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# 1 Introduction

## 1.1 About this document

The translation of the original instruction manual must be kept in close proximity and accessible to personnel at all times. The translation of the original instruction manual must be carefully read and understood by such personnel before use.

This enables the safe and efficient handling of the cardan shaft. The basic prerequisite for safe working is compliance with all specified safety instructions and handling instructions in this translation of the original instruction manual. In addition, the national as well as local accident prevention regulations and general safety regulations apply to the area of use of the cardan shaft.

### 1.1.1 General equal treatment

This translation of the original instruction manual uses after the German spelling reform the masculine Writing form in a neutral sense to keep the text easier to read. It always speaks Women and men in the same way. We ask the readers for understanding for this Simplification in the text.

### 1.1.2 Trademark

It is pointed out that the designations used in this translation of the original instruction manual as well as brand names of the respective companies are subject to general trademark protection. All other third-party trademarks used are hereby acknowledged.

The manufacturer reserves the right to assert all rights in the event of an infringement of trademark rights.

### 1.1.3 Feedback

The manufacturer makes every effort to create a complete and correct translation of the original instruction manual for the cardan shaft .

However, if you have any suggestions for improvement or comments, please do not hesitate to let us know. Please send your comments by e-mail to the following address. Please write this e-mail in English or German. The contact details are on page 2.

## 1.2 Representation conventions

Information with special meaning is highlighted in this translation of the original instruction manual by symbols, typography or wording.

### 1.2.1 Use of illustrations

The illustrations in this translation of the original instruction manual are for basic understanding and may differ from the actual design. No claims can be derived from any deviations.



### 1.2.2 Use of position numbers

The position numbers are numerical and start with the number 1. Each position number exists only once per chapter.

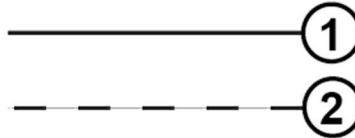


Figure 1: Example

| Pos. | Designation                               |
|------|---|
| ①    | Example designation                       |
| ②    | Example designation of a hidden component |

Table 1: Example

### 1.2.3 Marking in text

|     |   |
|-----|---|
| 1.  | Indicates a numbered instruction for action                   |
| □   | Indicates an intermediate result (instruction for action)     |
| ➤   | Indicates a final result (instruction for action)             |
| a.  | Indicates a list element of level 1 (letters)                 |
| ●   | Indicates a level 1 list item                                 |
| ■   | Indicates a level 2 list item                                 |
| ◆   | Indicates a level 3 list item                                 |
| ↪   | Indicates a cross-reference to a page, an image or a document |
| (1) | Identifies an item number in a figure                         |

Table 2: Typographic highlights

### 1.2.4 Marking of safety instructions

Please also note the "Warning and safety instructions" guide in our store. This explains and illustrates the differences between warnings and safety instructions, the correct structure according to the SAFE standard and many other points.

#### Warning function

Warning labels warn of hazards when handling the product. The hazards are classified, named, described and supplemented by instructions on how to avoid them.

- If a warning is placed before a list of instructions, the hazard exists throughout the activity.
- If a warning is placed immediately before an instruction, the danger is present at the next action step.



## Warning label design

All warnings are identified by a signal word and a warning symbol. The combination of signal word and warning symbol determines the degree of danger.

## Hazard levels

The safety and warning notes used in this translation of the original instruction manual are based on the standards DIN ISO 3864-2 (signal words), ISO 3864-1 (safety colors) and DIN EN 82079-1 (design).

| Signal word    | Meaning   |
|----------------|---|
| <b>DANGER</b>  | Indicates a hazardous situation which, if not avoided, will result in death or serious injury.          |
| <b>WARNING</b> | Indicates a hazardous situation which, if not avoided, could result in death or serious injury.         |
| <b>CAUTION</b> | Indicates a hazardous situation which, if not avoided, may result in minor injury or property damage.   |
| <b>NOTE</b>    | Indicates ease of use and cross-references. It eliminates hazards of property damage or risk of injury. |

Table 3: Hazard levels

### Example:

#### NOTE



#### Warning symbol!

- The warning symbol may be supported by another hazard symbol, which symbolizes the type of hazard, to draw the reader's attention.



#### DANGER



#### Description of the type and source of the possible danger!

Description of the consequences of non-compliance.



- Description of the security measures.



## 2 Transport & Storage

For transport to the installation site, VDI 2700, Procedural instructions for securing loads in road traffic, must be observed.

### 2.1 Transport

#### NOTE



#### Staff

- Only use qualified personnel who can prove that they are qualified to operate the conveying equipment used.

#### Safety instructions

Failure to comply with the safety instructions and regulations may result in occupational accidents.

- Observe safety instructions and regulations.
- Comply with applicable accident prevention regulations.
- Carefully check all activities several times.
- Carry out all transports horizontally only. If vertical transport cannot be avoided, secure displacement against sliding out.
- Always secure the cardan shaft against rolling away with wedges or prism during transport and storage.
- If several cardan shaft are stacked on top of each other, use only suitable wooden racks that prevent rolling out.

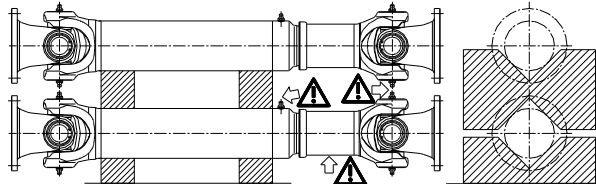


Figure 2: Stacked cardan shaftn

- Secure cardan shaftn with centered double joint to prevent it from buckling too far during transport and storage. Otherwise the centering bearing will be damaged.

#### 2.1.1 Transport machine with forklift

- When transporting, underlay with wood and lift only under the pipe.
- Always pay attention to the grease nipples. Squared lumber and lifting ropes must not come into contact with the grease nipples.
- The profile guard must not be loaded under any circumstances during storage and transport.
- Only use plastic ropes or lifting slings for crane transport. If only steel ropes are available, provide the slinging point with edge protection.

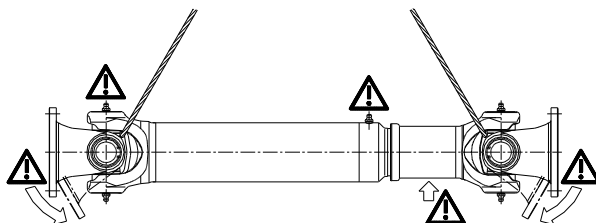


Figure 3: Transport with forklift truck



### WARNING



#### **Danger of collision!**

Danger of accident during transport by forklift truck.

→ Make sure that no one is in the working area of the forklift.

### CAUTION



#### **Material damage due to improper transport!**

Improper handling during transport can damage the cardan shaft .

→ Make sure that the cardan shaft is not exposed to impacts.



## 2.2 Storage

### 2.2.1 Storage instructions

- Suitable storage space (dry, clean, vibration-free, without chemical fumes and level floor) available.
- Do not expose the cardan shaft to extreme cold or heat.
- The cardan shaft must only be supported under the pipe. Joints, flanges, displacements, profile protection and grease nipples must be exposed and must not be loaded.
- Cover the cardan shaft to protect against dust and contamination.
- All parts should be stored in their original packaging.

### NOTE



#### **Observe note for storage!**

- If these specifications are observed, cardan shafts and pillow blocks can be stored for up to 5 years.
- However, before commissioning parts that have been stored for longer than 1 year, the old lubricant must be completely replaced by lubrication.





## 3 Assembly & disassembly

### 3.1 Flange fittings

High-strength cardan bolts of strength class 10.9 or hexagon bolts similar to DIN 960-10.9 should be used for bolting the universal joint shaft flange to the connecting flange. If bolts to DIN 931-10.9 or DIN 933-10.9 are used for connecting flanges with threaded holes, the modified torque values must be observed. Only self-locking nuts according to DIN 980-10 should be used. When using other nuts, the nut must be secured accordingly. When using threaded holes in the connecting flange, the screw must be secured.

#### NOTE



#### Observe mounting direction!

- ➔ The screws cannot always be inserted from the cardan shaft side.
- ➔ The bolts should be pushed through from the connecting flange side and the nut screwed on from the flange side.
- ➔ All our cardan shafts are delivered in this form unless otherwise specified.

Unless otherwise requested, the cardan shafts are delivered without screw set. Of course, we can supply any set of screws upon request. The screw connection should be made in a lightly oiled condition. However, never apply too much oil or even grease to the bolts and nuts. When tightening or loosening the locking screws or nuts, the existing thread locking is always destroyed. Therefore, always re-secure the nut or bolt when tightening or loosening it.

#### 3.1.1 Screwing DIN flanges

- According to ISO 7646
- Cardan bolts strength class 10.9
- Hexagon head screws similar to DIN 960-10.9
- Hexagon nut DIN 980-10

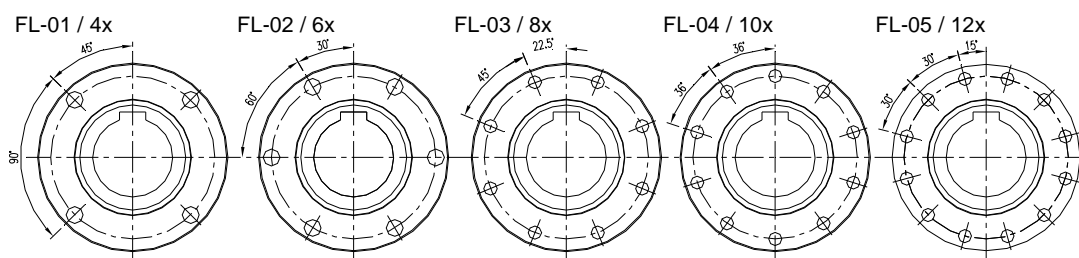
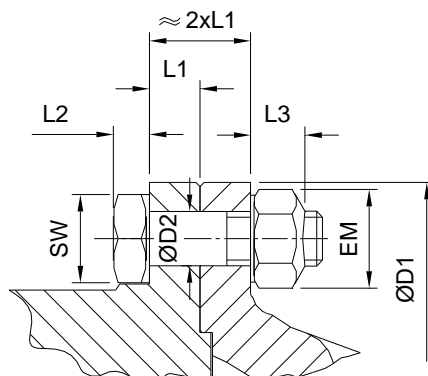


Figure 4: Screwing DIN flanges



Anschlussflansch Kardanflansch  
companion flange cardan flange

Figure 5: Screw connection DIN flanges - connecting flange / cardan flange

| ØD1<br>mm | L1<br>mm | ØD2<br>mm | Flange     | Screws     |          |          |          |          |          |
|-----------|----------|-----------|------------|------------|----------|----------|----------|----------|----------|
|           |          |           |            | Dimension  | SW<br>mm | EM<br>mm | L2<br>mm | L3<br>mm | Mt<br>Nm |
| 58        | 4        | Ø5        | FL-01 (4)  | M5x15      | 8        | 8.8      | 3.5      | 5        | 9        |
| 65        | 5        | Ø6        | FL-01 (4)  | M6x20      | 10       | 11.1     | 4        | 6        | 14       |
| 75        | 6        | Ø6        | FL-02 (6)  | M6x20      | 10       | 11.1     | 4        | 6        | 14       |
| 90        | 8        | ø8        | FL-01 (4)  | M8x1x25    | 13       | 14.4     | 5.3      | 8        | 36       |
| 100       | 8        | ø8        | FL-02 (6)  | M8x1x25    | 13       | 14.4     | 5.3      | 8        | 36       |
| 120       | 10       | ø8        | FL-03 (8)  | M8x1x30    | 13       | 14.4     | 5.3      | 8        | 36       |
|           |          | ø10       |            | M10x1x30   | 17       | 18.9     | 6.4      | 10       | 70       |
| 150       | 12       | Ø10       | FL-03 (8)  | M10x1x35   | 17       | 18.9     | 6.4      | 10       | 70       |
|           |          | Ø12       | FL-04 (10) | M12x1.5x40 | 19       | 21.1     | 7.5      | 12       | 120      |
|           |          | Ø14       | FL-05 (12) | M14x1.5x45 | 22       | 24.5     | 8.8      | 14       | 190      |
| 180       | 14       | Ø12       | FL-03 (8)  | M12x1.5x45 | 19       | 21.1     | 7.5      | 12       | 120      |
|           |          | Ø14       | FL-04 (10) | M14x1.5x45 | 22       | 24.5     | 8.8      | 14       | 190      |
|           |          | ø16       | FL-05 (12) | M16x1.5x50 | 24       | 26.8     | 10       | 16       | 300      |
| 225       | 15       | ø16       | FL-03 (8)  | M12x1.5x50 | 19       | 21.1     | 7.5      | 12       | 120      |
|           |          |           | FL-05 (12) | M16x1.5x50 | 24       | 26.8     | 10       | 16       | 300      |
| 250       | 18       | ø18       | FL-03 (8)  | M18x1.5x60 | 27       | 30.2     | 11.5     | 18       | 450      |
| 285       | 20       | ø20       | FL-03 (8)  | M20x1.5x65 | 30       | 33.6     | 12.5     | 20       | 620      |
| 315       | 22       | ø22       | FL-03 (8)  | M22x1.5x75 | 32       | 35.8     | 14       | 22       | 830      |
| 350       | 25       | Ø22       | FL-04 (10) | M22x1.5x75 | 32       | 35.8     | 14       | 22       | 830      |
| 390       | 28       | Ø24       | FL-04 (10) | M24x1.5x85 | 36       | 40       | 15       | 24       | 1100     |
| 435       | 32       | Ø27       | FL-04 (10) | M27x1.5x95 | 41       | 45.2     | 17       | 27       | 1600     |

Table 4: Bolting DIN flanges - Overview



### 3.1.2 Bolting SAE flanges

- According to ISO 7647
- Cardan bolts strength class 10.9
- Hexagon head screws DIN 960-10.9
- Hexagon nut DIN 980-10

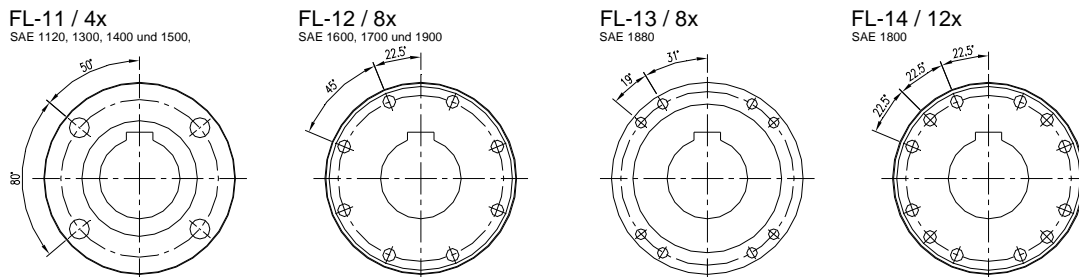


Figure 6: Bolting SAE flanges

| ØD1<br>mm | SAE<br>Type  | L1<br>mm | ØD3<br>mm    | Flange                  | Screws                      |    |      |     |    |            |
|-----------|--------------|----------|--------------|-------------------------|-----------------------------|----|------|-----|----|------------|
|           |              |          |              |                         | Dimension                   | SW | EM   | L2  | L3 | Mt<br>Nm   |
| 90        | 1100         | 6        | ø8           | FL-11 (4)               | M8x1x25<br>5/16 "x1"        | 13 | 14.4 | 5.3 | 8  | 36         |
| 96        | 1300         | 7        | Ø10<br>Ø9.5  | FL-11 (4)               | M10x1x30<br>3/8 "x1 3/16"   | 17 | 18.9 | 6.4 | 10 | 70         |
| 116       | 1400         | 8        | Ø12<br>Ø11.2 | FL-11 (4)               | M12x1.5x40<br>7/16 "x1 5/8" | 19 | 21.1 | 7.5 | 12 | 120        |
| 150       | 1500         | 8        | Ø14<br>Ø12.7 | FL-01 (4)               | M14x1.5x45<br>1/2 "x1 3/4"  | 22 | 24.5 | 8.8 | 14 | 190<br>120 |
| 175       | 1600         | 10       | Ø10<br>Ø9.5  | FL-12 (8)               | M10x1x30<br>3/8 "x1 3/16"   | 17 | 18.9 | 6.4 | 10 | 70         |
| 203       | 1700<br>1800 | 11       | Ø12<br>Ø11   | FL-12 (8)<br>FL-14 (12) | M12x1.5x40<br>7/16 "x1 5/8" | 19 | 21.1 | 7.5 | 12 | 120        |
| 245       | 1880         | 15       | Ø16          | FL-13 (8)               | M16x1.5x50                  | 24 | 26.8 | 10  | 16 | 300        |
| 250       | 1900<br>GS   | 18       | Ø12          | FL-14 (12)              | M12x1.5x50<br>7/16 "x1 5/8" | 19 | 21.1 | 7.5 | 12 | 120        |
| 276       | 1900         | 18       | Ø16          | FL-12 (8)               | M16x1.5x60                  | 24 | 26.8 | 10  | 16 | 300        |

Table 5: Bolting SAE Flanges - Overview

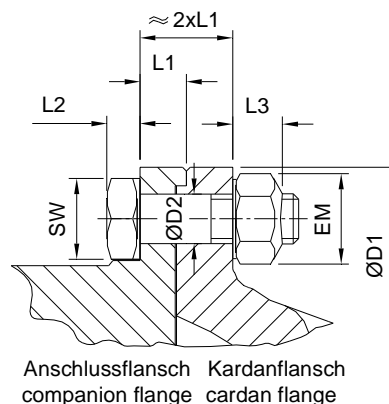


Figure 7: Bolting SAE Flanges - Connecting flange / Cardan flange



### 3.1.3 Bolting KV flanges

- According to ISO 12667 and ISO 8667, All cross-toothed flanges have 4 bolts per flange. Cardan bolts strength class 10.9, hexagon bolts similar to DIN 960-10.9, hexagon nut DIN 980-10.

| $\varnothing D1$<br>mm | L3<br>mm | $\varnothing D2$<br>mm | Screws     |          |          |          |          |          |
|------------------------|----------|------------------------|------------|----------|----------|----------|----------|----------|
|                        |          |                        | Dimension  | SW<br>mm | EM<br>mm | L2<br>mm | L3<br>mm | Mt<br>Nm |
| 100                    | 10       | $\varnothing 8$        | M8x1x30    | 13       | 14.4     | 5.3      | 8        | 36       |
| 120                    | 14       | $\varnothing 11$       | M10x1x40   | 17       | 18.9     | 6.4      | 10       | 70       |
| 150                    | 16       | $\varnothing 13$       | M12x1.5x45 | 19       | 21.1     | 7.5      | 12       | 120      |
| 180                    | 18       | $\varnothing 15$       | M14x1.5x55 | 22       | 24.5     | 8.8      | 14       | 190      |
| 200                    | 20       | $\varnothing 15$       | M14x1.5x55 | 22       | 24.5     | 8.8      | 14       | 190      |

Table 6: Bolting KV Flanges - Overview

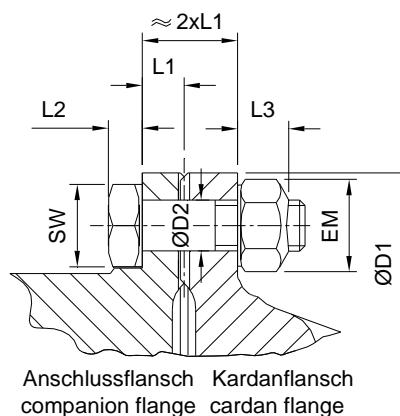


Figure 8: Bolting KV flanges - Connecting flange / Cardan flange

## 3.2 Installation of the cardan shaft

1. Remove any transport locks before installation.
2. Before installation, check that the cardan shaft is assembled exactly according to the marking on the displacement.

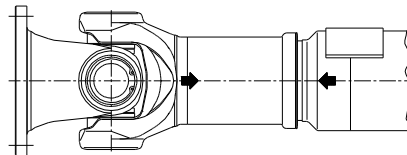


Figure 9: Installation - Marking on the displacement

3. When painting over the cardan shafts, make sure that the length compensation area remains free.
4. Only use bolts and nuts of the correct quality and dimensions.
5. Always install in such a way that dirt is repelled from the displacement and water can run off.
6. Always tighten flange bolted connections crosswise with a torque wrench.
7. Always clean dirt, grease, oil, rust inhibitors and paint from the faces of the cardan shaft flanges and mating flanges before screwing them together.

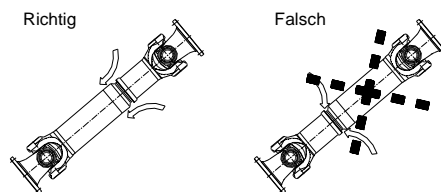


Figure 10: Installation - Cleanliness of the front surfaces

8. Never interchange the displacement or even other cardan shaft parts of different cardan shafts.
  - The cardan shafts would no longer be properly balanced.
9. If it is necessary to pull the cardan shaft completely out of the displacement, pay close attention to the marking when assembling the displacement.
10. Never remove balancing plates or other parts from the cardan shaft or make any modifications. The function of the cardan shaft would no longer be guaranteed, and our warranty would expire immediately.
11. After installation, the length compensation must have freedom of movement to both sides so that both the maximum and minimum operating condition length can be achieved with the length compensation.
12. Always install universal cardan shafts without length compensation in a tension-free manner.
13. On gearboxes, intermediate bearings, and similar machine elements with cardan shaft connections on both sides, the cardan shafts should be flange-mounted with 90° offset in each case.

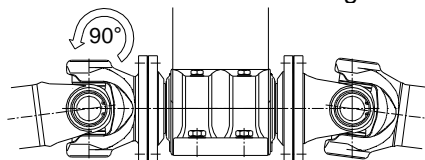


Figure 11: Installation - With 90° offset

14. Never rotate the cardan shaft in the joint using assembly tools such as slip-on tubes or lever rods.
  - Grease nipples and seals could be damaged.
15. Check the connection flanges. They must exactly match the cardan shaft flange in shape and dimensions.
16. Protect cardan shafts with a centered double joint from excessive tilting during assembly.
  - Otherwise, the centering bearing may be damaged.

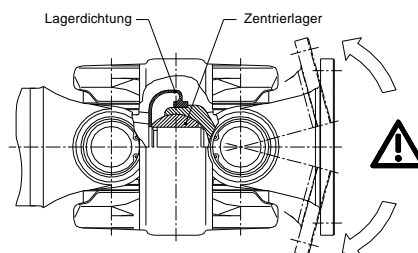


Figure 12: Installation - Damage to the center bearing

17. All other machine parts must be outside the working area and the rotation diameter of the cardan shaft.
18. Machine elements important for the safety of the vehicle must be protected in such a way that they cannot be damaged in the event of a defect in the cardan shaft. Possibly provide a frame and catch bracket.
19. Carefully read the lubrication instructions before starting up the cardan shaft.



### 3.2.1 Additional information on cardan shaft trains

1. Intermediate shafts and cardan shaft trains are supplied fully assembled with the associated center bearings. Therefore, never dismantle the bearings before installation, but fasten them together with the cardan shaft.
2. Never loosen or retighten the lock nut or lock screw(s) of the bearing, as this would destroy the safety mechanism.

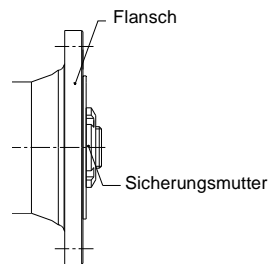


Figure 13: Installation - Lock nut

3. When installing the cardan shaft train, observe the relevant installation instructions of the manufacturer.
4. Do not attach the center bearing to the vehicle until the input and output sides of the cardan shaft train have been attached. The center or intermediate shaft bearing must always be installed without constraint.
5. The cardan shaft train is usually long and therefore large leverage forces occur on the joints during installation. To prevent the joints from being damaged during assembly, avoid sagging of the cardan shaft train and overbending of the joints.
6. The intermediate bearing must always be at right angles to the intermediate shaft and the cardan shaft train.
7. The frame under the bearing mounting must be stable and strong enough to absorb the forces introduced.

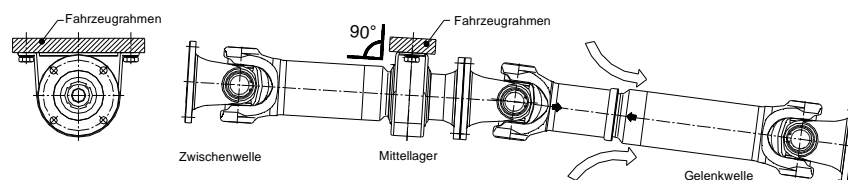


Figure 14: Installation - Bearing mount

8. Always install in such a way that dirt is repelled from the displacement and water can run off.
9. To fasten the center bearing to the vehicle frame, observe the vehicle manufacturer's instructions and use the screws specified there and secure them accordingly.
10. After installation, the length compensation must have freedom of movement to both sides so that both the maximum and minimum operating condition length can be achieved with the length compensation.

### 3.3 Dismantling the cardan shaft

1. Secure the displacement against slipping out.
2. If the marking on the displacement is no longer visible, apply position marking to spline shaft and spline hub before pulling them apart.
3. Always work safely. Secure joints against tipping. When removing under the vehicle, secure the cardan shaft against falling down.
4. Never interchange different parts of different cardan shafts.



## 4 Service and maintenance

Regular maintenance and cleaning at the prescribed intervals is an indispensable prerequisite for efficient use of the cardan shaft. The specified intervals are guide values and depend on the use of the cardan shaft and may therefore be necessary more often than specified. In this case, correct the information in these translation of the original instruction manual and instruct the personnel accordingly. Any necessary repair work must be carried out by qualified personnel in due time, i.e. immediately after the damage has been detected.

### 4.1 Maintenance and lubrication plan

| <i>Vehicle or machine</i>  | <i>Lube all</i>       | <i>or at maximum after</i>                | <i>inspection all</i> | <i>or at maximum after</i> |
|--|-----------------------|---|-----------------------|----------------------------|
| Commercial vehicles in long-distance traffic and all comparable vehicles   | 50,000 km             | 12 Months                                 | 100,000 km            | 12 Months                  |
| Commercial vehicles in mixed on-road / off-road use<br>Commercial vehicles in urban traffic<br>All comparably used vehicles                                  | 25000 km              | 6 months                                  | 50,000 km             | 12 Months                  |
| Long-distance buses  | 50,000 km             | 12 Months                                 | 100,000 km            | 12 Months                  |
| Buses in urban traffic   | 25,000 km             | 3 months                                  | 50,000 km             | 6 months                   |
| Commercial vehicles and construction machinery in use on construction sites*<br>Work vehicles, tractors, military vehicles*<br>All comparable vehicles used* | 12,500 km<br>or 250 h | 3 months<br>or according to<br>Water ride | 25,000 km             | 6 months                   |
| Marine propulsion  | 1,500 h               | 12 Months                                 | 1,500 h               | 12 Months                  |
| All kind of production intensive industrial equipment and lifting equipment  | 500 h                 | 6 months                                  | 500 h                 | 6 months                   |

\*After passing through rivers or other bodies of water, lubrication must be carried out in any case

Table 7: Maintenance and lubrication plan

### 4.2 Cleaning

Never clean the cardan shaft with a high-pressure cleaner or steam jet. However, if such cleaning can not be avoided, in any case the cardan shaft then lubricate in the manner described until only fresh grease comes out at the seals.

### 4.3 Lubrication

Clean the grease nipples before greasing and ensure grease passage. Do not lubricate with too much pressure and do not lubricate jerkily. We recommend 5 bar. Lubricate until the fresh grease comes out at the seals of the bearings. For the sliding piece, lubricate only 2-3 grease gun strokes per interval. Always keep an eye on the seals and lubricate with feeling.



## 4.4 Lubricant

The cardan shaft is always supplied by the manufacturer in a lubricated condition. Cardan shafts that have been stored for longer than 6 months should always be lubricated again before being put into operation. Only lithium saponified greases should be used. We use and recommend Fuchs Renolit LX-PEP 2 or Microlube GL 262 as standard grease. They are special greases based on mineral oil with a lithium special soap. Other lubricant brands that can also be used for our standard grease:

- BP Energ grease LS 2
- Esso - Beacon EP 2
- Shell Alvania EP 2
- Mobilux 2

Do not use soda greases, Molykote lubricants or lubricants with MoS<sub>2</sub> additives! If the cardan shaft is equipped with a low or high temperature cross fitting, use only the appropriate greases! Unless otherwise stated in the drawing, the grease nipples of our cardan shafts comply with DIN 71412. All DIN 71412 grease nipples are fitted with a removable plastic cap to protect against dirt and moisture.

Any other lubricants for standard operation that meet the following requirements can be used:

- |                                    |  |
|------------------------------------|--|
| • Operating temperature:           | -30°C to +140°C                                  |
| • Consistency class:               | 2 (DIN 51818, NLGI)                              |
| • Penetration:                     | ca.265-295 (DIN ISO 2137)                        |
| • Drip point:                      | > 220-250°C (DIN ISO 2176)                       |
| • Density:                         | approx. 0.9 g/cm <sup>3</sup> (DIN 51757 at 20°) |
| • Water resistance:                | approx. 1 - 90 (DIN 51807 - 3h/90°C)             |
| • Flow pressure:                   | approx. 1400 mbar (DIN 51805 - 25°C)             |
| • Corrosion protection properties: | 1 (DIN 51802 Emcor Test)                         |
| • Speed characteristic:            | approx. 300 000-400 000 (dm x n)                 |

## 4.5 Inspection checklist

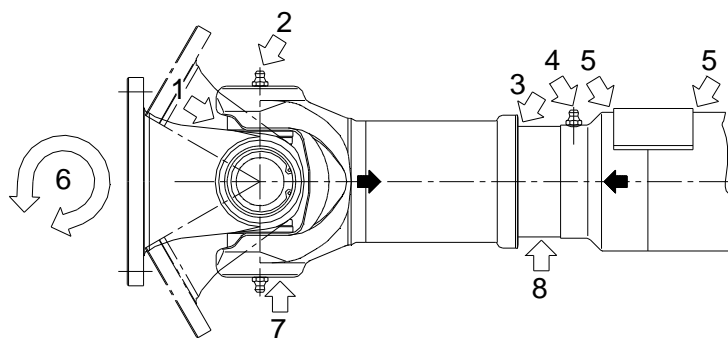


Figure 15: Inspection - Graphic overview

1. Check flanges and screw connections for tightness and retighten with a torque wrench if necessary.
2. Check whether all bearing bushings of the cross fittings are still firmly secured with safety rings (7).





3. Check can bottom whether discoloration or deformation has occurred, which indicate a position defect and overheating (7).
  - In case of discoloration, the entire cross set must be replaced.
4. Check the bottom of the bush for turning marks under the circlip, which indicate a bush turning (7).
  - In this case, the fork element and the cross fitting must be replaced.
5. Check if balancing plates have loosened or lost (5).
  - In case of damaged or lost balancing plates, the cardan shaft must be rebalanced.
6. All seals of the cross fittings in sight (1).
  - If a seal is damaged, worn or lost, the cross fitting should be replaced.
7. All seals of the displacement and any plastic coating for damage (1+3+8) examine.
  - In case of damage, the seals must be replaced or the corresponding parts must be replaced by the manufacturer.
8. check all lubrication nipples (2+4) and their protective cap.
  - Replace grease nipples if necessary and clean lubrication channels if necessary and make them free for grease to pass through.
9. By lifting slightly relieve the shaft and try to twist the displacement and joints (6).
  - If twisting is possible, the cardan shaft has too much play and must be overhauled.
10. Visually inspect for dents in the tube or profile protection and inspect all parts of the cardan shaft for visible cracks or breaks.
  - If cracks appear or there is a dent in the tube, the shaft must be overhauled by the manufacturer.
11. For intermediate shafts and cardan shaft trains, inspect center bearings:
  - The bearing must not make any noise when running. If noises occur, the bearing must be replaced.
  - For **elastic intermediate** bearings: The elastic rubber insert must not show any cracks or damage, must be exactly in place and well anchored there. The rolling bearing must also be anchored exactly in place in the bearing frame. The seat of the bearing in the rubber insert must not have any play. Check fastening screws. Tighten if necessary. The actual rolling bearing must not have any damage, must run smoothly, have no play and make no noise when running. The connecting flange must be firmly seated on the bearing shaft and must not be able to move. There must be no play whatsoever when turning or even in the horizontal plane. An indication of a loosened flange may be a loose washer or guard plate. Tighten the locking screws or nut, if necessary, according to the above table.



## 5 Attachments

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