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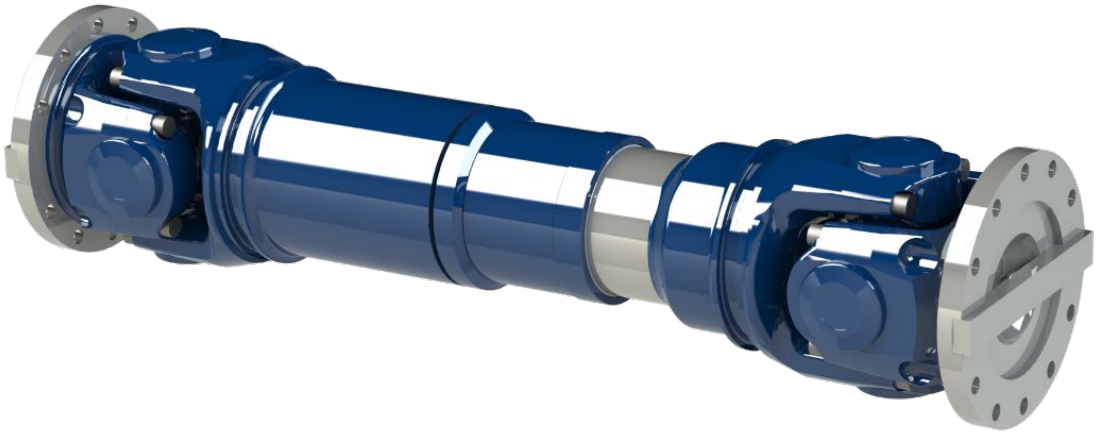
Recommendations for Cardan Shafts Maintenance



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Original Recommendations for Cardan Shaft Maintenance

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1. General information

1.1 Notes on the recommendations for Maintenance

These maintenance instructions have been prepared in accordance with the product-specific and use-related requirements of laws, regulations, directives, technical standards, guidelines and contracts.

The cardan shaft is a component of a machine. Therefore, the documentation of the person placing the machinery on the market is to be regarded as the primary leading document. This maintenance instruction is a general one and subordinate to the machine documentation.

The cardan shafts do not fall within the scope of Directive 2006/42/EC. These maintenance instructions are nevertheless based on the requirements of this directive for the drafting of operating instructions.

The maintenance instructions must be read carefully before commissioning and must be accessible at all times!

In addition to this documentation, all operating instructions and data sheets for the components installed in the system/machine apply.

1.2 Usage of cardan shafts

The cardan shafts are used to transmit torque between spatially offset input and output drivelines and are available with or without length compensation.

1.3 Intended Use

The intended use includes:

The cardan shafts may only be operated within the specified operating limits (e.g. speed, torque, lengths, deflection angle, etc.).
  Furthermore, the permissible ambient conditions (temperature, ambient medium, etc.) must be observed and complied with. Please contact us if you have any questions.
The cardan shafts may only be serviced by authorised qualified personnel.
Only fault-free components approved for the specific use may be used in cardan drives.

1.4 Reasonably Foreseeable Misuse

Any use that is not part of the intended use or the following applications/scenarios are considered misuse:

Use outside the defined limits (e.g. speed and torque range, deflection angle, temperature range, lengths, operating conditions, etc.)
Use in damaged condition
Non-observance of maintenance instructions
Use of unauthorised lubricants and auxiliary materials
Inadequate or improper maintenance
Incorrect cleaning
Unauthorised modifications
Operation of cardan shafts not certified in accordance with Product Directive 2014/34/EU (hereinafter referred to as ATEX) in potentially explosive atmospheres.

1.5 Warranty and Liability

The following requirements must be met for the warranty to be granted:

During the warranty period, all activities specified in the maintenance plan must be carried out.
No technical modifications may be made by the operator.
Only use original spare and wear parts, spare parts approved by the manufacturer and only approved lubricants and auxiliary materials.

2. Safety

2.1 Standards and guidelines

The cardan shafts are built in accordance with the currently valid rules of technology and the recognised safety regulations.

The basic safety requirements, standards and directives were applied in the design of the cardan shafts.

All safety information refers to the currently valid regulations of the European Union. In other countries, the applicable laws and national regulations must be observed.

In addition to the safety instructions in these maintenance instructions, the generally applicable regulations on accident prevention and environmental protection must be observed and complied with.

All information in the maintenance instructions must be followed without restriction.

2.2 Design of the safety instructions

The safety instructions in this document are labelled with safety symbols and are designed according to the SAFE principle. They contain information on the type and source of the hazard, possible consequences and how to avert the hazard.

DANGER
Warns of an accident that will occur if the instructions are not followed. The accident leads to serious, possibly life-threatening injuries or death.

WARNING
Warns of an accident that may occur if the instructions are not followed. The accident can lead to serious, possibly life-threatening injuries or death.

CAUTION
Warns of an accident that may occur if the instructions are not followed. The accident may result in minor injuries.

ATTENTION
Warns of possible damage to property

NOTICE
Important general note

NOTICE
Important note on environmental protection

2.3 Symbols and abbreviations used

Symbol	Meaning
↗	Cross-reference "see section "xx", page yy"

Tab. 1: Symbols used

2.4 General safety instructions

Maintenance may only be carried out by authorised qualified personnel.
Wear personal protective equipment (protective shoes, protective gloves, hard hat) for all work on and with the cardan shafts.
Observe the ATEX directives (Product Directive 2014/34/EU and Operating Directive 1999/92/EC) when servicing cardan shafts in potentially explosive atmospheres.
Observe all information in these maintenance instructions.
Only use original spare and wear parts, spare parts approved by the manufacturer and only approved lubricants and auxiliary materials. The use of other accessories and spare parts may impair the function and safety of the cardan shafts.
Check the cardan shafts regularly for damage and unusual heating or noises. If the cardan shafts are damaged, have them checked or replaced.
Observe the maintenance intervals.
For all work on the cardan shafts, the drive must be load-free and in the idle position. Switch off the upstream and downstream drive units and secure them against unauthorised restarting.
High-speed cardan shafts are dynamically balanced to ensure vibration-free running. The balancing plates mounted on the cardan tubes or yokes, or balancing weights on heavy cardan shafts, must not be removed or modified, as this will cause the imbalance to be lost. Joint assemblies must not be concealed in the profile or interchanged. Observe the marking arrows.
Safety precautions must be taken to prevent hazards from the rotating cardan shaft.

2.5 Definition of persons

Manufacturer

Manufacturer within the meaning of the Machinery Directive means any natural or legal person who designs and/or constructs machinery, partly completed machinery or components covered by this Directive and is responsible for the conformity of the machinery, partly completed machinery or components with this Directive with a view to their being placed on the market under his own name or trade mark or for his own use.

Operator

Operator according to the EU definition is any natural or legal person who operates or owns a machine or plant or to whom (if provided for in national legislation) the decisive economic power of disposal over the technical operation of the plant or machine has been transferred.

Qualified personnel

Qualified personnel are persons who, due to their professional training, experience and instruction, have sufficient knowledge of

Safety regulations,
Accident prevention regulations,
Guidelines and recognised rules of technology (e.g. guidelines and standards).

The qualified personnel must

be able to assess the work assigned to him/her and recognise and avoid potential hazards,
be authorised by the person responsible for the safety of the system to carry out the necessary work and activities,
have been trained for their tasks by the manufacturer or by personnel authorised by the manufacturer.

2.6 Requirements for the operator

The operator must fulfil the following requirements:

He is obliged to operate the cardan shafts only in perfect and operationally safe condition. The technical condition must comply with legal requirements and regulations at all times.
The maintenance instructions must be accessible at all times.
Before starting any work, the personnel must have been familiarised with the dangers of the cardan shaft and the applicable safety and accident prevention regulations.
Only original spare and wear parts and the specified lubricants and auxiliary materials may be used for maintenance and servicing work, as otherwise operational safety is jeopardised and warranty claims will be invalidated.
The operator of the cardan shaft and the personnel authorised by him are responsible for accident-free operation.
The operator must ensure that only authorised personnel are present in the area of the cardan shaft.

2.7 Handling lubricants and auxiliary materials

The regulations and EC safety data sheets of the respective manufacturer regarding storage, handling, use and disposal must be observed for all lubricants, auxiliary materials and cleaning agents used in connection with the operation and maintenance of the cardan shafts.

Please note the following:

Lubricants and auxiliary materials must be collected, stored and disposed of in suitable containers. The applicable legal regulations must be observed for disposal.
Personal protective equipment must be worn when handling hazardous substances (eye and/or hand protection, etc.).

3. Technical description

3.1 Layout

The cardan shaft consists of the following assemblies:

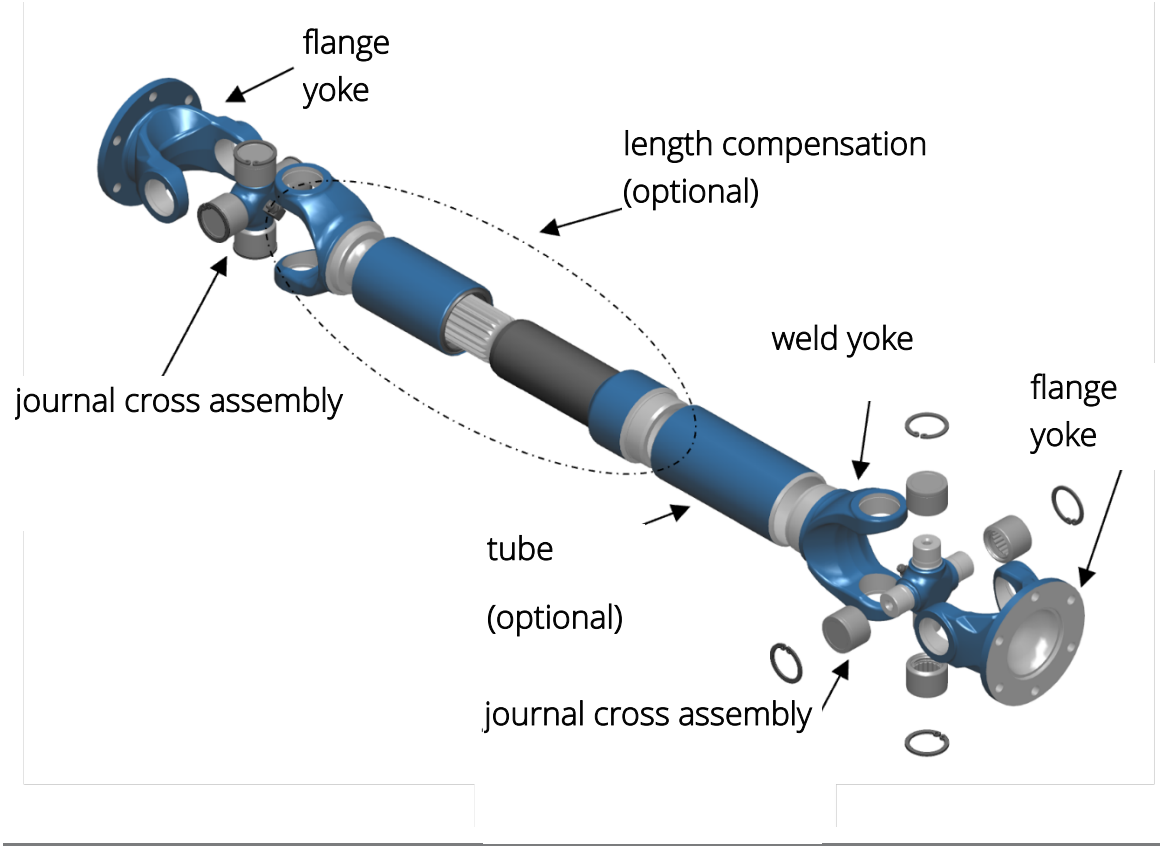

Fig. 1: Layout

3.2 Definition of the drawing numbers

The design of the cardan shaft can be read from the drawing number. For further information, please refer to the relevant product catalogue.

4. Maintenance

4.1 Safety instructions

WARNING

Risk of injury due to improper maintenance!

- Maintenance may only be carried out by authorised qualified personnel.
- Before starting maintenance work, switch off the load on the drive and ensure that it is in the idle position. Switch off the upstream and downstream drive units and secure them against unauthorised restarting.
- For cardan shafts in vehicles: Secure the vehicle against start-up/movement.
- Wear personal protective equipment!
- Before recommissioning the cardan shaft/system, refit all protective devices.

WARNING

Danger due to breakage of machine components!

- Check the cardan shaft regularly for damage (corrosion, vibrations, unusual heating, etc.). Do not operate if there is damage.
- Replace damaged corrosion protection.
- Check that the flange screw connections are tight.
- Observe maintenance intervals.
- Only use authorised lubricants and auxiliary materials.

WARNING

Danger of burns on hot surfaces! Cardan shafts can heat up to over +70 °C.

- Carry out all work only when the cardan shaft has cooled down.
- Wear personal protective equipment!

CAUTION

Risk of slipping due to leaking lubricant!

- Wear safety shoes with non-slip, oil-resistant soles, safety goggles, safety helmet and fall protection.
- Remove any leaking lubricant immediately.

CAUTION

Health hazard due to corrosive substances and additives in cleaning agents!

- Wear personal protective equipment!
- Make sure there's enough ventilation/airflow.
- Avoid direct body contact and inhalation.
- Observe the manufacturer's safety data sheets.

ATTENTION

Risk of damage due to improper cleaning!

- Do not use aggressive chemical cleaning agents.
- Do not use pressurised water or steam jets (high-pressure cleaners).

4.2 General Instructions

The user or operator must observe the statutory safety regulations and take suitable precautions before starting maintenance work.
Check the flange screw connections for tightness.
Remove dirt deposits regularly in order to rule out any impairment of the balancing quality and any source of ignition.
Cardan shafts without grease nipples are maintenance-free and do not require relubrication.
The grease nipples must be cleaned before lubrication in order to prevent dirt ingress into the bearing points. Non-observance can lead to the destruction of the spigot crosses.
Regularly relubricate the lubrication points of the cardan shaft to replenish used lubricant, remove any dirt particles that have penetrated and apply fresh grease to the sealing lips.
Lubrication of relubricable length compensation should be carried out in the fully compressed state or in the shortest possible operating length.
Avoid hard pressure surges when lubricating to prevent damage to seals.
Vent valves must not be removed, closed or replaced with grease nipples.

4.3 Maintenance schedule

The maintenance intervals for the cardan shafts primarily depend on the usage conditions. The following intervals should therefore be regarded as guidelines.
Above-average loads, speeds and ambient temperatures as well as heavy exposure to dirt or water cause the lubricant to be consumed more quickly.
The activities required and recommended for maintenance are summarised below:

Lubricating the journal crosses

⇨ If the journal cross does not have a lubrication point at the factory, it is a journal cross with lifetime lubrication. In this case, the point "Lubricating the journal crosses" is omitted.
⇨ Clean the grease nipples.
⇨ Place the grease gun on the grease nipple (1) on the journal cross.
⇨ Operate the grease gun until the lubricant emerges at all sealing points of the bearings.

Lubricating the length compensation

⇨ If the length compensation does not have a lubrication point at the factory, it is a length compensation with lifetime lubrication. In this case, the item "Lubricating the length compensation" is omitted.
⇨ Clean the grease nipple.
⇨ If possible, the length compensation should be lubricated when fully compressed (L_z) or at the shortest operating length of the cardan shaft. Always observe the maximum lubrication quantity specified. Non-observance can lead to a high axial load, which can damage the connection bearings.
⇨ Place the grease gun on the grease nipple (2).
⇨ Lubricate the splined shaft connection (2) of the length compensation with a maximum quantity of lubricant of approx. 10 - 40 g (depending on the cardan shaft series).

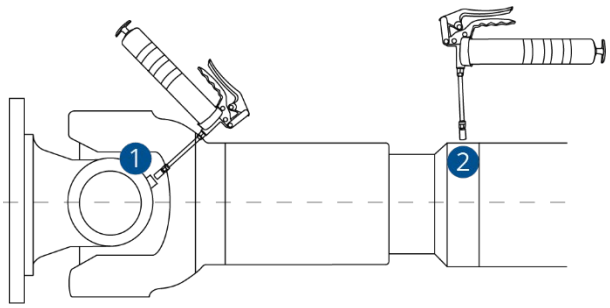

Fig. 2: Lubricate cardan shaft

1	journal cross	2	Length compensation

The following lubricants are recommended:

Lithium complex greases of specification KP 1-2 N-30 or KP 2 N-20, DIN 51502 with EP additives for European climates.

NOTICE

If the operating temperature limits are outside the normal range of -25 °C to +100 °C, appropriate special greases must be used.

Generally recommended maintenance intervals

Cardan shafts in:	Maintenance Intervals
Motor vehicles: • on-road use • on-road and off-road use • construction site and off-road use	 50,000 km or annually 30,000 km or annually 10,000 km or 250 operating hours
Rail vehicles	3,000 operating hours or 6 months
Stationary systems	500 operating hours
Crane systems	500 operating hours
Ship propulsion drives	1,500 operating hours or 6 months

Tab. 2: Maintenance Intervals

Deviating from this, special maintenance intervals may be agreed under certain circumstances.

Generally recommended inspection work

Control	½ annually or according to maintenance schedule
Carry out a visual inspection, e.g. for damage, anomalies.	x
Check the screw connections and connecting flanges for tightness and zero backlash. Restore the original state if necessary.	x
If present, check the tightness of the grease nipples. Replace if leaking.	x
Check the axial play of the journal crosses.	x
Check the tilting clearance of the length compensation.	x

Tab. 3: Inspection intervals

Deviating from this, special intervals and scopes of the inspection work may be agreed under certain circumstances.

ATTENTION

Risk of damage to the cardan shafts!

- The use of lubricants with a different saponification base should be avoided, as lubrication compatibility is not necessarily guaranteed. Greases with MoS_2 or other solid lubricant additives must not be used for the spherical plain bearings, as these have a negative effect on the functionality of the bearings.

ATTENTION

Risk of damage to the cardan shafts!

- To prevent damage to the seals, hard pressure surges and pressures above 15 bar (1.5 MPa) are not permitted.

NOTICE

- The joints and sliding spline are lubricated via conical grease nipples in accordance with DIN 71412 or flange grease nipples in accordance with DIN 3404.
- If there are two lubrication points next to each other on a joint, lubrication via one grease nipple each is sufficient.

NOTICE

Splined shaft connections with Rilsan coating and without lubrication points are lubricated for the entire service life.

4.4 Cleaning

CAUTION

Health hazard due to corrosive substances and additives in cleaning agents!

- Wear personal protective equipment!
- Make sure there's enough ventilation/airflow.
- Avoid direct body contact and inhalation.
- Observe the manufacturer's safety data sheets.

ATTENTION

Risk of damage due to improper cleaning!

- Cleaning the cardan shaft, in particular the sealing areas, with a high-pressure cleaner is prohibited.

Clean the cardan shaft at regular intervals to remove dirt deposits, as these can impair the balancing quality and serve as a source of ignition when heated.

5. Disposal

5.1 Safety Instructions

WARNING

Risk of injury due to improper disposal!

- Disposal may only be carried out by authorised qualified personnel.

NOTICE

Incorrectly handling materials which are hazardous to the environment (through incorrect disposal in particular) can cause considerable harm to the environment.

- When disposing of the cardan shaft and the associated lubricants and auxiliary materials, the locally applicable laws and regulations must be observed.

5.2 Disposal

Care must be taken to ensure that material recyclability, dismantling and separability of materials and assemblies are taken into account as well as environmental and health hazards during recycling and disposal.

5.3 Disposal of lubricants and auxiliary materials

Lubricants and auxiliary materials may only be stored separately in suitable containers and labelled accordingly. Used lubricants and auxiliary materials must be treated as hazardous waste.

The disposal of this type of waste must be carried out in accordance with the applicable legal regulations.

5.4 Disposal of metal components and plastics

Metals and plastics of different types must be sorted and sent to the appropriate recycling or disposal process.

5.5 Hazardous waste

Hazardous waste poses a high-risk potential for people and the environment and is subject to special legal regulations. Hazardous waste includes all used lubricants and auxiliary materials.

6. Storage

Store the cardan shaft in dry, closed rooms in suitable racks lying next to each other (not on top of each other) or upright. Take appropriate precautions against overturning and rolling away.

Directories

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