulation of flanged bearing types  |
|--|--|
|   |    |
| <p>The stuffing boxes may be insulated. Because the packing is a maintenance part, we recommend fitting an easily removable sheet metal rosette with a minimum diameter D of 200 mm.</p> <p>For working on the valve after the first warm commissioning, we recommend in the case of butterfly valves with flanged or sandwich connections that the insulation in this area is designed to be removable (see section 6.2.1).</p> |  <p style="text-align: center;"><b>Illustration 1: Insulation rosette</b></p> |

**Table 3:** Insulation

|   |  |   |
|---|--|---|
|  | <p><b>Warning</b></p> <p>The surfaces of the valve could be hot due to the medium. After insulating, safeguard these surfaces against contact and label them with the adjacent sign!</p> |  |
|---|--|---|

#### 5.3.1 Safeguarding against hot surfaces

All accessible surfaces are to be safeguarded by means of heat insulation so that the maximum occurring surface temperature does not exceed 50 °C. In the case of surface temperatures > 50 °C, appropriate warning signs are to be posted and suitable personal safety gear is to be worn.

---

## 5.4 Connections

The making of power connections such as sealing air, electricity and compressed air for the drives and controlling equipment is to be carried out by qualified personnel in compliance with the specifications given in the technical documentation as per section 1.1 as well as the associated documentation on the attached equipment (drives, control elements etc.). The relevant local regulations such as VDE or equivalent regulations and standards are to be observed (VDE: German Electrical Engineers Ass.).

---

## 6. Commissioning and operation

A functional check is carried out on all butterfly valves at the factory during which mechanical stops and path limit switches are set where fitted. These settings are to be checked after installation and before commissioning!

When commissioning the complete plant, valves should in principle be opened to prevent damage from pressure shocks.

Note: The butterfly setting (longitudinal axis of the butterfly) can be recognised by the indentation on the front face of the butterfly spindle.

### 6.1 Prior to first commissioning.

The following checks are to be carried out prior to first-time commissioning:

- Installation check
- Check all supply lines
- Check the setting of the mechanical stops, path switches and limit switches.
- Functional check of the valve

A summary of the work to be carried out can be found in section 9.1

#### 6.1.1 Butterfly valves with "spring-opening" drives

Butterfly valves with "spring-opening" (normally open) drives are sometimes, for transporting reasons, supplied with the drive assembled at 90° to the normal position where the butterfly would protrude beyond the face-to-face length. These valves are identified by a label on the drive as follows:

Spring-opening,  
air-closing clockwise

**Caution, drive opens under spring pressure!**

The drive is turned through 90° for transportation. Prior to commissioning, remove the drive screws and turn the drive along with the butterfly through 90° **anti-clockwise**. Then refit the drive screws and re-tighten.

Spring-opening,  
air-closing anti-clockwise

**Caution, drive opens under spring pressure!**

The drive is turned through 90° for transportation. Prior to commissioning, remove the drive screws and turn the drive along with the butterfly through 90° **clockwise**. Then refit the drive screws and re-tighten.

## 6.2 Warm commissioning

The following checks are to be carried out after the first warm operation:

- Functional check of the butterfly valve
- Check the supply lines
- Check the stuffing boxes for the correct torque and leak-tightness

### 6.2.1 Butterfly valves with flanged connections and for sandwich mounting between flanges.

After the first warm operation, the screwed connections must be re-tightened and the flange connection checked for leak-tightness, hence the insulation in this area should be executed accordingly.

### 6.2.2 Butterfly valves for welding-in

After the first warm operation, check the weld seam for leak-tightness and correct where necessary.

**Warning**

Escaping medium can cause personal injury and material damage.

## 6.3 Operation

Operation of the butterfly valves may only be carried out by competent and briefed personnel. Appropriate operating instructions are to be compiled by the operating company and made available to the operating personnel.

The butterfly valves may only be operated within the specified application limits. Use outwith the application limits, even for brief periods, e.g. due to pressure shocks, can result in damage to the butterfly valve and safe operation can no longer be guaranteed. The butterfly valves are to be taken out of commission immediately after a pressure shock. No safety equipment which is necessary for the safe operation of the butterfly valve may be removed during operation.

## 7. Maintenance

The different equipment options are described below. The corresponding drawing gives information as to whether the relevant component has been built into or onto the valve and which materials have been used.

**Warning**

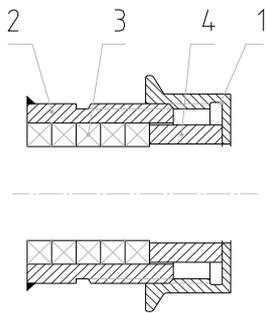
During all maintenance work, the valve is to be secured against external, self-activated or inadvertent actuation!

A summary of the maintenance work necessary can be found in section 9.2

### 7.1 Stuffing boxes (optional)

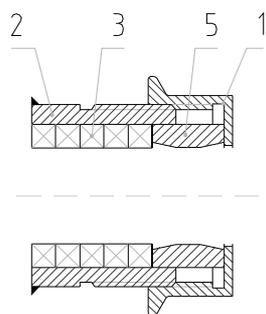
Shaft sealing is by means of a stuffing box packing which is deployed in different versions.

### Design



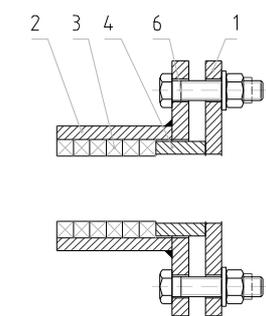
| Item | Name           | Wear part |
|------|----------------|-----------|
| 1    | Bearing cap    |           |
| 2    | Bearing holder |           |
| 3    | Packing        | V         |
| 4    | Pressure ring  |           |

### Illustration 2: Type: SDK



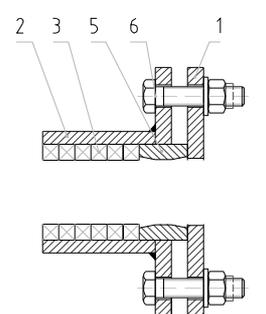
| Item | Name           | Wear part |
|------|----------------|-----------|
| 1    | Bearing cap    |           |
| 2    | Bearing holder |           |
| 3    | Packing        | V         |
| 5    | Plain bearing  | V         |

### Illustration 3: Type: SGK



| Item | Name             | Wear part |
|------|------------------|-----------|
| 1    | Spectacle flange |           |
| 2    | Bearing holder   |           |
| 3    | Packing          | V         |
| 4    | Pressure ring    |           |
| 6    | Fixing screws    |           |

### Illustration 4: Type: SDB



| Item | Name             | Wear part |
|------|------------------|-----------|
| 1    | Spectacle flange |           |
| 2    | Bearing holder   |           |
| 3    | Packing          | V         |
| 5    | Plain bearing    | V         |
| 6    | Fixing screws    |           |

### Illustration 5: Type: SGB

**Table 4:** Stuffing box assembly

### 7.1.1 Stuffing box with sealing gas connection (optional)

This type of shaft seal is deployed on problematic media and ensures absolute sealing even after many operating hours. The bearing housing is provided with a pipe connection **A** via which the sealing gas is fed to the packing cavity. The lantern ring **B** situated directly below it distributes the sealing gas in both directions thereby preventing the passage of corrosive gas.

The position of the sealing gas connection is to be taken from the corresponding drawing!

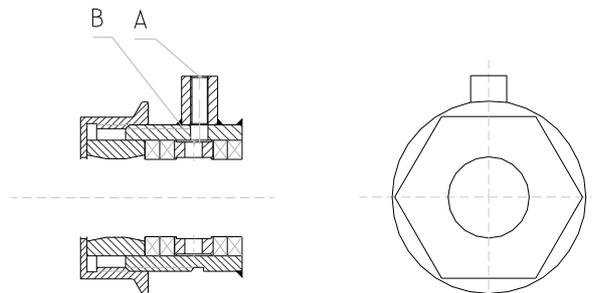


Illustration 6: Type SDKS & SGKS

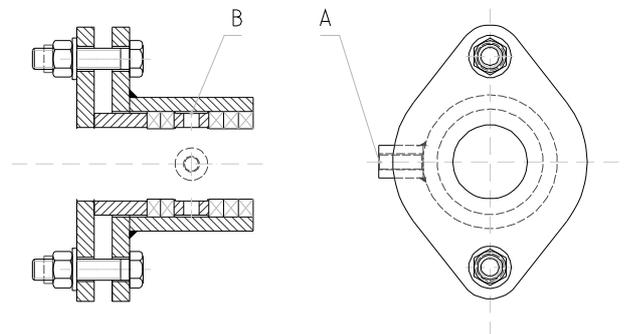


Illustration 7: Type SBDS & SBGS

| Spindle Ø                                 | 16                            | 22     | 32 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
|---|-------------------------------|--------|----|----|----|----|----|----|----|-----|
| Sealing gas connection socket to DIN 2986 | G 1/8"                        | G 1/4" |    |    |    |    |    |    |    |     |
| Flow                                      | 0.10 to 0.5 m <sup>3</sup> /h |        |    |    |    |    |    |    |    |     |
| Sealing gas pressure                      | Medium pressure + 10 mbar     |        |    |    |    |    |    |    |    |     |

Table 5: Stuffing box with sealing gas connection

|  |   |
|--|---|
|  | <p><b>Warning</b></p> <p>Because the sealing gas can also escape to atmosphere through the stuffing box, only harmless gas may be utilised, e.g. air or nitrogen.</p> |
|--|---|

### 7.1.1.1 Maintenance

The stuffing box must be checked for leak-tightness at regular intervals. If the bearing cap is leaking (types SKG – SKD), tighten the fixing screws in accordance with the torque given in section 9.3 (tables 10 to 14).



#### Caution

If the tightening torque is too high, this will generate an excessive torsional moment at the valve spindle and can lead to sluggishness and seizing.

#### 7.1.1.1.1 Packing replacement

- Where necessary, remove attachments such as drive, flange or pedestal bearings, operating lever and switch cams
- Detach bearing cap or spectacle flange and withdraw from the spindle.
- Completely remove the old packing
- Clean the packing cavity and spindle: the surfaces must be brightly metallic and free from scoring.
- When using bulk stock, cut the packing to length (L) at 45°, appropriate to the spindle diameter (d) and the packing cross-section (s)<sup>1</sup>,  $L=(d+s) \times p + s$ .
- Insert 4 rings maximum with the cut ends rotated 90° to each other. They are then pressed over the spindle with the aid of a fitting mandrel. The remaining rings then inserted and compressed
- Insert plain bearing, pressure ring or lantern ring according to assembly
- Set the bearing cap or spectacle flange in place and tighten to the torque setting specified in section 9.3 (tables 10 to 14) – when tightening, it is imperative to avoid any tilting. The spindle should be rotated several times while the stuffing box is being tightened down in order to check the necessary operating forces.

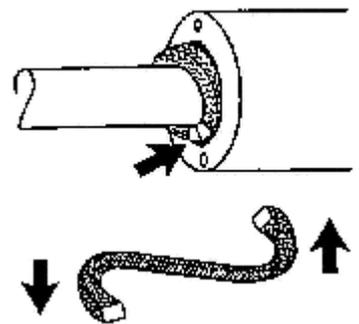


Illustration 8: Packing

#### 7.1.1.1.2 Tightening torque

The necessary contact pressure when tightening the stuffing box packing should be approx. 2x the medium pressure, in any case at least 20 N/mm<sup>2</sup>.

<sup>1</sup> When using the ENA wear part kit, the packing rings are pre-cut accordingly.

## 7.2 Flange or pedestal bearings (optional)

### 7.2.1 Assembly

Flange or pedestal bearings serve to support the spindle and are fixed to appropriate mounting brackets on the valve. Two or four-hole types are used dependant on loading. All bearing housings are equipped with a hydraulic -type lubricating nipple H1.

To control the thermal expansion of the butterfly spindle, fixed bearings and floating bearings can be mounted on the butterfly. Fixed bearings are marked **FP** on the butterfly valve drawing.

### 7.2.2 Maintenance

Every 2000 operating hours, the bearings must be re-lubricated accordingly at the same time checking that the bearing housing is firmly seated and checking the fixed bearing function.

| Bearing type                              | Bearing temperature °C |     |     |      |                               |      |      |    | Composition                            | Consistency: NLGI class | <br>spezialschmierstoffe<br>Wartungsprodukte<br>Korrosionsschutz |  |      |      |      |     |  |
|---|------------------------|-----|-----|------|-------------------------------|------|------|----|--|-------------------------|---|---|------|------|------|-----|--|
|   | 50                     | 0   | +50 | +100 | +150                          | +200 | +250 |    |  |                         |   |   |      |      |      |     |  |
| UCF & UCFL                                | -30                    |     |     | +120 |                               |      |      |    | A                                      | 2                       | OKS 402   |   |      |      |      |     |  |
| PCJ & PCJT                                | -30                    |     |     | +150 |                               |      |      |    | B                                      | 2                       | OKS 404   | Isoflex<br>Topas L152   |      |      |      |     |  |
| RCJ...FA125                               | -20                    |     |     |      |                               |      | +250 |    | C                                      | 2                       | OKS 4220  | Barrierta<br>L55/2  |      |      |      |     |  |
| Composition                               | <b>A</b> Lithium soap  |     |     |      | <b>B</b> Lithium complex soap |      |      |    | <b>C</b> PTFE / Perfluorpolyether oils |                         |   |   |      |      |      |     |  |
| <b>Lubricant quantity for re-greasing</b> |                        |     |     |      |                               |      |      |    |  |                         |   |   |      |      |      |     |  |
| Spindle Ø                                 | 15                     | 20  | 25  | 30   | 35                            | 40   | 45   | 50 | 55                                     | 60                      | 65  | 70  | 75   | 80   | 90   | 100 |  |
| Quantity [ g ]                            | 2.0                    | 2.5 | 3.0 | 4.5  | 5.5                           | 7    | 7.5  | 8  | 10                                     | 10.5                    | 14  | 14  | 14.5 | 15.5 | 20.5 | 26  |  |

**Table 6:** Recommended lubricants

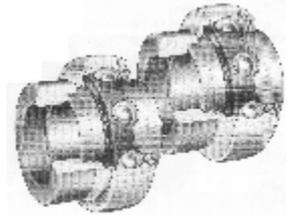
### 7.2.3 Flange bearing used as fixed point **FP**

Two different bearing inserts are fitted:

- Bearing insert with set screws for location

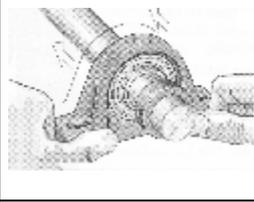
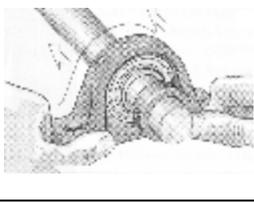
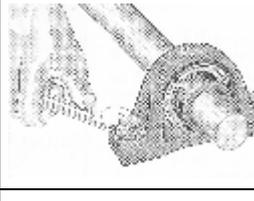
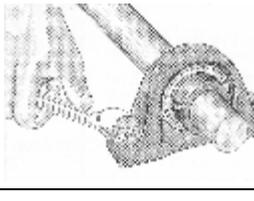


- Bearing insert with eccentric ring for location



The floating bearings are not tightened and therefore supplied without an eccentric ring or set screws.

### 7.2.4 Bearing replacement

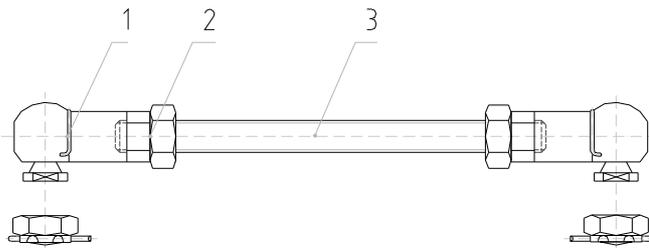
| Bearing housing with eccentric ring  |   | Bearing housing with set screw  |   |
|--|---|---|---|
| Remove attachments such as drives, operating levers and switch cams, remove old bearing housings                 |   |   |   |
| Push the housing unit onto the spindle and align it taking into account the pre-tension specified in the drawing |   | Push the housing unit onto the spindle and align it taking into account the pre-tension specified in the drawing  |   |
| Screw the housing to the mounting bracket (note tightening torque $M_A$ )  |  | Screw the housing to the mounting bracket (note tightening torque $M_A$ )   |  |
| Push the eccentric ring onto the machined face of the bearing inner ring and tension by hand                     |  | Tighten the set screw with an Allen key noting the tightening torque $M_G$ (Table 8: <b>Tightening torque for set screws</b> ), secure with thread locking paste, e.g. OKS90. |  |
| Tighten the eccentric ring using a punch and hammer  |  | <i>Pictorial illustrations are for the fitting of pedestal bearing housings, for flange bearing housings, proceed accordingly!</i>  |   |
| Replace attachments as per drawing, check the functioning of the valve   |   |   |   |

### 7.3 Connections (optional)

Linkages are used with multiple-winged butterfly valves, with butterfly valves which are connected together or with the connection between butterfly and lever drive. Various designs are used depending on the forces to be transmitted.

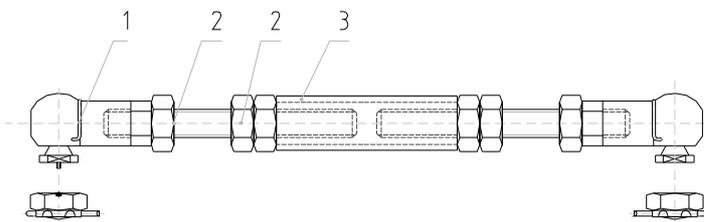
#### 7.3.1 Linkage rods

##### 7.3.1.1 Design



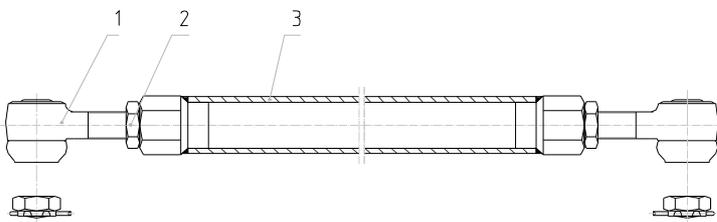
| Item | Name              |
|------|-------------------|
| 1    | Angle joint       |
| 2    | Locking nut       |
| 3    | Extension element |

Illustration 9: Linkage rod AS13-K & AS19-K



| Item | Name              |
|------|-------------------|
| 1    | Angle joint       |
| 2    | Locking nut       |
| 3    | Extension element |

Illustration 10: Linkage rod AS19-L



| Item | Name              |
|------|-------------------|
| 1    | Angle joint       |
| 2    | Locking nut       |
| 3    | Extension element |

Illustration 11: Linkage rod AH32-.....

### 7.3.1.2 Maintenance

The linkage rods are maintenance-free apart from regular checks for firm seating approx. every 500 operating hours.

#### 7.3.1.2.1 Adjusting the linkage rods

In principle, setting work must be assumed to apply to the driven spindle. The linkage rods are equipped with a right hand and left hand threaded angle joint (1) so that after loosening the locking nuts (2), adjustment is possible in both directions by rotating the connecting element (3).

- Where fitted, set the drive in both end positions: to do this consult the relevant drive documentation
- Loosen all locking nuts (2)
- Rotate the connecting element (3) - clockwise to shorten, anti-clockwise to lengthen the linkage rod
- Check the setting
- Re-tighten all locking nuts (2), note the permitted tightening torque in accordance with section 9.3:

Table 10: Tightening torque for screws with metric fine threads

Table 9: Tightening torque for screws with metric threads

| Linkage rod travel adjustment | Type / designation       | Adjustability | Thread size |
|-------------------------------|--------------------------|---------------|-------------|
|                               | Linkage rod AS13-K       | ± 5 mm        | M 8         |
|                               | Linkage rod AS19-K       | ± 5 mm        | M 14 x 1.5  |
|                               | Linkage rod AS19         | ± 56 mm       | M 14 x 1.5  |
|                               | Linkage rod AH32-1 22x25 | ± 23 mm       | M 16 x 1.5  |
|                               | Linkage rod AH32-1 30x25 | ± 25 mm       | M 28 x 1.5  |
|                               | Linkage rod AH32-1 35x25 | ± 27 mm       | M 30        |

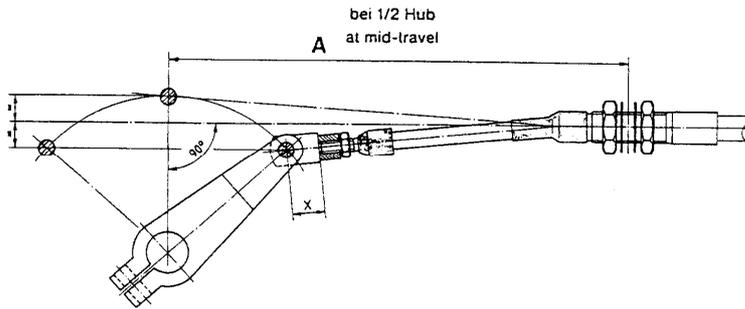
**Table 7:** Linkage rod travel adjustment

|   |   |
|---|---|
|  | <p><b>Notice</b></p> <p>When setting, ensure that at least 3 full threads are still engaged in the connecting tube (3) or the angle joint (1) as the case may be otherwise the effective forces cannot be safely transmitted.</p> |
|---|---|

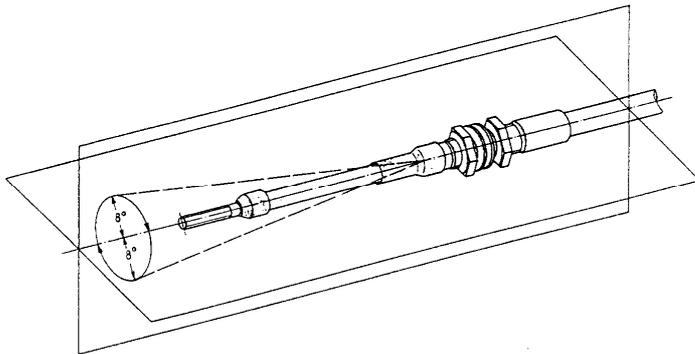
### 7.3.2 Push-pull cable

#### 7.3.2.1 Fitting and adjusting

If a push-pull cable is fitted to a lever which describes an arc, it must be fitted at right angles to the mid-travel position and at half the arc height of the lever. Jointed ends allow an all-round deflection of ± 8°.



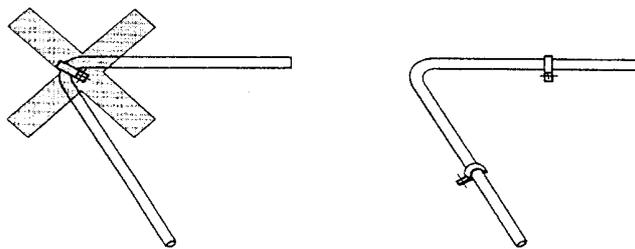
**Illustration 12:** Push-pull cable



**Illustration 13:** Push-pull cable linear operating travel

With linear operating travel, the cable end must be aligned exactly in the two planes which intersect on the axis of the object being actuated (e. g. valve operator)!

Only expert fitting and positioning will guarantee trouble-free operation. Fix ends securely so that they cannot move or twist under load. Cable clamps for routing the cable should be fitted at around one meter intervals; they should fasten the cable but not constrict it - at bends: always clamp only at the ends of a bend.



**Illustration 14:** Push-pull cable routing



### Caution

The push-pull cable may not be insulated or partly routed through the insulation.

### 7.3.2.2 Maintenance

- Only use push-pull cables which fall within the technical data specified.
- Push-pull cables are designed for optimum performance and lubricated for life; do not under any circumstances re-lubricate or attempt any other form of maintenance.
- Do not remove seals!
- The cables cannot be dismantled!
- Cables which have taken in water or have frozen should be replaced. Permeated dampness cannot be eliminated by heating.
- Protect cable where possible from mechanical damage, e.g. kinking, pinching, vibration and contamination by water, dirt and chemicals. Do not under any circumstances paint the cable ends!
- A sudden or gradual increase in no-load operating friction or loss of travel is a sign of reduced cable efficiency. We recommend precautionary replacement.



#### Notice

Push-pull cables and other remote operating elements contain thermoplastic materials, e.g. as knob or grip, coverings or seals as well as inner lining or outer sheathing. Such materials as polythene, polyacetals, Polyamides and PTFE may be deployed. Under normal usage, these materials are completely harmless. However, when burning, some of these materials can give off toxic gases, therefore suitable fire protection measures are to be observed.

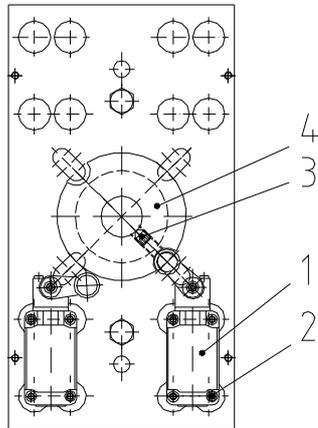
## 7.4 Limit switches (optional)

Limit switches serve to signal the end positions or an intermediate position. They are either fitted to the butterfly spindle or directly to the drive. Information on limit switches fitted to the drive can be obtained from the appropriate drive documentation (see section 1.1).

### 7.4.1 Configuration

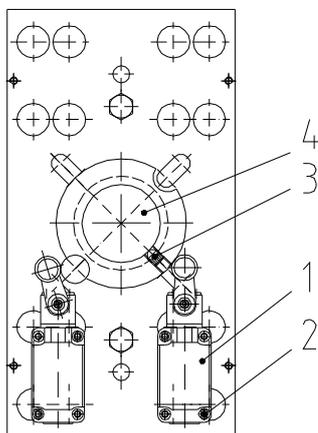
With the butterfly spindle configuration, there are the following designs:

- Limit switch mounting brackets for a maximum of two switches
- Limit switch mounting brackets for a maximum of four switches
- Positive switching cam: switch is activated on reaching the end position
- Negative switching cam: switch is not activated on reaching the end position



**Illustration 15:** Limit switch with negative switching cam

| Item | Name                                  |
|------|---------------------------------------|
| 1    | Limit switch                          |
| 2    | Fixing kit (screws and counter-plate) |
| 3    | Set screw                             |
| 4    | Switching cam, negative               |



**Illustration 16:** Limit switch with positive switching cam

| Item | Name                                  |
|------|---------------------------------------|
| 1    | Limit switch                          |
| 2    | Fixing kit (screws and counter-plate) |
| 3    | Set screw                             |
| 4    | Switching cam positive                |

Illustrated above is the mounting bracket version for a maximum of four switches. The version for a maximum of two switches has the same configuration.

From the third switch or by customer's request, two switching cams which are individually adjustable are arranged on the butterfly spindle.

### 7.4.2 Maintenance

Every 500 operating hours, check fixings, electrical connections and function.

### 7.4.3 Setting

|  |   |
|--|---|
|  | <p><b>Notice</b></p> <p>The limit switches are factory pre-set. This setting must be checked after installation and prior to commissioning and adjusted where necessary. Secure set screw (3) with thread locking paste, e.g. OKS90 (<a href="http://www.oks-germany.de">www.oks-germany.de</a>)!</p> |
|--|---|

### 7.4.3.1 Adjustment of negative switching cams

- Move the butterfly to the appropriate end position
- Loosen the set screw (3) and turn the switching cam until the limit switch lever roller is **not actuated** in this position. It may be that the roller lever on the limit switch has to be adjusted in accordance with the instructions for the appropriate switch in the appendix
- Re-tighten the set screw (3) noting the tightening torque  $M_G$  (section 9.3 Table 8: **Tightening torque for set screws**)
- Check the settings for the other end positions
- Secure the set screw (3) with thread locking paste
- If the required setting has not been achieved using the above procedure, the following steps are to be taken:
  - § Loosen the fixing screws (2)
  - § Move the limit switch (1) on the mounting bracket until the required position is reached
  - § Re-tighten the fixing screws (2) and lock if necessary

### 7.4.3.2 Adjustment of positive switching cams

- Move the butterfly to the appropriate end position
- Loosen the set screw (3) and turn the switching cam until the limit switch lever roller is **actuated** in this position. It may be that the roller lever on the limit switch has to be adjusted in accordance with the instructions for the appropriate switch in the appendix
- Re-tighten the set screw (3) noting the tightening torque  $M_G$  (section 9.3 Table 8: **Tightening torque for set screws**)
- Check the setting for the other end positions
- Secure the set screw with thread locking paste
- If the required setting has not been achieved using the above procedure, the following steps are to be taken:
  - § Loosen the fixing screws (2)
  - § Move the limit switch (1) on the mounting bracket until the required position is reached
  - § Re-tighten the fixing screws (2) and lock if necessary

|   |   |
|---|---|
|  | <p><b>Notice</b></p> <p>If required by the customer, the switching cams can be keyed to the butterfly spindle. With this version, the option of adjustment using the switching cam is no longer available. Detailed information can be obtained from the corresponding drawing (see section 1.1).</p> |
|  | <p><b>Warning</b></p> <p>Electrical connection may only be carried out by qualified personnel.</p>  |

## **7.5 Manholes and cleaning apertures (optional)**

For the purpose of maintenance and cleaning, butterfly valves can be equipped with cleaning apertures. Detailed information on the configuration can be found in the corresponding drawing (see section 1.1).

|   |   |
|---|---|
|  | <p><b>Warning</b></p> <p>Manholes or cleaning apertures may only be opened when it has been firmly established that the plant is pressure-free and the butterfly has been secured against self-activated or inadvertent movement.</p> <p>Medium still remaining in the valve can lead to severe bodily or personal injury! Before opening, neutralise the medium without fail, e.g. by flushing the line with fresh air.</p> <p>Before closing, care must be taken that no persons are shut in and that no loose parts such as tools remain in the plant.</p> |
|---|---|

When closing the aperture, check the seal and replace if necessary.<sup>2</sup>

## **7.6 Hand levers and drives (optional)**

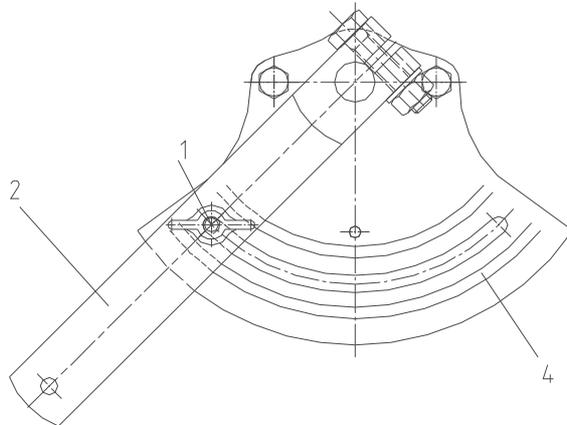
For operating the butterfly valves, the most diverse makes and types of drive are deployed. To ascertain which drive has been utilised on the butterfly valve, consult the corresponding drawing or documentation (see section 1.1).

### **7.6.1 Hand lever**

Depending on the size of the butterfly valve, hand levers of various sizes and designs are used which serve to manually operate the valve. To ascertain which hand lever type has been utilised, consult the corresponding drawing (see section 1.1).

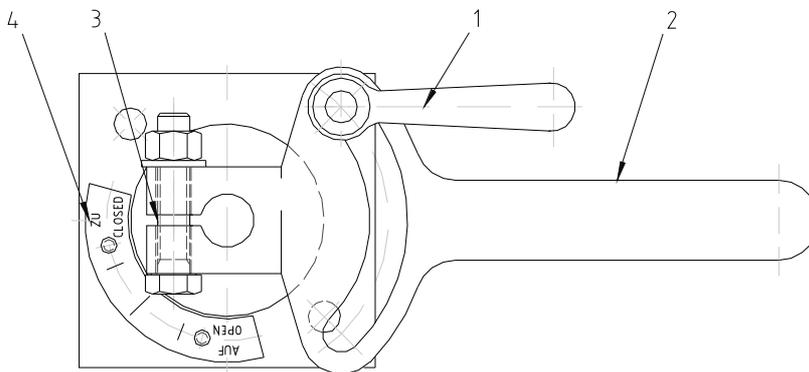
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<sup>2</sup> Manhole or cleaning aperture seals can be ordered from ENA as a wear part kit.



The hand lever HH63-250 is steplessly variable. By loosening the clamping screw (1), the butterfly can be steplessly regulated manually via the hand lever. The position of the butterfly can be read from the position of the hand lever (1) against the scale (4).

**Illustration 17:** Hand lever HH63-250



The hand levers HH280-500 or HH560-1000 are steplessly variable. By loosening the clamping screw (1), the butterfly can be steplessly regulated manually via the hand lever. The position of the butterfly can be read off the scale (4) at the positioning slit (3).

**Illustration 18:** Hand lever HH280-500 / HH 560-1000

|  |   |
|--|---|
|  | <p><b>Caution</b></p> <p>After operating the butterfly valve, re-tighten the clamping screw (1) without fail otherwise the butterfly can move out of control.</p> |
|--|---|

### 7.6.2 Drives

Drives serve to operate the butterfly valve automatically. Various types are deployed:

- Electrical drives
- Pneumatic drives
- Hydraulic drives
- Mechanical gearboxes with manual regulation

To ascertain which type of drive has been utilised, consult the corresponding documentation (see section 1.1).



### Warning

It is imperative to observe the associated documentation when performing all work such as installation, commissioning and maintenance (see section 1.1).

### 7.6.3 Installation – direct mounted

Direct mounted drives are built directly onto the butterfly spindle or connected to the butterfly spindle via a coupling or an adapter.



### Notice

With butterfly valves, the recommended mounting position for the drives is the CLOSED end position.

*Exception:* For drives with safety position: spring actuated OPEN, the recommended mounting position is the OPEN end position.

- Check the connecting dimensions of the spindle or adapter and drive mounting bracket
- Move the butterfly and drive manually to the same end position; see information above
- Attach the drive and screw in the drive screws with spring washers to DIN 127
- Tighten the screws and apply the tightening torque in accordance with section 9.3, table 14
- Set the mechanical end position stops and limit switches in accordance with the drive documentation (see section 1.1)
- Connection of the electric, pneumatic or hydraulic lines is in accordance with the associated drive documentation (see section 1.1)



### Warning

The electric, pneumatic or hydraulic connection may only be undertaken by appropriately trained or qualified personnel. It is imperative that the relevant national regulations are complied with.

### 7.6.4 Installation – drives with lever drive

Drives with lever drive are fitted onto a drive mounting bracket. The connection to the butterfly spindle is via a linkage rod on an operating lever.



### Notice

With butterfly valves, the recommended mounting position for the drives is the **CLOSED** end position.

- Check the connecting dimensions of the drive mounting bracket and linkage rod connection
- Move the butterfly and drive manually to the same end position; see information above

- Place the drive onto the drive mounting bracket in accordance with the corresponding drawing and fasten with screws observing the tightening torque in accordance with section 9.3, table 11.
- Fit the linkage rod and carry out adjustment in accordance with section 7.3
- Set the mechanical end position stops and limit switches in accordance with the drive documentation (see section 1.1)
- Connection of the electric, pneumatic or hydraulic lines is in accordance with the associated drive documentation (see section 1.1)

**Warning**

The electric, pneumatic or hydraulic connection may only be undertaken by appropriately trained or qualified personnel. It is imperative that the relevant national regulations are complied with.

### 7.6.5 Commissioning drives

**Caution**

Prior to first commissioning, it is imperative to compare the connection data on the drive identification plate with the respective butterfly valve data sheet.

The drives are factory pre-set, check the mechanical end stops and limit switches before first commissioning and adjust where necessary.

### 7.6.6 Drive maintenance

Approx. every 1000 operating hours the supply lines must be examined for correct seating and leak-tightness.

The limit switches must be checked for faultless functioning and correct switching point every 1000 operating hours.

**Warning**

Observe the associated drive maintenance documentation (see section 1.1) without fail.

### 7.7 Abrasion and erosion

Through erosion, corrosion and abrasion, sacrificial and wear parts can cause wear on the housing wall and butterfly. This wear is to be monitored by carrying out regular checks such as visual examination or ultra-sonic wall thickness measurements, taking into account in-house operating experience and the anticipated operating mode.

**Warning**

High levels of abrasion and erosion can lead to leakage and functional faults in the plant.



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## **8. Safety guarding requirements in accordance with EN ISO 12100-1/2**

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Butterfly valves are components which are intended for incorporation into a machine or plant. This incorporation creates ramifications for the plant constructor or plant operator under certain circumstances of having to equip the butterfly valves with the following safety guarding in accordance with the Machinery Guidelines.

Please contact ENA GMBH with all queries relating to the application of EN ISO 12100, parts 1 and 2.

Contact: see section 2

### **8.1 Isolating safety guarding**

Due to moving operating levers and linkage rods, a crushing hazard to the operating or maintenance personnel can be assumed. Moreover, high surface temperatures can also present hazards to personnel. Because the layout of the butterfly valve within the plant determines whether it presents a hazard, the plant constructor or plant operator must establish whether the respective components have to be made safe with protective guarding. EN 294 or respectively EN 563 contain adequate information on this point.

### **8.2 Precautions for safe access**

Butterflies are plant components which are subject to maintenance. To ensure safe working, staging or platforms should be installed. Where this staging allows access to hazardous areas (see Safety guarding), that access should be guarded.

If permanent equipment is not feasible, portable staging can also be used.

For butterfly valves with a nominal diameter greater than 1000 mm or respectively 0.8 m<sup>2</sup> cross-sectional area, a manhole should be provided in the pipeline or duct for internal inspection. This manhole should be positioned as closely as possible to the butterfly valve.

### **8.3 Precautions for power isolation and energy dissipation**

For maintenance work, devices must be available with which each individual source of energy can be isolated. With components which are connected via plugged connections, disconnecting the plug from the socket is sufficient. It must be possible to discharge any residual energy or accumulated energy which is still present after isolation without presenting a hazard – *this applies particularly to pneumatic and hydraulic components*

## 9. Tables

### 9.1 Summary of commissioning work

| Component                   | Interval after |                       | Work to be performed  | Info.<br>see<br>section |
|-----------------------------|----------------|-----------------------|---|-------------------------|
|                             | installation   | warm<br>commissioning |   |                         |
| Surface protection          | <b>X</b>       |                       | Make good damage  | 5.2                     |
| Screwed connection flange   |                | <b>X</b>              | Re-tighten screwed connections and check for leak-tightness | 6.2.1                   |
| Welded connection flange    |                | <b>X</b>              | Check leak-tightness  | 6.2.2                   |
| Stuffing box                |                | <b>X</b>              | Check leak-tightness  | 7.1.1.1                 |
| Flange or pedestal bearings |                | <b>X</b>              | Check fixed bearing function                                | 7.2.2                   |
|                             |                | <b>X</b>              | Check fixing  | 7.2.2                   |
| Linkage rod connections     |                | <b>X</b>              | Check fixing  | 7.3.1.2.1               |
|                             |                | <b>X</b>              | Check setting   | 7.3.1.2.1               |
| Push-pull cable conn.       |                | <b>X</b>              | Check the setting   | 7.3.2.1                 |
| Limit switch                | <b>X</b>       |                       | Check the setting   | 7.4.3                   |
|                             | <b>X</b>       |                       | Secure the set screw with thread locking paste              | 7.4.3.1                 |
| Manholes                    |                | <b>X</b>              | Check leak-tightness  | 7.5                     |
| Hand lever                  | <b>X</b>       | <b>X</b>              | Check function  | 7.6.1                   |
| Drive                       | <b>X</b>       | <b>X</b>              | Check mechanical end stops and limit switches               | 7.6.3<br>7.6.4          |
|                             | <b>X</b>       | <b>X</b>              | Functional check  | 7.6.5                   |
| "spring opening"            | <b>X</b>       |                       | Mount drive as per label                                    | 6.1.1                   |
| General                     | <b>X</b>       | <b>X</b>              | Check supply lines  | 5.4                     |
|                             | <b>X</b>       | <b>X</b>              | Functional check of the butterfly valve                     | 6.1                     |

## 9.2 Summary of maintenance work

| Component                       | Interval (operating hrs.) |        |    |      |      | Work to be performed                  | Info.<br>see<br>section |
|---------------------------------|---------------------------|--------|----|------|------|---------------------------------------|-------------------------|
|                                 | Daily                     | Yearly | 50 | 1000 | 2000 |                                       |                         |
| Butterfly valve generally       |                           | X      |    |      |      | Functional check                      | 6.1                     |
| Stuffing box                    |                           |        |    |      | X    | Tighten down stuffing box packing     | 7.1.1.1                 |
|                                 |                           |        |    |      | X    | Check stuffing box for leak-tightness | 7.1.1.1                 |
| Flange or pedestal bearings     |                           |        |    |      | X    | Lubricate bearings                    | 7.2.2                   |
|                                 |                           |        |    |      | X    | Check fixed bearing function          | 7.2.2                   |
|                                 |                           |        |    |      | X    | Check fixing                          | 7.2.2                   |
| Linkage rods                    |                           |        | X  |      |      | Check fixing                          | 7.3.1.2                 |
| Push-pull cable                 |                           |        | X  |      |      | Check fixing                          | 7.3.2                   |
| Limit switch                    |                           |        | X  |      |      | Check fixing                          | 7.4.2                   |
|                                 |                           |        | X  |      |      | Check function (switching point)      | 7.4.3                   |
|                                 |                           |        | X  |      |      | Check electrical connections          | 7.4.2                   |
| Manholes and cleaning apertures |                           |        |    | X    |      | Check leak-tightness                  | 7.5                     |
| Hand lever                      | X                         |        |    |      |      | Check clamping                        | 7.6                     |
| Drive                           |                           |        | X  |      |      | Check fixing                          | 7.6.3 and 7.6.4         |
|                                 |                           |        |    | X    |      | Check function                        |                         |
|                                 |                           |        |    | X    |      | Check supply line connections         | 7.6.6                   |
|                                 |                           |        |    | X    |      | Check travel switch-off               | 7.6.6                   |

### 9.3 Tightening torque for screwed connections

| SW  | M <sub>G</sub> |
|-----|----------------|
| 2.5 | 3.6 Nm         |
| 3   | 6 Nm           |
| 4   | 14 Nm          |

| SW | M <sub>G</sub> |
|----|----------------|
| 5  | 26 Nm          |
| 6  | 42 Nm          |

**Table 8:** Tightening torque for set screws

| Size | M <sub>A</sub> |
|------|----------------|
| M6   | 10 Nm          |
| M 8  | 25 Nm          |
| M10  | 41 Nm          |
| M12  | 72 Nm          |

| Size | M <sub>A</sub> |
|------|----------------|
| M14  | 115 Nm         |
| M16  | 180 Nm         |
| M18  | 245 Nm         |
| M20  | 345 Nm         |

**Table 9:** Tightening torque for screws with metric threads, strength class 8.8

| Size     | M <sub>A</sub> |
|----------|----------------|
| M8x1     | 27 Nm          |
| M10x1.25 | 52 Nm          |
| M12x1.25 | 95 Nm          |
| M12x1.5  | 90 Nm          |

| Size    | M <sub>A</sub> |
|---------|----------------|
| M14x1.5 | 150 Nm         |
| M16x1.5 | 225 Nm         |
| M18x1.5 | 325 Nm         |

**Table 10:** Tightening torque for screws with metric fine threads, strength class 8.8

| Size | M <sub>A</sub> |
|------|----------------|
| M6   | 3.5 Nm         |
| M 8  | 16 Nm          |
| M10  | 32 Nm          |
| M12  | 56 Nm          |

| Size | M <sub>A</sub> |
|------|----------------|
| M16  | 135 Nm         |
| M20  | 280 Nm         |
| M24  | 455 Nm         |
| M 30 | 1050 Nm        |

**Table 11:** Tightening torque for stainless and acid resistant A2 / A4 steel screws, strength class 70

| Size | M <sub>A</sub> |
|------|----------------|
| M6   | 10 Nm          |
| M 8  | 25 Nm          |
| M10  | 50 Nm          |
| M12  | 86 Nm          |

| Size | M <sub>A</sub> |
|------|----------------|
| M16  | 220 Nm         |
| M20  | 420 Nm         |
| M 30 | 1500 Nm        |
| M36  | 2500 Nm        |

**Table 12:** Tightening torque for drive fixing screws