

# \* Operating Manual

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## Traction Gearbox GKD 1-52-372C

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# GKD 1-52-372C

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## 1 ABOUT THIS OPERATING MANUAL

### 1.1 Manufacturer

TRAKTIONSSYSTEME AUSTRIA GmbH

Place of business: Wiener Neudorf

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### 1.2 To the user

#### 1.2.1 Operating manual

This operating manual contains all the essential information that is required for the secure and smooth operation of the Traction Drive. It provides important information that enables you to perform maintenance and repair work correctly.

Work carefully through the operating manual before you commence maintenance and repair work.

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## 1.2.2 Warning and safety instructions formats

Hazards and notes in this Operating Manual are classified and illustrated as follows:



Describes an immediately threatening danger.

If the danger is not avoided, death or very serious injuries (mutilation) may result.



Describes a potentially dangerous situation.

If the dangerous situation is not avoided, death or very serious injury (mutilation) may result.



Describes a potentially dangerous situation.

Not avoiding this dangerous situation may result in slight or minor injuries



Indicates a potentially harmful situation.

Not avoiding this harmful situation may lead to damage to the product or objects in its surroundings.



Notes provide useful tips and supplementary information on the equipment.

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## 1.3 Intellectual property

All developments, patents, design drawings, etc. as well as this operating manual that are connected with the Traction Gearbox are intellectual property of **TRAKTIONSSYSTEME AUSTRIA GmbH**. These documents or parts thereof should neither be duplicated nor made available to third parties without a written approval from **TRAKTIONSSYSTEME AUSTRIA GmbH**. Violation infringes copyright and is liable to compensation.




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**Exception:** The use and reproduction of all data and documents from these operating instructions (for project planning purposes or for the operator) is permitted without restriction!

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## 1.4 Condition for changes

Specifications, graphs and drawings can differ from the actual design as a result of our efforts to carry out continuous upgrades in the Traction Gearbox.

We mention here that we reserve the right to make technical changes. Of course, we will send you necessary documents for your information and to complement your operating manual if amendments and changes were carried out on the Traction Gearbox or its accessories after compiling this operating manual.

## 1.5 Warranty and guarantee claims

In order not to lose the warranty and guarantee claims in any relevant case, please contact:

### **TRAKTIONSSYSTEME AUSTRIA GmbH / Service**

Brown-Boveri-Straße 1

A-2351 Wiener Neudorf

Tel.: +43 (0) 2236 8118-111

E-Mail: [service@tsa.at](mailto:service@tsa.at)




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We will decline every right to warranty payments if changes or repairs are carried out on the Traction Gearbox by a third party without our consent during the warranty and guarantee period.

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In the event of any faults, shut down the Traction Drive (Motor and Gearbox) immediately and contact the manufacturer (see the address above).

For repair works within the warranty period, you need previous approval from the manufacturer.

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## 1.6 Spare parts

Those parts that are possibly needed are mentioned in the spare parts list in this manual (see section 12.2.2). There is no explicit reference to the fitting material. There is a difference between parts that are subject to normal wear, therefore, regarded as "essential" spare parts and those that could be faulty, therefore, just "recommended" as spare parts only.

## 1.7 General information for disassembling and assembling of gearbox

In the following descriptions used numbers set in brackets i.e. (12) refer to item No. in the figures and the corresponding item/position No. in the parts list(s) in [section 12.1](#).



Installation and deinstallation of the Traction Drive are not included in this operating manual.

## 1.8 Abbreviations

NDE	Non-Drive End
DE	Drive End
HS	High Speed
LS	Low Speed
MS	Motor Side
WS	Wheel Side



## 2 SAFETY INSTRUCTIONS

### 2.1 Intended use



#### **WARNING!**

Improper use may result in danger to the life of the operating personnel or other persons or cause injuries or extensive damage to property.

- ▶ The manufacturer is not liable for damage resulting from improper use. The risk is carried by the user alone.
- ▶ Ensure that the Traction Gearbox is only operated within the intended use and within the technical data.

This Traction Gearbox is exclusively designed for fitting and operation in railway vehicles.

No warranty and liability are assumed if it is used beyond the specified intended use and without observing the necessary requirements and safety measures.

The Traction Gearbox is designed in accordance with the state of the art and recognized safety-related regulations. When in use, however, there can be a threat to life and physical condition of the user or third party; and/or damages to the Traction Gearbox and other material assets can occur.

Therefore, use the Traction Gearbox only in technically good order and condition, and according to the law, safety-conscious and risk conscious in compliance with the operating manual! Faults that can affect safety should be rectified immediately.

Intended use also includes adhering to the operating manual and compliance with the inspection and maintenance intervals.

Any other or further use of the Traction Gearbox is not as intended.

Improper use may result in a danger to the lives of the operating personnel or other persons or cause injury or extensive material damage.

The manufacturer is not liable for damage resulting from improper use. The risk shall be borne solely by the user.

## 2.2 Basic safety instructions

- In addition to the operating manual, pay attention and follow the generally accepted, legal and other related rules for accident prevention and environmental protection.
- Such responsibilities can also be related to, e.g., hazardous materials handling, putting something at somebody's disposal/wearing personal protective equipment.
- Before starting work, the authorized personnel in charge of operations on the Traction Drive must have read the operating manual and, in particular, the section "Safety Instructions". It is too late when carrying out the assignment. This applies in particular to personnel who are only rarely assigned a task on the machine, such as changeovers or maintenance.
- At least, one should occasionally inspect the safety-conscious and risk conscious operations of the personnel in compliance with the operating manual.
- The personnel should not have loose long hair, loose clothes, or jewellery, including rings. There is risk of injury e.g. by getting caught or drawn in.
- Personal protective equipment should be used if necessary or required by regulations.
- All safety and hazard instructions on the Traction Drive should be observed.
- All safety and hazard instructions at/on the Traction Drive should be complete and kept in good legible state.
- In the event of safety-relevant modifications or operating performance, shut down the Traction Drive immediately and report the fault to the relevant office / person.
- No modifications, additions and reconstructions that could affect safety should be carried out on the Traction Drive without the approval of the manufacturer! The same is true for the installation and setting of safety installations.
- Spare parts must meet the specified technical requirements of the manufacturer. This is always warranted with genuine spare parts.
- Adhere to the specified or stated deadlines for periodic review/inspections in the operating manual.
- Appropriate places for work should be provided for carrying out maintenance measures.
- Pay attention to fire detecting and firefighting possibilities.

## 2.3 Selection of personnel and qualification – basic duties

- Handling and operation, cleaning, maintenance and repair of the Traction Drive and its components must only be carried out by authorized personnel in accordance with details in these operating instructions. Pay attention to the legally permissible age.
- Make sure that operations on the Traction Drive are only carried out by authorized (trained or instructed) and assigned personnel for that purpose.
- Clearly state the responsibilities of the personnel for the operation, setting up, maintenance and repair.
- State the responsibility of the machine operator and permit him to reject instructions from a third party that are contrary to safety regulations.
- Personnel who are undergoing training, instruction and Induction or personnel who are generally in vocational training must only work on the Traction Drive under the constant supervision of an experienced person.
- Working on electrical equipment must only be carried out by a qualified electrician or by instructed persons under the leadership and supervision of a qualified electrician in accordance with the electro-technical regulation.
- No warranty payments or liabilities of any kind whatsoever are assumed by **TRAKTIONSSYSTEME AUSTRIA GmbH** for all types of damage that arises as a result of disregarding the operating instructions, warnings and safety instructions mentioned in the operating manual or that arises from inappropriate operation.

## 2.4 Cleaning and maintenance

- In the interest of our customers, we want to point out that you can boost the performance of the Traction Drive via systematic planning of the maintenance and cleaning work. One can minimize faults and damage by carrying out regular cleaning and maintenance. In this way, you reduce the time and effort in repairs and energy and the consequent costs.
- Observe the setting, maintenance and inspection activities specified in the operating manual as well as deadlines including the specifications for changing components / component fittings.
- These activities must only be carried out by qualified personnel.
- For all operations that relate to handling, maintenance, inspection and repair, pay attention to the activation and deactivation operations in accordance with the operating instructions and details for maintenance work.
- Secure a spacious maintenance area if necessary.
- Carry out maintenance and repair work only when the Traction Drive is switched off and secured on a level and stable surface.
- If the Traction Drive is completely switched off during maintenance and repair work, it must be secured against inadvertent restarting.
- During installation work above head height, designated or other climbing aids and working platforms that are in conformity with security norms should be used.
- Machine parts should not be used as climbing aids.
- Keep all handle holds, steps, railings, stair heads, platforms, and ladders free from dirt, snow and ice.
- At the beginning of maintenance/repair work, clean the Traction Drive, particularly, the connections and screwed fittings of oil, fuel or maintenance bushing plates! Do not use any abrasive cleansing material! Use fibre-free cleaning rags.
- During maintenance and repair work, always tighten screw connections that have come loose.
- Screws that are tightened with a tightening torque should be marked.
- If dismantling of the safety installations is required during setting up, maintenance and repair, new installation and inspection of the safety installations should be carried out immediately after completing the maintenance and repair work.
- Make sure that there is safe and environmentally friendly disposal of consumables and auxiliary materials as well as replacement parts.
- Whenever working with components carrying compressed air, ensure that the components are depressurized.

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## 2.5 Reference notes on types of risk

### 2.5.1 Electrical power

- In the case of any intervention, the power supply to the Traction Drive should be disconnected.
- In case of faults in the electrical system, the Traction Drive should be shut down immediately.
- The electrical equipment should be inspected regularly. Defects such as loose connections or burnt cables must be rectified immediately.
- Check all hoses, cables and connections regularly for leaks and externally noticeable damage. Damage should be rectified immediately.

### 2.5.2 Hazards of rotating parts

- Serious or fatal injuries possible due to parts not secured against rotation (couplings, shafts, fans, rotors).
- Follow the local accident prevention regulations and general safety regulations applicable to the area of use of the Traction Drive.

### 2.5.3 Gas, dust, vapour, smoke

- Observe the applicable regulations for the site of operation.
- Welding, burning and grinding operations on the Traction Drive should only be carried out if this is expressly approved. There can be fire and explosion hazard.
- Before welding, burning and grinding, the Traction Drive and its surroundings should be cleaned of dust and combustible materials and you must make sure there is enough ventilation (explosion hazard).

### 2.5.4 Oils, grease and other chemical substances

- When dealing with oils, grease and other chemical substances, pay attention to the safety instructions applicable to the bushing plate.
- Watch out when dealing with hot consumables and auxiliary materials (burn or scalding hazard).
- Pay special attention to specifications concerning personal protective equipment, specifications on toxicology and the reference notes on waste disposal in the safety data sheets as well as country-specific regulations.

## 2.5.5 Transport and recommissioning

- Only load and convey in accordance with the operating instructions.
- Only use suitable means of conveyance and hoisting devices with adequate load carrying capacity.
- Individual components and bigger components should be carefully fastened and secured to the hoisting devices during replacement. Only use suitable and technically perfect hoisting devices as well as load-carrying equipment with adequate load carrying capacity.
- Only experienced people should be entrusted with fastening of loads and instructing the crane operators. The banks man must remain within the range of vision of the operator, or they must be able to speak to each other.
- Do not stand or work under suspended loads.
- During recommissioning, proceed only in accordance with the operating manual.

## 2.5.6 Liability

- **TRAKTIONSSYSTEME AUSTRIA GmbH** assumes no warranty payments or liabilities of any kind whatsoever for all types of damage that arises as a result of disregarding the operating instructions, warnings and safety instructions mentioned in the operating manual, or from inappropriate operation.
- Manipulations or modification to the Traction Gearbox in order to change or manipulate its intended use or its performance led to liability exclusion.
- We will decline every right to warranty payment if changes or repairs are carried out on the Traction Gearbox by a third party without our consent during the guarantee period.
- Repair work within the warranty period needs the prior approval of the gearbox manufacturer.

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## 2.6 Safety regulations

### 2.6.1 Specialists

Specialists are persons who:

- Have the training and experience,
- Who know the applicable standards, regulations, requirements and accident prevention regulations respectively,
- Are instructed about the mode of operation and operating conditions of the electric machines,
- Can spot and avoid dangers.

### 2.6.2 Qualified and authorised personal



**WARNING!**

#### RISK OF DAMAGE AND INJURY!

Handling the machines and materials improperly can result in severe injury, death, and/or major material damage. Therefore, please observe the notes in this section when performing all work.

- ▶ All assembly, dismantling, maintenance work and repairs may only be carried out by appropriately qualified personnel and authorized bodies.
- ▶ Take note of DIN VDE 0105 and IEC364 in this respect.
- ▶ Traction Drives may only be transported, positioned, connected, commissioned, serviced, and operated by skilled personnel who are fully conversant with the applicable safety regulations and installation provisions. All work must be checked by authorized skilled personnel.
- ▶ The skilled personnel must be authorized to perform the necessary activities by the plant's safety officer.
- ▶ The prescribed maintenance intervals and the repair and replacement instructions must be strictly observed.

**DANGER!****HIGH VOLTAGE – DANGER TO LIFE!**

The deployment of unqualified staff and ignorance of sources of danger can lead to injuries and death.

- ▶ Ensure that only personnel with qualifications corresponding to the purpose of the task are used.

**NOTE****RISK OF DAMAGE!**

The deployment of unqualified staff and the incorrect use of equipment can lead to damage to the Traction Gearbox and the operator's property.

- ▶ Only use qualified personnel for all activities.

### 2.6.3 Disconnect power from Traction Motor

**DANGER!****ATTENTION HIGH VOLTAGE – DANGER TO LIFE!**

Before opening active parts of the Traction Motor, make sure that the Traction Motor is switched off according to instructions. This applies especially during removal from and mounting into the vehicle, and after carrying out inspections on the Traction Motor.

Here, the "safety rules" are (e.g. in accordance with DIN VDE 0105):

- ▶ Disconnecting
- ▶ Securing against re-starting
- ▶ Ensuring that the unit is de-energized
- ▶ Earthing and short-circuiting (for voltages above 1000 V)
- ▶ Disabling or covering of adjacent parts



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## 2.6.4 Shorts circuits



### HIGH VOLTAGE – DANGER TO LIFE!

Short circuiting as a result of uninsulated areas puts the Traction Motor out of operation, on the one hand, and carries the risk of subsequent injury or death, on the other.

- ▶ Ensure that any damage detected is remedied immediately.

## 2.6.5 Operating manual



This operating manual is to be stored in such a way that it is freely accessible to operational personnel during operation, maintenance, and repair without any restrictions.

## 2.6.6 Safety instructions



### RISK OF DAMAGE OR INJURY!

Failure to observe the warnings and safety instructions in this operating manual can lead to damage and/or injury.

- ▶ Traction Drives may only be transported, positioned, connected, commissioned, serviced, and operated by skilled personnel who are fully conversant with the applicable safety regulations and installation provisions.
- ▶ Ensure that all work is checked by authorized skilled personnel.

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## 2.6.7 Protective devices and personal protective equipment



**DANGER!**

### RISK OF INJURY or DANGER TO LIFE!

Faulty or missing protective equipment or damaged protective equipment can lead to injury or death.

- ▶ Never operate Traction Drives without protective equipment (air grilles on the air inlets of the DE side bearing plate) or with the terminal box open.
- ▶ Insulated tools insulated protective clothing, protective devices, safety belts, devices, and other auxiliary material must be maintained in perfect condition.
- ▶ The user must check insulated protective clothing for obvious damage before each use.
- ▶ Damage to insulated protective clothing may only be repaired by appropriately qualified workshops.
- ▶ However, gloves may not be repaired and must be replaced with NEW ones instead.
- ▶ Insulated gloves and shoes/boots must also be tested at certain intervals with respect to their electrical protection capability.
- ▶ Wristwatches, rings, and bracelets may not be worn at work.

## 2.6.8 Firefighting



- Switch Traction Drive off immediately.
- Secure against restarting.
- Notify the fire department and indicate that there is an electrical fire.
- Fight fire with appropriate extinguishing agents (e.g. powder or foam extinguisher).

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## 2.6.9 First aid measures



### HIGH VOLTAGE – DANGER TO LIFE!

The following measures must be carried out immediately in the event of electrical accidents:

- ▶ Interrupt the current by switching off the machine, pulling the plug, and/or removing the fuse.
- ▶ If these measures are not immediately possible, the accident victim(s) must be separated from the live components using non-conducting objects or must be dragged away by their clothes.
- ▶ Persons providing assistance must ensure that they are insulated, for instance by standing on a dry wooden board, on dry clothing, or on a thick pile of newspapers. Persons providing assistance must not touch anything else.

Emergency number: .....

Emergency services control centre: .....

Tel.: .....

*(Please enter your country-specific emergency numbers yourself!)*

Administer first aid until the doctor arrives:

- ▶ Immediately place the victim in a resting position.
- ▶ Check breathing and pulse.
- ▶ Perform artificial respiration if there is no breathing.
- ▶ Perform CPR (cardiopulmonary resuscitation) if there is no pulse.
- ▶ Place the victim on their side if they are unconscious but breathing.
- ▶ Cover burns with a sterile dressing.

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## 3 PRODUCT DESCRIPTION

### 3.1 Technical data

Designation	partly suspended	
Traction Gearbox design	one stage helical gear	
Motor coupling	curved teeth coupling	
Connection Traction Gearbox to wheel set	direct	
Type designation	GKD 1-52-372C	
Outline drawing	TSA024288	
Traction Gearbox assembled	TSA024556R0001	
Housing concept	horizontal split	
Traction Gearbox housing material	spherical cast iron (GJS400-15 acc. DIN EN 1563)	
Colour	RAL 9005	
Min. / max. ambient temperature	$T_{\min.} / T_{\max.}$	0 / +50 °C
Mass of Traction Gearbox without oil filling (incl. coupling half)	$g_{\text{gearbox}}$	440 ±5% kg
Gear ratio (approx.)	$i$	5.158
Motor continuous speed	$n_{\text{motor}}$	3574 rpm
Max. motor speed (operational speed, with worn wheels)	$n_1$	4992 rpm
Max. motor speed (test speed, with new wheels)	$n_1$	5174 rpm
Output speed	$n_2$	968 rpm
Starting torque	$M_{\text{starting}}$	2355 Nm
Max. wheel set torque (wheel slip torque $\mu = 0.33$ )	$M_{\text{wheel\_slip}}$	26,196 Nm
Gear Oil	Indian Oil Company: SERVO SYNGEAR 75W-90 LL / KLÜBER Lubrication: KLÜBER GE 4 75 W 90	

Drive unit (excl. wheel set)	$m_{\text{drive}}$	1340 kg
Track gauge	--	1,676 mm
New wheel diameter	$D_{\text{new\_wheel}}$	952 mm
Worn wheel diameter	$D_{\text{worn\_wheel}}$	877 mm
Minimum ground clearance at worn wheels (without deflection of the primary spring)	--	>103 mm
Maximum longitudinal vehicle acceleration	--	1 m/s <sup>2</sup>
Maximum uncompensated lateral acceleration (vehicle)	--	1 m/s <sup>2</sup>
Centre distance Traction Gearbox (x)	--	372 mm
Max. vehicle speed (operation)	$v_{\text{max.}}$	160 km/h
Max. vehicle speed (test speed)	$v_{\text{max.}}$	180 km/h
Maximum axle load	$m_{\text{axle}}$	17,000 kg

The operation of this Traction Gearbox may only take place within the scope of this data.

In the case of different applications, a written declaration of consent must always be obtained from the manufacturer of Traction Gearbox!

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## 3.2 Description

### 3.2.1 Main assemblies of Traction Drive

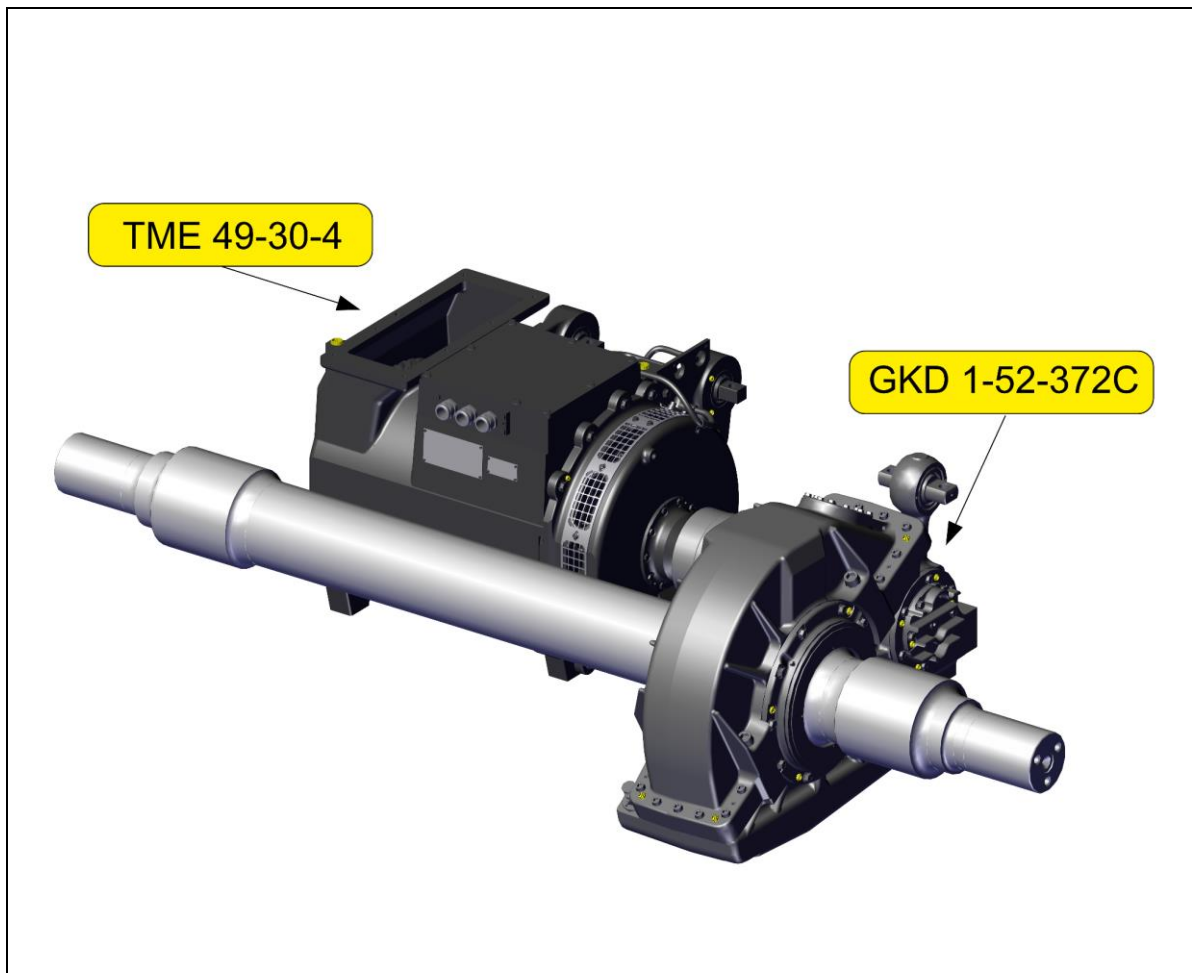


Figure 1: Main assemblies of Traction Drive

Partly suspended Traction Drive with bogie frame fixed motor and axle-mounted gear. Motor shaft and Traction Gearbox input shaft are connected by a coupling that transfers torque and compensates displacements between Traction Motor and Traction Gearbox.

The main gear is mounted directly onto the wheel set shaft and transfers torque directly to the wheel set shaft.

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## 3.2.1.1 Motor coupling

A curved teeth coupling connects Traction Motor with Traction Gearbox. The coupling is torsional rigid, the halves are self-centring by the teething. The coupling consists of two halves whose flanges are bolted together.

The coupling is lubricated by grease (optional by oil).

The coupling halves are mounted onto the shafts by tapered press fits, including hydraulic connections for mounting and dismounting.

The coupling transfers torque and compensates radial, axial and angular misalignments between Traction Motor and Traction Gearbox.

At the general overhaul the coupling has to be checked visually for checking the ability for further use in operation.

A slipping bush is installed at the Traction Gearbox side to protect the Traction Gearbox of too high shock torques that can be generated in the Traction Motor in case of a converter short circuit.

The Traction Motor sided coupling halve is insulated; this ensures that the Traction Gearbox bearings are not affected by discharging currents of the rotor.



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## 3.2.2 Main assemblies of Traction Gearbox

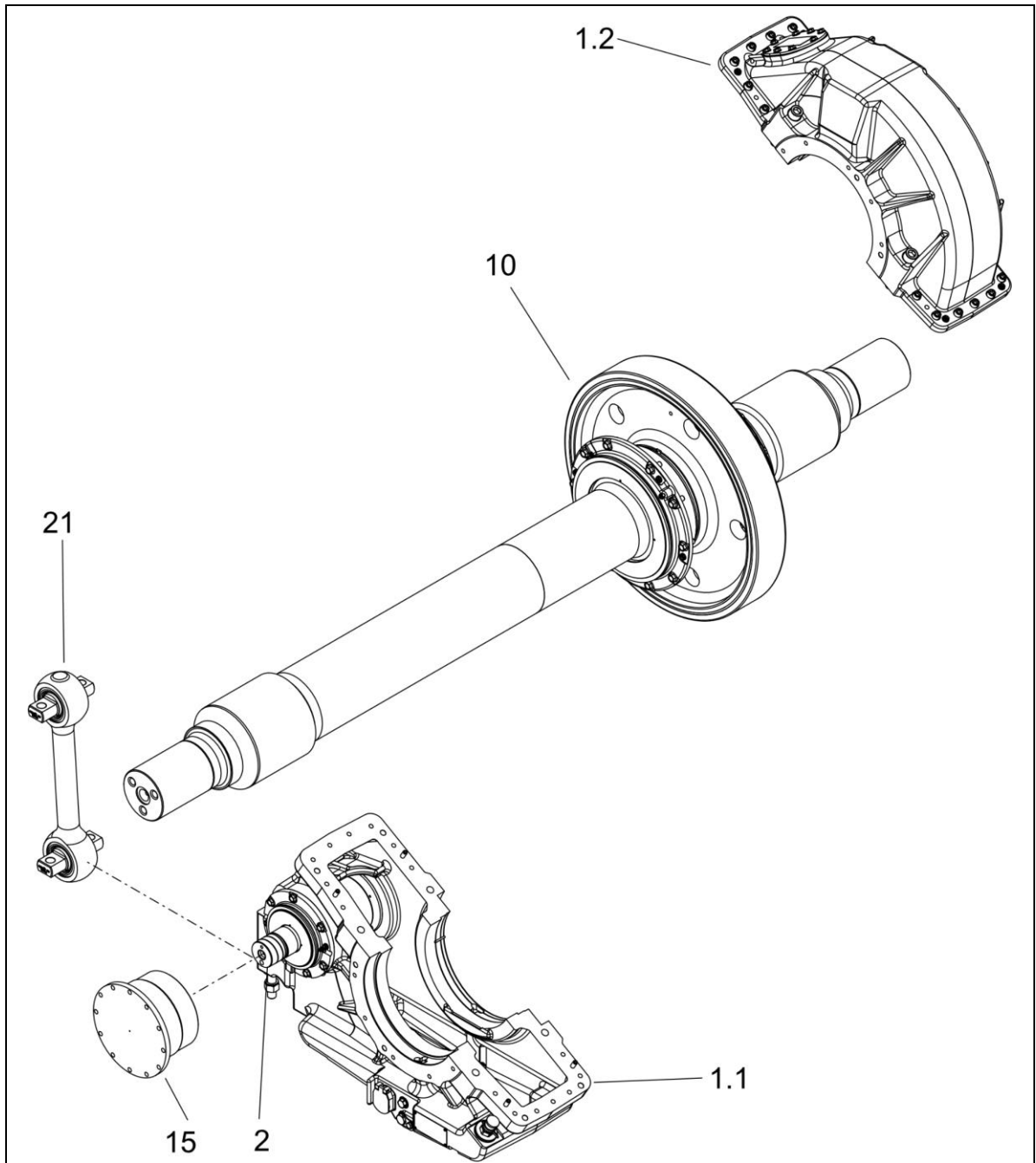


Figure 2: Main assemblies of Traction Gearbox

### 3.2.2.1 Traction Gearbox

The Traction Gearbox is a helical gear with oil sump splash lubrication.

### 3.2.2.2 Connection Traction Gearbox to wheel set

The main gear is directly mounted onto the wheel set shaft by a cylindrical shrink fit (the main gear is heated up for the joining operation), including hydraulic connections for dismounting.

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## 3.2.2.3 Traction Gearbox Housing

The Traction Gearbox housing is casted. The Traction Gearbox housing is designed to high stiffness and low noise radiation and protects oil level indicator from direct hits by rocks from the track.

## 3.2.2.4 Traction Gearbox support

The Traction Gearbox is supported by a reaction rod on the bogie frame. The reaction rod incorporates two spherical bearings. During operation the elastomers will wear and must be checked regularly and exchanged when the end of the life time is reached.

## 3.2.2.5 Gearing

The gearing will be produced out of case hardening steel 18CrNiMo7-6 according to DIN EN 10084. The raw material is drop-forged or rolled. Pinions and main gears are case-hardened and after that grounded. The gearing is fatigue-proof. For optimal teeth contact and lower noise generation the tooth flanks are modified in flank and profile direction. The output main gear consists of one piece.

## 3.2.2.6 Bearings

The input shaft is supported in the Traction Gearbox housing by two cylindrical roller bearings and one four-point contact bearing for the axial forces. These bearings have single piece solid brass cages.

The output shaft is supported by two tapered roller bearings. For the tapered roller bearings pressed steel cages are used.

All bearings are oil lubricated. For each bearing at least two producers are approved.

The inner rings of the bearings and the slinger rings will be assembled by heating up and disassembled by flame.

## 3.2.2.7 Lubrication and cooling

The gears are lubricated by oil splash lubrication. The Traction Gearbox is cooled by convection.

The design of the bearing area (oil stow provisions) ensures that a minimum amount of oil remains in the bearing. A smooth start-up of the Traction Gearbox is allowed, especially at low speeds and low environmental temperatures.

The Traction Gearbox includes an oil filling hole, an overfill protection, an oil sight glass (changeable from outside) and a magnetic drain plug, which collects metallic wear floating in the oil.

The oil level can be checked quickly and reliably through an oil sight glass, marked with minimum and maximum.

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## 3.2.2.8 Sealing

Contact-free labyrinths are used to seal the shaft, with additional barrier grease chamber. The Traction Gearbox housing and covers are sealed with liquid sealing substances. O-rings are used for sealing the bearing cartridges, bearing covers and labyrinth covers.

During cleaning of the vehicles pay attention, that high-pressure water is not directed into the labyrinth gaps or protect them with covers.

## 3.2.2.9 Monitoring of the Traction Gearbox

The magnet on the oil stick or the drain plug allows to check the conditions of the Traction Gearbox visual.

## 3.2.2.10 Labelling of components

Every Traction Gearbox is equipped with a type plate. The type plate contains: manufacturer, Traction Gearbox type, serial number, year of production, gear ratio and mass (kg). Traction Gearbox housing, gears, shafts and couplings are equipped with a serial number, which allows a back-tracing to component inspections.

## 3.2.3 Painting – corrosion protection

The Traction Gearbox is permanent protected against corrosion by 2K-epoxy priming and 2K-epoxy top layer, total thickness according to coating instruction **TSA000075 – V56** (see [section 14.3](#))

- Traction Gearbox: RAL 9005 (jet black)

## 3.2.4 Scope of delivery

The scope of delivery consists of:

- Traction Drive ready for shipment - TSA024555R0001

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## 3.3 Identification

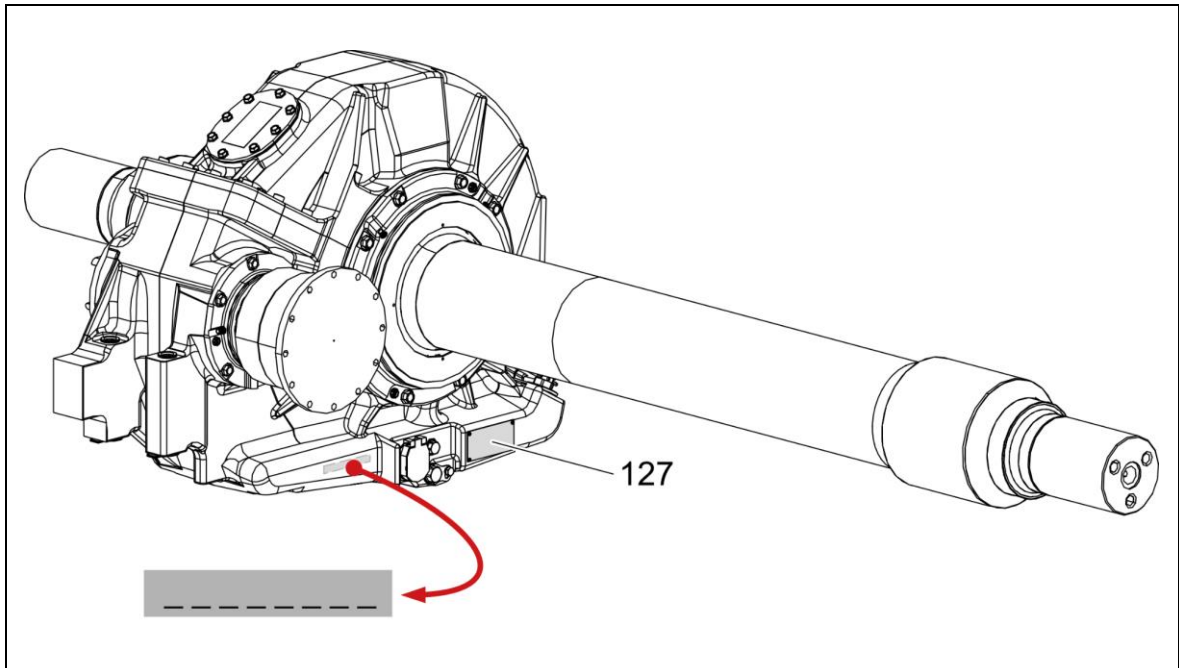


Figure 3: Type plate and serial number

The Traction Gearbox type plate (127) is fixed to the gearbox housing. The serial number of the Traction Gearbox is stamped at the bottom of the gearbox housing and is a eight-figure number ( \_\_\_\_\_ ).

The type designation identifies the basic design features of the Traction Gearbox.

**G K D      1 - 5 2 - 3 7 2 C**

- GKD**      **G** = Gearbox, **K** = Cardanic coupling, **D** = Direct (partly suspended)
- 1**          Single stage spur gear
- 52**        Gear ratio (ratio x 10 rounded)
- 372**      Centre distance in main direction, in mm
- C**          Project-specific code letter

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## 4 PACKAGING, TRANSPORT AND STORAGE

### 4.1 Packaging

During the delivery, the Traction Drive is packed on a pallet and wrapped in plastic.

Check the Traction Drive and its components for transport damage.

The packaging must be disposed of according to the waste control statute on-site.

### 4.2 Transport



#### NOTE

#### RISK OF DAMAGE!

- ▶ The Traction Gearbox may only be transported and stored in a horizontal position. Tilting should be avoided, because otherwise, residual oil from the series test run in the manufacturing plant that is left in the Traction Gearbox may run into the labyrinth seals, causing these to leak already during storage and transport (or during later operation), and may lead to oil leakage.
- ▶ To protect the Traction Motor against bearing damage it should always be transported fixed to the Traction Gearbox.
- ▶ When Traction Motor is removed from the bogie the air inlet on the stator housing and the openings in the cable glands must be closed. Otherwise, this could lead to motor damage.

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## 4.2.1 Precautions for Transport of Traction Gearbox without wheelset shaft

### a) General notes

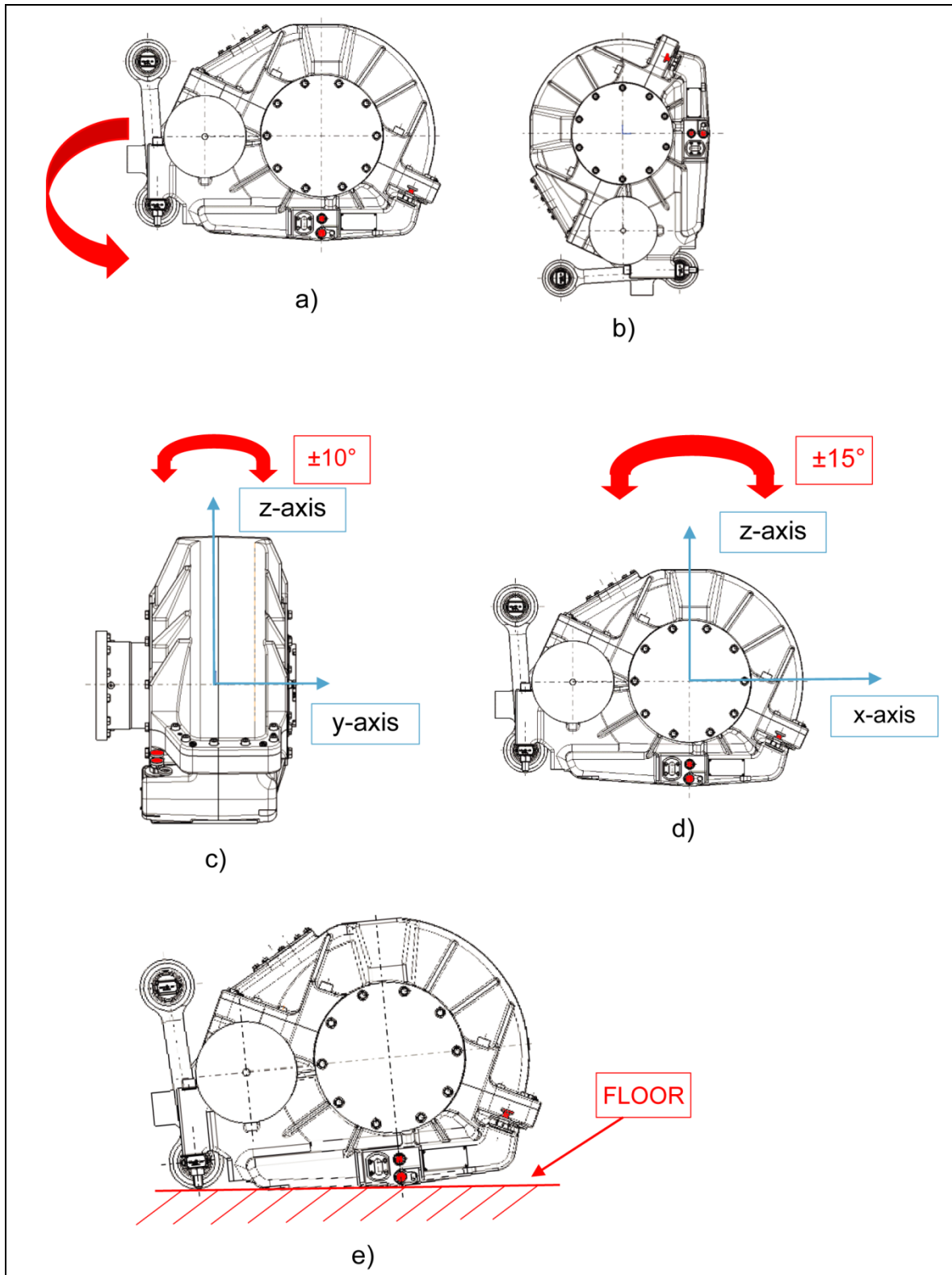


Figure 4: Maximum inclinations of Traction Gearbox

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Only in oil drained state it is possible to turn the Traction Gearbox by 90° in direction of HS. In this state also the in-house handling is possible (a and b).

If the Traction Gearbox has to be moved with oil the following inclinations must not be exceeded.

±10° around the x-axis (c)

±15° around the y-axis (d)

For storage the Traction Gearbox can be placed with the bottom of the Traction Gearbox housing on to the floor. In this position (e) the inclination is approximately 4°.

## b) Traction Gearbox pre-assembled without wheelset shaft



Load swivels M12 can be used to lift the Traction Gearbox (are not part of the scope of delivery).

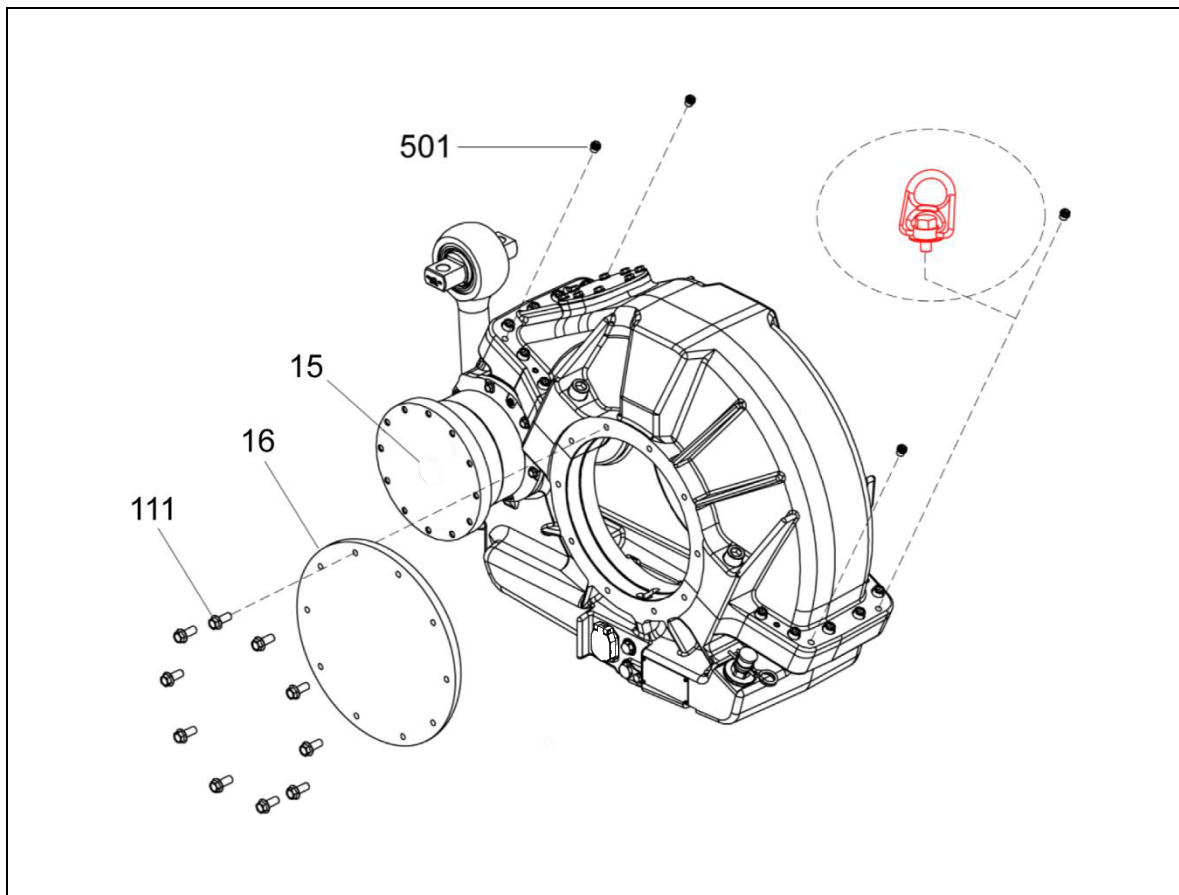


Figure 5: Lifting points, transport covers LS, transportation lock of gear coupling half

**WARNING!****RISK OF DAMAGE OR INJURY!**

Avoid jerky motions, impacts, or vibrations on the Traction Motor/Drive when loading!

It's not allowed to lift the Traction Gearbox on the emergency catch because lifting accessories could slide down!

- ▶ Use only the lifting points where you can fix eye bolts on the Traction Gearbox!

- 1 Drain the gearbox oil completely – [see section 8.4.4](#).
- 2 To protect the interior of the Traction Gearbox both transport covers LS (16) must be mounted by using the hexagon head ribbed flange bolts (111).
- 3 Tighten hand tight.
- 4 Remove the four screw plugs (501) and keep them for later use.
- 5 Install in place of the screw plugs four load swivels M12.



Use adequate hoisting devices for the corresponding weights.

**Mass of Traction Gearbox = approx. 440 kg**



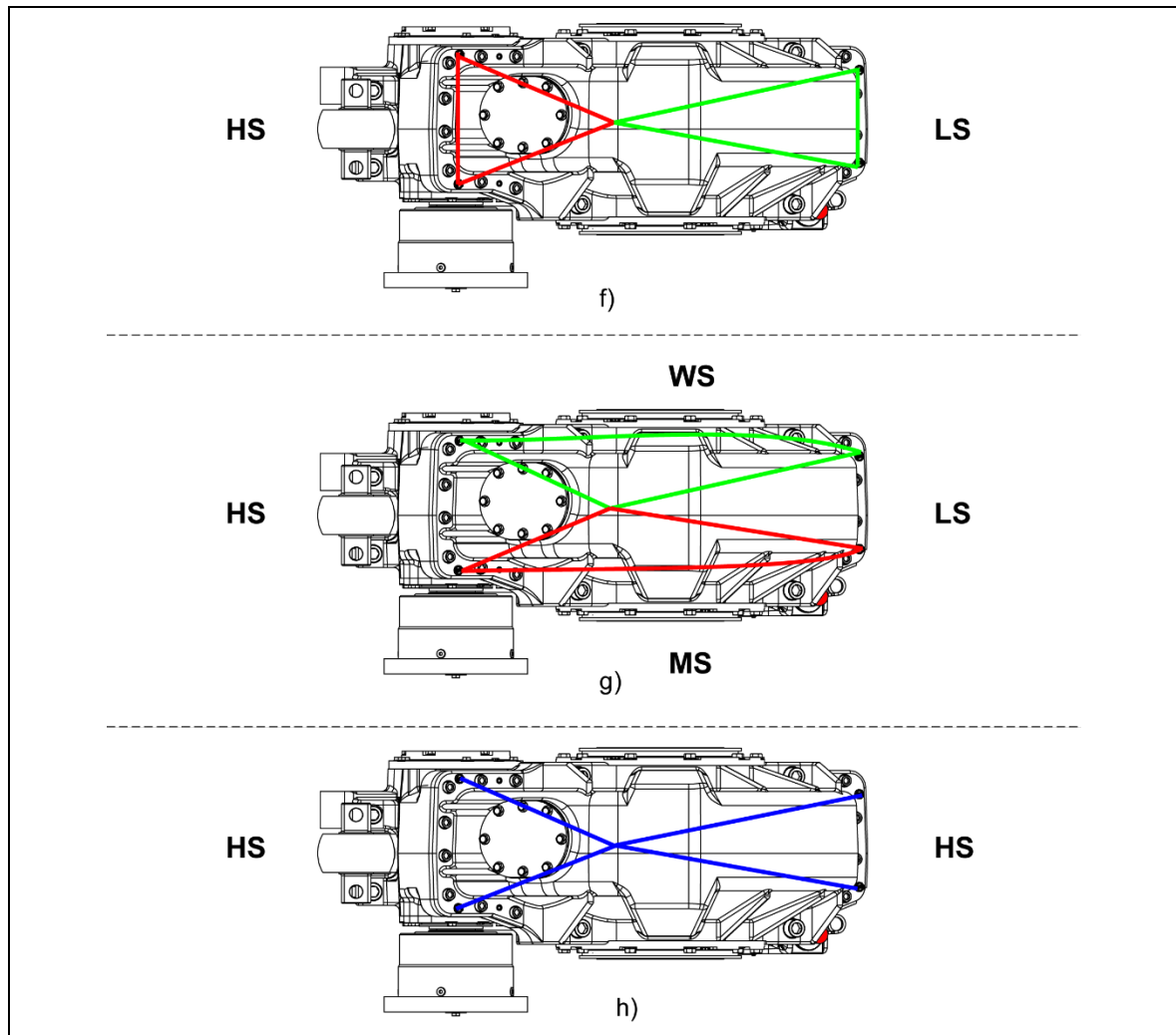


Figure 6: Different slinging means

Depending on the slinging means there are three possibilities to lift the Traction Gearbox:

See Figure 6 f):

With two belts, at which the first hoisting sling is fed through the HS lifting rings and afterwards fixed to hook of the hoisting device. The second hoisting sling is fed through the LS lifting rings and afterwards fixed to hook of the hoisting device

See Figure 6 g):

With two belts, at which the first hoisting sling is fed through the MS lifting rings and afterwards fixed to hook of the hoisting device. The second hoisting sling is fed through the WS lifting rings and afterwards fixed to hook of the hoisting device

See Figure 6 h):

With a four-strand chain, at which each strand is hooked to a lifting ring and afterwards to the hook of the hoisting device.

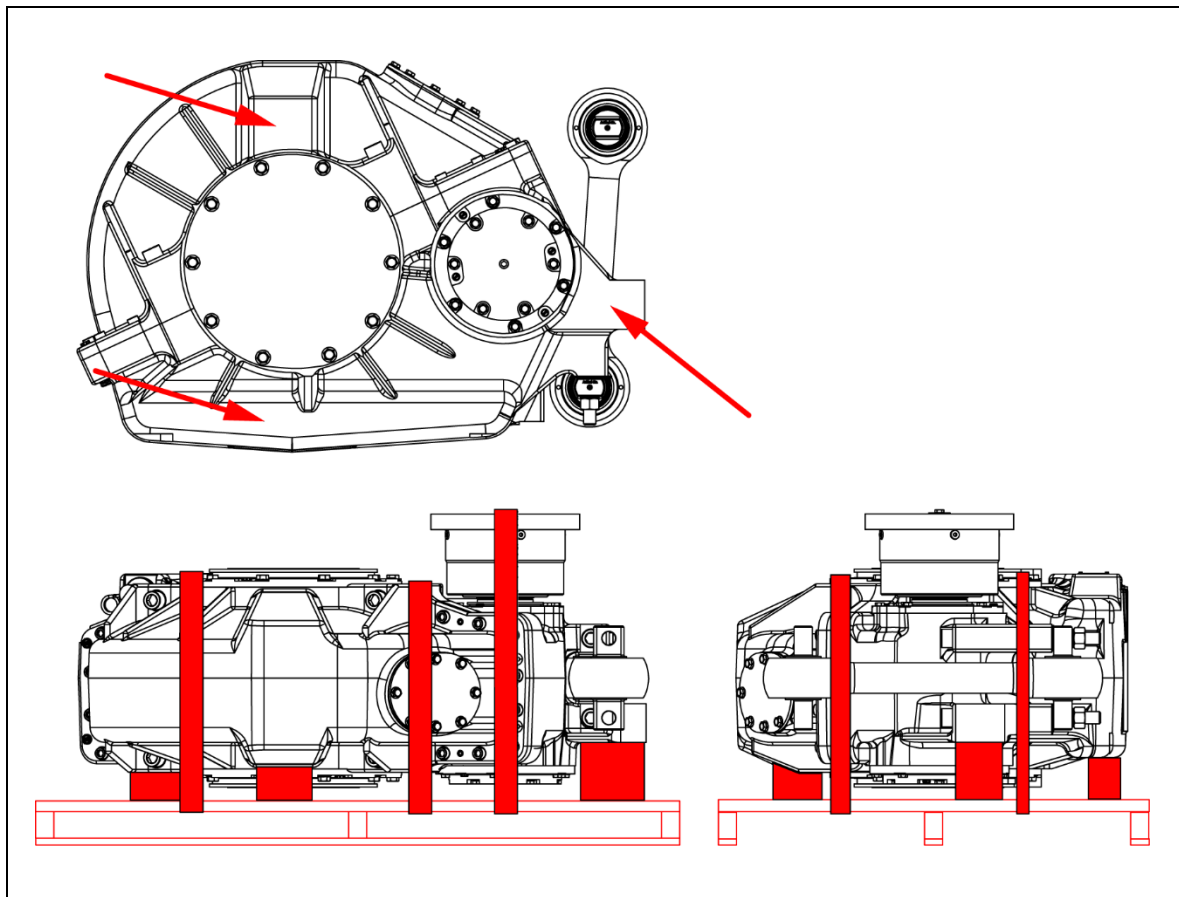


Figure 7: Traction Gearbox fixed on pallet

For transportation of the Traction Gearbox:

- It has to be drained,
- the transportation lock of the gear coupling must be tightened
- the transport covers LS have to be mounted
- it has to be laid down onto WS.

The Traction Gearbox must be laid on wooden blocks.

Position the wooden blocks underneath:

- under the gating LS-WS
- under the emergency catch
- under the oil pan

The Traction Gearbox must be secured to a pallet with straps during transportation (see [Figure 7](#)).

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## 4.2.2 Precautions for Transport of Gearbox with wheelset shaft and Drive Wheels

### a) General notes

If the Traction Gearbox is not mounted to the wheelset shaft, the transport covers LS must be mounted.

The transportation lock of the gear coupling must be tightened until the coupling halves of Traction Gearbox and Traction Motor will be assembled.

Only in oil drained state it is possible to turn the Traction Gearbox by 90° in direction of HS. In this state also, the in-house handling is possible (see Figure 4, a and b).

If the Traction Gearbox has to be moved with oil the following inclinations must be observed (see Figure 4 but with wheel set shaft and drive wheels).

±10° around the x-axis (c)

±15° around the y-axis (d)

It's allowed to place the Traction Gearbox onto the support for the reaction rod (use a wooden block as shown in Figure 9 and Figure 11).

### b) Traction Gearbox with mounted wheelset shaft



Lifting equipment is not part of the scope of delivery.

Use lifting device(s) with an appropriate load bearing capacity:

**Mass of Traction Gearbox (440 kg) with wheelset shaft (500 kg) = approx. 940 kg**

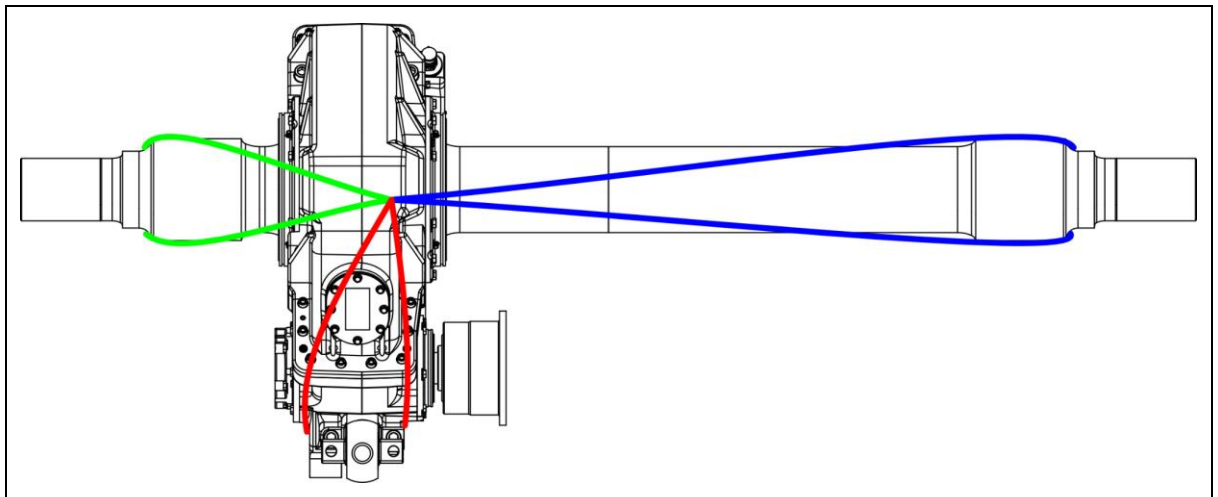


Figure 8: Lifting points for Traction Gearbox assembled to wheelset shaft

The assembly Traction Gearbox with wheelset shaft has to be lifted with three hoisting slings. One hoisting sling is put under the wheelset shaft WS, the second one under the wheelset shaft MS and the third one is put under the reaction rod support on the Traction Gearbox. Afterwards all three hoisting slings are hooked to hook of the hoisting device.

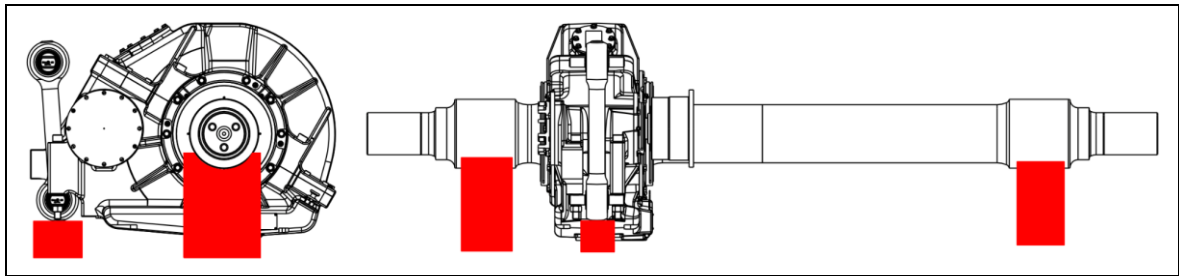


Figure 9: Storage of Traction Gearbox assembled on wheelset shaft



## NOTE

### RISK OF DAMAGE!

During storage of Traction Gearbox assembled to wheelset shaft additional consider that the weight of the Traction Gearbox rests on the wheelset shaft and not reversed.

- ▶ Jack up the wheelset shaft on wooden blocks and put a wooden block under the reaction rod support respectively under the reaction rod.

### c) Traction Gearbox with mounted wheelset shaft and drive wheels



Lifting equipment is not part of the scope of delivery.

Use lifting device(s) with an appropriate load bearing capacity:

**Mass of Traction Gearbox with wheelset shaft, drive wheels and brake disk = approx. 1435 kg**

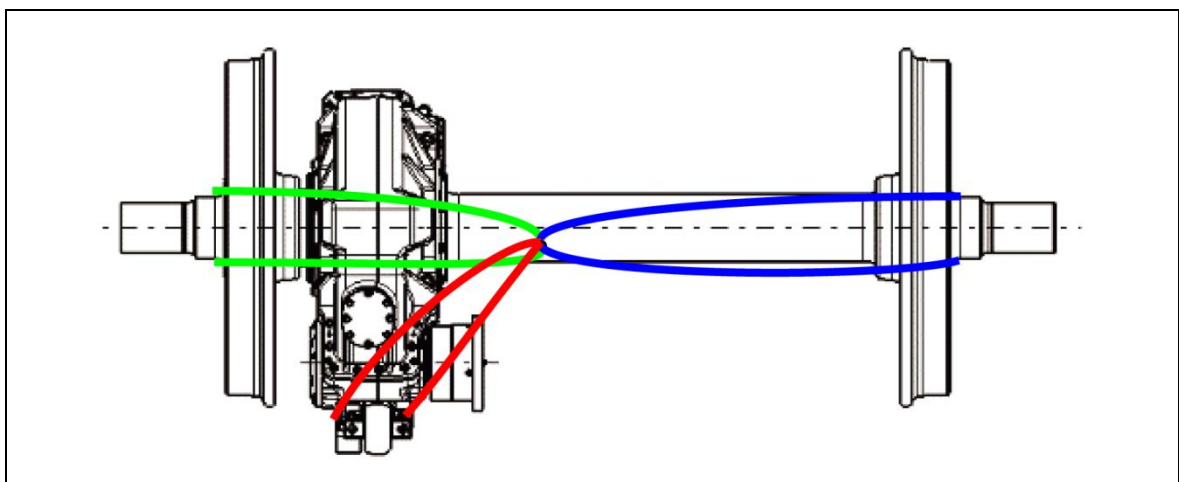


Figure 10: Lifting points for Traction Gearbox assembled to wheelset shaft and drive wheels

The assembly Traction Gearbox with wheelset shaft and drive wheels has to be lifted with three hoisting slings. One hoisting sling is put under the wheelset shaft WS, the second one under the wheelset shaft MS and the third one is put under the reaction rod support on the Traction Gearbox. Afterwards all three hoisting slings are hooked to the hook of the hoisting device.

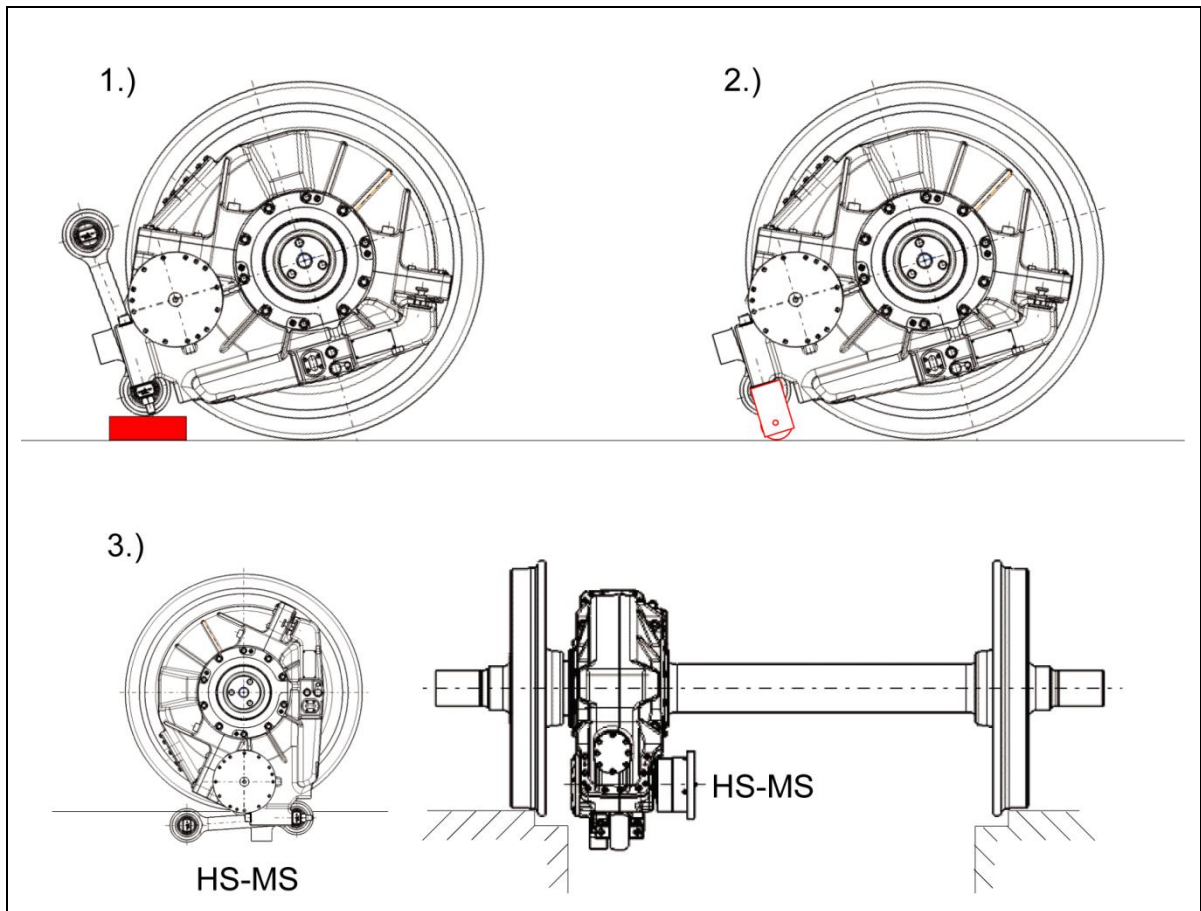


Figure 11: Storage and moving of Traction Gearbox assembled on wheelset shaft and drive wheels



## NOTE

### RISK OF DAMAGE!

During storage and in-house handling of Traction Gearbox assembled to wheelset shaft and drive wheels consider that the weight of the Traction Gearbox rests on the wheelset shaft and drive wheels and not reversed.

There are three possibilities to store and move the complete assembly (see [Figure 11](#)).

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- 1 Put a wooden block under the reaction rod support respectively under the reaction rod to protect the Traction Gearbox.
- 2 Drive wheels are on rail and under the support for the reaction rod there is a device with a carrying wheel which enables an easier moving of the wheel set with the Traction Gearbox mounted.
- 3 Drive wheels are on rail and Traction Gearbox is tipped down to the assembling hole.



## NOTE

### RISK OF DAMAGE!

When transporting complete bogies or vehicles, the vibrations generated by the transport mode (ship, truck, etc.) can cause arresting marks in the roller bearings, which can lead to preliminary damage to the bearings. Transports over longer distances may require the use of transport locks. These should be agreed in consultation with the manufacturer.

No-load shifting of bogies with Traction Gearboxes without gear oil is permitted as part of the assembly process, as long as this procedure is done at walking pace and the movement range is limited to just a few meters.

If a vehicle is parked for a longer period of time, monthly drives are required to lubricate the roller bearings and protect the inner parts against corrosion. Do not exceed half of the permitted maximum speed or tow the vehicle when carrying out this procedure.

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## 4.2.3 Precautions - disassembling Gearbox from wheelset shaft or Drive Wheels

After the wheelset shaft with taper roller bearings, Slinger rings, stow discs and labyrinth covers has been removed from the Traction Gearbox. The gearbox housing has to be protected against dirt and corrosion.

This means, that the housing parts have to be assembled again, the transport covers LS have to be mounted and the transportation lock of the gear coupling has to be tightened – see Figure 8.

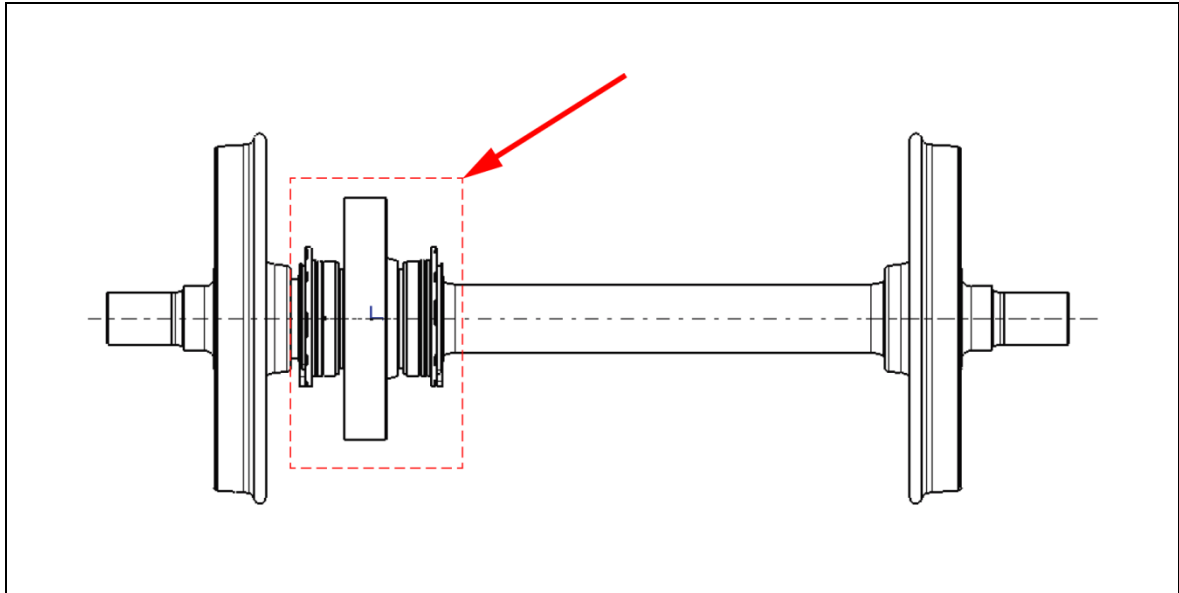


Figure 12: Protecting dismantled wheelset shaft with drive wheel

The dismantled wheelset shaft with all components must be protected against dirt and corrosion.

Wheelset shaft with tapered roller bearings, stow discs, slinger rings, labyrinth covers and the main gear have to be covered and protected against corrosion by appropriate measures.

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## 4.3 Storage

### 4.3.1 Storage conditions

All blank surfaces are treated with an appropriate agent at the time of delivery from the factory and are protected against corrosion.

If the Traction Gearbox has to be stored temporarily because it cannot be assembled and put into operation immediately after arrival at the destination, the following must be observed when choosing the location:

The Traction Gearboxes and equipment belong in enclosed storage rooms that

- are well ventilated, dry and vibration-free,
- provide protection against dampness, cold, heat, dust and grit,
- are protected against vermin, such as rodents, termites etc.



#### NOTE

#### RISK OF DAMAGE!

Stacking the Traction Drive (Motors or Gearboxes) on top of each other is not permitted!



#### NOTE

#### RISK OF DAMAGE!

The use of airtight packaging or packaging containing a desiccant is recommended for storage in high-humidity environments, see also DIN 55474.

The packaging, desiccants and corrosion protection must be checked at regular intervals and replaced if necessary.

The Traction Gearbox must not be subjected to large or constant temperature differences during storage as this may lead to an excessive infiltration of air humidity into the Traction Gearbox interior. This can lead to inadmissible water levels in the gear oil of Traction Gearboxes that have already been filled with oil.

### 4.3.2 Long-term storage (longer than 3 months)

For long-term storage without operational service, the Traction Drive (Motor or Gearbox) must be protected, in addition to the storage conditions (see [section 4.3.1](#)), against damage by special preservation measures. All bare surfaces must be protected against corrosion by coating with an appropriate agent.

Traction Drives (Motors or Gearboxes) must be protected from sunlight, other UV effects (e.g. welding) and weather. The temperature must not exceed 45 °C.

The Traction Gearbox with wheelset shaft should be supported as the Traction Gearbox should rest on the wheelset shaft and not contrary.

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## 4.3.3 Inspection during storage

The Traction Gearbox should undergo a test **biannually**.

Check for obvious (external) damages such as mechanical deformations, scratches, abrasions, patches of rust, etc.

The most important points are:

- Damage to the wire insulation of the electric cables.
- Damage to the terminal box (squashed, cracked) of the Traction Motor.
- Damage to the fixing points for the Traction Gearbox and chassis suspension.
- Examine the polished surfaces for corrosion.

If possible, operate the Traction Gearbox with Traction Motor during this period.

If commissioning is not possible, the Traction Gearbox must be set in rotation manually to avoid a standstill mark on the roller bearings.

## 4.3.4 Storage of Traction Gearboxes taken out of operation or decommissioning

If Traction Gearboxes that have been taken out of operation are put into storage or decommissioned, the Traction Gearbox oil must first be drained, and the “gearbox without oil filling” sign must be attached. Fill the Traction Gearbox with anti-corrosive oil. Turn the shaft by hand until the internal components are coated with anti-corrosive oil. The procedure should be repeated once a year. The anti-corrosive oil may remain in the Traction Gearbox if this is permissible for the storage location. Before commissioning, drain the anti-corrosive oil completely and then flush and fill with Traction Gearbox oil.

## 4.3.5 Commissioning after Long-term Storage

The rubber elements (reaction rod) should be visually inspected before recommissioning. Check for cracks, and, if necessary, measure the depth of the cracks.



### NOTE

#### RISK OF DAMAGE!

The gearbox oil loses its functional properties after approx. 5-6 years, depending on the environmental conditions.

For vehicles that are ready to drive that have not operated for 6 months or longer, an oil analysis should be performed before recommissioning to detect water in the oil. The limit is **0.2%** water in the oil. If this limit is exceeded, perform an oil change.

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## 4.3.6 Storage of roller bearings



### NOTE

#### RISK OF DAMAGE!

The bearings should remain in their original packaging until they are installed to protect them from contamination.

Unmounted roller bearings can be damaged due to vibrations and shocks if no protective measures are taken.

Roller bearings may only be stored in rooms suitable for this purpose.

The room temperature must be kept constant at  $20 \pm 5$  °C and the formation of condensation must be prevented.

Roller bearings should be stored at a relative humidity below 55 %.

No chemicals may be stored in the same room.

The bearings are pre-lubricated by the manufacturer and **should not** be washed and/or additionally greased.

The storage from delivery to mounting the bearing unit should not be more than one year. This limitation is caused by the grease inside the bearing.

The sealing function will be fulfilled through an axial labyrinth with a sheet metal cover, which is integrated into the bearing.

An additional sealing on the shaft is recommended.

If bearings are reused, they must also be preserved and packed in the same way as a new bearing.

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## 5 TRACTION DRIVE MOUNTING / DEMOUNTING

### 5.1 General notes

This operating manual only provides general information on the assembly and commissioning of the Traction Drive. For the assembly and disassembly of the plug base, the Traction Gearbox and the associated couplings, the manufacturer's instructions must be observed.

For the installation and removal of the Traction Drive in the bogie, the instructions of the person responsible for the component apply.

If the Traction Drive (Gearbox or Motor) must be taken out of operation for a longer period, observe the instructions in [section 4.3](#).

If the Traction Drive has been out of service for a longer period, the instructions according to [section 4.3](#) must be considered.

Mounting:

- Visual inspection of the Traction Drive for damage, especially for paint damage. Paint damage must be repaired in accordance with painting instructions **TSA000075** and **TSA900099** ([see section 14.3](#)).
- Damaged mounting parts and fastening elements must be repaired or replaced.
- Before assembling the Traction Drive (Gearbox or Motor), check if the gear coupling is clean and undamaged ([see chapter 14](#)).
- Check all connection surfaces for damage and cleanliness before mounting the Traction Drive.
- Remove the transport lock, if necessary.
- Check the shaft end to ensure that it is undamaged and clean.
- Check that the Traction Drive / Traction Gearbox can be turned by hand.
- Check the terminal box of the Traction Motor for damage ([see chapter 14](#)).
- Check for missing/loose bolts and gearbox oil and lubricant that have leaked.
- The attachment of the Traction Drive in the bogie must be checked according to the bogie manufacturer's manual.
- Before commissioning, drain the anti-corrosive oil completely and then flush and fill with gearbox oil.
- After filling gearbox oil, remove the "gearbox without oil filling" sign.

**NOTE****RISK OF DAMAGE!**

When operating the Traction Gearbox, it must be ensured that the Traction Gearbox area within the bogie is free from ice or snow. Otherwise, the defrosting process caused by the heating of the Traction Drive during operation can cause water to enter and damage the Traction Gearbox. Particular attention needs to be paid to the areas of the labyrinth seals and gear ventilation.

Driving on flooded track sections is not permitted. Flooded Traction Drives must not be put into service without inspection by the manufacturer.

Soiling of the Traction Gearbox area of the bogie can negatively affect heat dissipation and cause the Traction Gearbox to overheat. If gear ventilation is hampered by dirt, this can lead to leakage at the labyrinth seals. The Traction Drive must be cleaned before operation if underfloor areas are heavily soiled.

## 5.2 Mounting



For installation of the Traction Drive in the vehicle, see [vehicle documentation](#).

The fastening and connecting elements are not included in the scope of delivery.

## 5.3 Demounting



For the removal of the Traction Drive from the vehicle, see the [vehicle documentation](#).

## 6 COMMISSIONING

### 6.1 General Information

This instruction manual only contains general information for installing and commissioning the Traction Drive. It is necessary to comply with the manufacturer's instructions while mounting and demounting the electrical connections, the Traction Gearbox, and all other drive components.

The manufacturer's instructions apply to mounting and demounting the Traction Drive on the bogie.

If Traction Gearboxes or Traction Motors must be taken out of operation for a longer period of time, observe the instructions in [section 4.3](#).



#### NOTE

During operation of the Traction Gearbox, it must be ensured that the area around Traction Gearbox in the chassis is free of snow and ice. The thawing process caused by the drive heating up in use can lead to water ingress into the Traction Gearbox, resulting in damage to the Traction Gearbox. Particular attention should be paid to the areas around the labyrinth seals and the gearbox ventilation.

Flooded track sections may not be traversed. Flooded Traction Drives may not be commissioned without being checked first by the manufacturer.

A build-up of dirt on the chassis in the area around the Traction Gearbox can lead to impaired heat dissipation capacity and to the Traction Gearbox overheating. The labyrinth seals may start to leak if gearbox ventilation is impaired by the build-up of dirt. If there is a heavy accumulation of dirt in the underfloor area, the dirt must be cleaned from the Traction Drive before commencing operation (see document [TSA009129](#) in [section 14.2](#))

### 6.2 Checks before Commissioning

The following must be checked before commissioning:

- Check Traction Drive for damage; pay special attention to damage to the coating. Damaged surfaces should be repaired in accordance with TSA000075VAR56 (see [section 14.3](#)). Damaged mounted and attached components should be replaced or repaired.
- Before assembling the Traction Drive (Motor and Gearbox), check if the gear coupling is clean and undamaged (see [section 14.3](#)).
- Inspect shaft ends and fitting surfaces and ensure that they are clean and free of damage.
- Check whether the Traction Gearbox/Drive can be rotated by hand in the correct direction.

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- Check the Traction Motor and/or the electrical connections according to the Traction Motor operating manual (see [section 14.2](#)).
- Check for missing/loose screws, gearbox oil and lubricant that have leaked.
- The attachment of the Traction Drive in the bogie must be checked according to the bogie manufacturer's manual.
- Before commissioning, drain the anti-corrosive oil completely and then flush and fill with gearbox oil.
- After filling gearbox oil, remove the “gearbox without oil filling” sign.
- All screws are tightened with specified tightening torque.
- All tightened screws are marked according to [section 8.1.1](#).
- Visual inspection of the mechanical connections (see [section 8.4.2](#)).
- Checking the conductivity between the grounding brush and the Traction Gearbox.
- All transport locks have been removed, if necessary.
- All protective covers and cover plates have been closed.
- Traction Drive (Traction Motor and Traction Gearbox) does not show any visible damage (see [section 8.4.1](#)).

## Final inspection:

- All covers that were dismantled for electrical and mechanical testing are fitted.
- Test run completed (see [section 6.3](#)).



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## 6.3 Test run

After each reassembling on maintenance or repair work, a test run has to be carried out with the Traction Motor.

The Traction Motor should be operated at 1200 min<sup>-1</sup> on the rotor shaft for at least 15 minutes in a suitable set-up.

A faulty test run will show the following:

- noticeable noises
- strong vibrations
- increased temperatures that are not within the value range



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New bearing units may experience a temperature rise during start-up. Nevertheless, the temperature goes down immediately when the grease has dispersed in the bearing.

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In the event of a faulty test run, observe [chapter 11](#) and contact the manufacturer's service department.



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Manufacturer:  
**TRAKTIONSSYSTEME AUSTRIA GmbH / Service**  
Brown-Boveri-Straße 1  
A-2351 Wiener Neudorf  
Tel.: +43 (0) 2236 8118-111  
E-Mail: [service@sa.at](mailto:service@sa.at)

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## 7 OPERATION

### 7.1 Operating conditions



#### NOTE

#### RISK OF DAMAGE!

Operating the Traction Drive outside the specified data may cause damage.

- ▶ Only operate the Traction Drive within the scope of the machine data, (see [section 3.1](#)).
- ▶ In case of different use, obtain written consent from the machine manufacturer.

### 7.2 Deviations from normal operation

Any deviation from normal operation (higher power consumption, oscillations, unusual noises or smells, fluids or lubricant leaking, activation of the monitoring devices etc.) show that the operation is affected.

Promptly inform the competent maintenance personnel to prevent faults which could directly or indirectly cause severe damages to people or property on your part.

In the event of malfunctions or abnormal operating conditions that may represent electrical or mechanical overloading of the Traction Drive, the Traction Drive must be shut down immediately, and appropriate maintenance work and tests must be conducted immediately in order to prevent damage from resulting.

A leakage exists

- when on the outer wall of the gearbox housing has a shining and/or clammy surface
- when oil drops can be seen on the outer wall of the gearbox housing
- when the outer parts of the gearbox housing are covered with a thick shining layer of oil and dust



The oil consumption of the gearbox should not be more than 0.5 l per 100,000 km.

**NOTE****RISK OF DAMAGE!**

For ambient temperatures below  $-20\text{ °C}$ , a warm-up phase of the Traction Gearbox is recommended.

- ▶ Do not exceed half of the permitted maximum speed during the first 10 minutes of this phase.

**NOTE****RISK OF DAMAGE!**

Long-term operation of the Traction Gearbox without traction torque (e.g. long periods of towing or redeployment Traction Drives, discontinued operation of a Traction Drive over a long period) can lead to slippage damage to the roller bearings of the Traction Gearbox and is therefore not possible without restriction. This applies in particular to Traction Gearboxes with relatively new bearings (after initial commissioning or bearing replacement).

To prevent damage during longer redeployment Traction Drives, a driving speed of no more than half the permissible maximum speed is recommended. For higher towing speeds, consultation with the manufacturer is recommended.

If operation of a Traction Drive is discontinued, the remaining daily routine of the vehicle can be completed without restriction. The Traction Drive should be put back into operation after 3 days at the latest.

Continuous operation at a low driving speed can interfere with the oil supply to the bearings and must be avoided. For longer distances, consultation with the manufacturer is recommended.

Application with torque and without rotation of the wheels (e.g. uphill stops), leads to insufficient lubrication of the toothing and roller bearings and therefore does not constitute a generally permissible operating condition.

### 7.3 Monitoring during operation

By appropriately designed control and speed monitoring, it must be ensured that the limit values specified in the technical data and on the rating plate are not surpassed.

### 7.4 Operation break

When taking the Traction Drive out of service for a longer period, the instructions according to [section 4.3](#) must be followed.

In case of recommissioning, [section 6.2](#) must be followed.

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## 8 MAINTENANCE

### 8.1 Maintenance work



#### WARNING!

#### RISK OF INJURY AND DAMAGE!

Risk of damage and injury due to improperly performed maintenance and repair work.

- ▶ Work must be carried out only when the Traction Drive is shut down.
- ▶ For carrying out the maintenance work, specialists of the operating company with qualification such as electricians and or locksmiths should be consulted.
- ▶ Re-commissioning of the Traction Drive which was shut down because of fault must only be carried out by authorized people. Restarting is possible without risk only after the cause of the stoppage was determined and rectified.
- ▶ It is advantageous to request for our assembly fitters in all cases where any types of problem develop in the plant.



#### NOTE

#### RISK OF DAMAGE!

Possible damage to the Traction Drive, due to loose or improperly tightened screw connections.

- ▶ Never use an impact wrench, otherwise the screws could break off or be damaged.
- ▶ Only use a torque wrench if tightening torques are specified for screws in the text of this operating manual or in the drawings.
- ▶ Mark the tightened screws (see [section 8.1.1](#)).

**CAUTION!****RISK OF INJURY!**

During operation, the Traction Drive reaches surface temperatures of more than 100 °C; there is an acute risk of injury.

- ▶ Appropriate protective equipment and clothing must be worn during maintenance and servicing work on a Traction Drive that has been recently shut down.

### 8.1.1 Marking of tightened screws

For all assembly work where screws are assembled, the following steps must be carried out to ensure a consistent and proper execution of the assembly process.

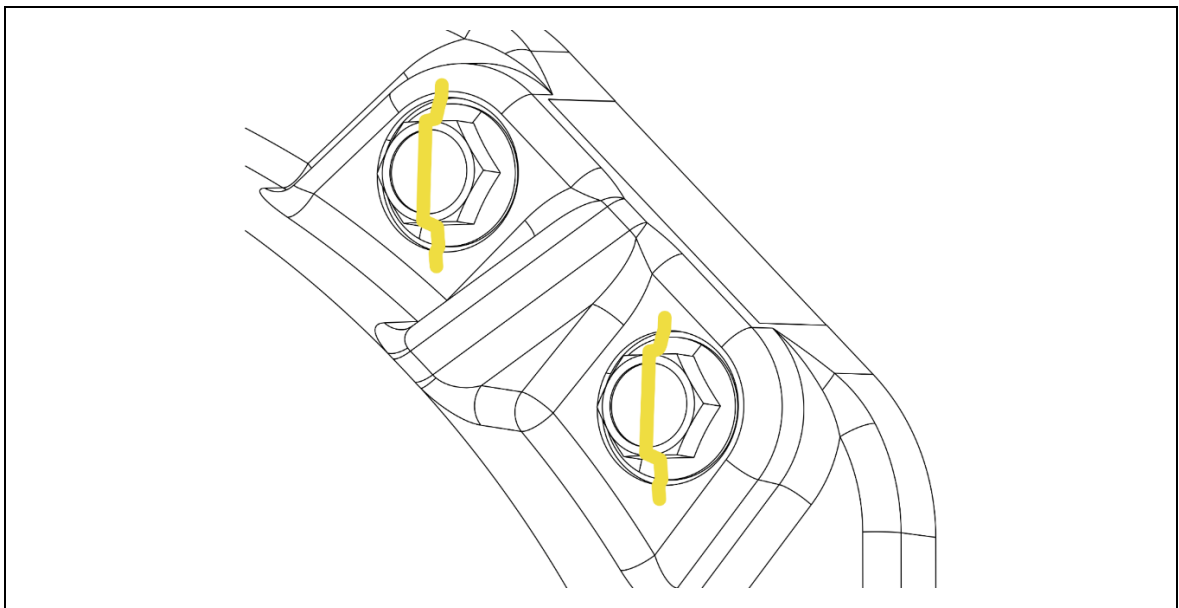


Figure 13: Marking of tightened screws

- 1 Clean all threaded holes with cleaner (e.g. LOCTITE SF 7063), blow out with compressed air and check for damage before assembling the screws.
- 2 If specified, apply thread locker or assembly paste to the threads of the screws.
- 3 Tighten the screws to the specified tightening torque and mark them with a paint stroke in a contrasting colour (e.g. RAL1004 - golden yellow).

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## 8.2 Maintenance intervals

Careful and regular maintenance is necessary to detect and correct possible faults in good time before these can develop into enormous damages.

The maintenance work to be carried out is listed below in the order of occurrence.

The definite maintenance intervals should be set in accordance with the records of the test operating time.



### NOTE

#### RISK OF DAMAGE!

In the event of malfunctions or exceptional operating conditions that represent an electrical or mechanical overload on the unit, the appropriate maintenance work and checks must be carried out immediately.

## 8.3 Maintenance schedule



Observe the Operating Manual of gear coupling (ZK 242-R2-BD) for inspection and maintenance intervals – see [section 14.2](#).

### 8.3.1 General inspection

Intervals	Maintenance task	Description see section
Every month or 5,000 – 25,000 km *)	Visual inspection for external damage	<a href="#">8.4.1</a>
	Checking the mechanical connecting elements	<a href="#">8.4.2</a>
	Initial oil change	<a href="#">8.4.4</a>
	Check oil level and general condition	<a href="#">8.4.3</a>
Every 6 months *)	Inspection oil stick or drain plug for wear	<a href="#">8.4.3</a>

\*) Maintenance work on the installed Traction Drive

## 8.3.2 Preventive maintenance

Intervals	Maintenance task	Description see section
Every year or 300,000 km *)	Oil change gearbox	8.4.4
Every 3,000,000 km	Changing bearings	8.4.5 - 8.7
	Changing barrier grease	
Every 4 years or 1,200,000 km	Changing elastomer of drive suspension <sup>***</sup> ) <sup>****</sup> )	8.5.9 and 8.7.9
Every 8 years or 1,600,000 km	Grease change coupling <sup>**</sup> )	See Operating Manual of gear coupling 14.2
	Regreasing the barrier grease <sup>*</sup> )	8.4.5

\*) Maintenance work on the installed Traction Drive

\*\*\*) To be assured by regular lubricant analysis

\*\*\*\*) To be assured by regular elastomer inspection

\*\*\*\*\*) Minimum value according to specification, can be extended if load cycle is defined

The Traction Drive must be cleaned completely prior to maintenance work. We recommend cleaning with dry ice as this, results in the least amount of subsequent treatment for components (see [section 8.4.5](#)).



### NOTE

#### RISK OF DAMAGE!

When using a high-pressure cleaner, ensure that no water penetrates into the Traction Gearbox. All openings must be covered; in particular, the labyrinths on the Traction Gearbox must be protected. Aiming a high-pressure jet at a labyrinth is not permitted.



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## 8.4 Maintenance tasks on the installed Traction Drive

Target values for bearing clearance, run-out error, backlash, and push on distance of the gear coupling are given in TSA024568, in the annexe (see [section 14.1](#)).

The thickness of adjustment sheet for the correct adjustment of the bearing clearance is given in TSA024862, in the annexe (see [section 14.1](#)).



### NOTE

#### Valid for all parts:

Note all serial numbers by disassembling. By assembling check if numbers match!

### 8.4.1 Checking for external damage

Preliminary work:	-
Tools:	-
Consumables:	-
Required manpower:	1 Mechanic
Intervals:	Every month or 5,000 – 25,000 km

Check Traction Drive for external damage due to mechanical causes (e.g. stone impact; visual inspection, if possible).

Dismantle damaged attachments and suspension elements, repair damage or replace attachments.

If necessary, the corrosion protection must be renewed at damaged points.

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## 8.4.2 Checking the mechanical connecting elements

Preliminary work:	-
Tools:	-
Consumables:	-
Required manpower:	1 Mechanic
Intervals:	Every month or 5,000 – 25,000 km

External screws must be checked for tightness by visual inspection of the marked screws (see [section 8.1.1](#)). Check if the external screw connections are seated firmly. Check the electrical connection of the Traction Motor to ensure safe contact (see Operating Manual of Traction Motor – [section 14.2](#)).



### NOTE

#### RISK OF DAMAGE!

Screw connections secured with **thread locker** must **not be retightened** as the required safety is no longer fulfilled.

- ▶ Ensure that the screw is removed, the thread recut (to clean it of excess adhesive residue) and a new screw is glued in and tightened with appropriate tightening torque
- ▶ Mark the tightened screws (see [section 8.1.1](#)).

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## 8.4.3 Checking oil level and visual inspection for abrasive wear dust in gearbox oil

**Preliminary work:** Cleaning the area around the filler plug of the magnetic stick (22), the magnetic stick (22) and the area around the oil level indicator (26).

**Tools:** -

**Consumables:** lint-free cleaning cloth  
O-ring (410)

**Required manpower:** 1 Mechanic

**Intervals:** Every month or 5,000 – 25,000 km

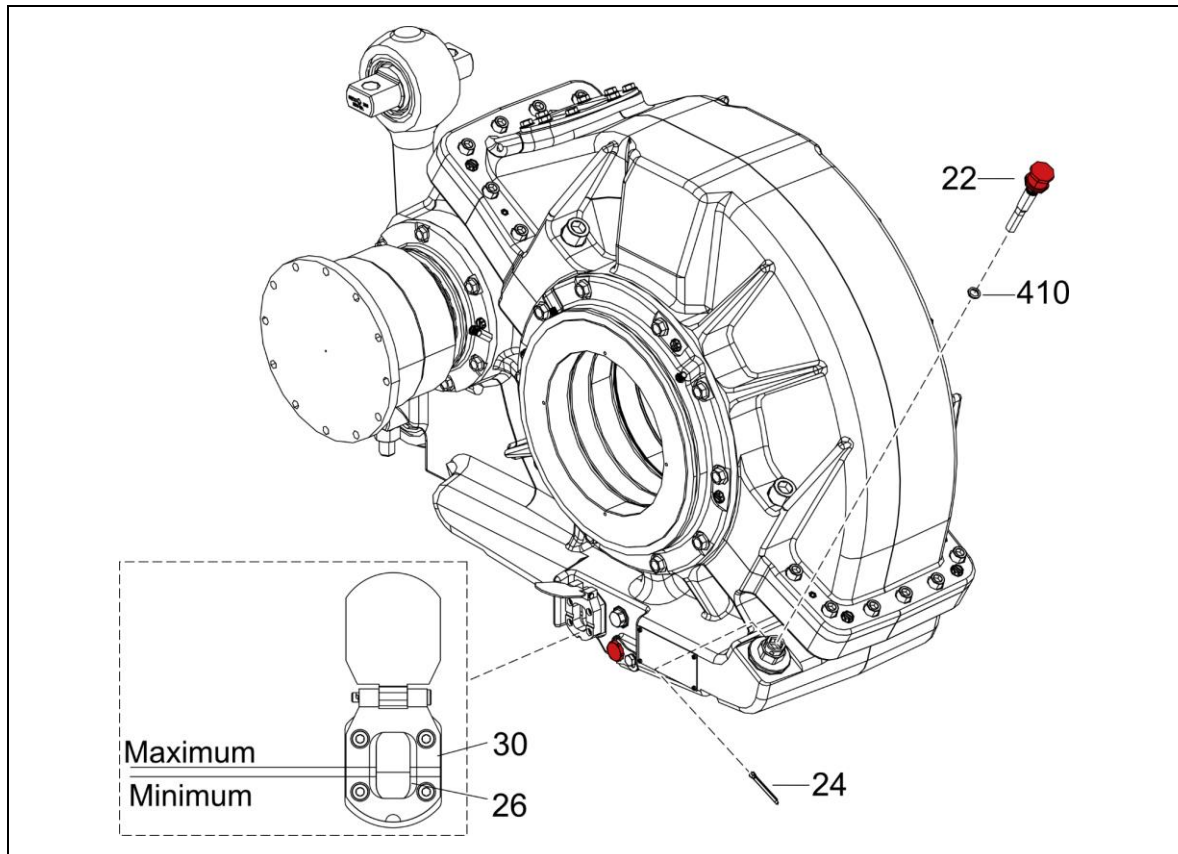


Figure 14: Oil level indicator and magnetic stick



Figure shown without wheelset shaft.

Read the oil level on the oil level indicator (26). Oil sight glass protection (30) and oil level indicator (26) have the same markings and are assembled.



## NOTE

### RISK OF DAMAGE!

The vehicle must be idle on a horizontal track for at least 30 minutes for the oil level check.

Otherwise, the gearbox oil will not yet have flowed back sufficiently into the oil pan, an incorrect oil level reading will result, and there will be a risk of overfilling the gearbox oil.

Overfilling the Traction Gearbox with gearbox oil can lead to excessive heat development and leaks in the labyrinths.

Filling too less oil can lead to damages on the pinion and the main gear.

Reading on the oil level indicator:

The oil level indicated does not depend on the loading condition of the vehicle. However, it is not possible to check for abrasive wear dust here.

The oil level must be at the marking groove on the oil level indicator (26).



## NOTE

### RISK OF DAMAGE!

In accordance with the maintenance schedule, the check for abrasive wear dust in the gear oil must also be performed along with the oil level check. The oil level must only be checked using the oil level indicator (26) and not with the magnetic oil dipstick. Only if the oil level is checked via the oil level indicator (26), it is ensured that the correct quantity is indicated, as the oil level is visible regardless of the loading condition of the vehicle.

- 1 Pull out the spring cotter (24).
- 2 Pull out the magnetic stick (22) and check it for abrasive wear dust.
- 3 Clean it.



## NOTE

### RISK OF DAMAGE!

If visible filings or a large quantity of abrasive wear dust is adhering to the

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magnet, the Traction Drive should be taken out of service and the cause should be determined. Otherwise, resulting damage cannot be ruled out.

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**NOTE****RISK OF DAMAGE!**

Check O-ring (410) for damage and replace if necessary.

---

- 4 Reinsert the magnetic stick (22) and secure it with the spring cotter (24).

**NOTE****RISK OF DAMAGE!**

If the oil has become discoloured when compared to new oil (noticeably darker or has turned black or is noticeably lighter or has turned white) or exhibits large or stable bubbles, the oil level must be evaluated as per [TSA009129](#), see [chapter 14](#).

It may be necessary to take the Traction Drive out of service and determine the cause, otherwise consequential damage cannot be ruled out.

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## 8.4.4 Oil change

Preliminary work:	Cleaning the area around the locking bolt (58) and the magnetic stick (22) and the area around the oil level indicator (26).
Tools:	Torque wrench Collecting receptacle (>8 l)
Consumables:	Fitting grease MOLYKOTE P40 Lint-free cleaning cloth Sealing rings (403, 404) O-ring (410) Gearbox oil – Servo SynGear 75W-90LL
Personnel requirements:	1 Mechanic
Intervals	Every 300,000 km or annually

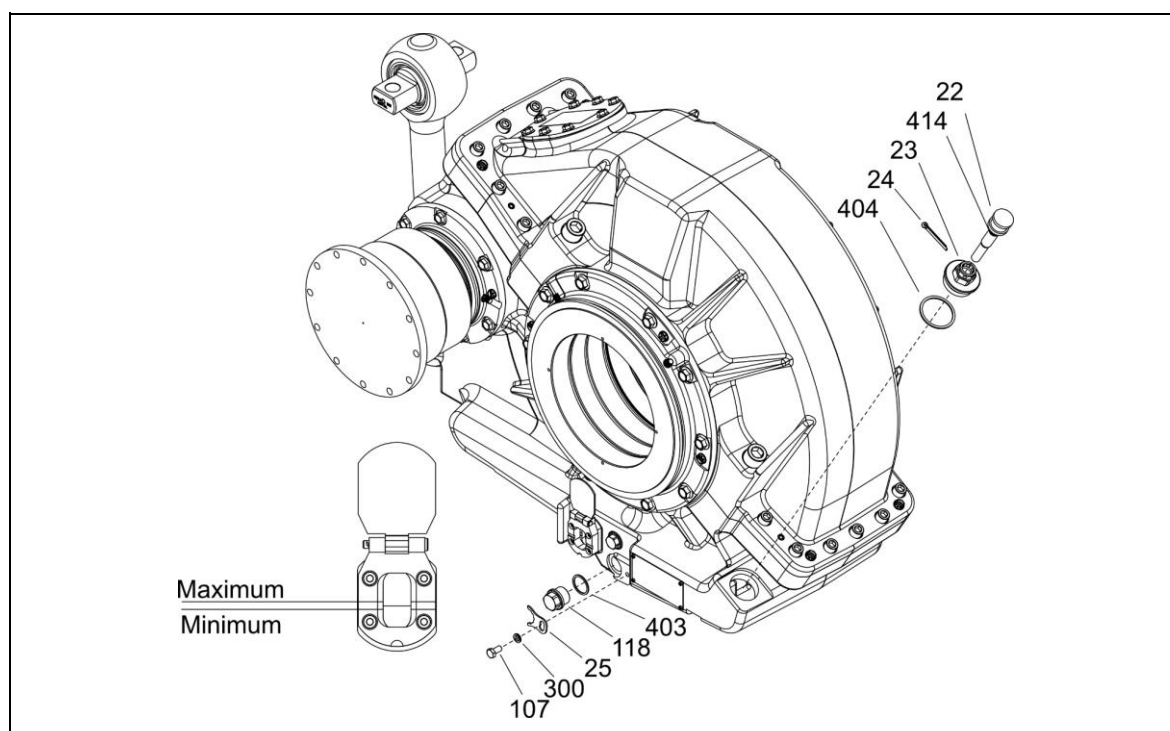


Figure 15: Oil change



Figure shown without wheelset shaft.



### NOTE

#### RISK OF DAMAGE!

Too much gear oil in the Traction Gearbox can lead to excess heat and leaks in the labyrinths.

Too little gearbox oil in the Traction Gearbox can lead to damage to the tothing and the roller bearings.



Oil changes must be performed at operating temperature so the gearbox oil is highly fluid and will flow more easily.

Wear particles are flushed out better this way.



## NOTE

### RISK OF DAMAGE!

A new sealing ring should be used every time, even if it appears undamaged. Copper seals are subject to work hardening that occurs with every installation procedure.

- 1 Position a collection receptacle under the oil drain plug (118).
- 2 Unscrew the hexagon head screw (107) and remove the Nord-Lock washer (300) and the locking segment (25).
- 3 Unscrew the oil drain plug (118) and remove the sealing ring (403).
- 4 Pull out the spring cotter (24) and the magnetic stick (22), unscrew the magnetic stick filler plug (23), and remove the sealing ring (402) and the O-ring (404).
- 5 Wait at least 30 minutes until the gearbox oil has completely drained off.
- 6 Clean any mechanical abrasive wear dust off the oil drain plug (118) and the magnetic stick (22).



## NOTE

### RISK OF DAMAGE!

If visible filings or a large quantity of abrasive wear dust is adhering to the magnet, the Traction Drive should be taken out of service and the cause should be determined. Otherwise, resulting damage cannot be ruled out.

- 7 Screw in the oil drain plug (118) with a new sealing ring (403) and tighten it with **a tightening torque of 30 Nm**.
- 8 Apply some fitting grease MOLYKOTE P40 in the bore hole; attach the locking segment (25) with the Nord-Lock washer (300) and the hexagonal head screw (107).
- 9 Tighten the hexagonal head screw (107) with a **tightening torque of 25 Nm**.
- 10 Slowly add approx. 5 litres (min. = 4.5 l / max. = 5.2 l) of gearbox oil and fill up to the maximum level marking. Oil level check via oil level indicator ([see section 8.4.3](#)).



- 11 Screw in the magnetic stick filler plug (23) with a new sealing ring (404) and tighten it with a ***tightening torque of 150 Nm***.
- 12 Insert the magnetic stick (22) with a new O-ring (410) and secure it with the spring cotter (24).



## NOTE

If there is visible swarf or a large amount of debris attached to the magnet, this should be evaluated in accordance with document [TSA009129](#), see [chapter 14](#). It may be necessary to take the Traction Drive out of service and determine the cause, otherwise consequential damage cannot be ruled out.

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## 8.4.5 Regreasing the barrier grease

Preliminary work:	-
Tools:	Lever grease gun
Consumables:	Barrier grease Klüber STABURAGS NBU 12
Required manpower:	1 Mechanic
Intervals:	Every 8 years or 1,600,000 km



To ensure correct amount of barrier grease is applied, press out one stroke from the lever grease gun on the sheet of paper and weight it. With the g/stroke determined in this way, the required number of strokes can be determined.

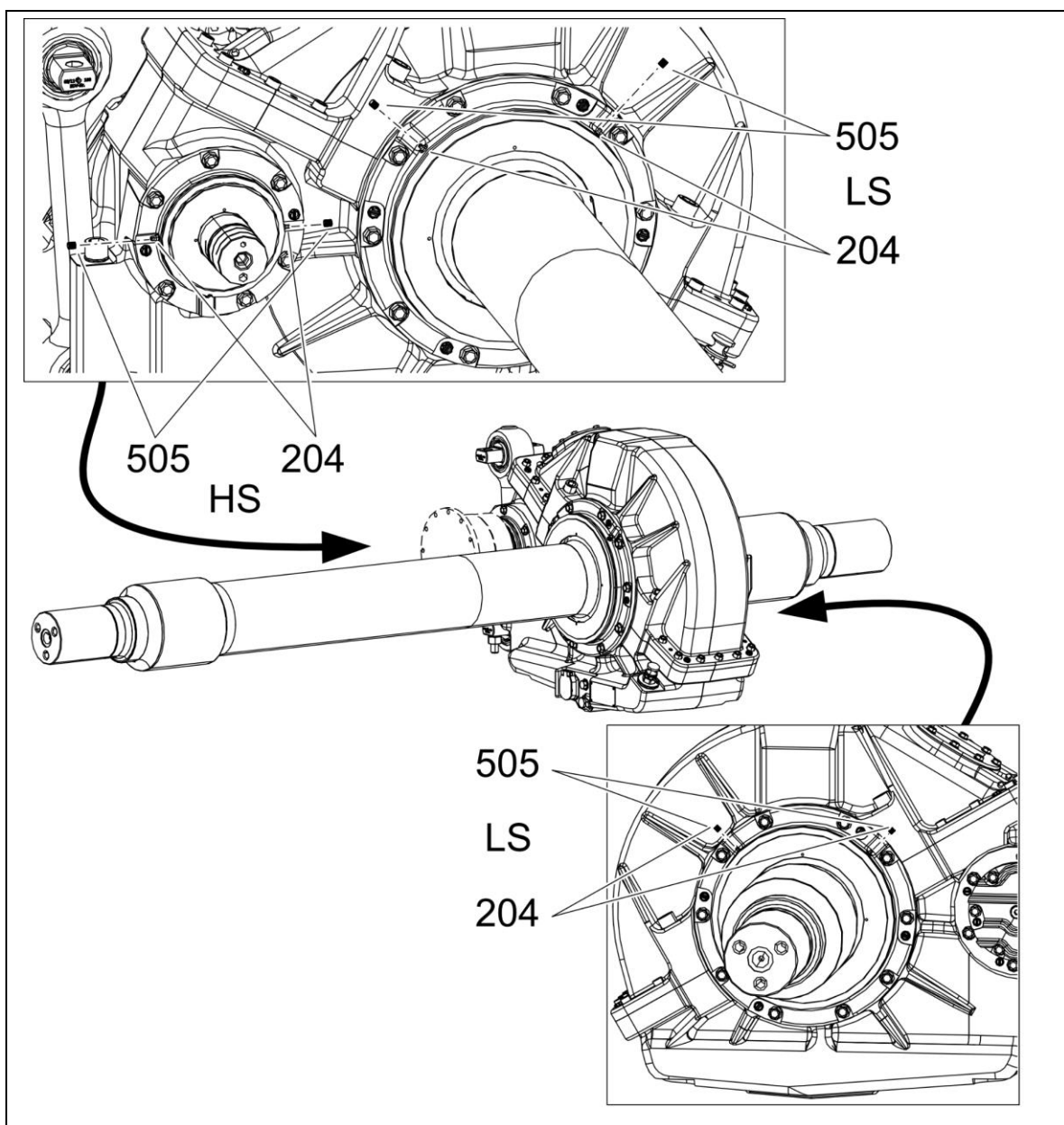


Figure 16: Regreasing the barrier grease

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- 1 Remove the six regreasing nipple caps (505).
- 2 Clean the six lubricating nipples (204).
- 3 Lubricate the LS-side with 20 g and the HS-side with 15 g of barrier grease.
- 4 Clean the regreasing nipple caps (505) and attach them.



If a regreasing nipple cap (505) has been lost during operation or maintenance work, it must be replaced with a new one.



## CAUTION!

### POLLUTION!

Grease can be hazardous to the environment.

- ▶ Clean off excess grease. Collect and dispose of contaminated clothes according to country-specific regulations.

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## 8.5 Maintenance Work on the disassembled Traction Drive

### 8.5.1 Preliminary Work



Dismounting of the Traction Drive from the bogie is not part of this operating manual.

Do not forget to disconnect the power lines, the cables of the speed sensor and resistance thermometer and the earthing connections.



Valid for all parts:

Note all serial numbers by disassembling. By assembling check if numbers match!



Observe [section 4.2](#) for further information about transport and loading.

### 8.5.2 External Cleaning

The Traction Drive must be cleaned completely prior to maintenance work. **TRAKTIONSSYSTEME AUSTRIA GmbH** recommends cleaning with dry ice as this, results in the least amount of subsequent treatment for components.



#### NOTE

#### RISK OF DAMAGE!

When using a high-pressure cleaner, ensure that no water penetrates into the Traction Gearbox. All openings must be covered; in particular, the labyrinths on the Traction Gearbox must be protected. Aiming a high-pressure jet at a labyrinth is not permitted.

### 8.5.3 Disconnecting the electrical lines

See Operating Manual of Traction Motor – [section 14.2](#).

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## 8.5.4 Separating Traction Gearbox and Traction Motor

See Operating Manual of gear coupling (chapter 10.5) – [section 14.2](#) for separating coupling halves of Taction Gearbox and Traction Motor.

For further information regarding the transport see [section 4.2](#).

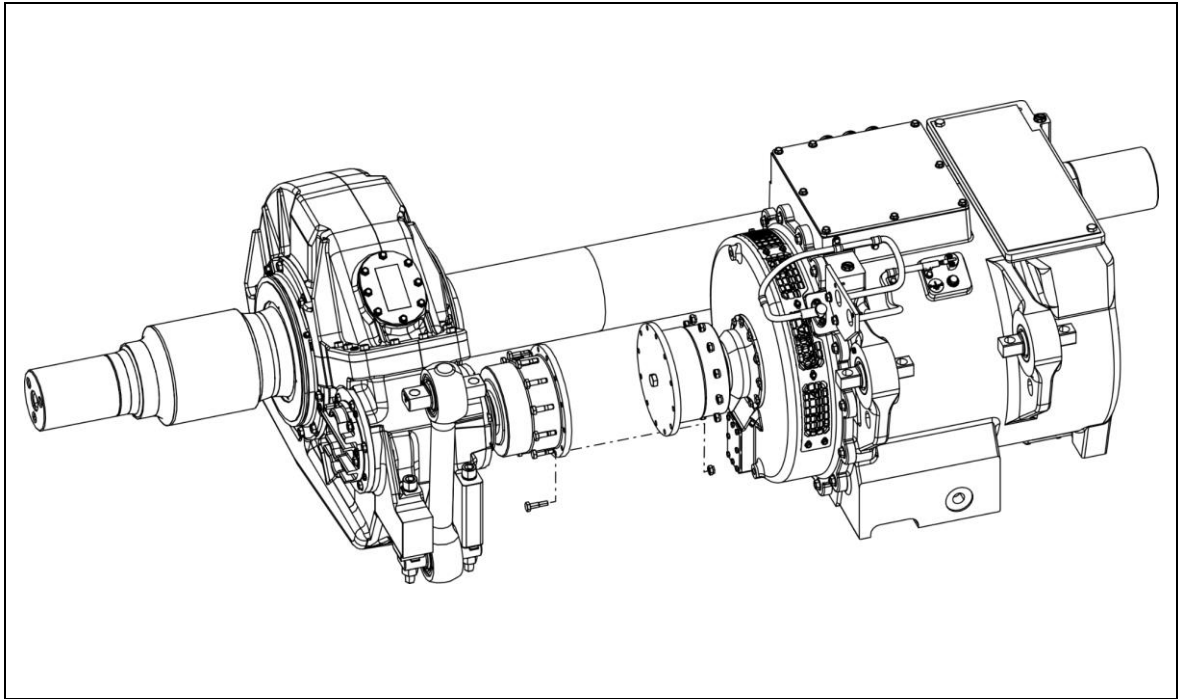


Figure 17: Separating the coupling halves

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## 8.5.5 Demounting the wheelset shaft from Traction Gearbox

Preliminary work:	Draining the gearbox oil (see <a href="#">section 8.4.4</a> ) External cleaning (see <a href="#">section 8.5.2</a> ) Disconnecting the power cables (see <a href="#">section 8.5.3</a> ) Traction Gearbox and Traction Motor (see <a href="#">section 8.5.4</a> )
Tools:	Induction heater with demagnetization and temperature probe Hoisting device (min. 500 kg) 2 - 3D lifting rings M12 2 - Support for the wheelset shaft 4 - Ejector screws M12
Consumables:	-
Required manpower:	1 Mechanic and 1 Assistant
Intervals:	Every 300,000 km

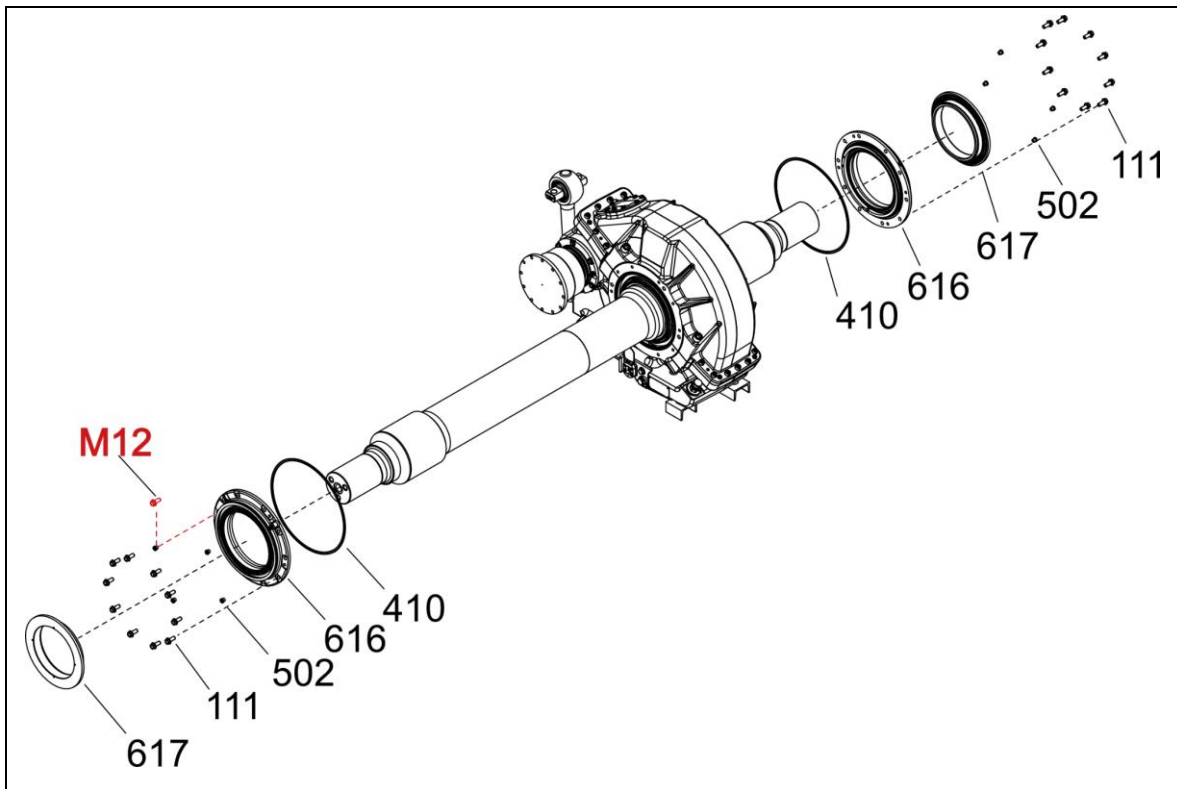


Figure 18: Demounting the wheelset shaft from the Traction Gearbox – part 1

- 1 Remove the ten hexagon head screws VR (111) at each labyrinth cover LS (616).
- 2 Remove the eight screw plugs (502).
- 3 Heat the slinger rings LS (617) to max. 120 °C and remove them carefully.
- 4 Use ejector screws (M12) in place of the screw plugs to release the labyrinth covers LS (616) from the gearbox housing.

- 5 Remove the labyrinth cover LS (616), the outer slinger rings LS (617) and the O-ring (410).
- 6 Discard the O-ring.

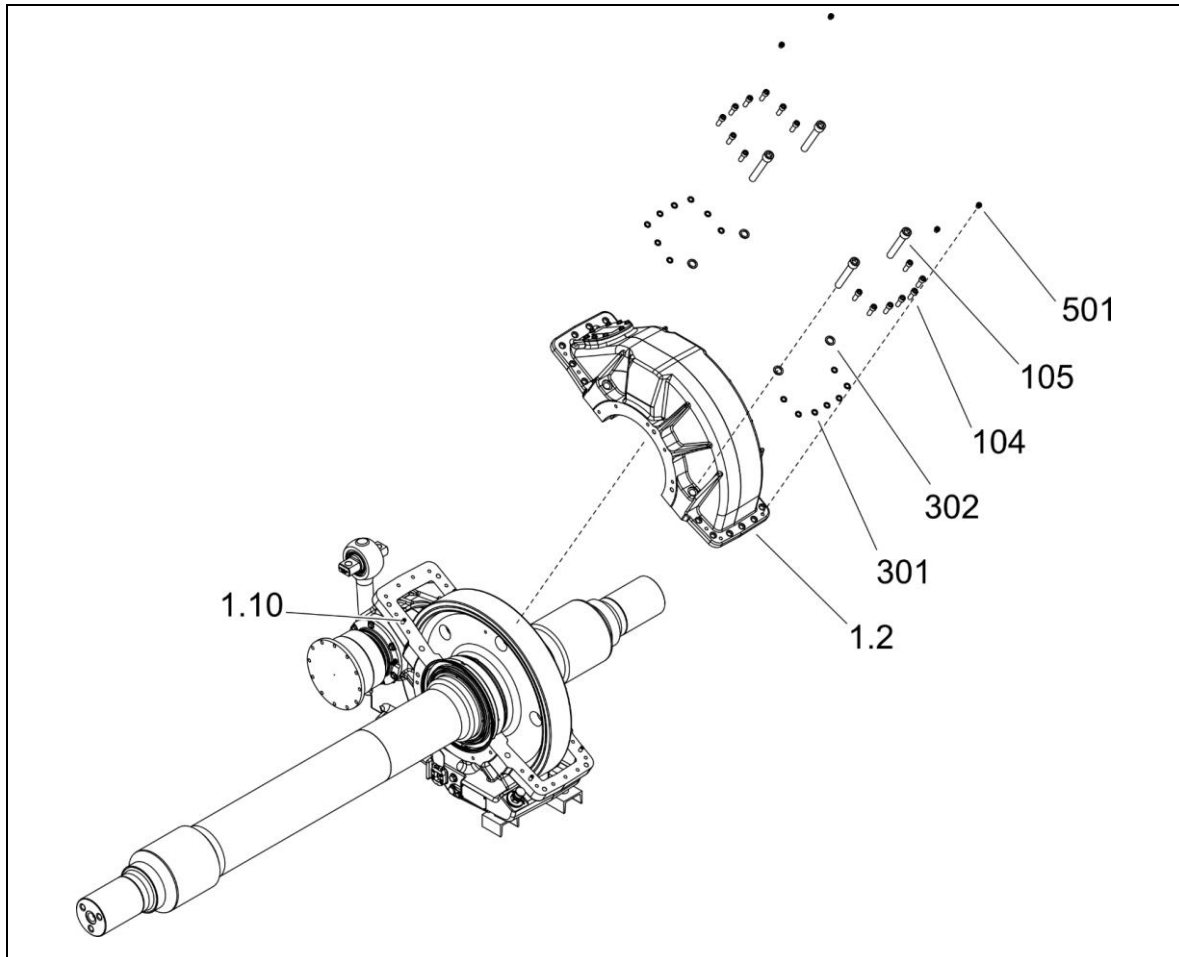


Figure 19: Demounting the wheelset shaft from the Traction Gearbox – part 2

- 7 If not already installed, remove four screw plugs (501) and install two 3D lifting rings.
- 8 Remove the fifteen protection caps (503) from the hexagon socket head cap screws (104).
- 9 Remove the fifteen hexagon socket head cap screws (104) and the associated Nord-lock washers (301).
- 10 Remove the four protection caps (504) from the hexagon socket head cap screws (105).
- 11 Remove the four the hexagon socket head cap screws (105) and the associated Nord-lock washers (302).
- 12 Bring the hoisting device in position.
- 13 Use two ejector screws (M12) in place of the screw plugs (501) and release the cover (1.2) of the gear box housing.



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14 Carefully lift the cover of the gear box housing taking care of the four cylinder pins (1.10) and place it on safe place.

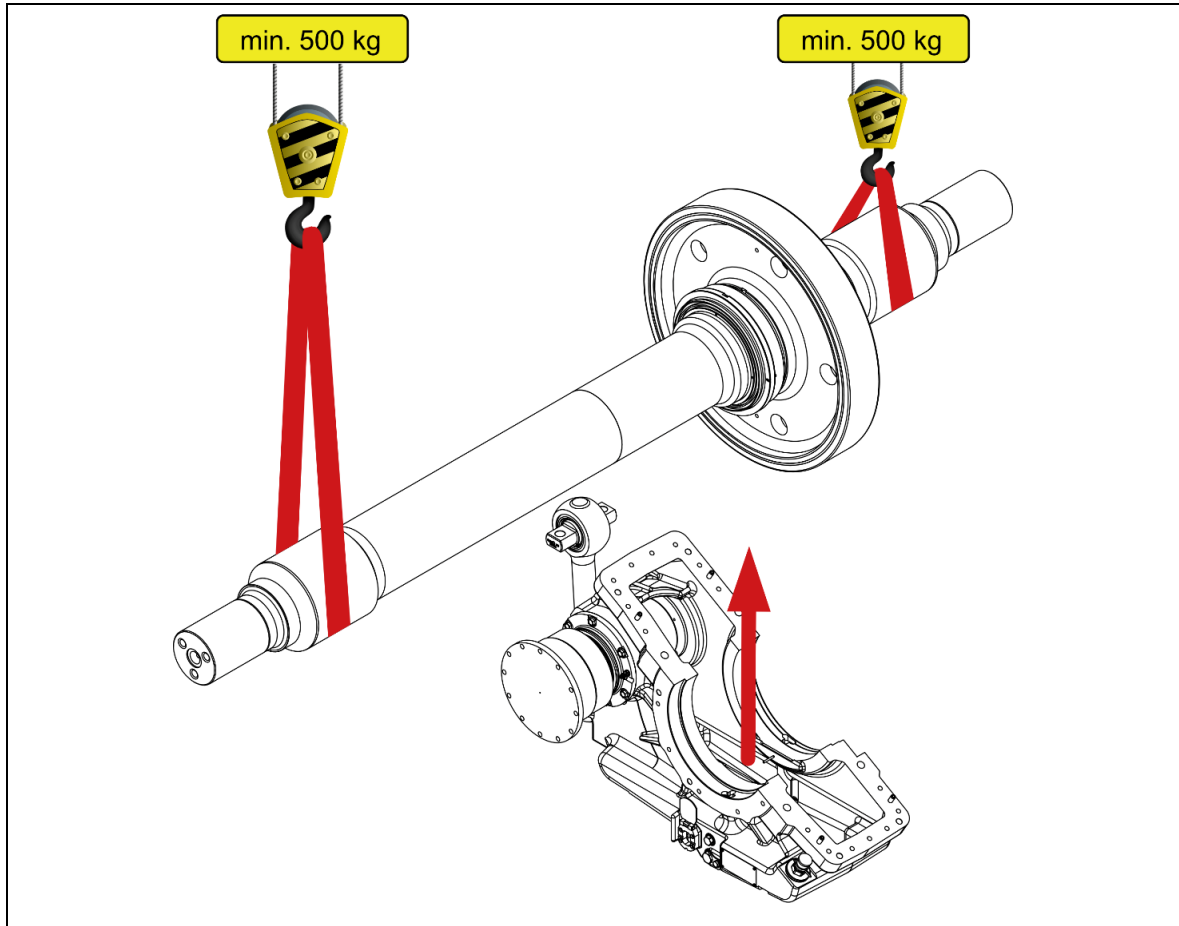


Figure 20: Removing the wheelset shaft from the Traction Gearbox

15 Lift the wheelset shaft out of the gearbox housing and place it onto the support for wheelset shaft.

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## 8.5.6 Removing LS-part from wheelset shaft

Preliminary work:	Remove wheelset shaft from Traction Gearbox (see <a href="#">section 8.5.5</a> )
Tools:	Induction heater with demagnetization and temperature probe
Consumables:	-
Required manpower:	1 Mechanic and 1 Assistant
Intervals:	Every 300,000 km

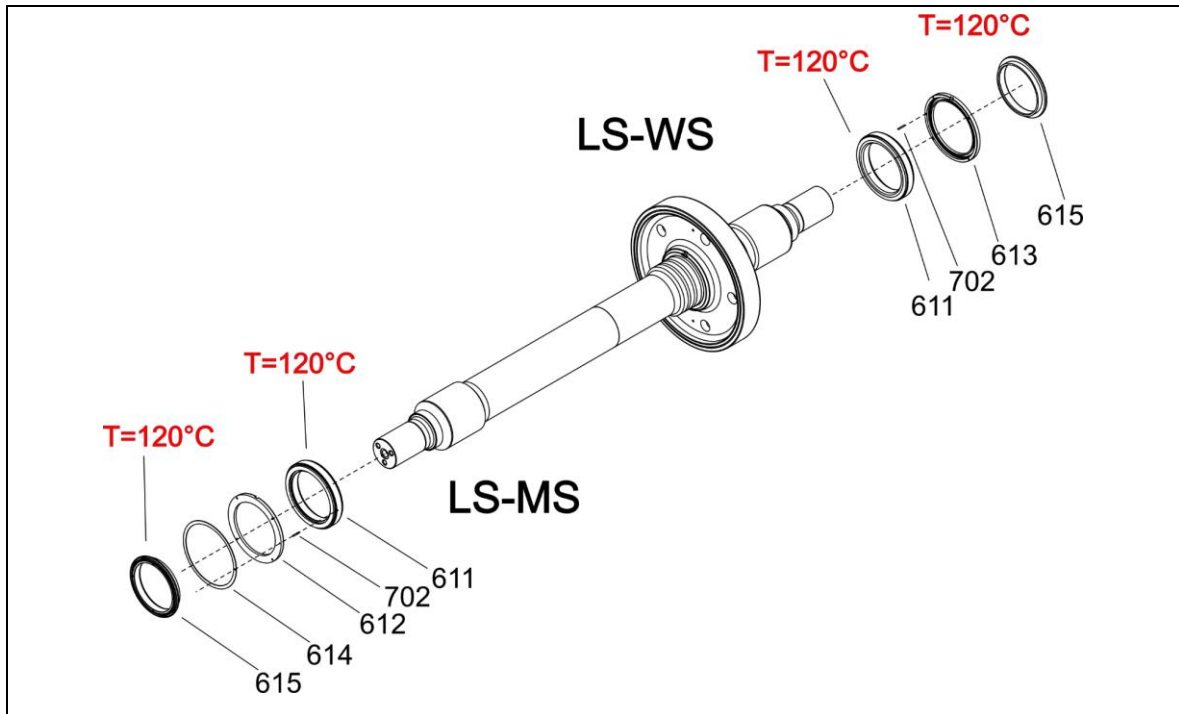


Figure 21: Removing the wheelset shaft from the Traction Gearbox

### Dismantling LS-MS parts

- 1 Remove the adjustment sheet LS (614) and the retaining disc LS-MS (612).
- 2 Check the cylinder pin (702) for damages and replace if necessary.
- 3 Remove the outer ring of the taper roller bearing (611).

**WARNING!**

#### RISK OF BURNS!

Risk of burns due to heated components.

- ▶ Wear appropriate heat resistant and protective gloves

- 4 Heat the slinger ring LS (615) to max. 120 °C and pull off the slinger ring.
- 5 Heat the inner ring of the taper roller bearing (611) to max. 120 °C and pull off the taper roller bearing (611).

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## Dismantling LS-WS parts

- 1 Remove the retaining disc LS-WS (613).
- 2 Check the cylinder pin (702) for damages and replace if necessary.
- 3 Remove the outer ring of the taper roller bearing (611).



### **WARNING!**

#### **RISK OF BURNS!**

Risk of burns due to heated components.

- ▶ Wear appropriate heat resistant and protective gloves

- 4 Heat the slinger ring LS (615) to max. 120 °C and pull off the slinger ring.
- 5 Heat the inner ring of the taper roller bearing (611) to max. 120 °C and pull off the taper roller bearing.

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## 8.5.7 Removing main gear from wheelset shaft

Preliminary work:	Remove LS-parts from wheelset shaft (see <a href="#">section 8.5.6</a> )
Tools:	Assembly device T1 High pressure pump for glycerine
Consumables:	Glycerine
Required manpower:	1 Mechanic and 1 Assistant
Intervals:	Only if necessary



### NOTE

#### RISK OF DAMAGE!

The main gear should be pressed off the wheel set shaft only for special causes, e.g. damaged main gear or damaged wheel set shaft.

- ▶ If possible, the main gear and the wheel set shaft should not be parted during planned maintenance.

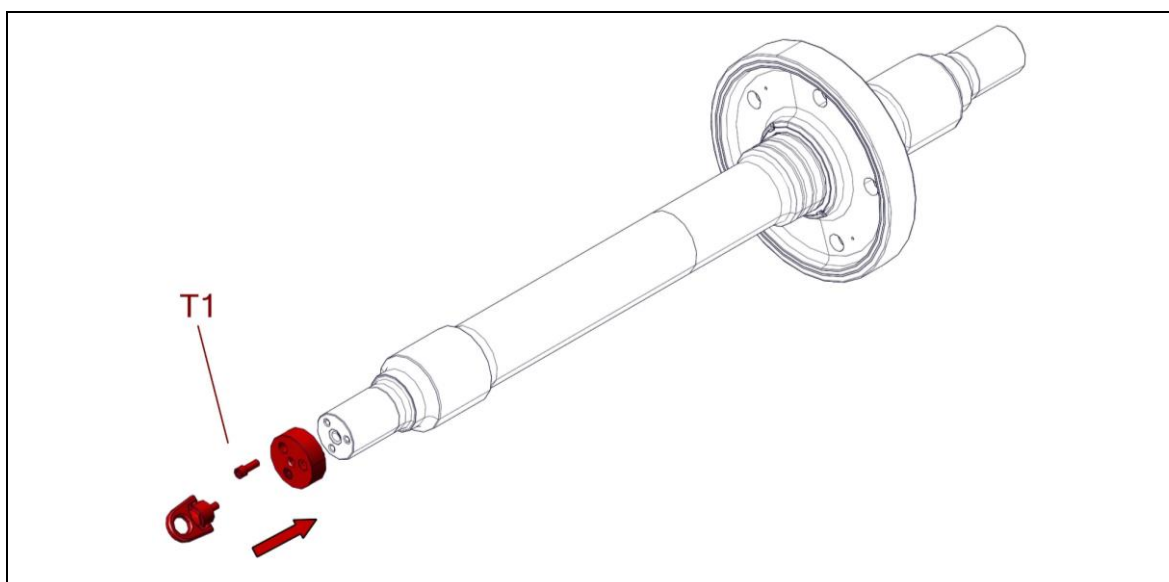


Figure 22: Installing shaft lifting device (part of T1) to the wheelset shaft

- 1 Fasten the lifting device with the three hexagon socket head cap screws to LS-MS of the wheelset shaft.
- 2 Screw in the 3D lifting ring completely into the lifting device.

**WARNING!****RISK OF INJURY – HEAVY WEIGHTS!**

Use adequate hoisting devices for lifting and transporting the wheelset shaft and the main gear.

- ▶ Mass of main gear approximately 104,3 kg
- ▶ Mass of wheel set shaft approximately 500 kg

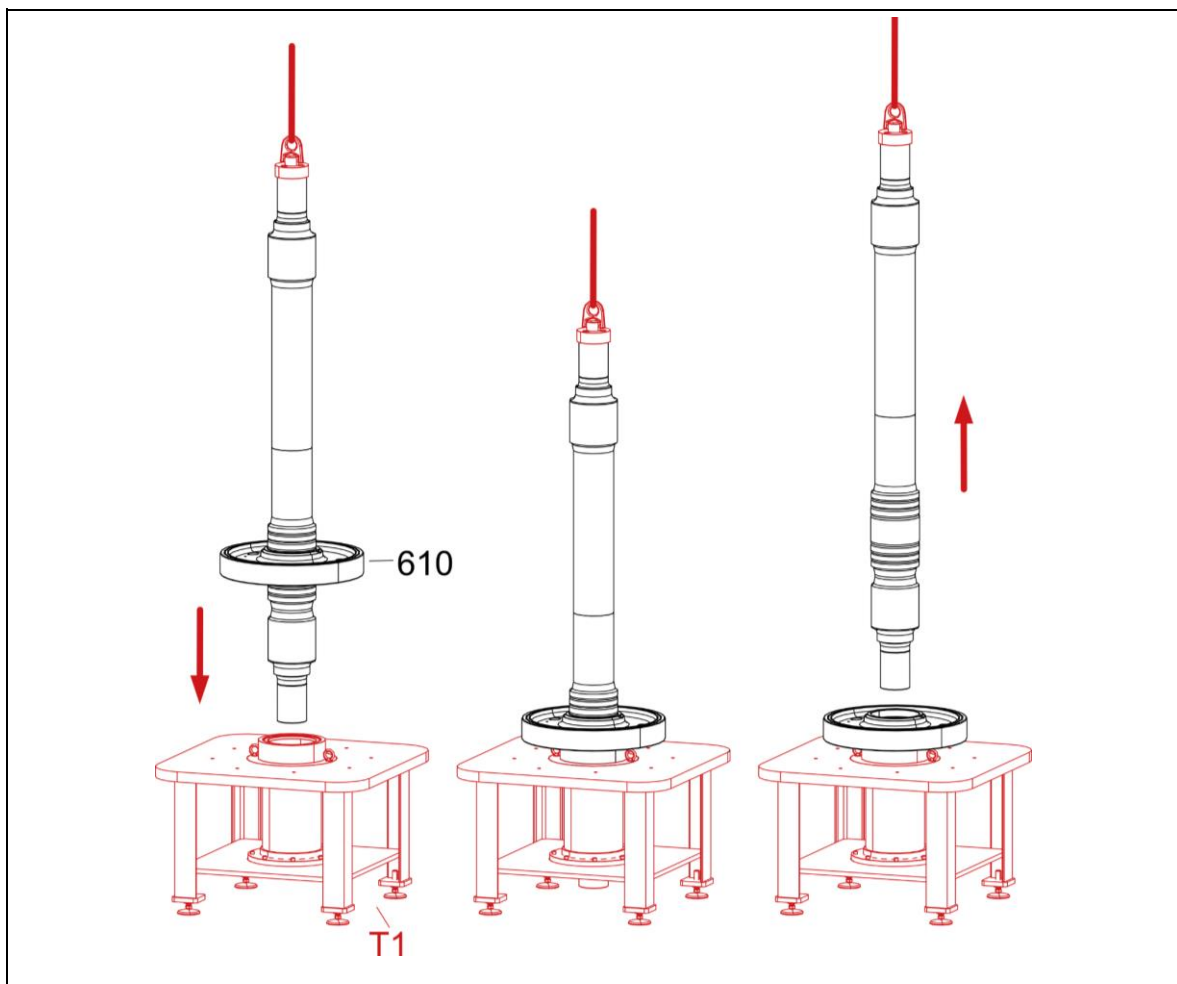


Figure 23: Removing the main gear from the wheelset shaft

- 3 Lift the wheelset shaft and lower it into the assembly device T1.
- 4 Leave the wheelset shaft hanging on the hoisting device.
- 5 Expand the main gear (610) with the help from a high-pressure pump (with glycerine).
- 6 It is important that the main gear (610) will be expanded slowly. At the same time press out the shaft slowly till both pressure channels can be seen.
- 7 Pull out the shaft from the main gear (610) to overcome the remaining overlapping.

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## 8.5.8 Removing coupling half

Preliminary work:	Remove wheelset shaft (see <a href="#">section 8.5.5</a> )
Tools:	High pressure pump for glycerine
Consumables:	Glycerine
Required manpower:	1 Mechanic and 1 Assistant
Intervals:	Every 300,000 km

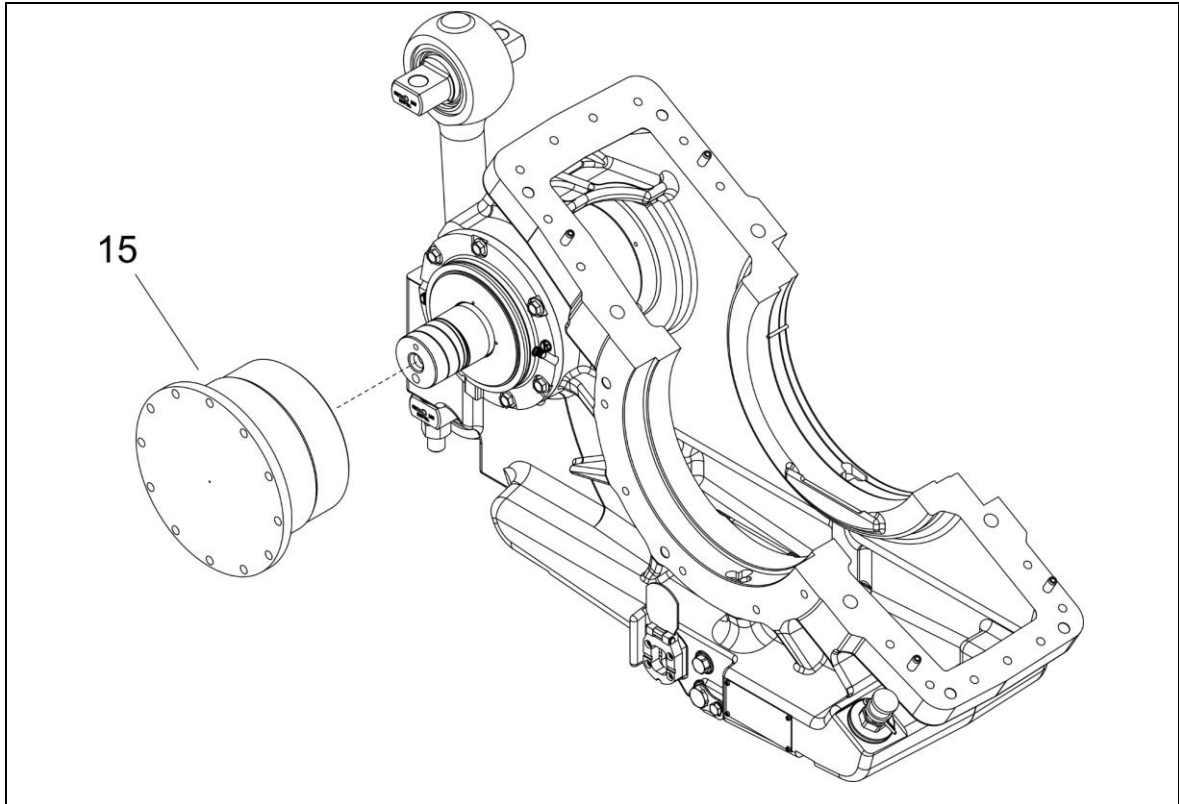


Figure 24: Removing the coupling half



### WARNING!

#### RISK OF INJURY!

Risk of injury due to coupling halves flying off.

- ▶ Therefore, only demount the coupling halve with appropriate equipment.

- 1 Demount the gear coupling half of the Traction Gearbox (15) according to the operating manual of the gear coupling (see [section 14.2](#)).
- 2 Clean loosened hub, check for damage, protect against corrosion, and set all loose parts aside for reuse.

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## 8.5.9 Removing reaction rod

Preliminary work:

Remove wheelset shaft (see [section 8.5.5](#))

Tools:

Press-out device T6

Pressing device T7

Consumables:

Glycerine

Required manpower:

1 Mechanic and 1 Assistant

Intervals:

Every 300,000 km (general inspection) or every 4 years  
or 1,200,000 km (change elastomer of drive suspension)

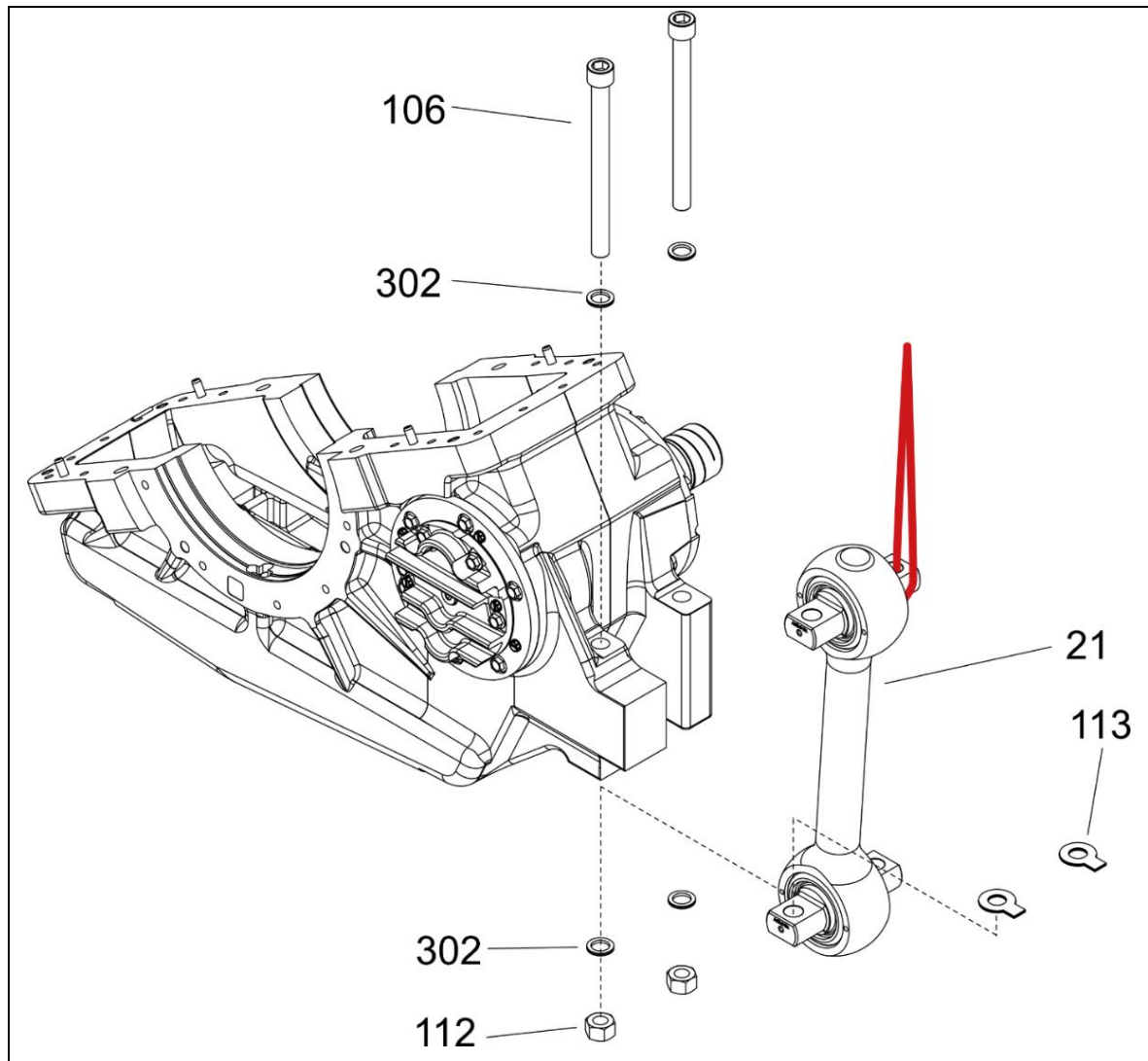


Figure 25: Removing the reaction rod from the Traction Gearbox



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## Removing the reaction rod



### WARNING!

#### RISK OF INJURY!

Weight of reaction rod approximately 18 kg.

- 1 Secure the reaction rod (21) against falling before removing the hexagon nuts (106).
- 2 Remove the two hexagon nuts (112) and the Nord-lock washers (302).
- 3 Lower the reaction rod (21) and remove the locking plates (113).
- 4 Remove the two hexagon socket head cap screws (106) and the upper Nord-lock washers (302).

## Removing the spherical bearings



To remove the reaction rod spherical bearings, see the assembly instructions - see [section 14.2](#).

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## 8.5.10 Removing HS-parts

Preliminary work:	Demounting coupling half (see <a href="#">section 8.5.8</a> ) Cleaning around the HS-WS bearing cover (3) and around the HS-MS labyrinth (12)
Tools:	Induction heater with demagnetization and temperature probe 2 threaded rods M10 4 hexagon nuts M10 Hydraulic cylinder Two-arm puller
Consumables:	Lint-free cleaning cloth
Required manpower:	1 Mechanic
Intervals:	Every 300,000 km

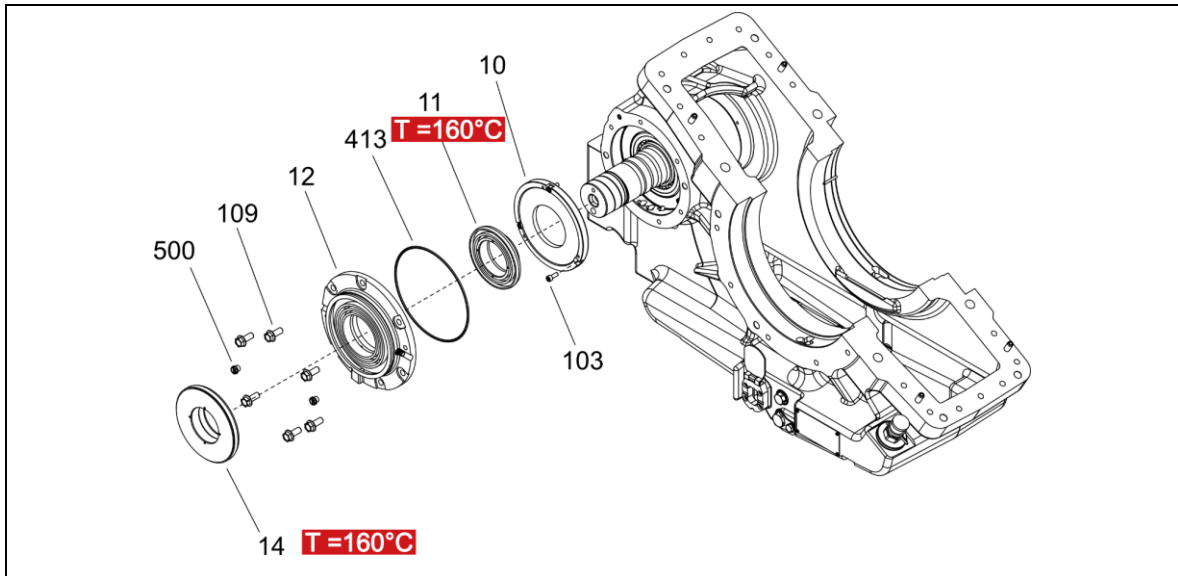


Figure 26: Removing HS-MS parts



### NOTE

#### RISK OF DAMAGE!

It is only allowed to disassemble the pre-assembled pinion from the housing if the main gear is not in the Traction Gearbox.

Otherwise, the HS-MS bearing could be damaged!

- 1 Remove the six hexagon head screws (109) of the labyrinth cover HS-MS (12).
- 2 Remove the two screw plugs (500)
- 3 Heat the slinger ring HS-MS (14) to max. 160 °C and remove it carefully.
- 4 Using four ejector screws M10, force the labyrinth cover HS-MS (12) and the slinger ring HS-MS (14) off; screw them in evenly to avoid tilting.

- 5 Remove the O-ring (413) and do not reuse (dispose accordingly).
- 6 Pull out the slinger ring HS-MS (11) with an extractor (catch into the groove or use the four threads of the slinger ring) (Heat to max. 160 °C if necessary).
- 7 Remove the three hexagon socket head cap screws (103).
- 8 Press or pull out the retaining disc HS-MS (10) over the three threaded bore holes.

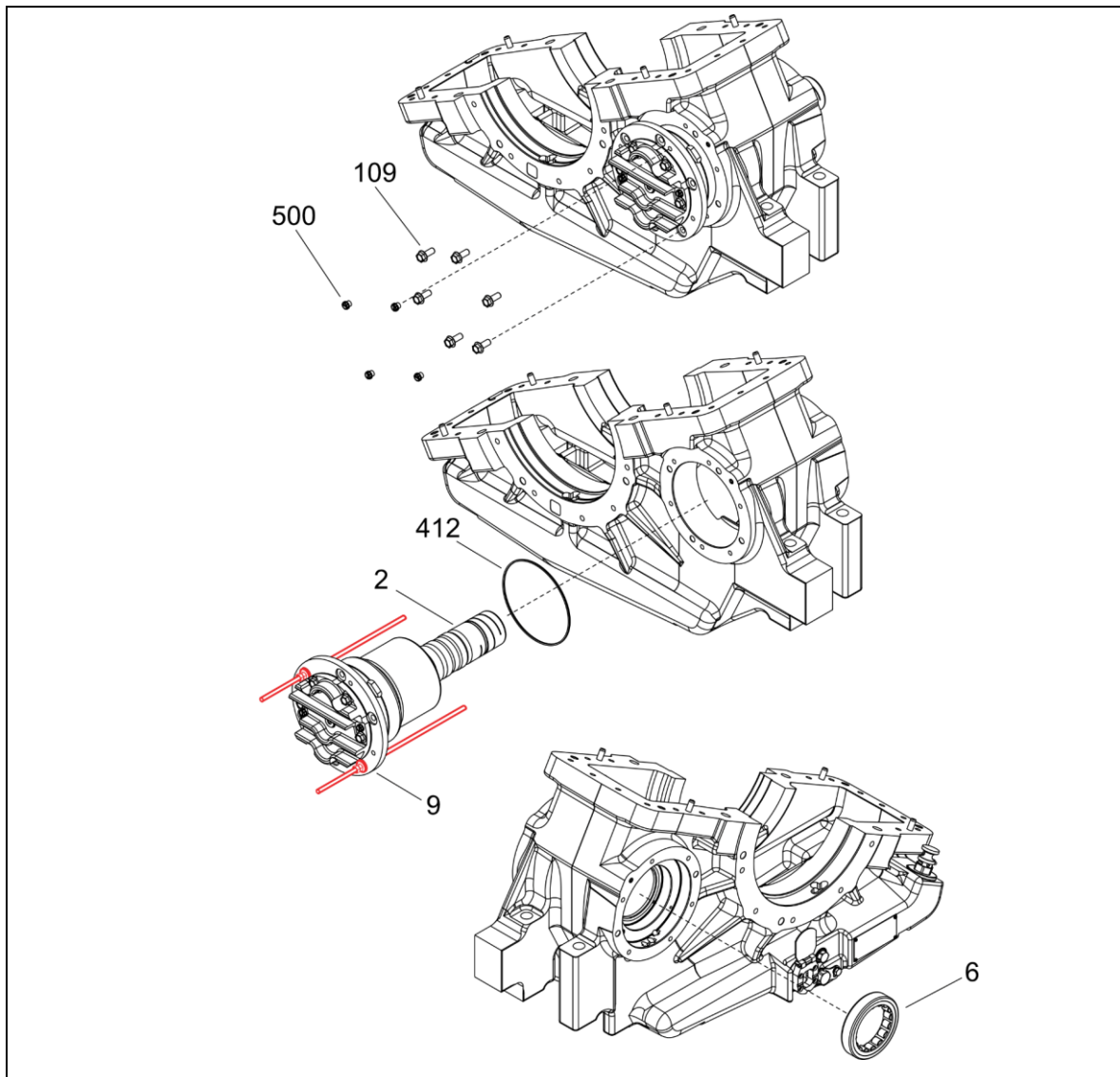


Figure 27: Removing HS-MS parts

- 9 Remove the six hexagon head screws (109) and the four screw plugs (500).
- 10 Press off the bearing cartridge HS-WS (9) with two threaded rods (M10).
- 11 Carefully remove the pinion (2), protect the tothing and press fits from damage.
- 12 Remove the O-ring (412) and do not reuse.
- 13 Pull out the cylindrical roller bearing (6) with a two-arm puller.

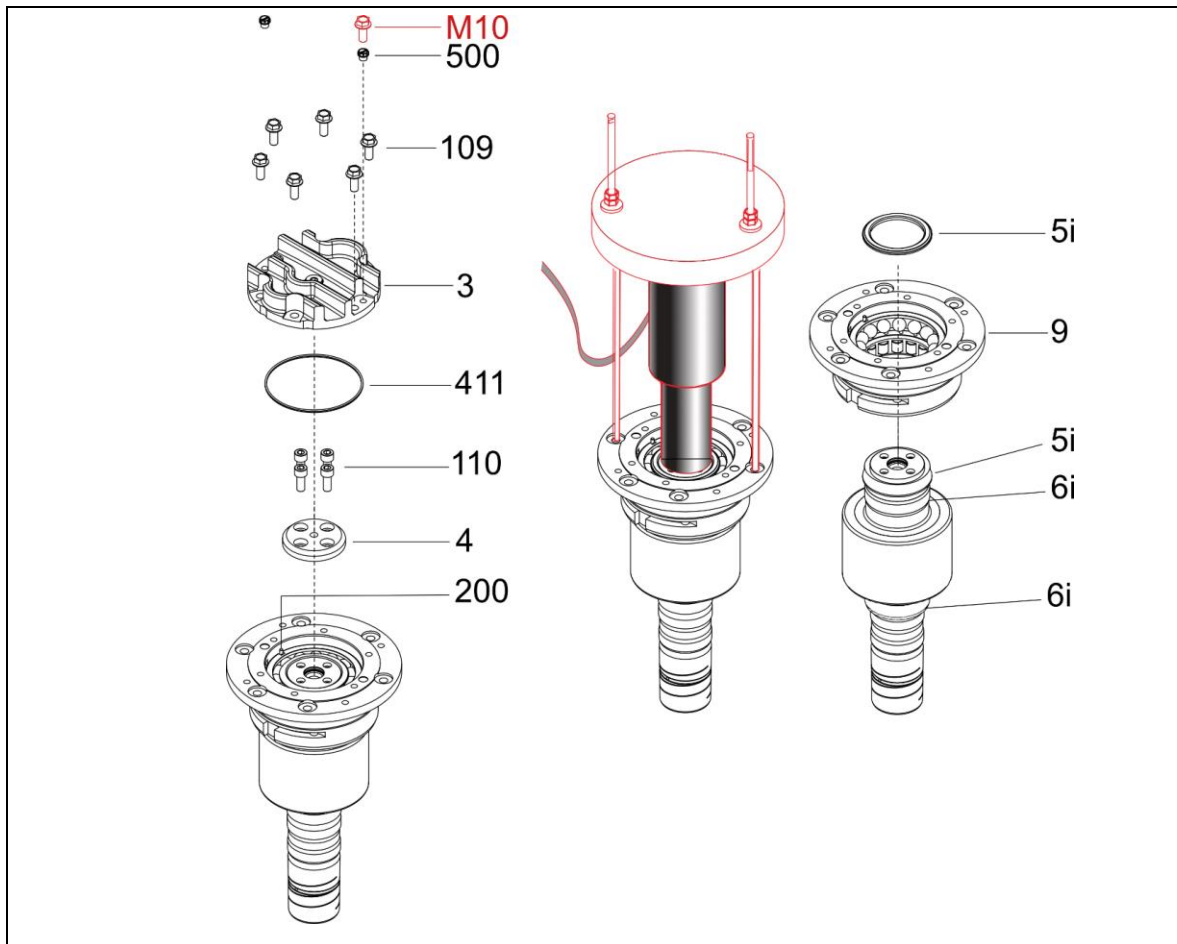


Figure 28: Removing bearing cover and bearing cartridge HS-WS

- 14 Remove the two screw plugs (500) and the six hexagon head screws (109).
- 15 Use two ejector screws M10 in place of the two screw plugs and press off the bearing cover HS-WS (3).
- 16 Remove the O-ring (411) and do not reuse.
- 17 Check the two cylinder pins (200) remaining in the bearing cover HS-WS (3) and replace if damaged.
- 18 Remove the four hexagon socket screws (110).
- 19 Remove the end plate HS-WS (4).
- 20 Use a hydraulic pressure device with traverse and thread rods and pull off the bearing cartridge HS-WS (9) together with the cylindrical roller bearing (6) and the four-point ball bearing (5).



The inner ring of the cylinder roller bearings (6i), the inner one of the splitted inner rings of the four-point ball bearing (5i) and the inner distance ring HS-WS (7) remain on the pinion.

- 21 Remove the outer one of the splitted inner rings (5i) of the four-point ball bearing from the bearing cartridge.

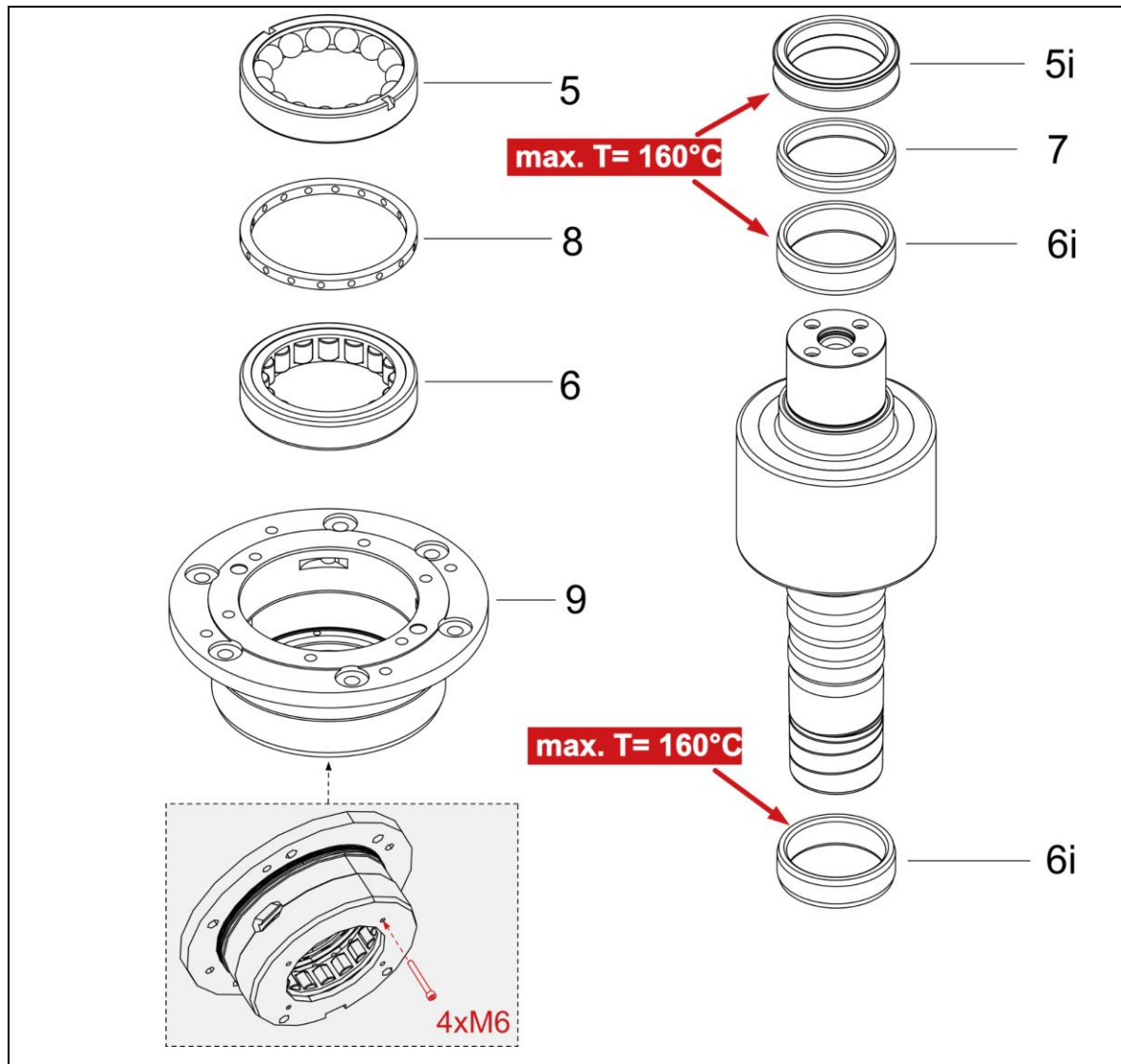


Figure 29: Removing bearing parts from bearing cartridge HS-WS and pinion

- 22 Use four ejector screws M6 to press out the four-point ball bearing (5) together with the outer distance ring (8) and the cylinder roller bearing (6) from the bearing cartridge HS-WS (9).



### WARNING!

#### RISK OF BURNS!

Risk of burns due to hot components.

- Use heat-insulating protective gloves.

- 23 Use a heat resistant shield to protect the toothing of the pinion (2).
- 24 Heat inner ring of the four point ball bearing (5i) and the inner ring of the cylinder roller bearings (6i) to max. 160 °C and pull off.
- 25 Clean all components except roller bearings and protect against corrosion. Check toothing for damage.

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## 8.5.11 Change oil level indicator

Preliminary work:	Cleaning around the oil level indicator
Tools:	-
Consumables:	Cleaning cloth Thread locker LOCTITE 243
Required manpower:	1 Mechanic
Intervals:	Every 300,000 km

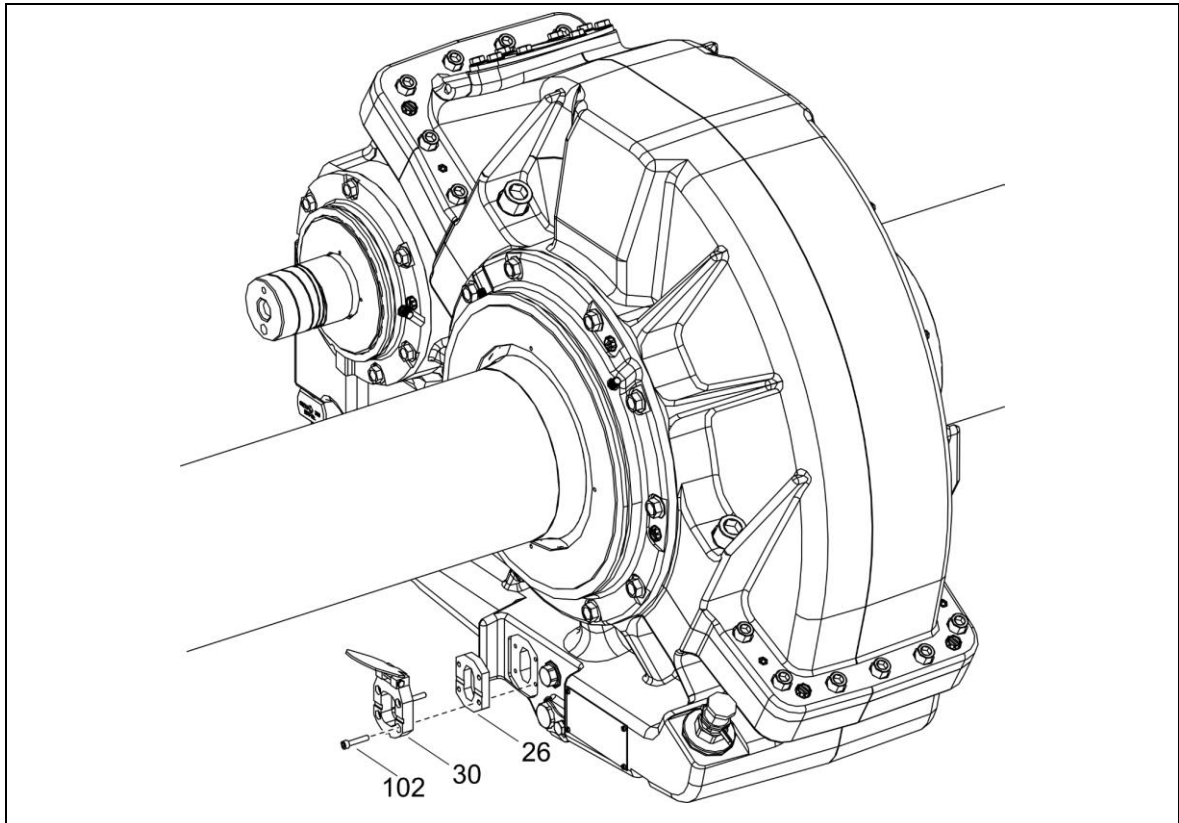


Figure 30: Change oil level indicator

- 1 Open the adapter cover of the oil sight glass protection (30).
- 2 Remove the four hexagon socket head cap screws (102), the oil sight glass protection (30) and the oil level indicator (26).
- 3 Check and replace if damaged.
- 4 Apply some thread locker to the threads of the four hexagon socket head cap screws (102).
- 5 Mount the oil level indicator (26) with oil sight glass protection (30) and fix with the four hexagon head screws (102).
- 6 Tighten the four hexagon head screws (102) with a ***tightening torque of 6 Nm.***

# GKD 1-52-372C

## 8.6 Cleaning

### 8.6.1 Introduction

In general, dry cleaning only must be carried out in normal maintenance. Frequent washing or cleaning with solvents compromises the insulation considerably more than normal dry dirt would.

Cleaning with solvents, e.g. mineral spirit is prescribed in particular in the case of oily contamination. If the Traction Drives are fully cleaned with solvents, subsequent waterproofing or repainting is necessary.



### WARNING!

#### HARMFUL TO HEALTH!

Halogenated hydrocarbons are **NOT** suitable as cleaning agents in the workplace as they pose a health hazard.

### 8.6.2 Dry cleaning

Use for Traction Gearboxes that are affected by normal levels of dirt, with either no oil deposits or light localised oil deposits. Wet Traction Gearboxes must be dried before cleaning in an oven for **12 hours** at **100 °C**.

Possible methods:

- Dry compressed air (with oil separator) and vacuum cleaner.
- Plastic brushes.
- Cleaning rags that must be changed frequently, etc.



### CAUTION!

#### RISK OF DAMAGE!!

Using mechanical tools may cause damage to the winding.

- ▶ Do not use mechanical tools (such as spatulas or scrapers).



### 8.6.3 Wet cleaning



One of the following cleaning methods must be chosen for wet cleaning (follow order):

- Dry ice
- Washing by hand
- Wet cleaning only with soft water spray at a pressure of **0.5 bar**, minimum duration (a few minutes in total) and a water temperature between **+10 °C** and **+40 °C**.

Any cleaning method not expressly permitted must be checked with **TRAKTIONSSYSTEME AUSTRIA GmbH** first.

#### Possible methods:

- Blast with compressed air (oil-free).
- Pre-wash with water or with water and detergent, soak and remove heavy dirt.
- Main wash with water and detergent.
- Rinse with water or water with anti-corrosive additives.



**CAUTION!**

#### **RISK OF DAMAGE!**

The use of high-pressure cleaning equipment is not permitted as this can damage the insulation.



**CAUTION!**

#### **RISK OF DAMAGE!**

It is **not permitted** to wash the Traction Gearbox in an industrial washing machine or immerse it completely in a water bath.

## 8.6.4 Cleaning agents

In principle, use halogen-free solvents only (see [section 8.6.4.1](#)). The aromatic content of the solvent must not exceed 30 % when cleaning silicone/rubber coatings.

Solvents containing halogens can cause stress corrosion cracking of CrNi steels (e.g. shafts) and are therefore not permitted.



### WARNING!

#### HARMFUL TO HEALTH CLEANING AGENTS!

Application by qualified specialists only!

- ▶ Solvents may contain halogens and may be toxic.
- ▶ Furthermore, for safety reasons, highly volatile solvents are not permitted for cleaning the Traction Gearbox. For example: acetone, nitro thinners and highly volatile petrol's.
- ▶ Work with solvents should only be carried out in well-ventilated rooms. Special protective measures may be necessary. In special cases, cleaning in special closed-circuit systems is appropriate.
- ▶ The safety regulations of the respective countries must be observed.



### CAUTION!

#### POLLUTION OF THE ENVIRONMENT!

Spent cleaning fluids must not be allowed to enter the canalisation, otherwise damage to the environment may occur!

- ▶ The safety regulations of the respective countries must be observed.
- ▶ Dispose of the used cleaning liquids according to the respective waste regulations.

Use as a supplement to dry cleaning in case of oily soiling and for repair objects, if the washing procedure cannot be applied. Re-impregnation and/or re-varnishing of the windings after cleaning is necessary.

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Cleaning procedure:

- Pre-clean mechanically (see [section 8.6.2](#)).



**CAUTION!**

## RISK OF DAMAGE!

It is **not permitted** to wash the Traction Gearbox in an industrial washing machine or immerse it completely in a water bath.

- Apply the cleaning agent with a brush, spray, etc. - Application time five to max. 10 minutes.
- Wiping with a cloth or rinsing with the cleaning agent max. 5 minutes.
- Oven drying

### 8.6.4.1 Permissible cleaning agents and solvent (involves cleaning with dry ice)

Mineral spirits: halogen-free, non-volatile, combustible

Density:	0.76 – 0.8 g/cm <sup>3</sup>
Boiling range:	140 – 200 °C
Abel-Pensky flash point:	> 21 °C
Aromatic content:	20 ±5 vol. %
Hazard class in accordance with DIN 51755:	A II
Poison category (CH):	4 – 5 depending on aromatic content
Xylol:	CHR (chemically pure)

Mineral spirits: halogen-free, medium volatility, combustible

Density:	0.86 – 0.87 g/cm <sup>3</sup>
Boiling range:	138 – 143 °C
Abel-Pensky flash point:	20 – 25 °C
Hazard class in accordance with DIN 51755:	A I
Poison category (CH):	4

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## 8.6.4.2 Not permissible cleaning agents and solvent



### CAUTION!

#### RISK OF DAMAGE!

Cleaning agents and solvents like **trichloroethane**, **trichloroethylene**, **perchloroethylene** and **fluorinated solvents** are not recommended.

If in doubt, contact our technicians for advice.

## 8.6.4.3 Cleaning with dry ice

Dry ice pellets or dry ice snowflakes are accelerated up to an **approximate speed of 150 m/s** with the aid of a dry ice blasting machine and strike the object to be cleaned. They trigger an isolated thermal shock when they strike the object. This temperature shock causes the coating or dirt that is to be removed to contract and come loose from the base material. The coating is removed by the resulting kinetic energy.

Dry ice leaves behind no moisture residue since it immediately changes to a gaseous state upon impact. Only the stripped coating remains; no blasting media needs to be removed. The surface quality of the base material is preserved as the pellets only have a hardness of **approximately 2 Mohs** and therefore do not cause any abrasion!



### CAUTION!

#### RISK OF DAMAGE!

- ▶ Crush pellets to snow.
- ▶ Limit the pressure setting to 6 bar.
- ▶ Blast the winding at a minimum distance of **15 to 30 cm**.

Measure the insulating resistance and, if necessary, dry the stator winding.

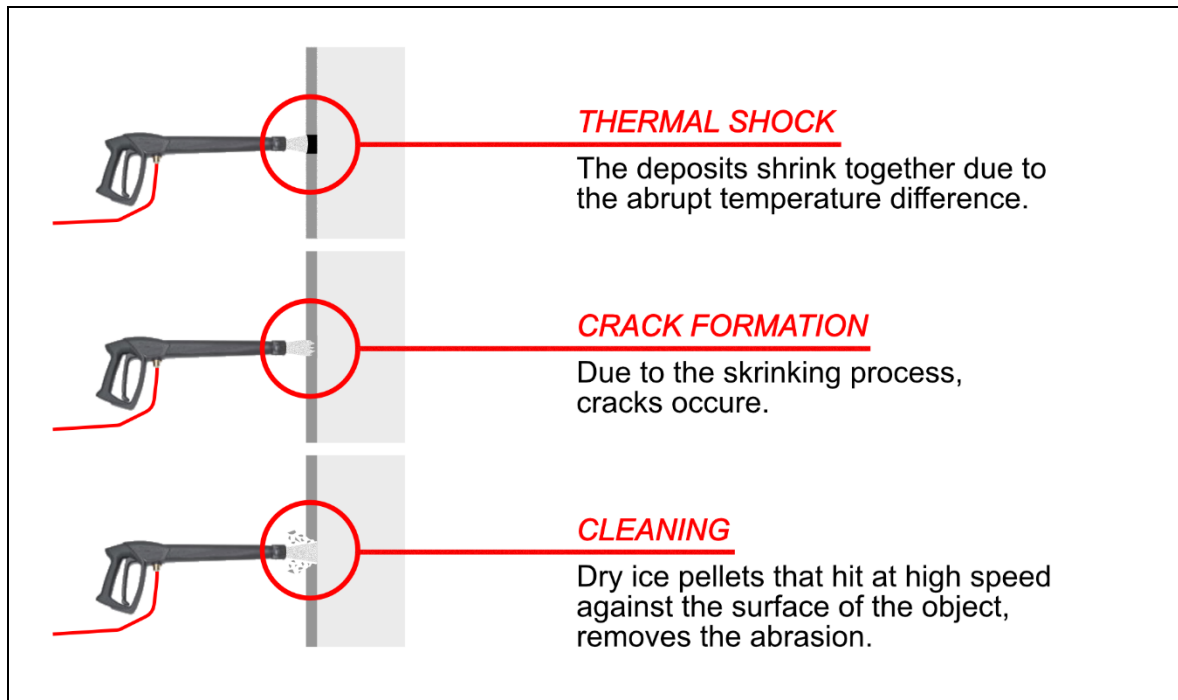


Figure 31: Dry ice cleaning

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## 8.7 Assembling Traction Gearbox



### Valid for all parts:

When dismantling, note down all serial numbers.

- ▶ When assembling, check whether the numbers correspond!

All fitting and bearing connecting surfaces as well as dismantled parts should be carefully cleaned before assembling, best by using an appropriate washing machine. If necessary: solvents, pressured air and fuzzing free cleaning cloths can be used. Remove residue of surface sealing agents, Loctite thread lockers and pipe sealing agents.

Follow specifications and instructions: Observe the specified tightening torques and the application of surface sealing agents, fitting lubricants, and thread lockers during reassembly. Make sure that the 48 hours waiting time prior the oil-filling is fulfilled.

Apply Loctite thread locker into the threaded boreholes (at least 90% coverage) for threaded blind holes and apply to bolt thread in the case of threaded through-holes.

Apply fitting lubricants (e.g., MOLYKOTE P40) to flange surface, sealing surfaces, or fitting surfaces with a paint brush or a roller. When applying them to a thread, always lubricate the blind hole to prevent them from getting under the head of the bolt.

The surfaces must then be wiped off with a lint-free cleaning cloth so that only the pores of the material are filled and a thin layer remains on the surface. If a thicker layer is needed (e.g., for increased corrosion protection), this is indicated in the relevant chapter.

Components that need to be heat-shrunk can be heated either in an oven or with inductive devices. Inductive heating is recommended since this guarantees uniform heating and prevents overheating. Cooling components in the freezer should be done over several hours, e.g., overnight.

Corrosion protection on damage areas should be renewed if necessary, according to the manufacturer's specifications.

Copper seals are subject to work hardening with every tightening procedure and may no longer have their sealing effect the next time they are used. They should be replaced each time.

All components made of elastomer materials (rubber) should be replaced during the general overhaul. This includes O-rings, flat gaskets and spherical bearings among other things.

Tightening torques: Screws must always be tightened with the tightening torques indicated.

To perform some of the maintenance and repair tasks special tools and adapters will be needed.

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## 8.7.1 Pre-assembly of the Pinion

Preliminary work:	Clean and check the pinion
Tools:	Induction heater with demagnetization and temperature measuring probe Lifting equipment (bearing capacity > 70 kg) Freezer T= -30 °C
Consumables:	Gearbox oil Servo SynGear 75W-90LL Fitting grease MOLYKOTE P40 Thread locker LOCTITE 243 Wheel Mount LOCTITE 609 Dry ice
Required manpower:	1 Mechanic
Intervals:	Every 300,000 km



### WARNING!

#### RISK OF BURNS/FREEZING!

Risk of burns/freezing due to heated/cooled components.

- ▶ Wear appropriate protective gloves.



### NOTE

#### RISK OF DAMAGE!

Always pay attention to condensation during assembly involving cooling.

- ▶ Do not clean new bearings.
- ▶ Cool at least 2 hours in the freezer in the original oil paper packaging.
- ▶ Treat with gearbox oil or rust-protection oil immediately after assembly, since otherwise condensation will attack the raceways between the rings and rollers.
- ▶ It's only allowed to take bearings from one supplier per shaft.



Matching parts of a roller bearing must always be installed. Switching individual bearing components between bearings is not permitted.



**NOTE****RISK OF DAMAGE!**

- The stage 1 pinion must be vertical during installation to ensure that the press fits are joined correctly.

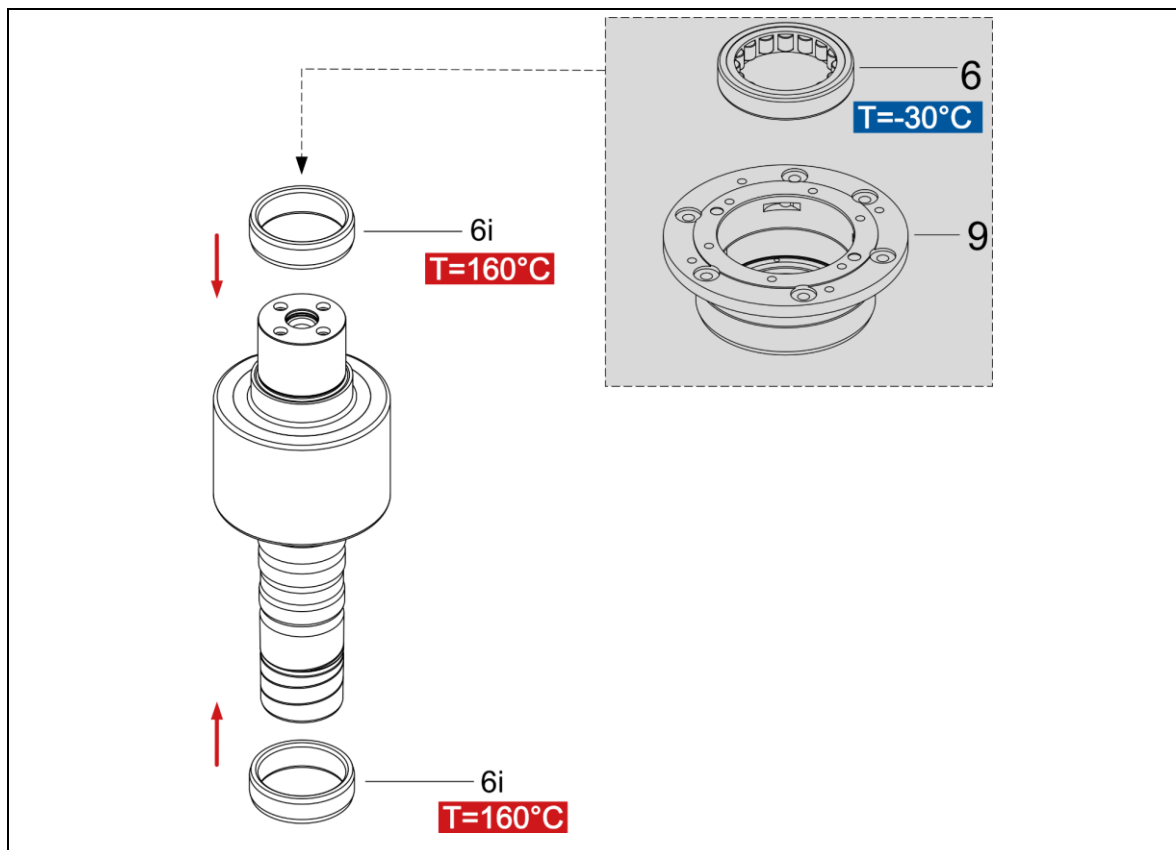


Figure 32: Installing the bearing inner rings to the pinion

- 1 Turn the pinion (2) in vertical position.
- 2 Heat the inner rings (6i) of the cylinder roller bearings (6) to 160 °C and place them on the pinion (2). The inner rings must be secured axially (pressed on) until they have reached room temperature.
- 3 Cool the outer ring of the cylinder roller bearing (6) to –30 °C and press it into the bearing cartridge HS-WS (9). The cylinder roller bearing must be secured axially (pressed on) until it warms up.



The inscription printed on the bearings-outer ring has to be visible after cylinder roller bearing is mounted.

- 4 Push the bearing cartridge HS-WS (9) onto the pinion (2) taking care that the cylinder roller bearing parts slide into each other.

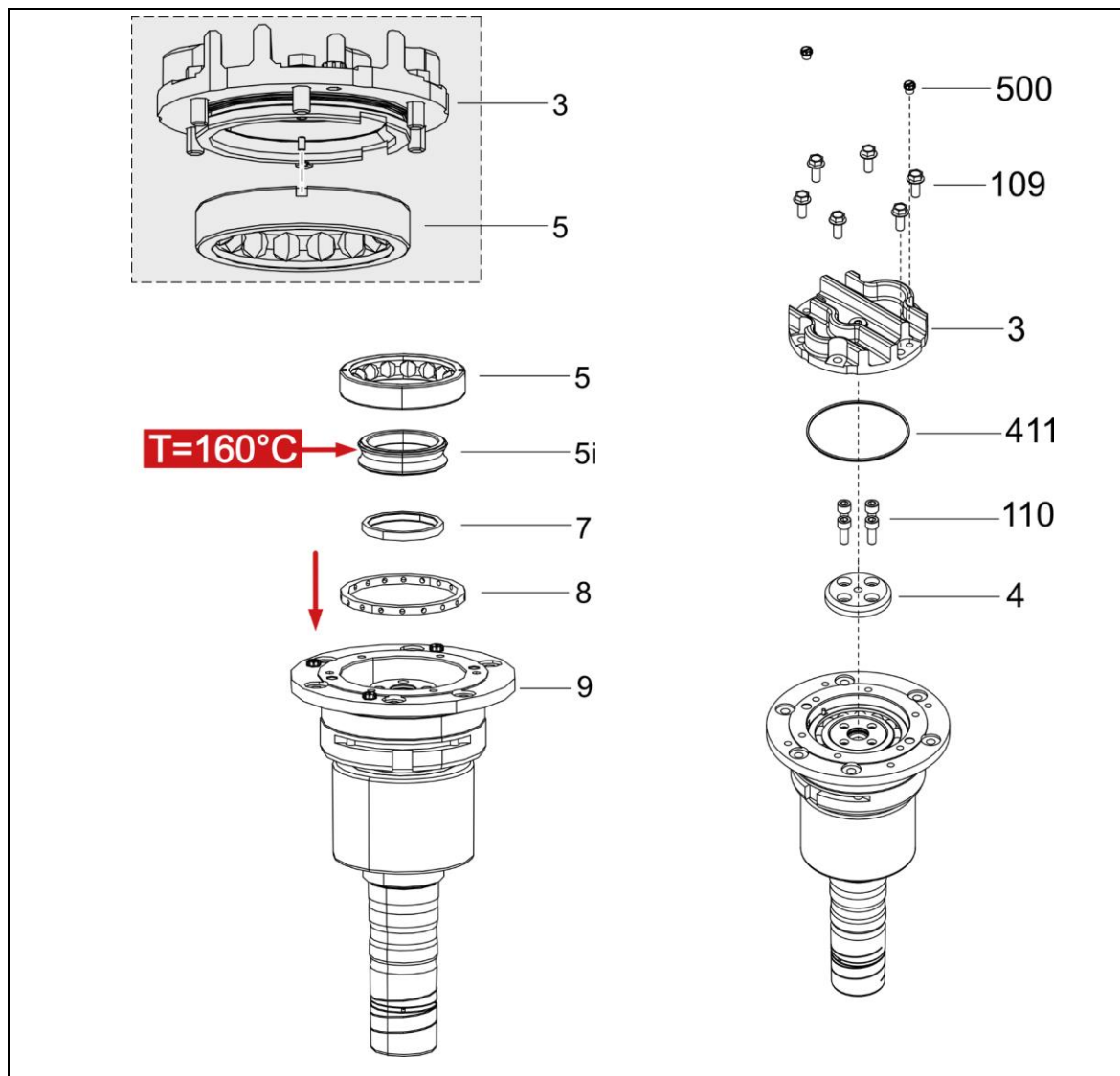


Figure 33: Mounting the four-point bearing and bearing cover

- 5 Mount the inner distance ring HS WS (7) and the outer distance ring HS-W (8).
- 6 Heat the inner ring (5i) of the four-point bearing (5) to 160 °C and place it on the pinion shaft. The inner ring must be secured axially (pressed on) until it has reached room temperature.
- 7 Put the four-point bearing (5) into the bearing cartridge (9).



The inscription printed on the bearings-outer ring has to be visible after cylinder roller bearing is mounted.

- 8 Turn the four-point bearing (5) into the correct position using the cylinder pins and the bearing cover (3).
- 9 Apply thread locker on the threads of four hexagon socket screws (110).

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- 10 Insert the end plate HS-WS (4) and secure it with four hexagon socket screws (110).
- 11 Tighten crosswise with a ***tightening torque of 38 Nm***.
- 12 Lubricate the recess for the O-ring (411) in the bearing cover HS-WS (3) with fitting grease.
- 13 Put the O-ring (411) into the recess and place the bearing cover (3) onto the bearing cartridge HS-WS.
- 14 Lubricate the threads of the six hexagon head screws (109) with fitting grease.
- 15 Fasten the bearing cover HS-WS (3) with the six hexagon head screws (109).
- 16 Tighten crosswise with a ***tightening torque of 85 Nm***.
- 17 Protect all bare surfaces against corrosion with gearbox oil.

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## 8.7.2 Mounting the Pinion to the Gearbox Housing

Preliminary work:	Pre-assemble the pinion – <a href="#">see 8.7.1</a>
Tools:	Induction heater with demagnetization and temperature measuring probe Freezer T= -30 °C Lifting equipment (bearing capacity > 150 kg) Torque wrench
Consumables:	Fitting grease MOLYKOTE P40 Thread locker LOCTITE 243 Barrier grease Klüber STABURAGS NBU 12
Required manpower:	1 Mechanic
Intervals:	Every 300,000 km



### NOTE

#### RISK OF DAMAGE!

It is only allowed to assemble the pre-assembled pinion from the housing if the main gear is not in the Traction Gearbox. Otherwise, the HS-MS bearing could be damaged!



### WARNING!

#### RISK OF BURNS/FREEZING!

Risk of burns/freezing due to heated/cooled components.

- ▶ Wear appropriate protective gloves.



### NOTE

#### RISK OF DAMAGE!

Always pay attention to condensation during assembly involving cooling.

- ▶ Do not clean new bearings.
- ▶ Cool at least 2 hours in the freezer in the original oil paper packaging.
- ▶ Treat with gearbox oil or rust-protection oil immediately after assembly, since otherwise condensation will attack the raceways between the rings and rollers.

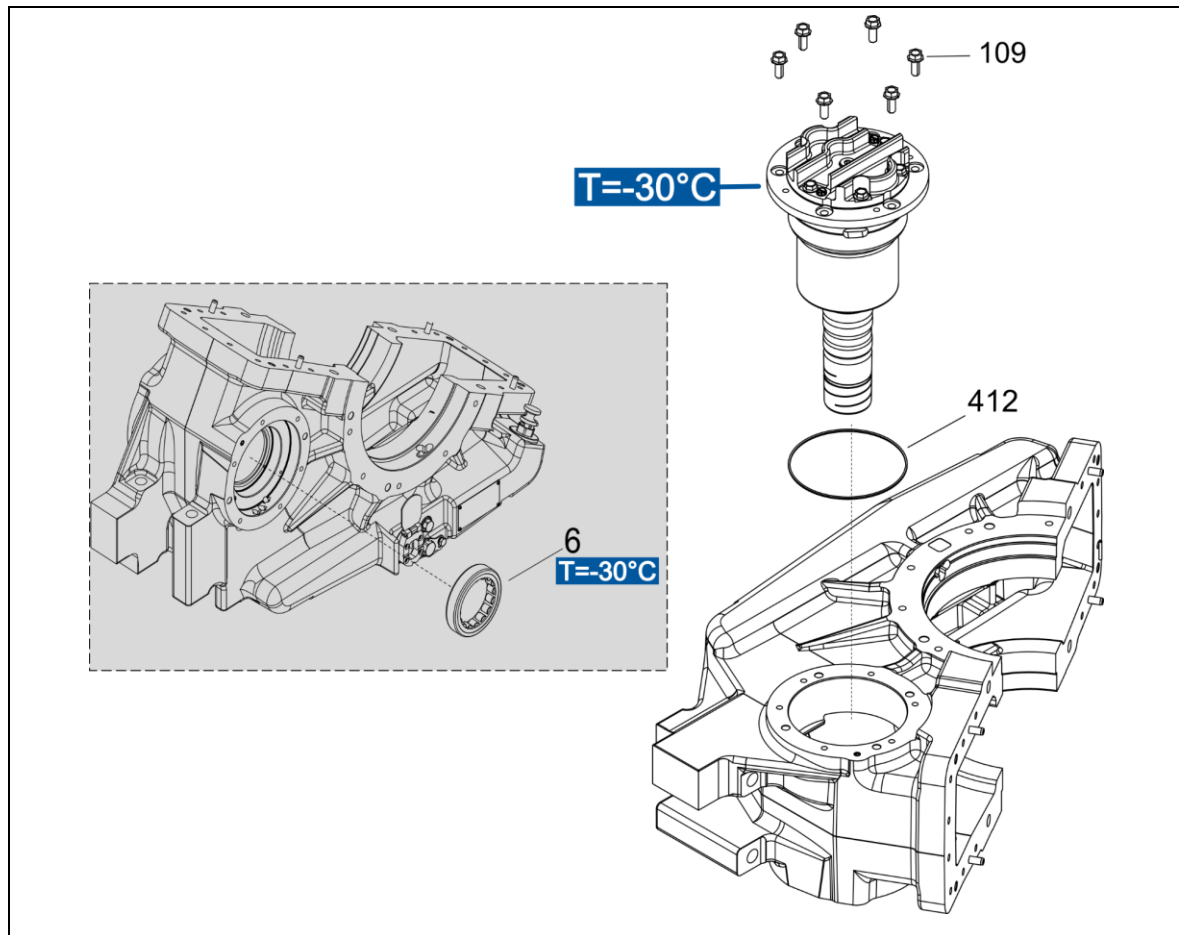


Figure 34: Mounting the pinion to the gearbox housing

- 1 Cool the outer ring of the cylinder roller bearing (6) to  $-30\text{ }^{\circ}\text{C}$  and press it into the gearbox housing. The cylinder roller bearing must be secured axially (pressed on) until it warms up.
- 2 Cool pre-mounted pinion to  $-30\text{ }^{\circ}\text{C}$ .
- 3 Lubricate the O-ring (412) with fitting grease and push it into the groove of the bearing cartridge (9).
- 4 Mount two threaded rods on the gearbox housing to align the bearing cartridge to the housing in the correct rotational position.
- 5 Push the pre-mounted pinion into the gearbox housing. When pushing it on, ensure that the motor-side cylinder roller bearing (6) will not be damaged.
- 6 Lubricate the threads of the six hexagon head screws (109) with fitting grease.
- 7 Fasten the pre-mounted pinion with the four hexagon head screws (109) to the gearbox housing.
- 8 Remove the two threaded rods from the gearbox housing and screw in the last two hexagon head screws (109).
- 9 Tighten crosswise with a *tightening torque of 85 Nm*.

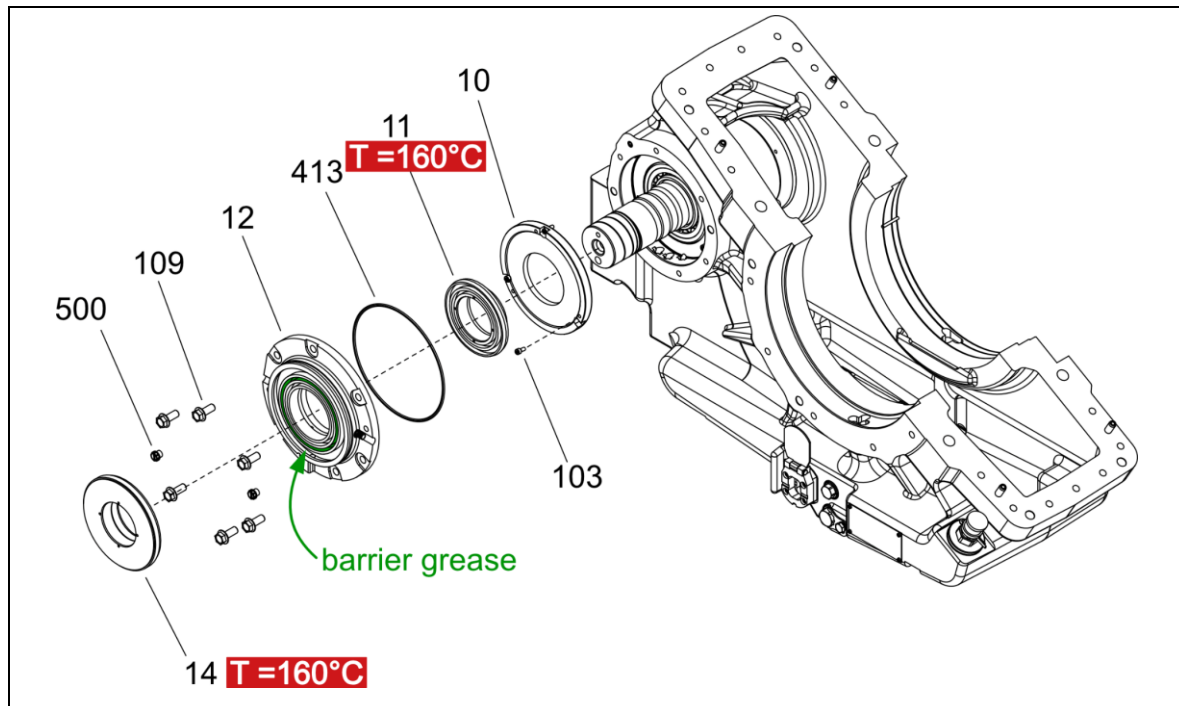


Figure 35: Mounting MS parts of the pinion

- 10 Apply some thread locker to the threads of three hexagon socket head cap screws (103).
- 11 Fasten the retaining disc HS-MS (10) with the three hexagon socket head cap screws (103).
- 12 Tighten them with a **tightening torque of 10 Nm**.
- 13 Apply wheel-mount to the joint diameter of the slinger ring HS-MS (11) on the pinion (2).
- 14 Heat the slinger ring HS-MS (11) to 160 °C and immediately push it onto the pinion shaft and hold it form closed until it has cooled down.
- 15 Coat the new O-ring (413) with fitting grease and mount it on the labyrinth cover HS-MS (12).
- 16 Coat the threads of six hexagon head screws (109) with fitting grease.
- 17 Put the labyrinth cover HS-MS (12) together with the O-ring (413) in installation position.
- 18 Apply barrier grease (20 g) to the labyrinth clearance of the labyrinth cover HS-MS (12).
- 19 Fasten the labyrinth cover HS-MS (12) with the six hexagon head screws (109) to the gearbox housing.
- 20 Tighten crosswise with a **tightening torque of 85 Nm**.
- 21 Mount the two screw plugs (500) again.
- 22 Heat the slinger ring HS-MS (14) to 160 °C and immediately push it onto the pinion shaft and hold it form closed until it has cooled down.

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## 8.7.3 Assembling the Main Gear to Wheelset Shaft

Preliminary work: -

Tools: Assembly device T1  
 Distance gauge T2  
 Induction heater with demagnetization and temperature probe  
 Lifting equipment (> 605 kg)

Consumables: -

Required manpower: 1 Mechanic

Intervals: If needed

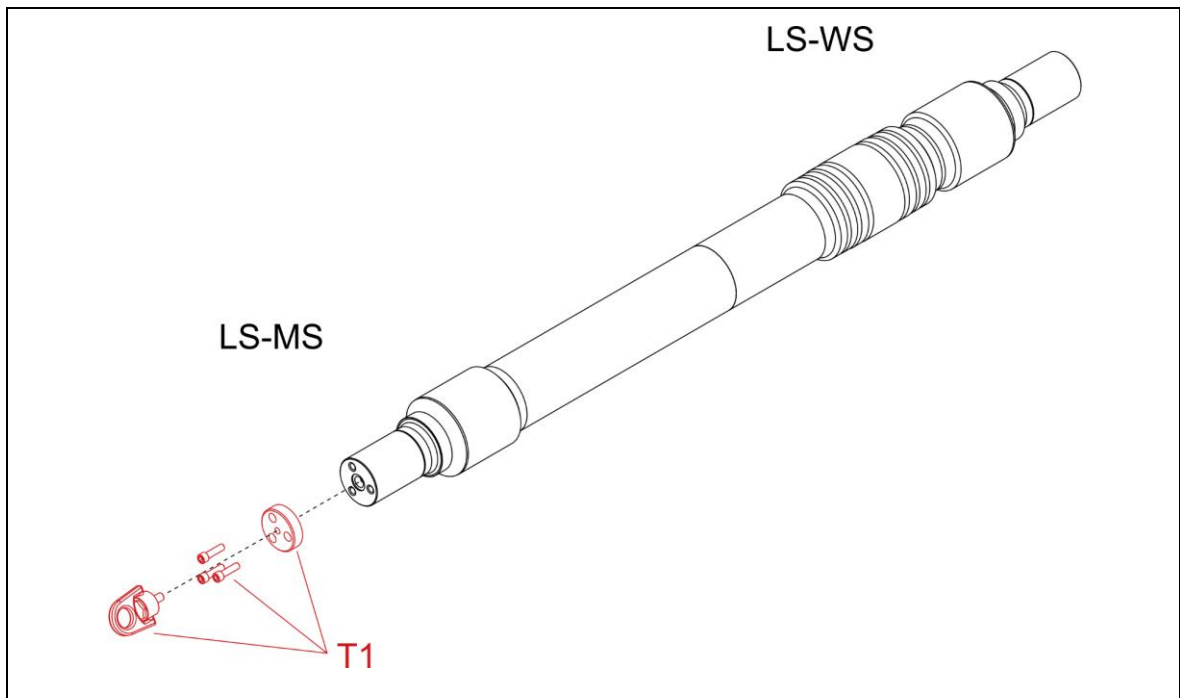


Figure 36: Installing shaft lifting device (part of T1) to the wheelset shaft

- 1 Fasten the lifting device with the three hexagon socket head cap screws to LS-MS of the wheelset shaft.
- 2 Screw in the 3D lifting ring completely into the lifting device.



### WARNING!

#### RISK OF INJURY – HEAVY WEIGHTS!

Use adequate hoisting devices for lifting and transporting the wheelset shaft and the main gear.

- ▶ Mass of main gear approximately 104,3 kg
- ▶ Mass of wheel set shaft approximately 500 kg

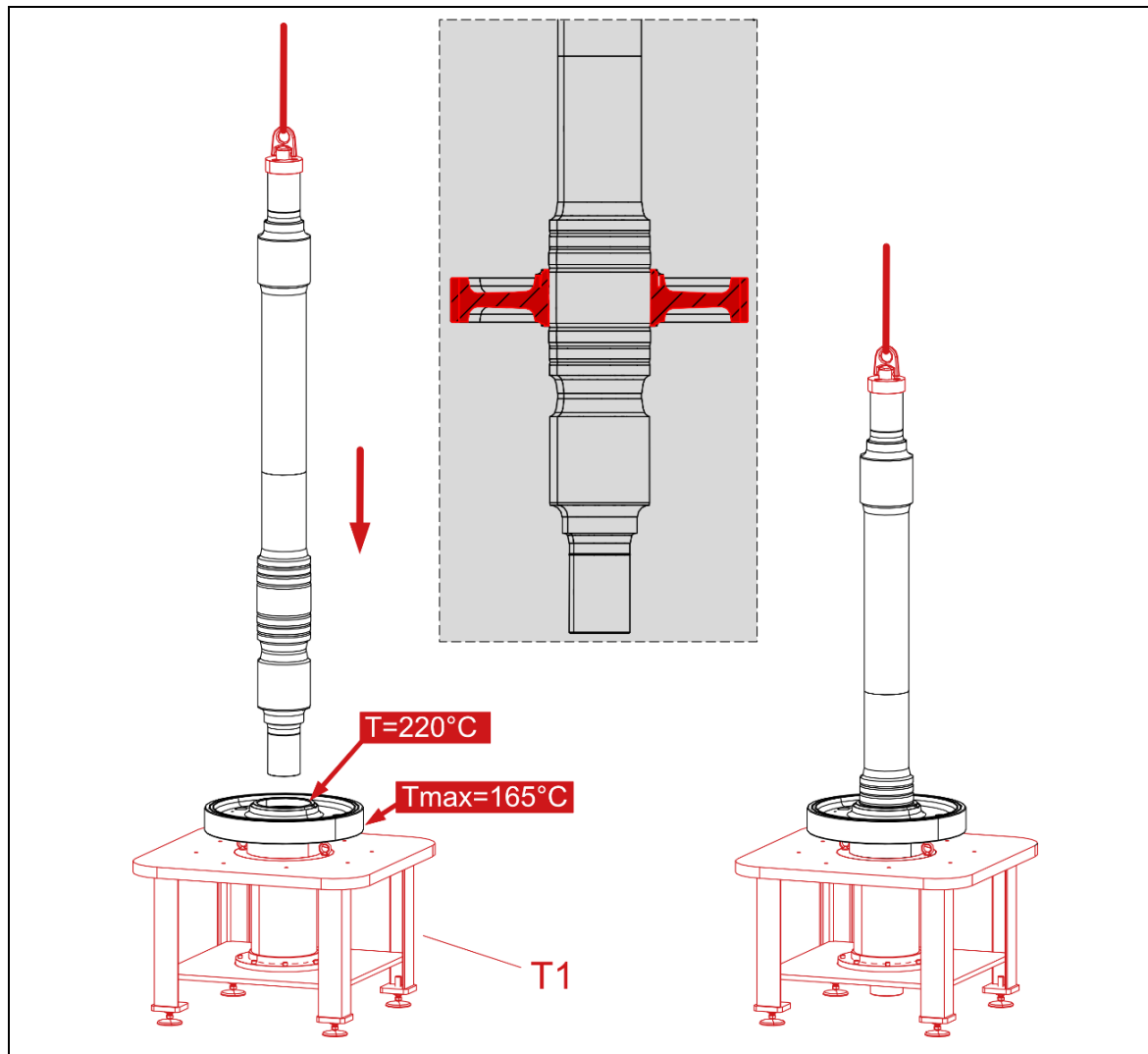


Figure 37: Mounting the main gear from the wheelset shaft

3 Heat the main gear (610) with induction heater to max. 220 °C on the hub.



### NOTE

#### RISK OF DAMAGE!

- ▶ The tooth temperature must lower than *max. 165 °C*, because a higher temperature can damage the main gear irreversible.

- 4 Place the heated main gear (610) onto the limit stop of the assembly device T1.
- 5 Lower the wheelset shaft into the main gear (610) until it reaches the stop sleeve in the assembly device T1.
- 6 Wait with the further assembly until the main gear has reached room temperature.



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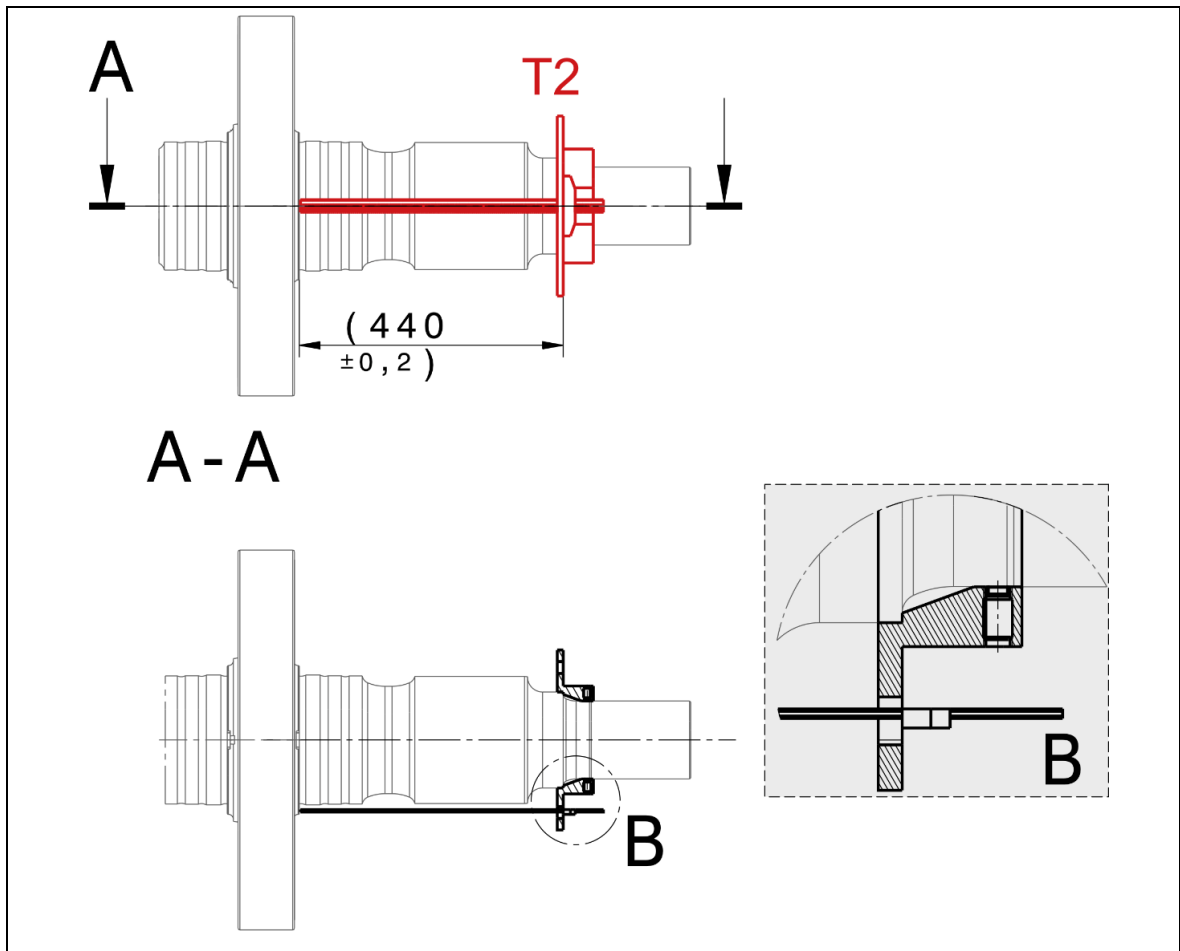


Figure 38: Measuring with distance gauge

7 Check the position of the main gear (610) using the distance gauge T2.

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## 8.7.4 Pre-assembling the Wheelset Shaft

Preliminary work:	Mount main gear to the wheelset shaft – <a href="#">see 8.7.3</a>
Tools:	Induction heater with demagnetization and temperature measuring probe Lifting equipment Torque wrench
Consumables:	Fitting grease MOLYKOTE P40 Thread locking LOCTITE 243 Wheel-mount LOCTITE 609
Required manpower:	1 Mechanic
Intervals:	Every 300,000 km



### NOTE

#### RISK OF DAMAGE!

It's only allowed to take bearings from one supplier per shaft.



### WARNING!

#### RISK OF BURNS

Risk of burns due to heated components.

- ▶ Wear appropriate protective gloves.

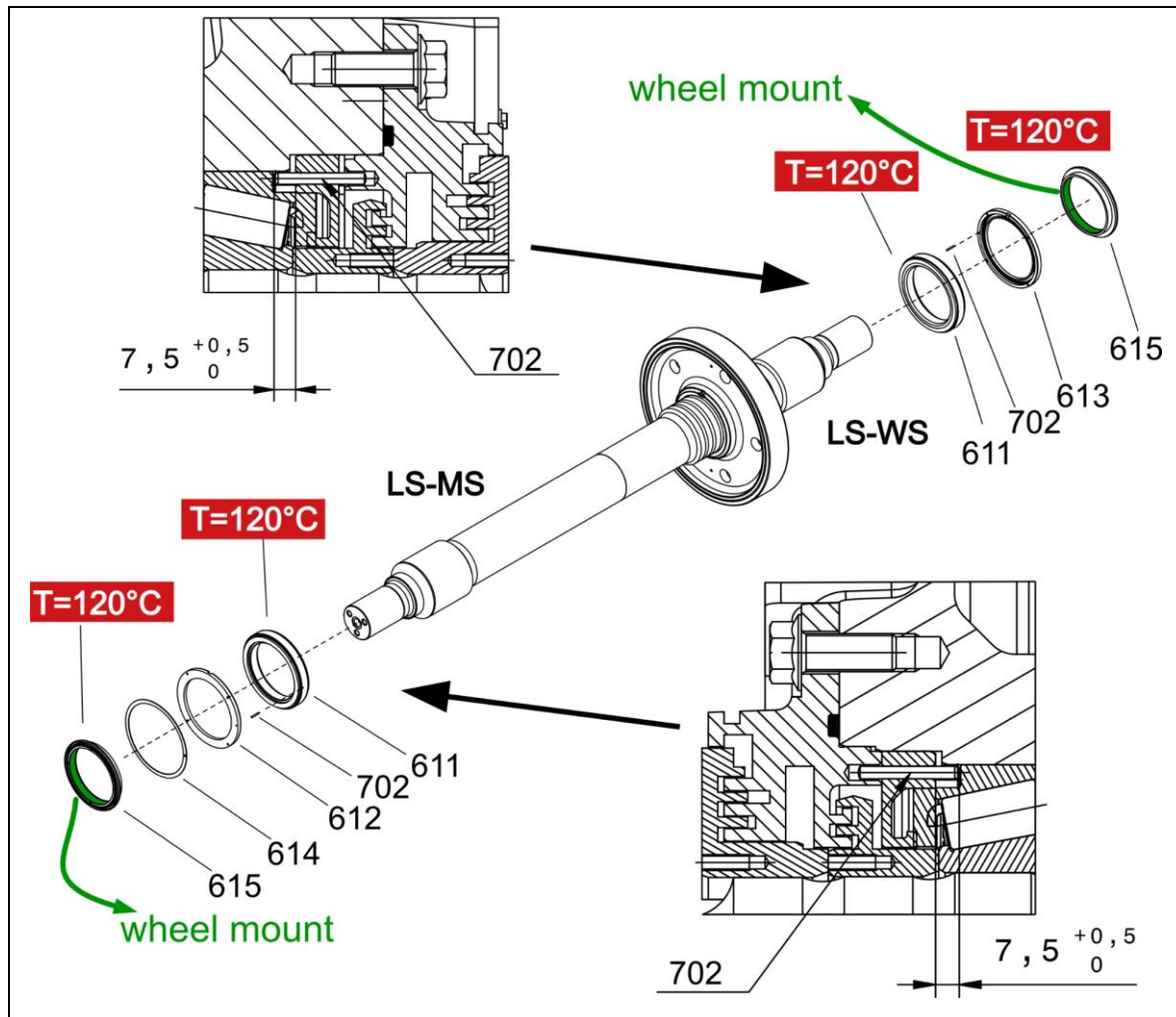


Figure 39: Pre-assembling the wheelset shaft

- 1 Heat the taper roller bearings (611) without the outer rings to max. 120 °C.
- 2 Push the taper roller bearings (611) onto the wheelset shaft and hold them form closed until they have settled and cooled down.
- 3 Push the outer rings of the taper roller bearings onto the bearing half mounted to the wheelset shaft. Taper roller bearing groove must be turned to 90°.
- 4 Check the overhang of the cylinder pins (702). Nominal size is  $7.5 \pm 0.5$  mm.
- 5 Mount the retaining discs LS-MS, LS-WS (612 and 613) taking care of the orientation.
- 6 Cover the fitting surface for the slinger rings (615) with wheel-mount.
- 7 Heat the slinger rings (615) up to 120 °C.
- 8 Push the slinger rings (615) onto the wheelset shaft and hold it form closed until it has settled and cooled down.
- 9 Install the adjustment sheet LS (614).

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## 8.7.5 Assembling the pre-assembled Wheelset Shaft to the Traction Gearbox

Preliminary work:	Pre-assemble the Wheelset Shaft – <a href="#">see 8.7.4</a>
Tools:	Lifting equipment Torque wrench
Consumables:	Fitting grease MOLYKOTE P40 Surface sealing ELRING CURIL T Wheel mount LOCTITE 609 Barrier grease Klüber STABURAGS NBU 12
Required manpower:	1 Mechanic
Intervals:	Every 300,000 km

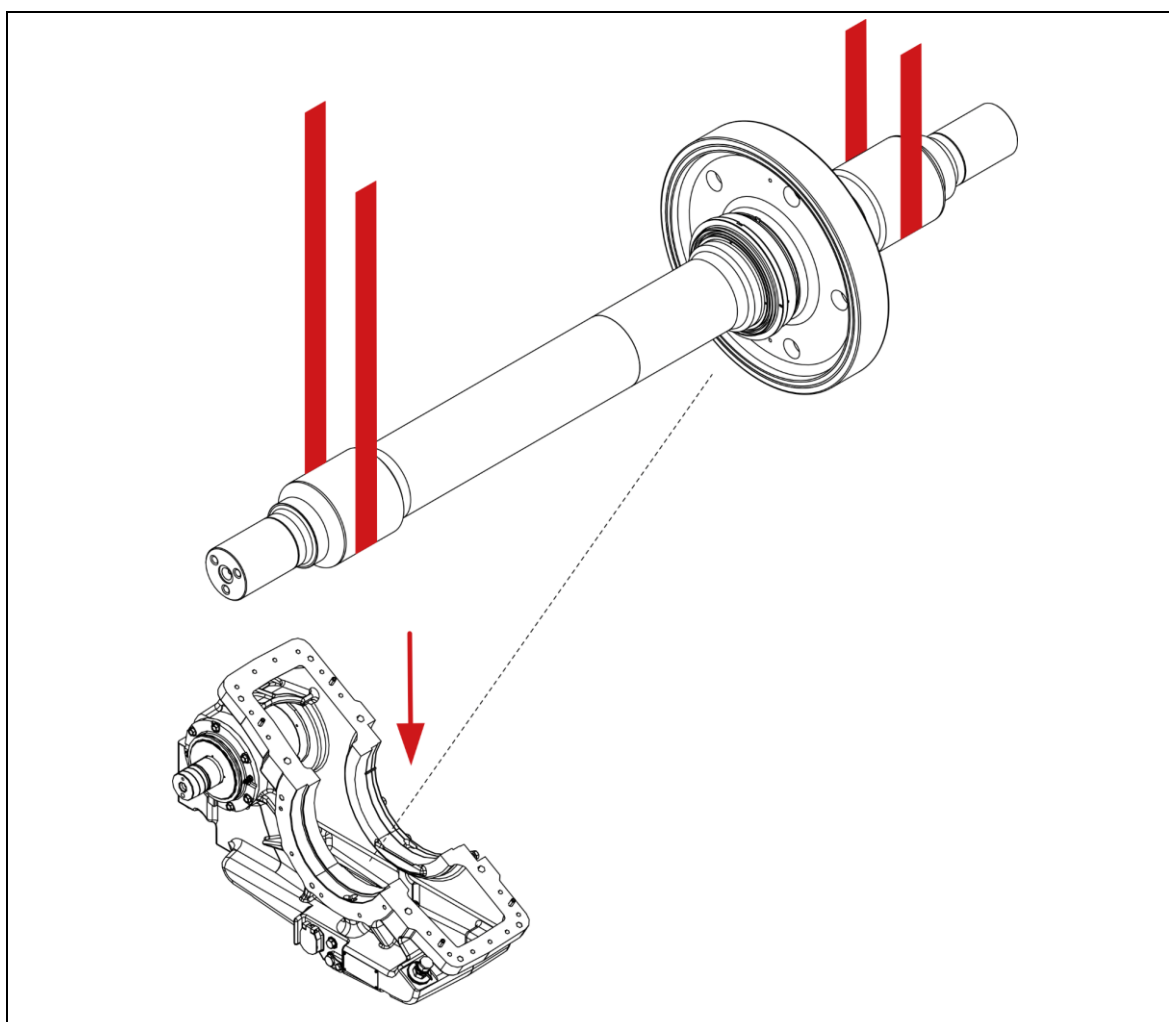


Figure 40: Lifting the pre-assembled wheelset shaft into the gearbox housing

- 1 Lift the pre-assembled wheelset shaft into the gearbox housing.
- 2 Keep the wheelset shaft hanging on the lifting device.

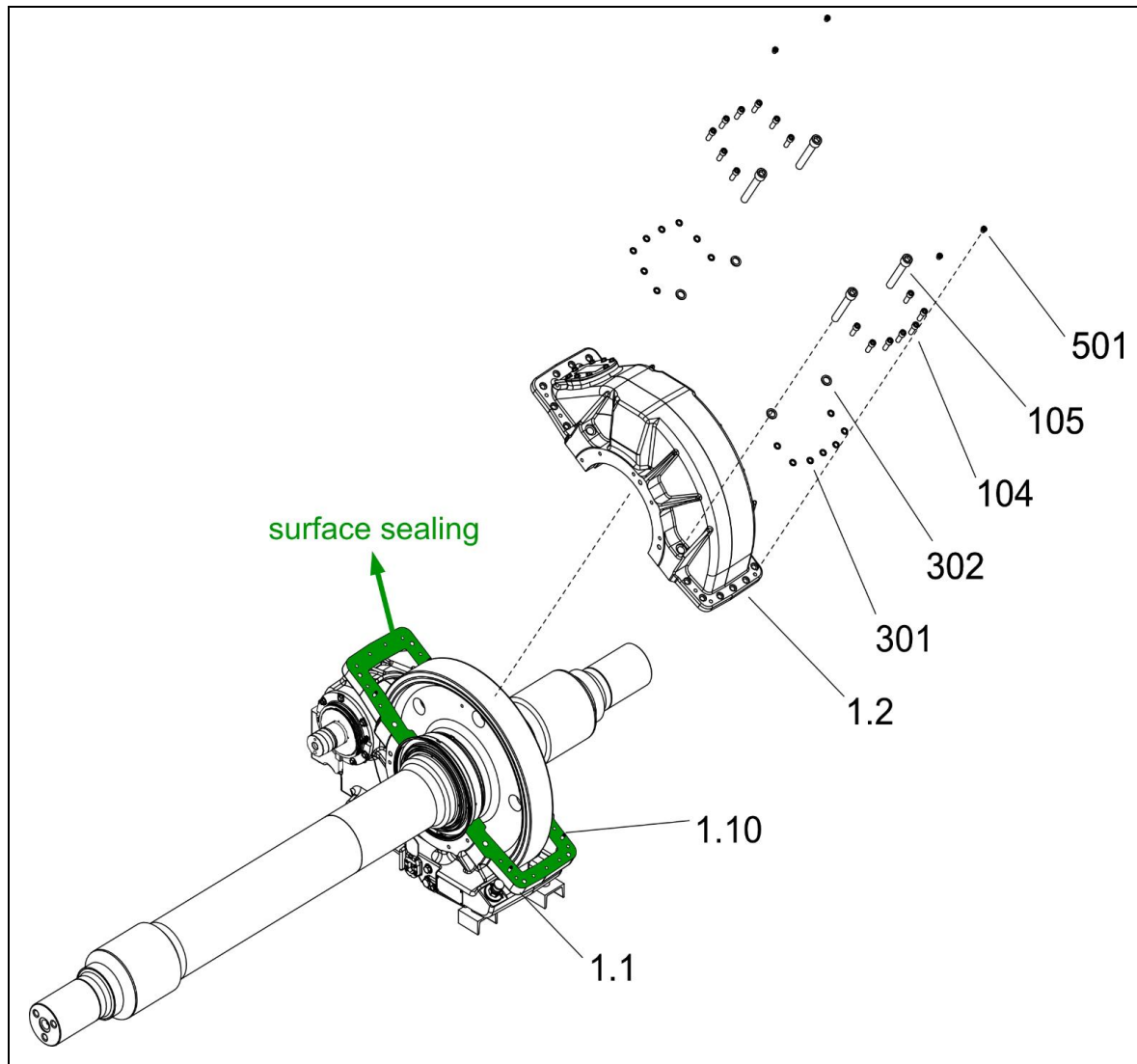


Figure 41: Assembling the gearbox housing halves

- 3 Check the four cylinder pins (1.1) and replace if damaged.
- 4 Cover the contact surfaces of the gearbox housing parts with surface sealing.



Before Assembling:

Check serial number of housing cover and housing for consistency!

- 5 Use the hoisting device to lift the cover of gearbox housing (1.2) onto the gearbox housing. Take care of the cylinder pins (1.10).
- 6 Apply some fitting grease to the threads of the hexagon socket head cap screws (104 and 105).
- 7 Install the fifteen hexagon socket head cap screws (104) with the Nord-lock washers (301).
- 8 Tighten crosswise with a ***tightening torque of 84 Nm***.
- 9 Install the fifteen protection caps (503).

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- 10 Install the four hexagon socket head cap screws (105) with the Nord-lock washers (302).
- 11 Tighten crosswise with a *tightening torque of 592 Nm*.
- 12 Install the four protection caps (504).

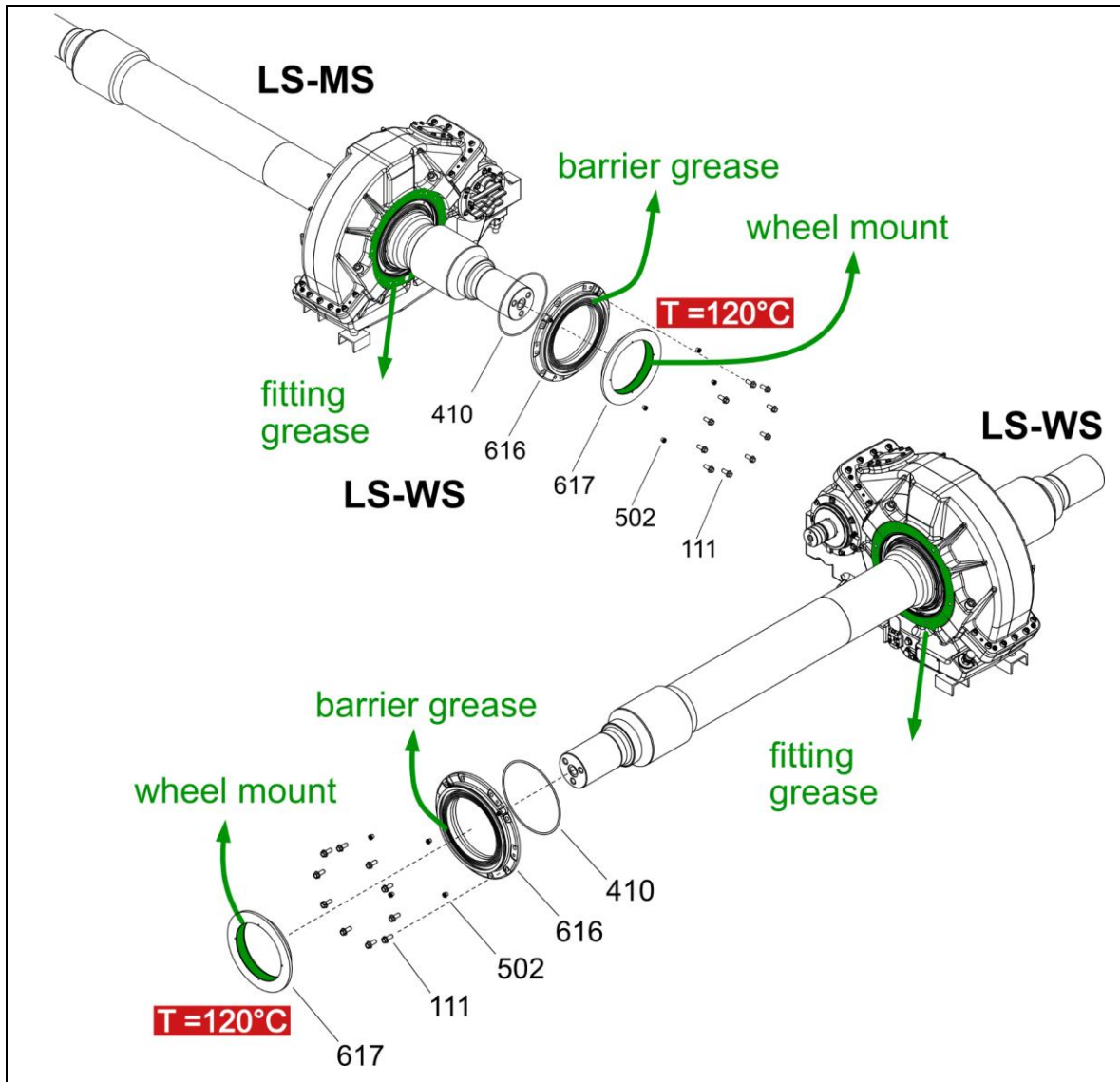


Figure 42: Assembling the labyrinth cover on WS and MS

- 13 Coat the flange surfaces with fitting grease.
- 14 Apply some fitting grease to the threads of six hexagon head screws VR (111) on WS.



Do not coat the threads of the four hexagon head screws VR (111) on WS (next to the screw plugs (502)) and the threads of the ten hexagon head screws VR (111) on MS yet. For more information see [section 8.7.6](#)

- 15 Lubricate the O-rings (410) and put them into the groove on the LS labyrinth covers (616).
- 16 Apply barrier grease (40 g) to the labyrinth clearance of the LS labyrinth covers (616).
- 17 Fasten the LS labyrinth covers (616) to the housing with the twenty hexagon head screws VR (111).
- 18 Tighten them crosswise with a ***tightening torque of 130 Nm***.
- 19 Mount the eight screw plugs (502) again.
- 20 Coat the surfaces of the outer slinger rings LS (617) with wheel mount.
- 21 Heat the outer slinger rings LS (617) to 120 °C and immediately push it onto the shaft and hold it form closed until it has cooled down.

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## 8.7.6 Measuring axial bearing clearance

Preliminary work:	Pinion mounted to gearbox housing (see <a href="#">section 8.7.2</a> )
Tools:	Adapter – measuring flank clearance T3
Consumables:	-
Required manpower:	1 Mechanic
Intervals:	Every 300,000 km

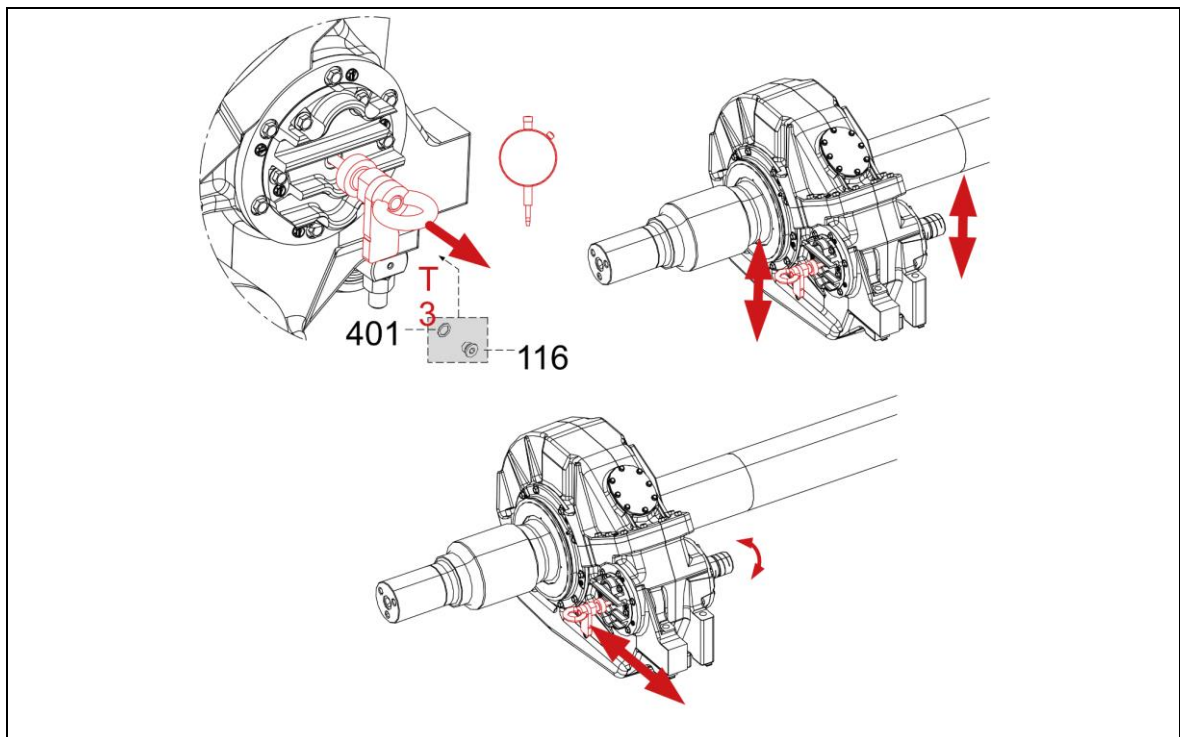


Figure 43: Installing adapter for measuring axial bearing clearance

- 1 Install the adapter measuring flank clearance T3.
- 2 Follow the instructions of the adjustment instruction (step 2 and 3) and look up allowed values in the dimension drawing for final inspection – see [section 14.1](#).
- 3 Record the measured value.



### NOTE

If the measured values do not match contact our service team (see [section 1.5](#)).

- 4 Finally install the hexagon socket pipe plug (116) with the sealing ring (401).

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## 8.7.7 Measuring the bearing clearance of taper roller bearings

Preliminary work:	Gearbox assembled to wheel set shaft – <a href="#">see 8.7.5</a>
Tools:	Lifting equipment Spring balance Torque wrench Adapter for measuring bearing clearance T8 Dimension drawing for final inspection TSA024568
Consumables:	Fitting grease MOLYKOTE P40
Required manpower:	1 Mechanic
Intervals:	Every 300,000 km

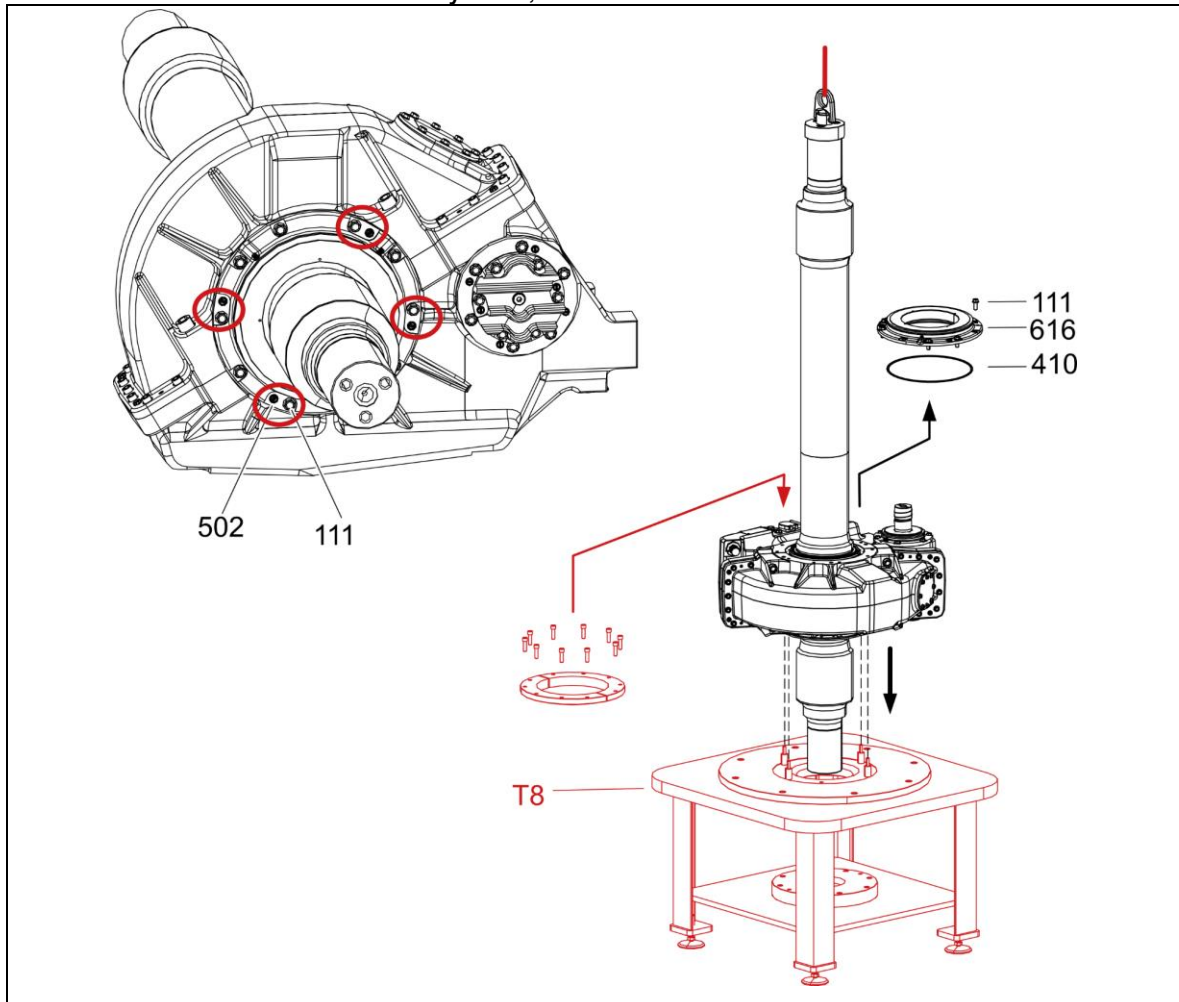


Figure 44: Using the adapter for measuring bearing clearance

- 1 Remove the four hexagon head screws VR (111) next to the screw plugs (502) from the labyrinth cover LS on WS.
- 2 Lift the Traction Gearbox assembled on wheelset shaft onto the adapter for measuring bearing clearance T8 and fasten it with the four hexagon socket head cap screws (M12x100) of the adapter.
- 3 Remove the ten hexagon head screws VR (111) the Labyrinth cover LS (616) and the O-ring (410).
- 4 Mount the measuring adapter with the ten hexagon socket screws M12x40.

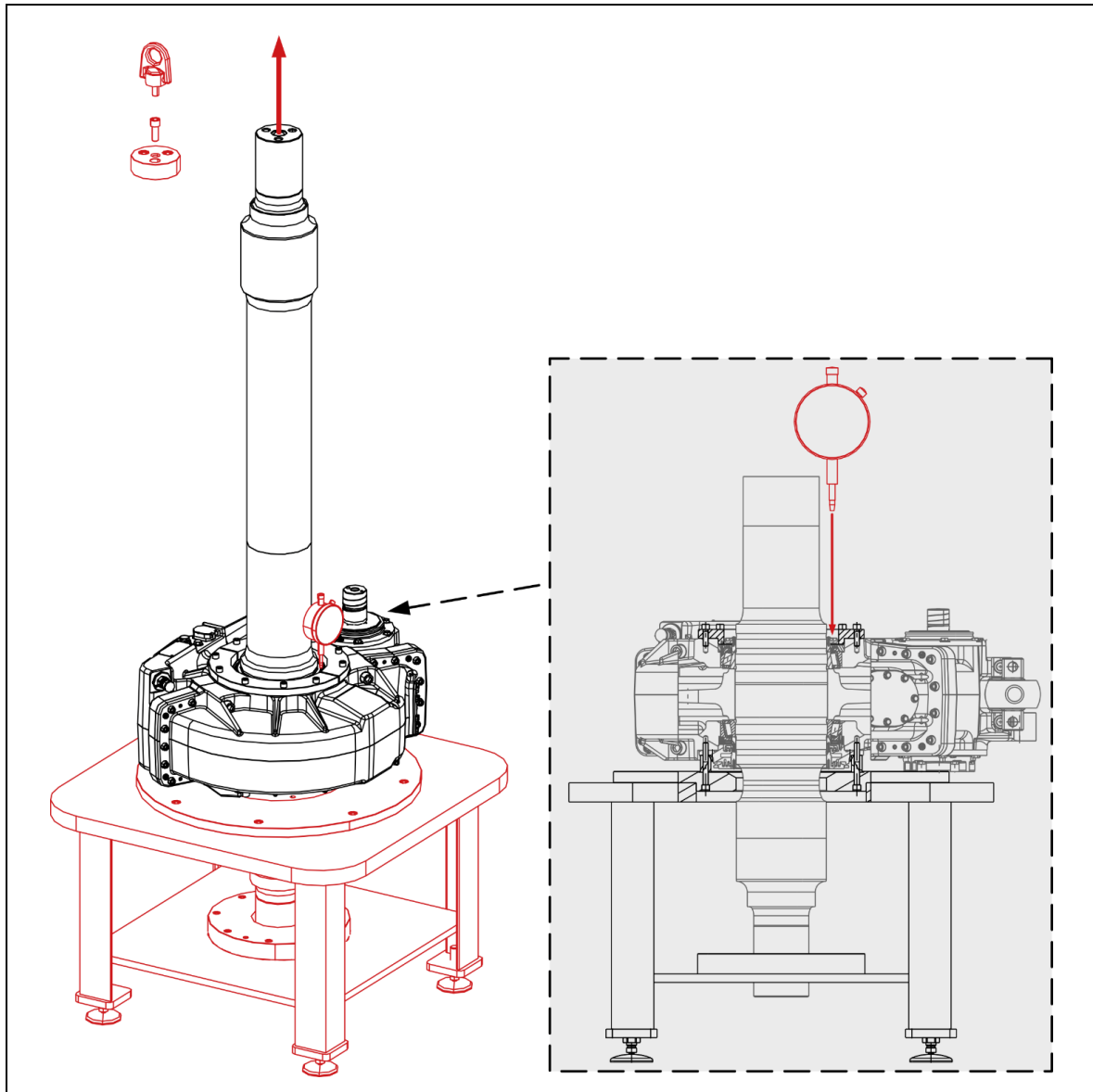


Figure 45: Measuring the bearing clearance of taper roller bearings

- 5 Remove the lifting device and place the dial gauge.
- 6 Follow the instructions of the adjustment instruction – see [section 14.1](#) and adapt the adjustment sheet (614) if required (see Figure 46).
- 7 Record the measured value.

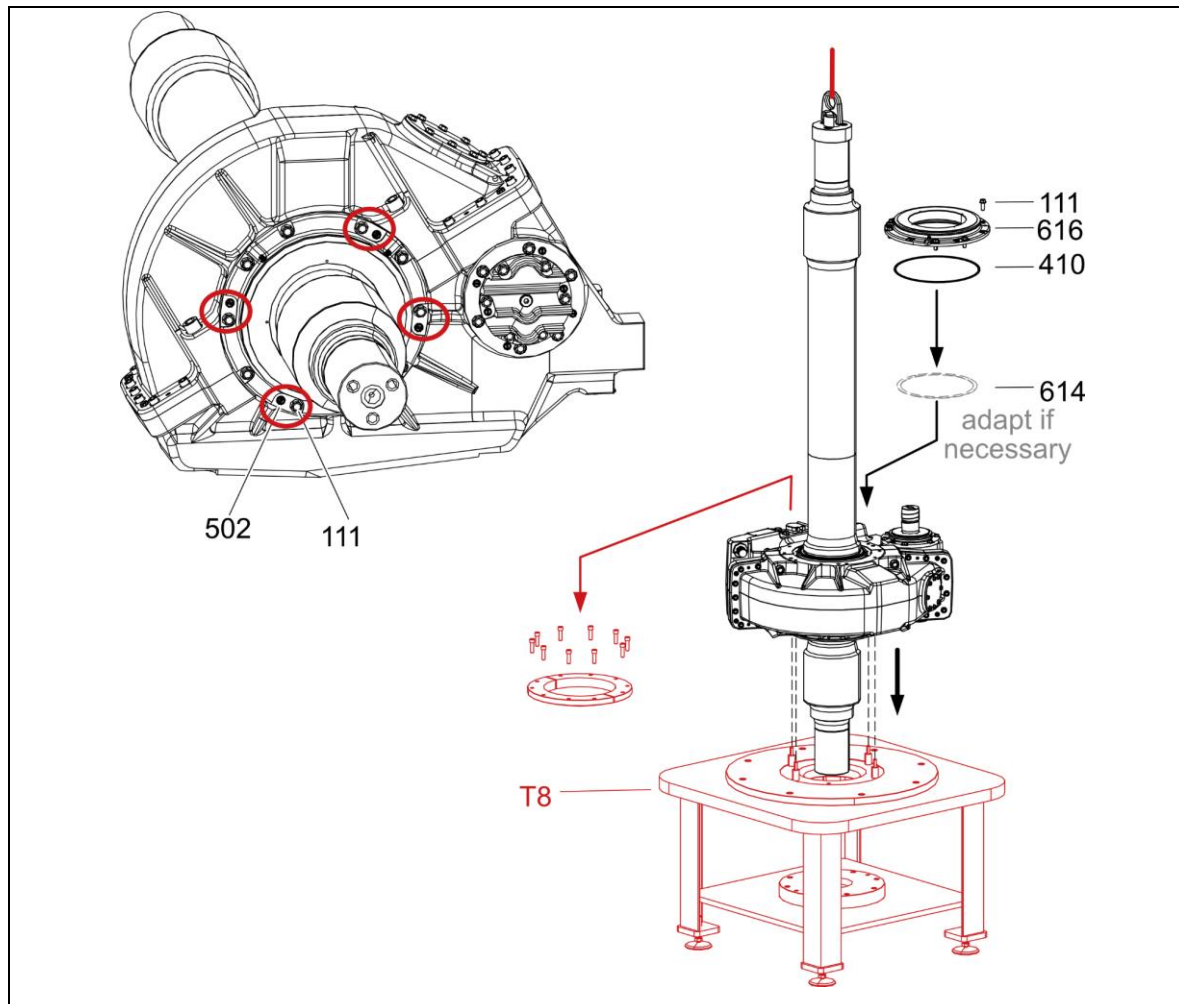


Figure 46: Finish measuring bearing clearance

- 8 When finished lower the wheelset shaft and mount the lifting device again.
- 9 Remove the measuring adapter with the ten hexagon socket screws M12x40.
- 10 Coat the flange surfaces with fitting grease.
- 11 Apply some fitting grease to the threads of ten hexagon head screws VR (111) on MS.
- 12 Lubricate the O-ring (410) and put it into the groove on the LS labyrinth cover (616).
- 13 Mount the Labyrinth cover LS (616) and the O-ring (410) with the ten hexagon head screws VR (111).
- 14 Tighten them crosswise with a **tightening torque of 130 Nm**.
- 15 Carefully lift the Traction Gearbox assembled on wheelset shaft and place it horizontal on a suitable underground.

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## 8.7.8 Installing the gear coupling

Preliminary work:	Gearbox assembled with wheelset shaft – <a href="#">see 8.7.5</a>
Tools:	High pressure pump for glycerine
Consumables:	Glycerine
Required manpower:	1 Mechanic
Intervals:	If needed

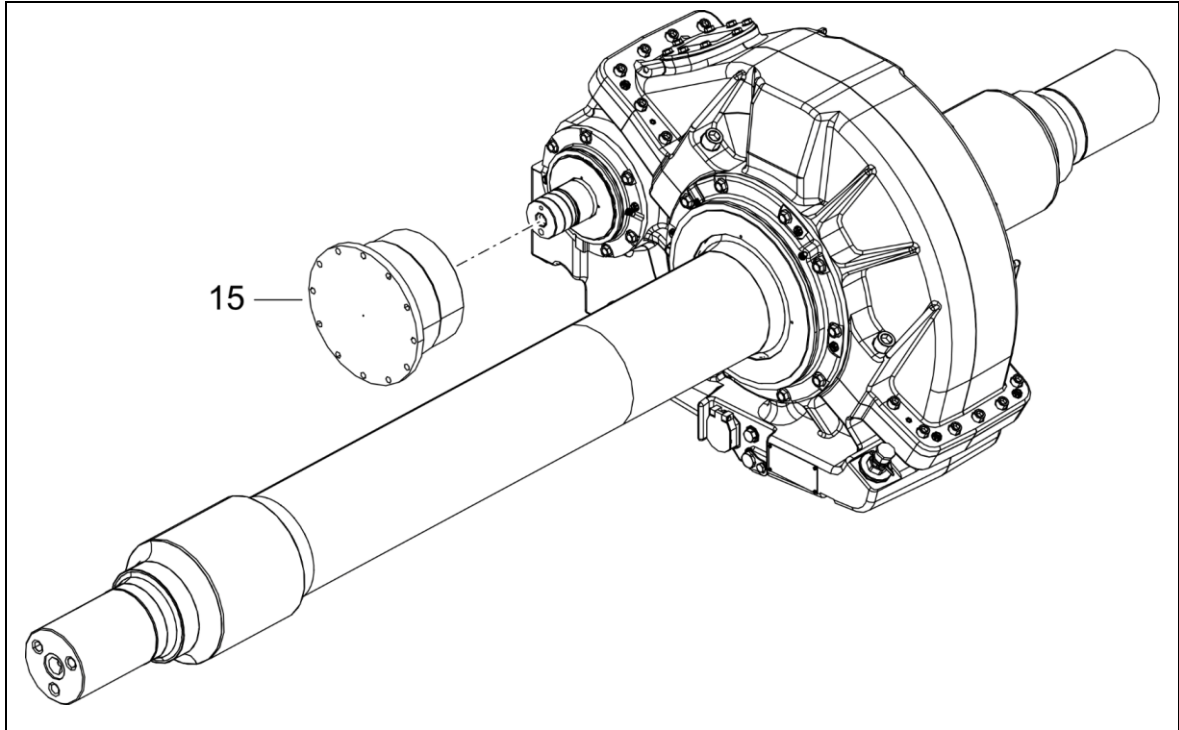


Figure 47: Installing the coupling half



### WARNING!

#### RISK OF INJURY!

Risk of injury due to coupling halves can break.

Coupling can jump off if the assembly device is removed too early.

► Therefore, mount coupling halves only with appropriate equipment.

- 1 Check joining surfaces of shaft and hub for damage. Clean and degrease thoroughly.
- 2 Mount the gear coupling half of the gearbox (15) according to the operating manual of the gear coupling (see [section 14.2](#))

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## 8.7.9 Installing the reaction rod

Preliminary work:	Spherical bearing installed in reaction rod
Tools:	Lifting device
Consumables:	Fitting grease MOLYKOTE P40
Required manpower:	1 Mechanic and 1 Assistant
Intervals:	Every 300,000 km (general inspection) or every 4 years or 1,200,000 km (change elastomer of drive suspension)

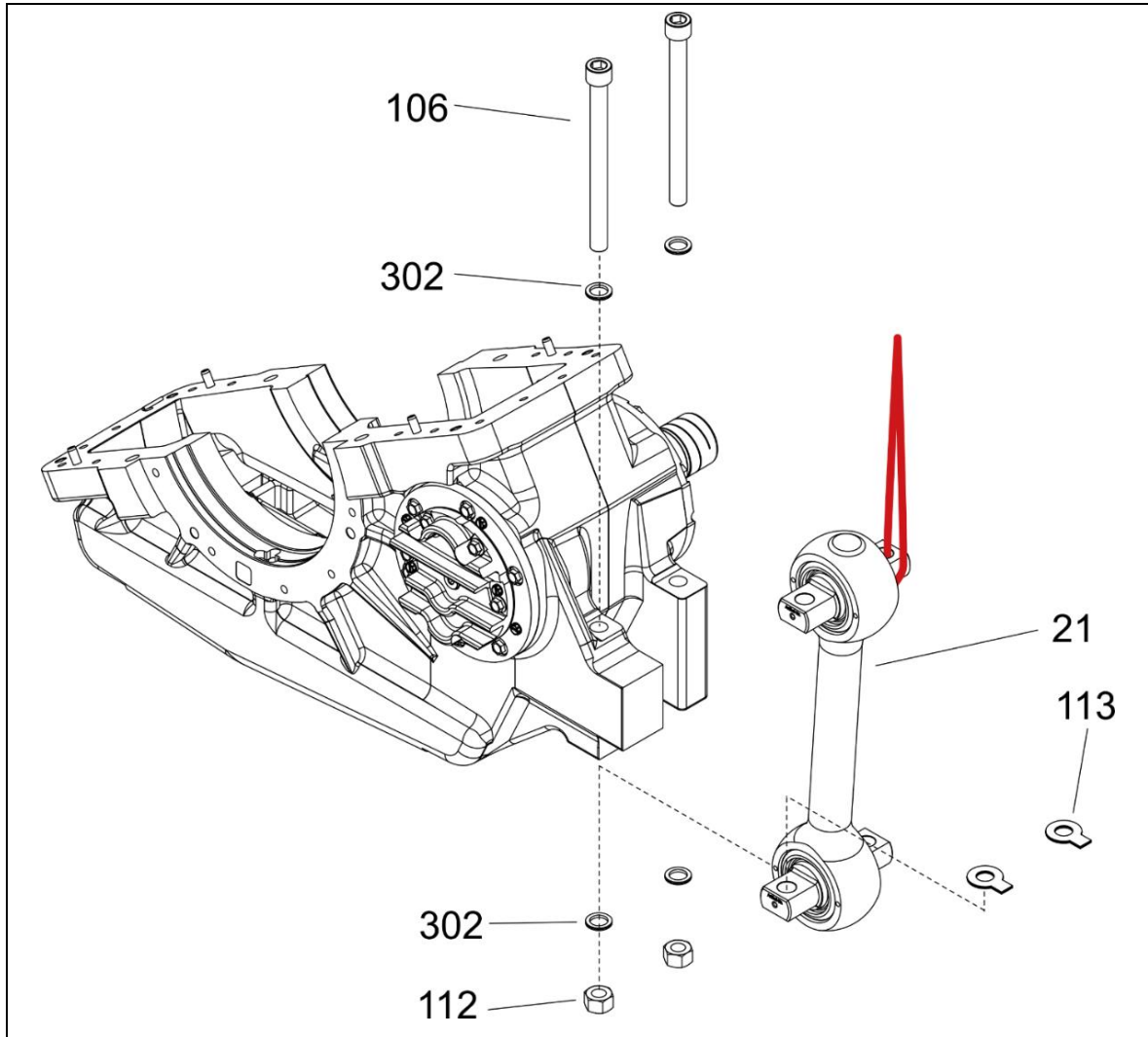


Figure 48: Installing the reaction rod to the Traction Gearbox

### Installing the spherical bearings



To install the reaction rod spherical bearings, see the assembly instructions - see [section 14.2](#).

**WARNING!****RISK OF INJURY!**

Weight of reaction rod approximately 18 kg.

- 1 Secure and lift the reaction rod (21) with a hoisting device.
- 2 Apply some fitting grease on the threads of the two hexagon socket head cap screws (106).
- 3 Fasten the reaction rod with the two hexagon socket head cap screws (106) and the upper Nord-lock washers (302).
- 4 Mount the locking plates (113) and the Nord-lock washers (302) onto the hexagon socket head cap screws (106) and screw in the two hexagon nuts (112).
- 5 Tighten the two hexagon socket head cap screws (106) with a ***tightening torque of 592 Nm***.

### 8.7.10 Final work for storing the Traction Gearbox assembled to wheelset shaft

Preliminary work:

Tools: -

Consumables: -

Required manpower: 1 Mechanic and 1 Assistant

Intervals: If needed

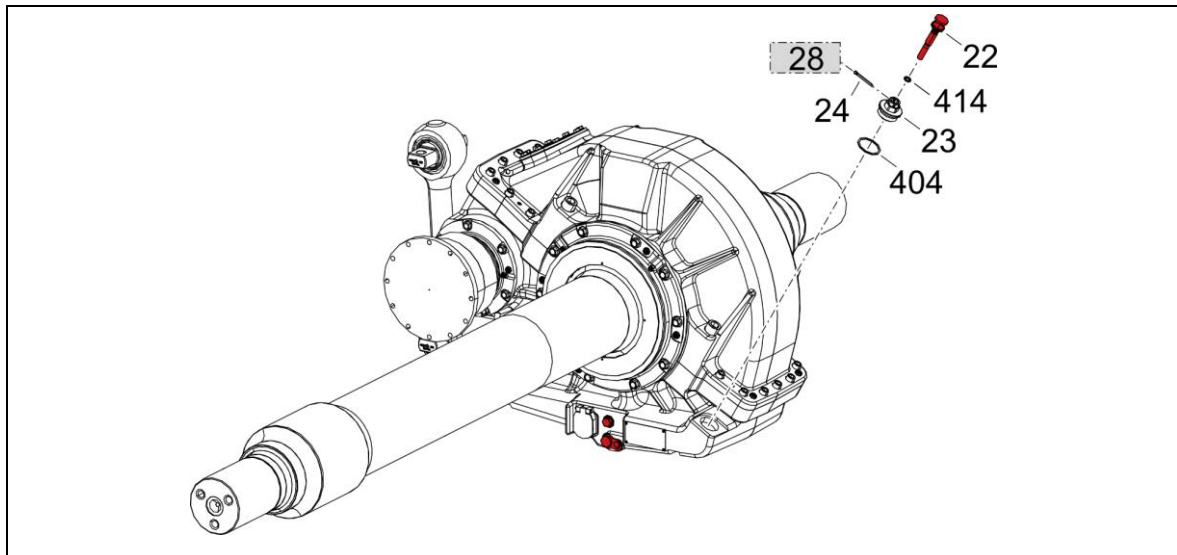


Figure 49: Installing the reaction rod to the Traction Gearbox

- 1 Check that the screws are complete and seated firmly.
- 2 Install the magnetic stick filler plug (23) with a new sealing ring (404) and tighten hand-tight.
- 3 Push-in the magnetic stick (22) with a new O-ring (414) and secure with split pin (24).
- 4 Fasten the warning sticker (28) to the split pin (24).
- 5 For further information concerning transportation and storage – see [chapter 4](#).



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## 8.7.11 Height adjustment after installing to bogie

Preliminary work:	Traction Gearbox with wheelset shaft and Traction Motor assembled to bogie (see <a href="#">vehicle documentation</a> )
Tools:	Height control device (AAV002153R0001) Torque wrench
Consumables:	Fitting grease MOLYKOTE P40
Required manpower:	1 Mechanic and 1 Assistant
Intervals:	Every 3,000,000 km

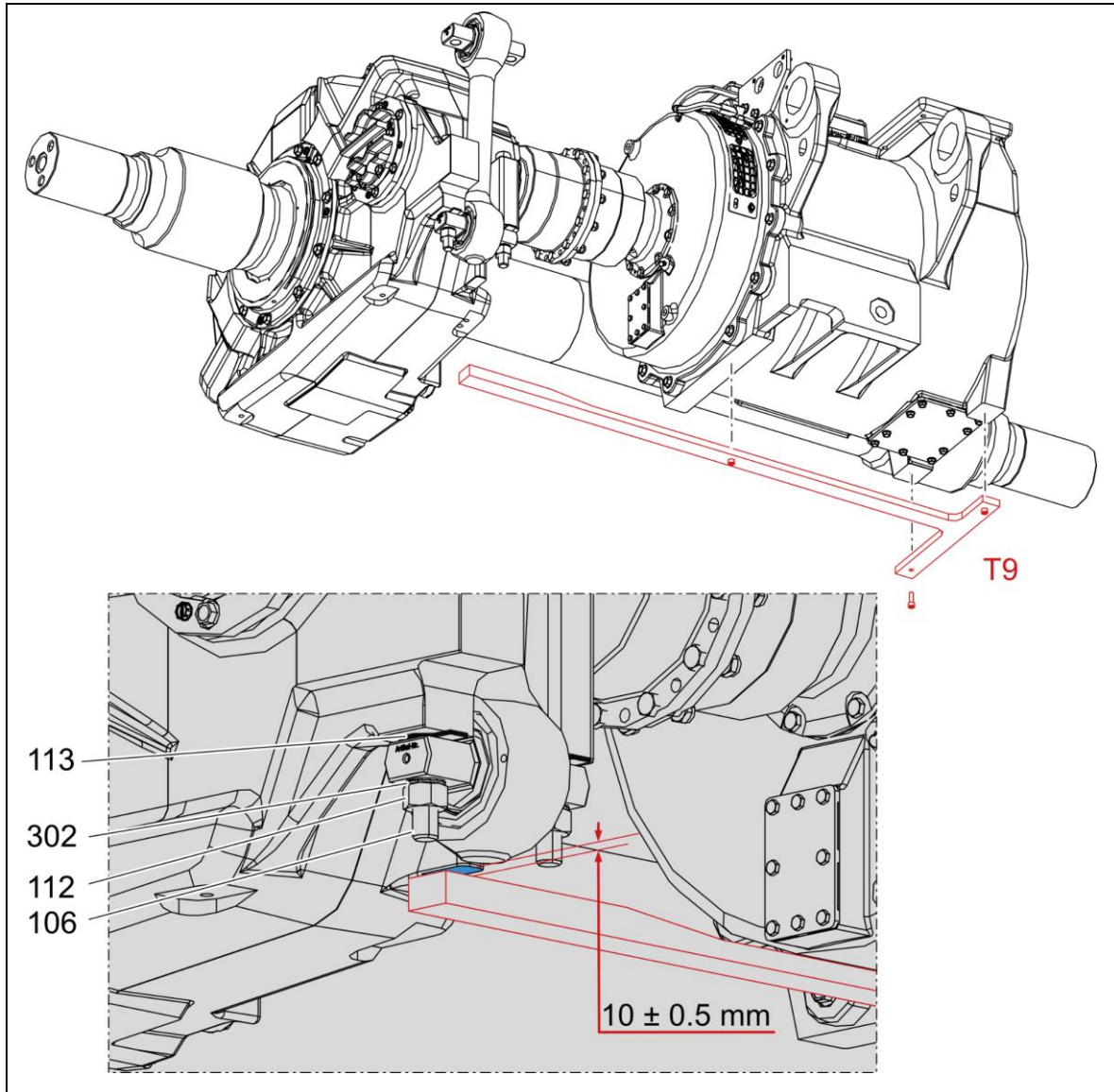


Figure 50: Checking and adjusting height of Traction Gearbox to Traction Motor

**NOTE****RISK OF DAMAGE!**

Do not connect the coupling halves without measuring and adjusting the height of the Traction Gearbox in relation to the Traction Motor.

**WARNING!**

The adjustment of the height must be done if bogie is in position tara ( $z=0$ )

You reach the position tara ( $z=0$ ):

1. Under the vehicle (car body resting on the bogies)
2. At the single bogie in a compression test stand (loaded with the weight of the empty car body)

A height adjustment at any other load conditions will lead to a wrong position of the coupling during operation and is therefore not permitted.



The test run of a drive system (unloaded test, see TSA024565) in an unload bogie is permitted:

1. If the height was adjusted at tara position before (bogie is then in lift stop position)
2. If the height was not adjusted at tara position before, but it was checked that height value during the test is between 0 and 20 mm (vertical offset of the coupling  $\pm 10$  mm)

**Checking the height**

- 1 The two socket screws (106) must be tightened with a ***tightening torque of 592 Nm.***
- 2 Fasten the control bar of height control device T9 with the three hexagon socket screws to the Traction Motor.
- 3 Measure the distance between gearbox housing and control bar.



The nominal value must be  $10 \pm 0.5$  mm.

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## Adjusting the height

- 1 Remove the two hexagon nuts (112) and the Nord-lock washers (302).
- 2 Push or lift the gearbox housing at the emergency catch to release the reaction rod.
- 3 Remove or add locking plates (113) to adjust the height.
- 4 Release the gearbox housing.
- 5 Apply some fitting grease to the threads of the hexagon socket head cap screws and re-install the hexagon nuts (112) with the Nord-lock washers (302).
- 6 Tighten two socket screws (106) with a *tightening torque of 592 Nm*.

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## 9 DECOMMISSIONING

- Dismantle the Traction Gearbox from the bogie (see [vehicle documentation](#)).
- Execute an external cleaning (e.g. with a cloth, brush or a vacuum cleaner).
- Repaint and apply corrosion protection in accordance with regulation TSA000075 (see [section 14.3](#)).
- Transport and store the Traction Gearbox (Traction Drive) according to [chapter 4](#).

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## 10 RECYCLING AND DISPOSAL

### 10.1 Introduction

The following instructions are only recommendations for environmentally friendly disposal of the Traction Gearbox. It falls within the operator's responsibility to observe the national regulations. A few customer-specific elements are, possibly, not included in this manual.

### 10.2 Recycling packaging material

The packaging materials must be disposed of after the Traction Gearbox has arrived at the premises of the vehicle manufacturer and the operator respectively.



In some countries, seaworthy packaging made of waterproof wood must be recycled in accordance with the regional regulations.

- The plastic material which encloses the Traction Gearbox can be recycled.
- Anti-corrosive agents which cover the surface of the Traction Gearbox can be cleaned with the recommended solvents. Dirty clothes should be disposed of in accordance with the regional regulations

### 10.3 Dismantling the Traction Drive

Disassembly proceeds in accordance with this instruction manual.

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## 10.4 Separation of individual materials

The gearbox contains the following materials, which must be collected for recycling separately:

- Cast parts housing,
- Shafts and gears are made of heat-treated steel
- Other turned or milled parts are made of structural steel
- Sealing elements are exceptions (NBR and copper)
- Connectors,
- Elastomer materials
- Roller bearings (brass cage)
- Sealing plugs (polythene)

and the following individual parts:

- Oil level indicator – glass, aluminium, rubber
- Magnetic stick – AlNiCo magnet
- Drain plug (magnet)

## 10.5 Hazardous materials

Paint, lacquer, cleaning agents and solvents as well as lubricants are harmful to the environment and should be collected and disposed of in accordance with the regional regulations. Pay attention to the material safety data sheets.



## 11 TROUBLESHOOTING

Abnormality	Possible causes	Measures
Abnormal noise	Bearing failure or damage	Replace bearings.
	Toothing failure or damage	Replace damaged gear wheels
Smoke emission	Bearing damage	Replace bearings
Vibration or knocking when load changes	Retaining screws of the gearbox mounting are loose or spherolastic bearing is defective (not part of TSA delivery!)	Check whether retaining screws are seated firmly on the gearbox mounting and retighten if necessary. Inspect spherolastic bearing visually; replace if necessary.
	Gear coupling defective	Check and replace the gear coupling according to operating manuals of the coupling
Oil escaping on the labyrinth seals of the shafts	Oil level in Traction Gearbox too high	Check oil volume on the oil level indicator and adjust if necessary.
	Water has penetrated the Traction Gearbox (e.g., while cleaning the wheelset Traction Gearbox)	Perform oil change.
	Gearbox was tilted too much (with oil filling)	Disassemble, clean and assemble labyrinth seal parts.
Oil escaping on a locking screw	Bolt not tightened according to specifications	Tighten bolt with specified torque.
	Seals worn or defective	Replace affected seal.
Wheelset, Traction Gearbox gets too hot	Oil level in Traction Gearbox too high or too low	Check oil volume on the oil level indicator or on the dipstick and adjust if necessary.

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## 12 ANNEXE

### 12.1 Parts list

#### 12.1.1 Traction Drive ready for shipment

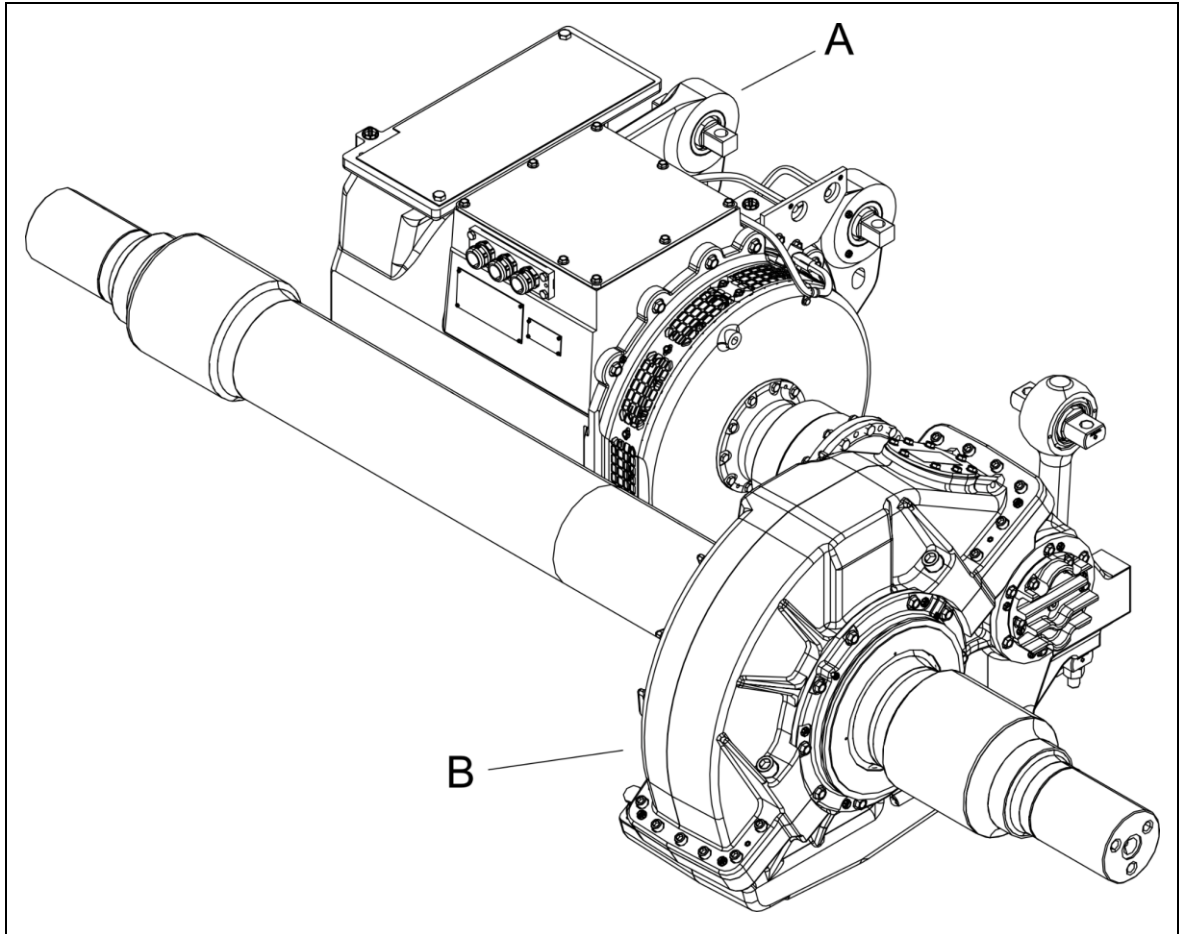


Figure 51: Traction Drive ready for shipment

Pos.	Designation	Part number	Quantity
-	Drive ready for shipment	TSA024555R0001	1
A	Machine ready for shipment	TSA024591R0001	1
B	Traction Gearbox assembled	TSA024556R0001	1

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## 12.1.2 Traction Gearbox assembled

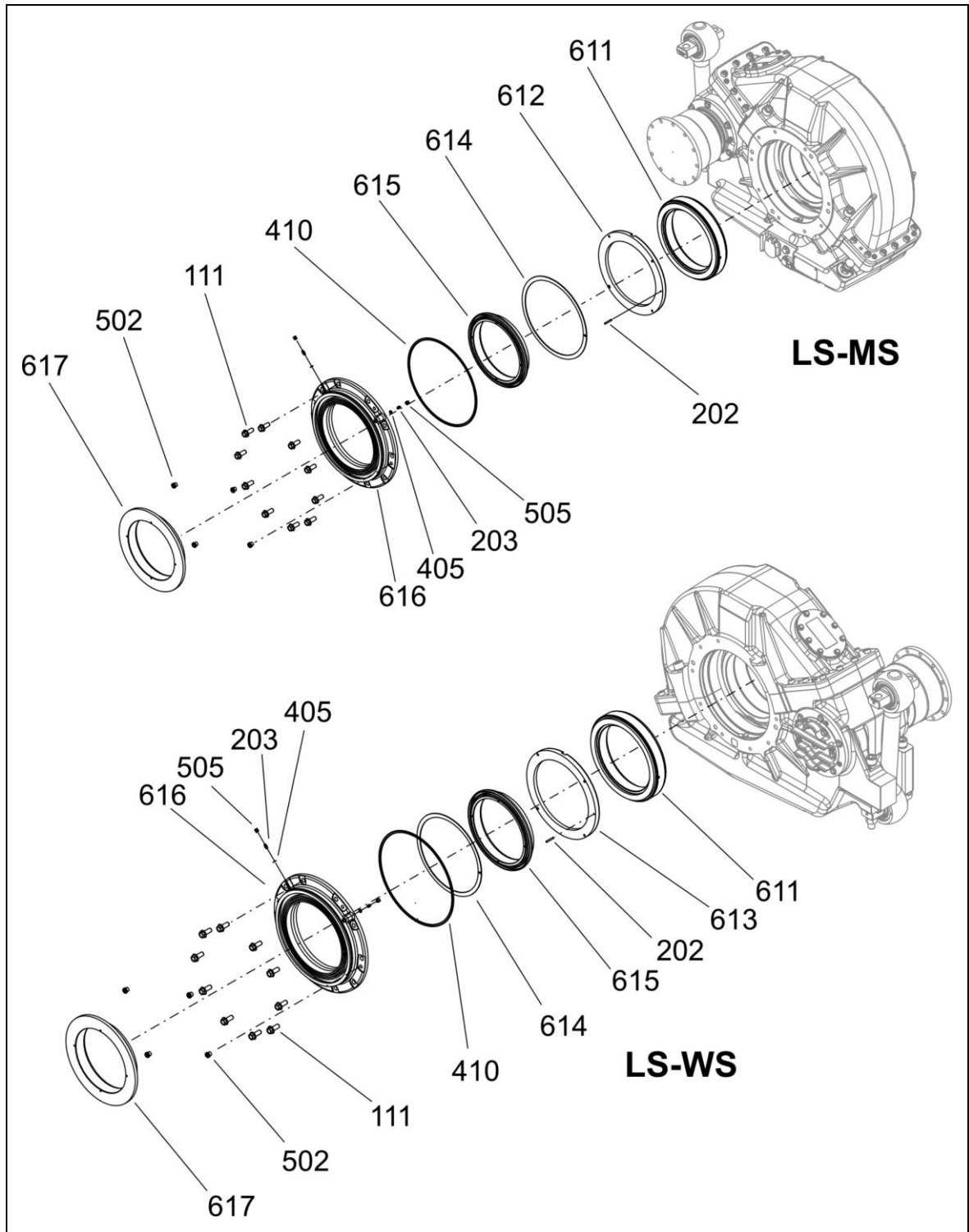


Figure 52: Traction Gearbox assembled - 1

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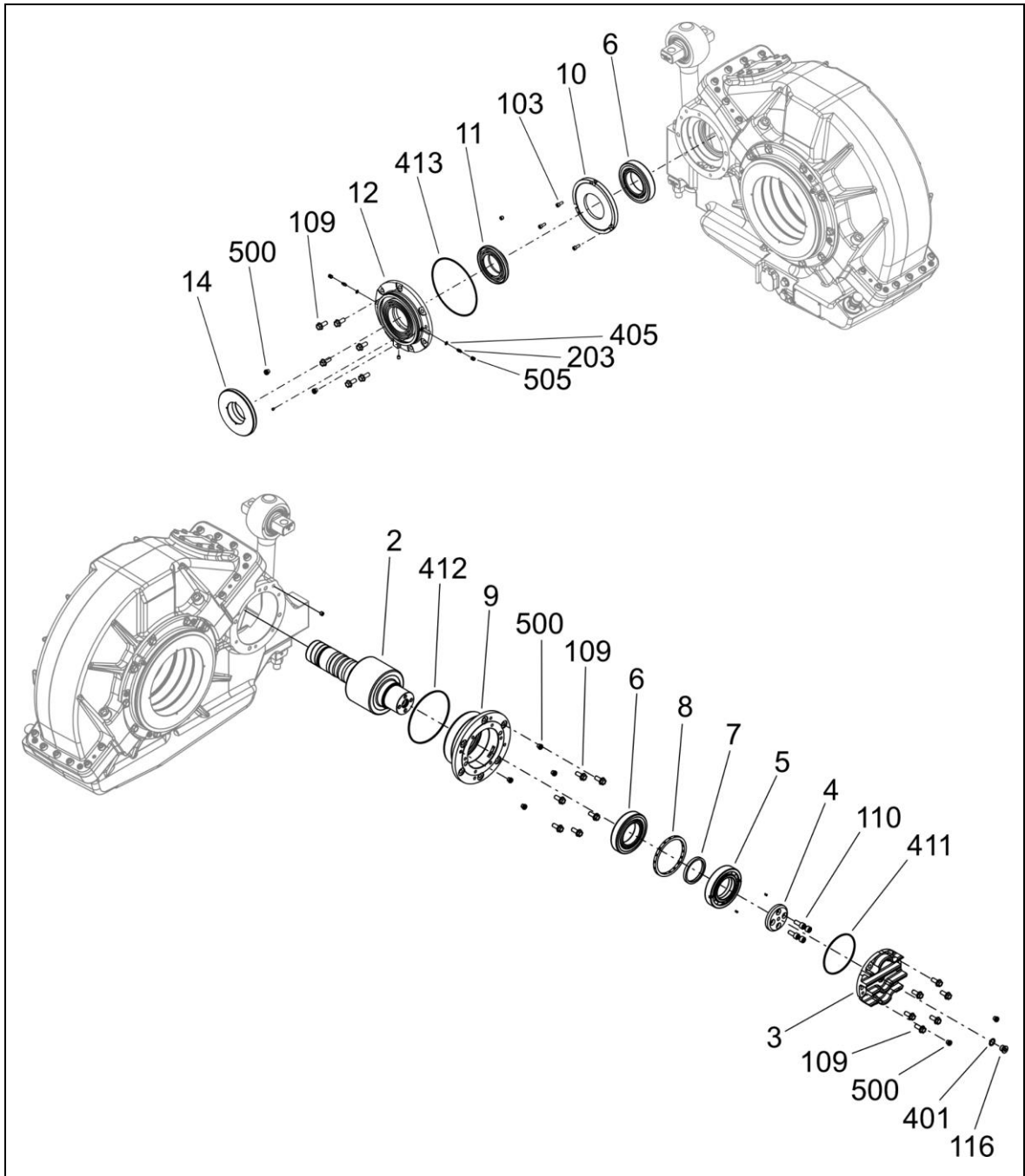


Figure 53: Traction Gearbox assembled - 2

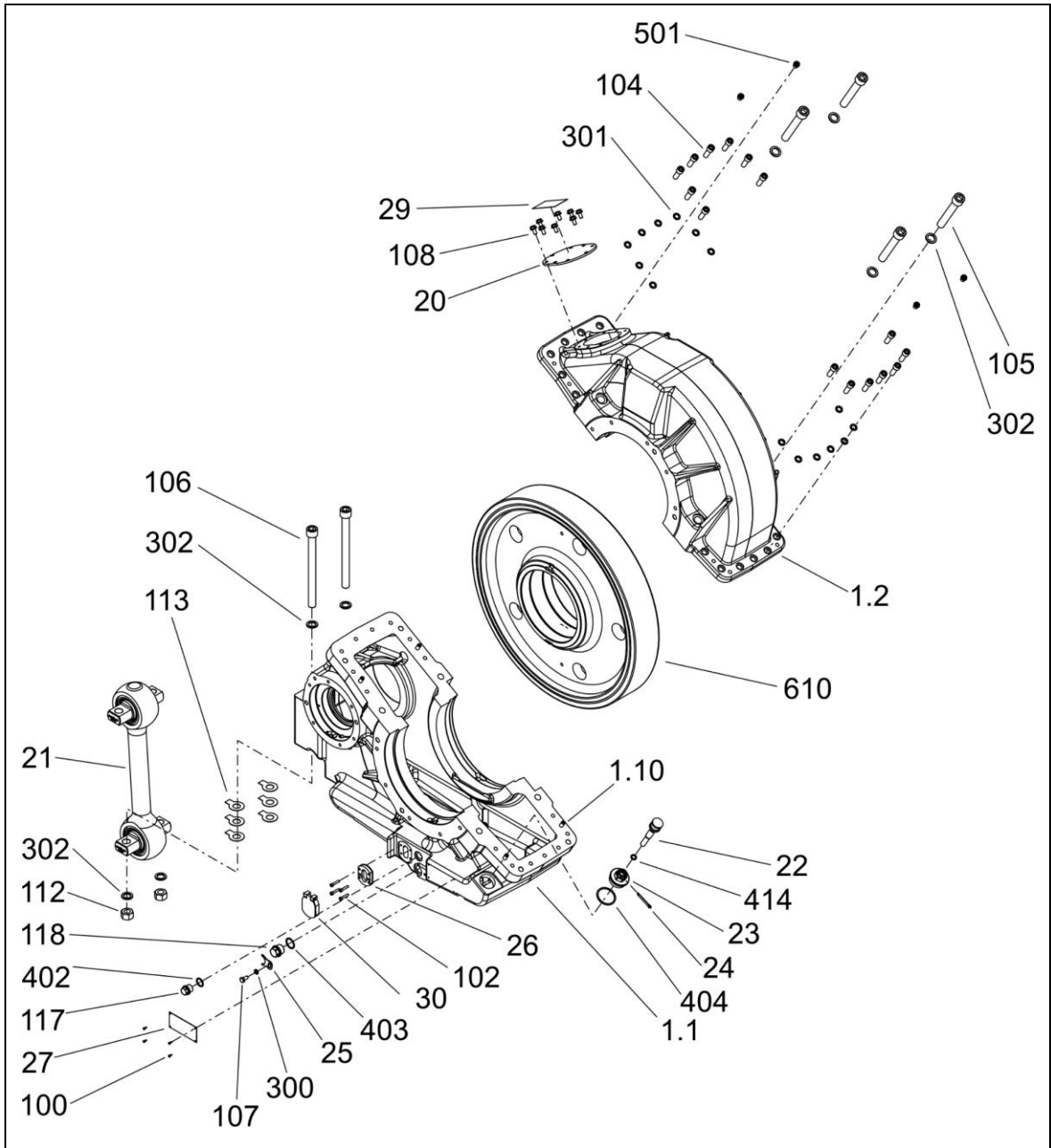


Figure 54: Traction Gearbox assembled - 3

Pos.	Designation	Part number	Quantity
<b>B</b>	<b>Traction Gearbox assembled</b>	<b>TSA024556R0001</b>	<b>1</b>
1	Gearbox housing	TSA024576R0001	1
1.1	Gearbox housing lower part	TSA024576P0001	1
1.2	Gearbox housing upper part	TSA024576P0002	1
1.10	Cylinder pin	TSA700167P0003	4
2	Pinion 372C	TSA024446P0001	1
3	Bearing cover HS-WS	TSA024444P0001	1
4	End plate HS-WS	TSA024445P0001	1
5	Four point bearing QJ214	TSA012919P0001	1
6	Cylindrical roller bearing NU214 ECML/C4H	TSA024470P0001	2
7	Distance ring HS-WS inner	TSA023947P0001	1
8	Distance ring HS-WS outer	TSA023948P0001	1
9	Bearing cartridge HS-WS	TSA024442P0001	1
10	Retaining disc HS-MS	TSA024441P0001	1
11	Slinger ring HS-MS inner	TSA024440P0001	1
12	Labyrinth cover HS-MS	TSA024437P0001	1
14	Slinger ring HS-MS outer	TSA024689P0001	1
15	Gear coupling half Traction Gearbox	TSA024594R0001	1
16	Transportation lock Traction Gearbox half	TSA024594R0004	1
17	Transport cover LS 372C	TSA024595P0001	2
20	Inspection cover	TSA013189P0001	1
21	Reaction rod	TSA013207R0001	1
22	Magnetic stick	TSA008399R0002	1
23	Magnetic stick filler plug	TSA011003P0001	1
24	Split pin, ISO 1234 - 5x40-St	TSA700243P0002	1
25	Locking segment SW24	TSA007250P0001	1
26	Oil level indicator SP60	TSA006258P0010	1
27	Type plate 372C	TSA024596P0001	1
28	Warning sticker	TSA013210P0001	1

Pos.	Designation	Part number	Quantity
29	Sticker GKD 1-52-372C	TSA024597P0001	1
30	Oil sight glass protection	TSA024938R0010	1
100	Hexagon socket screw thread rolling, DIN 7500, M3x8-St Eht 450-A4F	TSA700023P0001	4
102	Hexagon socket head cap screw, ISO 4762, M5x25-8.8-A2F	TSA700004P0160	4
103	Hexagon socket screw, ISO 4762, M6x16-8.8-A2F	TSA700004P0011	3
104	Hexagon socket head cap screw, ISO 4762, M12x35-8.8-A2F	TSA700004P0091	15
105	Hexagon socket screw, ISO 4762, M20x130-10.9	TSA700004P0181	4
106	Hexagon socket screw, ISO 4762, M20x240-10.9	TSA700004P0183	2
107	Hexagon head screw, DIN 933, M8x16-8.8-A2F	TSA700000P0001	1
108	Hexagon head cap ribbed flange bolt, M8x16-KI.100-GEO 500-A	TSA700005P0005	8
109	Hexagon head screw VR, M10x25-KI100-GEO 500-A	TSA700005P0019	18
110	Hexagon socket screw, ISO 4762, M10x25-8.8-A2F	TSA700004P0005	4
111	Hexagon head screw VR, M12x30-KI100-GEO 500-A	TSA700005P0006	20
112	Hexagon nut, ISO 4032, M20-10-A2F	TSA700001P0027	2
113	Locking plate	TSA700205P0001	8
116	Hexagon socket pipe plug, DIN 908, M16x1,5-A2F	TSA700109P0007	1
117	Hexagon head screw plug, DIN910, G1/2-St-A4F	TSA700163P0001	1
118	Drain plug, DIN910, G3/4-St-PM-A4F	TSA700164P0001	1

Pos.	Designation	Part number	Quantity
200	Pin D4x8	TSA024569P0001	2
201	Hexagon socket pipe plug, DIN906, M10x1-5.8-A2F	TSA700087P0012	2
202	Hexagon socket pipe plug, DIN906, M8x1-5.8-A2F	TSA700087P0001	1
203	Screw plug, DIN906, M6-A2F	TSA700087P0007	1
204	Lubricating nipple, DIN71412-A M6-VZ	TSA700010P0001	6
300	Nord-Lock washer NL 8	TSA700064P0009	1
301	Nord-Lock washer NL 12	TSA700064P0023	15
302	Nord-Lock washer NL 20	TSA700064P0012	8
401	Sealing ring, DIN7603-A, 16x22x1,5	TSA700105P0017	1
402	Sealing ring, DIN7603-A, 21x26	TSA700105P0004	1
403	Sealing ring, DIN7603-A, 27x32x2	TSA700105P0002	1
404	Sealing ring, DIN7603-A, 48x55x2	TSA700105P0012	1
405	Sealing ring, DIN7603-A, 6,5x9,5x1	TSA700105P0026	6
410	O-Ring, DIN3771, 290x5-N-P700	TSA700013P0110	2
411	O-Ring, 116x3, DIN3771, N-P700	TSA700013P0169	1
412	O-Ring, 153x3-N-P700	TSA700013P0171	1
413	O-Ring, DIN3771, 170x3-N-P700	TSA700013P0162	1
414	O-Ring, DIN3771, 11x3-N-P700	TSA700013P0170	1
500	Screw Plug, GPN700, M10	TSA700008P0004	8
501	Screw Plug, GPN700, M12	TSA700008P0001	4
502	Screw Plug, GPN700, M12	TSA700008P0001	8
503	Protection cap for hexagon socket SW10	TSA700199P0001	15
504	Protection cap for hexagon socket SW17	TSA700199P0002	6
505	Regreasing nipple cap, GPN985	TSA700085P0001	6
610	Main Gear 372C	TSA024517P0001	1



Pos.	Designation	Part number	Quantity
611	Taper roller bearing	TSA024593P0001	2
612	Retaining disc LS-MS	TSA024581P0001	1
613	Retaining disc LS-WS	TSA024582P0001	1
614	Adjustment sheet LS	TSA024583P0001	1
615	Slinger ring LS inner	TSA024580P0001	2
616	Labyrinth cover LS	TSA024578P0001	2
617	Slinger ring LS outer	TSA024579P0001	2
618	Flange connection set ZK 242-R6E-BD	TSA024594R0003	1
702	Cylinder pin ISO 8734 4M6x32	TSA700112P0022	2

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## 12.2 Spare parts

### 12.2.1 Order process

The following minimum data are necessary in order to ensure an accurate spare part handling.

- **Traction Gearbox data**

Type:.....GKD 1-52-372C

Traction Gearbox assembled: .....TSA024556R0001

Serial-No.:.....AW \_\_\_\_\_ (8-digit)

- **Spare part data: (on the example of a bearing ):**

Stock no.: .....TSA024470P0001

Designation:.....Cylindrical roller bearing NU214

Quantity ..... 1

- **Ordering address**

**TRAKTIONSSYSTEME AUSTRIA GmbH / Service**

Brown-Boveri-Straße 1

A-2351 Wiener Neudorf

Tel.: +43 (0) 2236 8118-111

E-Mail: [service@tsa.at](mailto:service@tsa.at)

Internet: [www.tsa.at](http://www.tsa.at)

# GKD 1-52-372C

## 12.2.2 Spare parts list

Manufacturer's recommended spare parts list for Traction Gearbox  
GKD 1-52-372C.

☀ Spare parts stock required    ○ Spare parts stock recommended

Item No.	☀ / ○	Designation	Part number	Quantity
2	○	Pinion 372C	TSA024446P0001	1
21	○	Reaction rod	TSA013207R0001	1
26	○	Oil level indicator SP60	TSA006258P0010	1
610	○	Main Gear 372C	TSA024517P0001	1
5	☀	Four point bearing QJ214	TSA012919P0001	1
6	☀	Cylindrical roller bearing NU214	TSA024470P0001	2
401	☀	Sealing ring, DIN7603-A, 16x22x1,5	TSA700105P0017	1
402	☀	Sealing ring, DIN7603-A, 21x26	TSA700105P0004	1
403	☀	Sealing ring, DIN7603-A, 27x32x2	TSA700105P0002	1
404	☀	Sealing ring, DIN7603-A, 48x55x2	TSA700105P0012	1
405	☀	Sealing ring, DIN7603-A, 6,5x9,5x1	TSA700105P0026	4
410	☀	O-Ring DIN3771 290x5-N-P700	TSA700013P0110	2
411	☀	O-Ring, 116x3, DIN3771, N- P700	TSA700013P0169	1
412	☀	O-Ring, 153x3-N-P700	TSA700013P0171	1
413	☀	O-Ring, DIN3771, 170x3-N-P700	TSA700013P0162	1
414	☀	O-Ring, DIN3771, 11x3-N-P700	TSA700013P0170	1
611	☀	Taper roller bearing	TSA024593P0001	2
614	☀	Adjustment sheet LS	TSA024583P0001	1

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## 12.3 Production equipment and consumables

### 12.3.1 Lubricating grease, locking agents and sealants

Designation	Specification	Quantity
Surface sealing	ELRING CURIL T	AR
Fitting grease	MOLYKOTE P40	AR
Thread locking	LOCTITE 243	AR
Thread sealant	LOCTITE 542	AR
Joining shaft/hub connections "WHEEL MOUNT"	LOCTITE 609	AR
Anti-corrosion oil	BLASOL 135	AR
Gearbox oil	Servo SynGear 75W-90LL	5l
Barrier grease	Klüber STABURAGS NBU 12	0.05 kg

AR ... as required

### 12.3.2 Surface treatment

Designation	Specification
Topcoat	The following colours are used: Traction Gearbox – RAL9005,
Painting specification	<b>TSA000075 - V56</b> (see <a href="#">section 14.3</a> )
Maintenance and repair of coatings	<b>TSA900099</b> (see <a href="#">section 14.3</a> )

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## 12.4 Devices, tools, measuring and auxiliary equipment

### 12.4.1 Devices

Pos.	Designation	Part number	Quantity
T1	Assembly device	AAV003022R0001	1
T2	Distance Gauge	AAV003025R0001	1
T3	Adapter – measuring flank clearance	AAV003020R0001	1
T4	Pressing device for clutch	AAV002156R0001	1
T5	Press-in device	AAV001673R0001	1
T6	Press-out device	AAV001683R0001	1
T7	Pressing device	AAV001799R0001	1
T8	Adapter – measuring bearing clearance	AAV003023R0001	1
T9	Height control device	AAV003024R0001	1

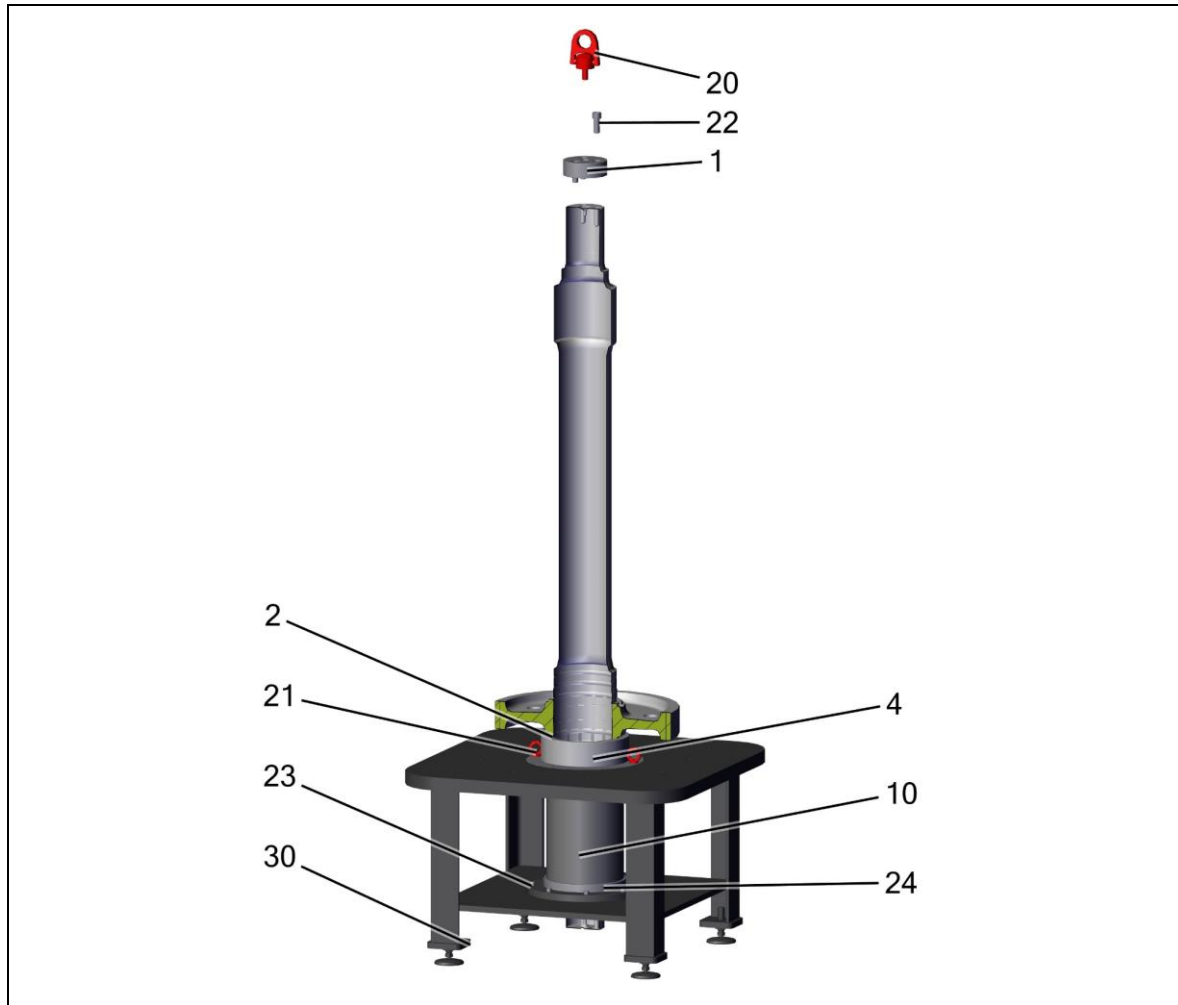


Figure 55: Assembly device - AAV003022R0001 – T1

Pos.	Designation	Quantity
1	Adapter disc	1
2	Insert	1
3	Pipe	1
4	Centring sleeve for main gear	1
10	stop device	1
20	Special ringbolt M20x30	1
21	Lifting eye bolt DIN580 M12-N-C15-A2F	2
22	Hexagon socket screw, ISO 4762, M20x50-10.9	3
23	Hexagon socket screw, ISO 4762, M12x40-8.8-A2F	8
24	Parallel pin, DIN7, 10m6x28	1
30	Assembly device desk	1

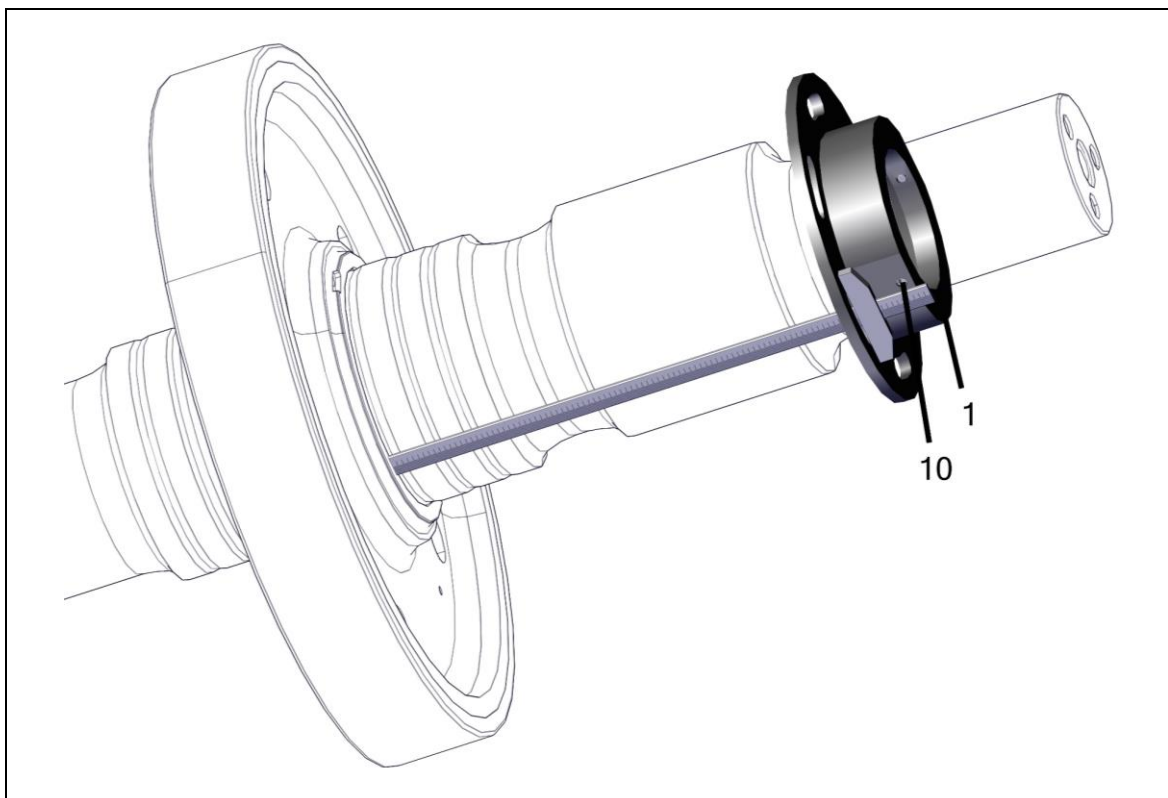


Figure 56: Distance Gauge - AAV003025R0001 – T2

Pos.	Designation	Quantity
1	Measuring plate	1
10	Pressure screw M12 x 22,1 POM 10.9	2

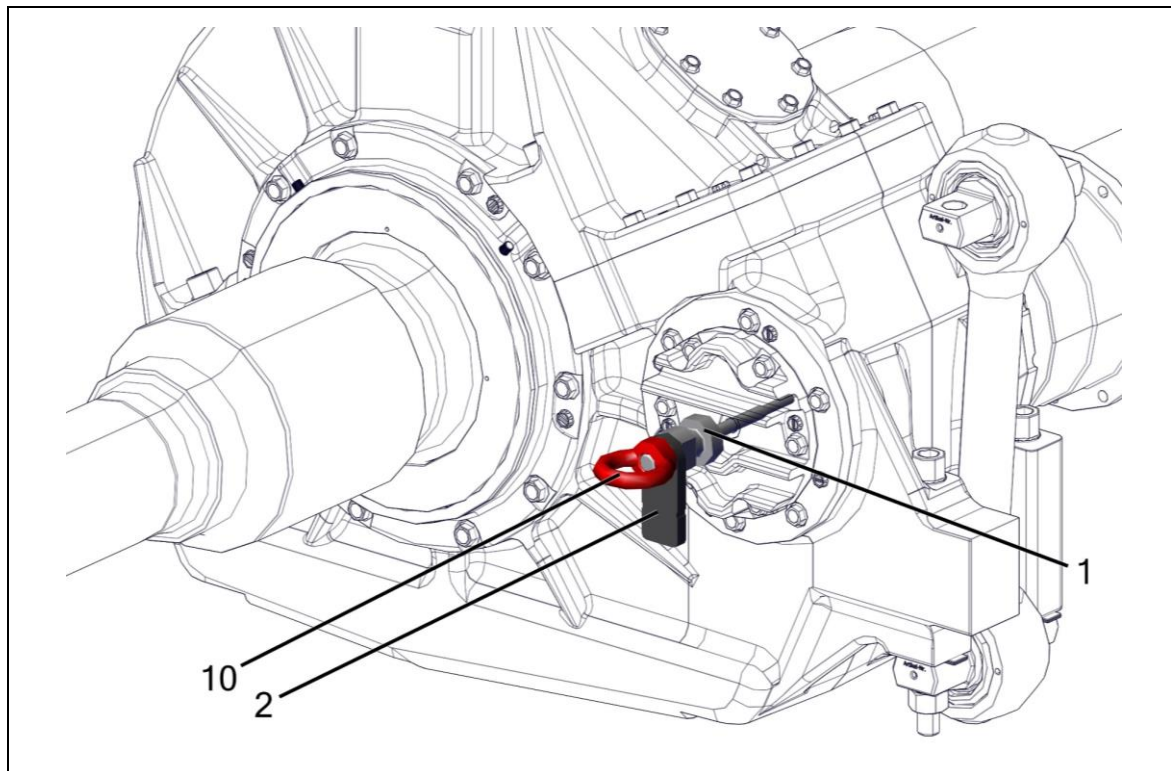


Figure 57: Adapter – measuring flank clearance - AAV003020R0001 – T3

Pos.	Designation	Quantity
1	Adapter Screw	1
2	Measuring plate	1
10	Eye nut, M20 DIN582	1



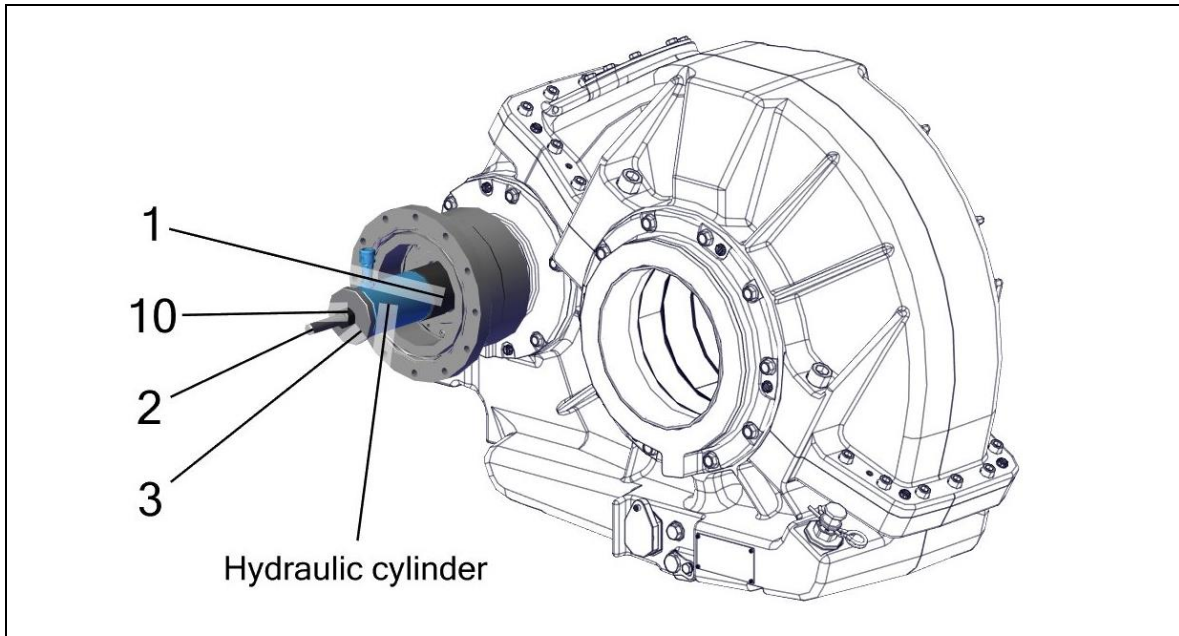


Figure 58: Pressing device for clutch - AAV002156R0001 – T4

Pos.	Designation	Quantity
1	Pressing disc	1
2	Threaded rod	1
3	Disc	1
10	Hexagon nut, DIN EN ISO 4032-M16-8-A2F	1

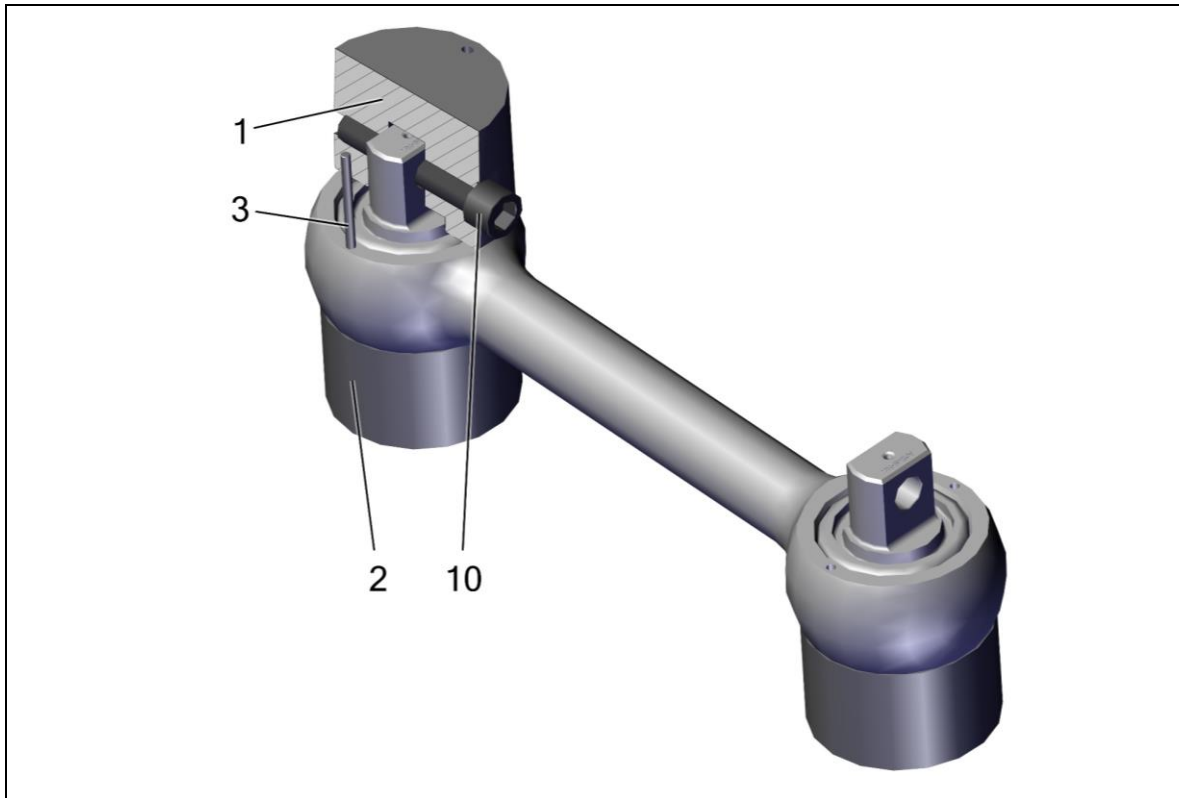


Figure 59: Press-in device - AAV001673R0001 – T5

Pos.	Designation	Quantity
1	Pressing block	1
2	Support tube	2
3	Guide pin	2
10	Hexagon socket screw, ISO 4762, M20x110-10.9	1

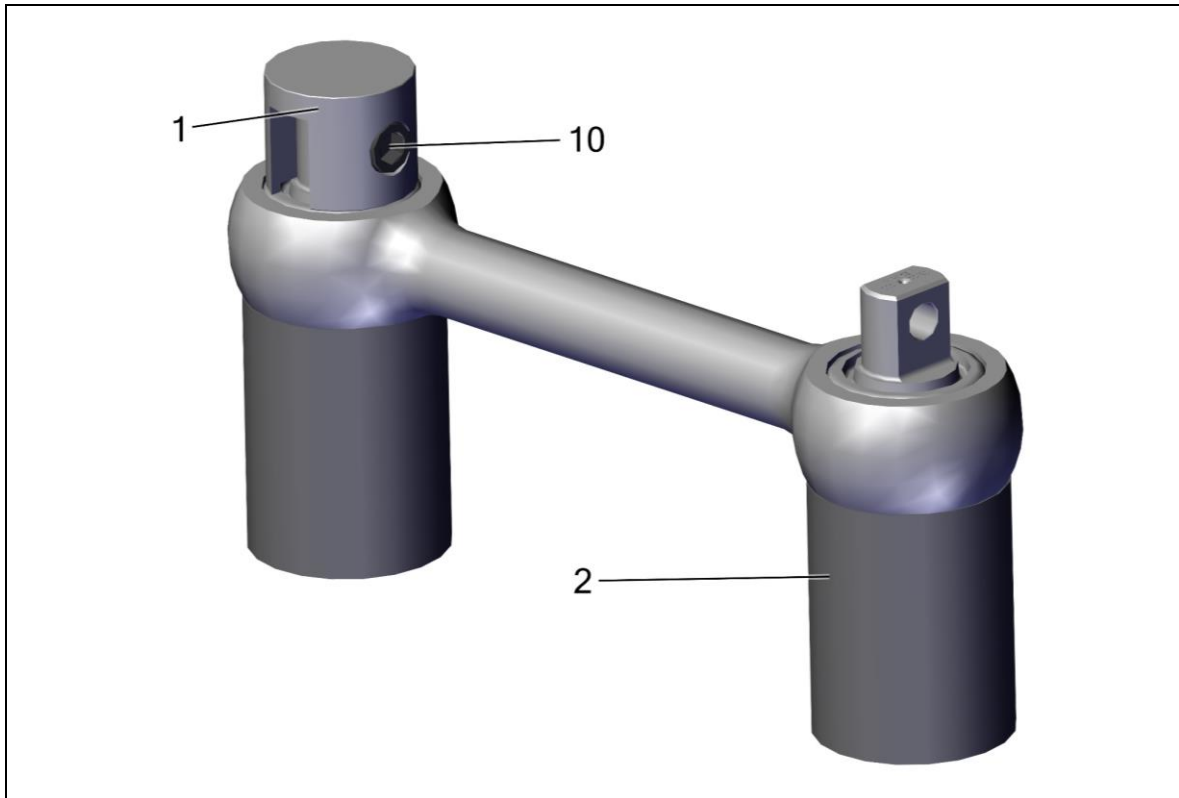


Figure 60: Press-out device - AAV001683R0001 – T6

Pos.	Designation	Quantity
1	Out pressing sleeve	1
2	Support tube	2
10	Hexagon socket screw, ISO 4762, M20x110-10.9	1

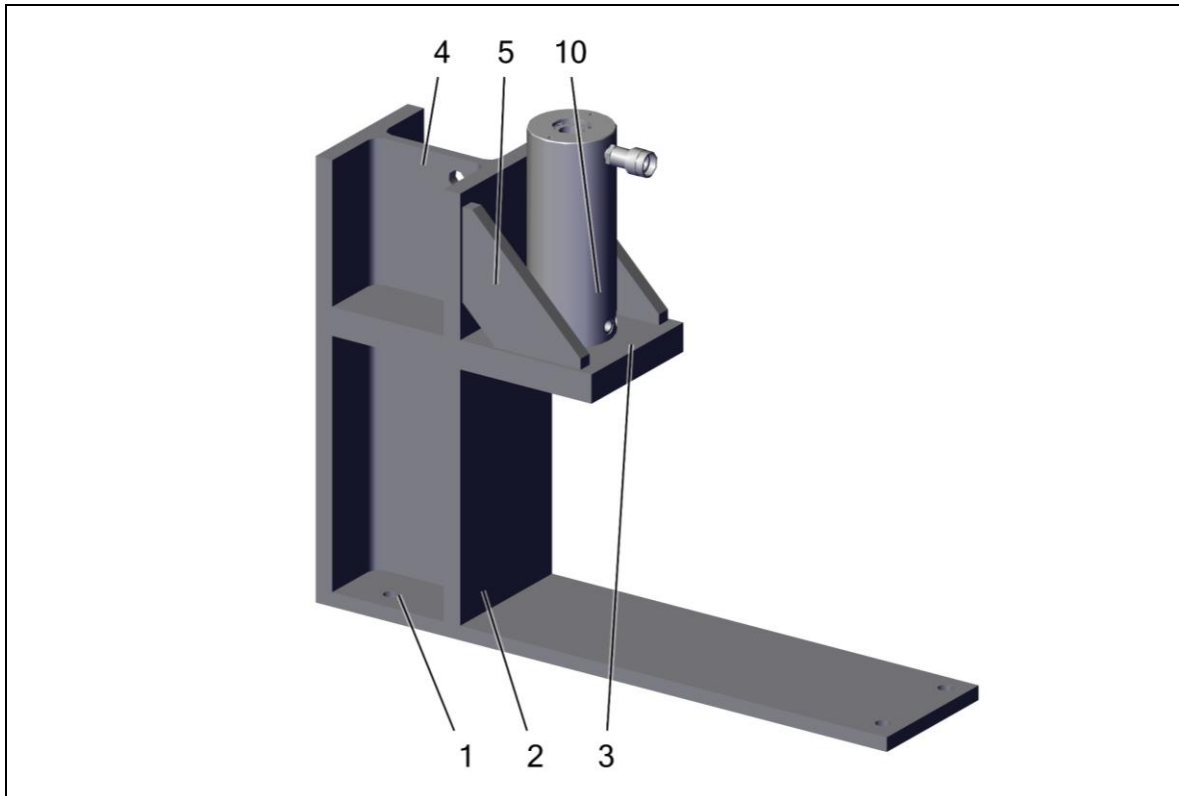


Figure 61: Pressing device - AAV001799R0001 – T7

Pos.	Designation	Quantity
1	Ground plate	1
2	Support	1
3	Holding plate	1
4	Support carrier	1
5	Stiffening	2
10	Enerpac hollow piston cylinder RCH-306	1

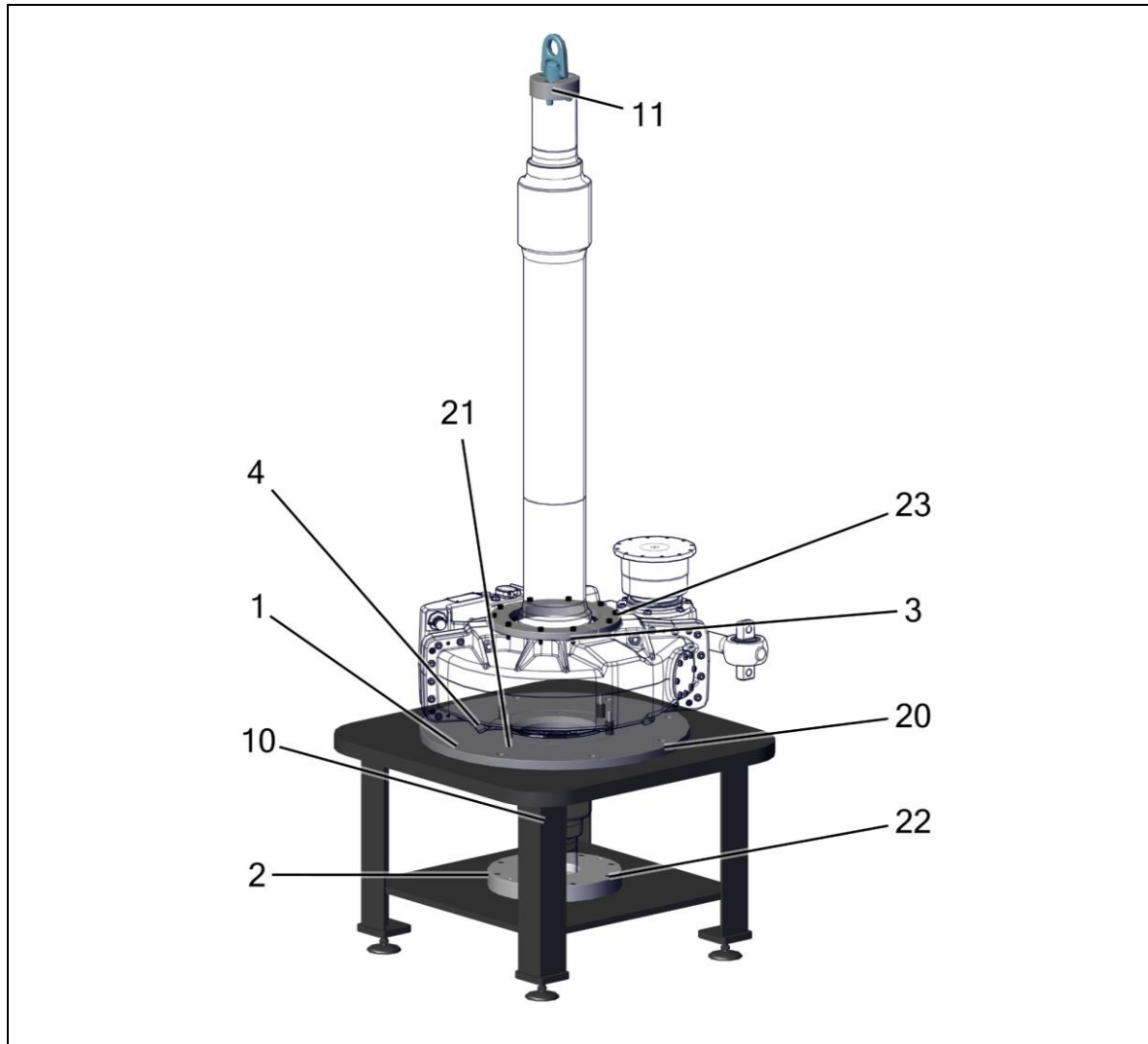


Figure 62: Adapter – measuring bearing clearance - AAV003023R0001 – T8

Pos.	Designation	Quantity
1	Support plate	1
2	Guide ring	1
3	Measuring adapter	1
4	Distance sleeve	4
10	Assembly device	1
11	Adapter disc	1
20	Hexagon socket head cap screw, DIN912, M16x35-8.8-A2F	8
21	Hexagon socket screw, ISO4762, M12x110-8.8-A2F	4
22	Hexagon socket screw, ISO4762, M12x50-8.8-A2F	8
23	Hexagon socket screw, ISO4762, M12x40-8.8-A2F	10

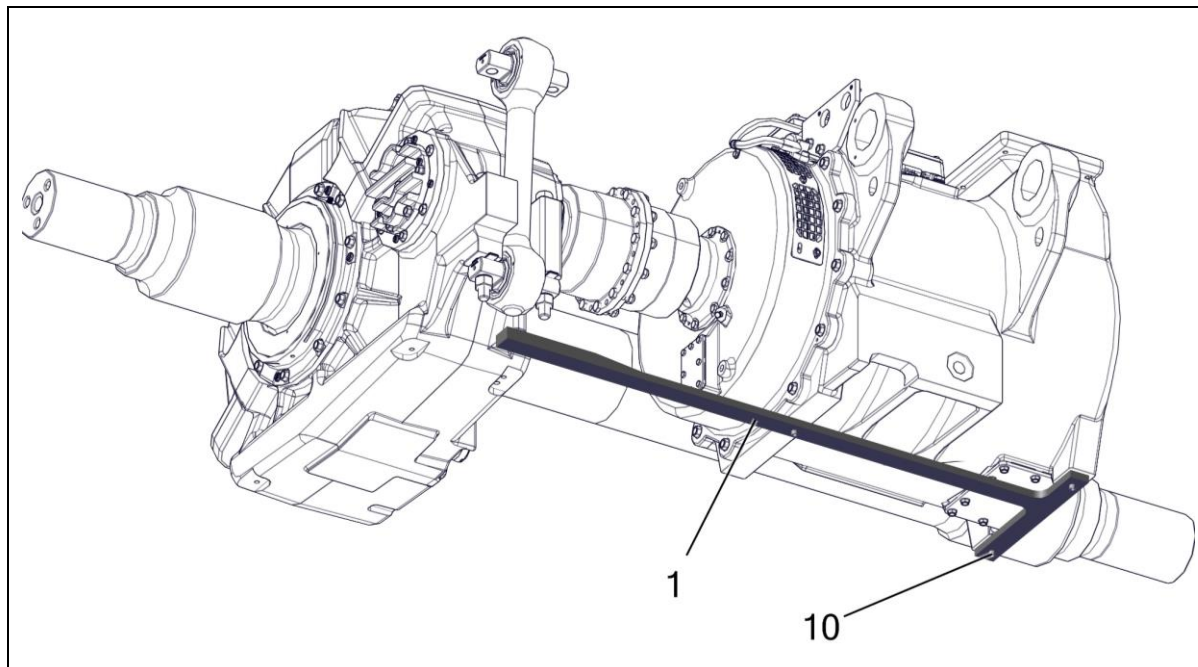


Figure 63: Height control - AAV003024R0001 – T9

Pos.	Designation	Quantity
1	Controlling bar	1
10	Hexagon socket screw	3

## 12.4.2 Tools, measuring device and auxiliary materials

Designation	Specification	Quantity
Lifting gears with a sufficient lifting capacity	for loads up to <b>1435 kg</b>	2
Ejector screws	M8, M12, various lengths	AR
Two-arm puller	-	1
Collecting tray	Volume > 8 l	1
Axial fastening for demounting coupling	-	1
Wooden blocks for supporting the wheelset shaft and the gear box	-	2
Compressed air	Dry and de-oiled	1
Spring balance	-	1
Threaded rod	M8, including M8 hex nuts	2
Hydraulic cylinder	-	1
Hollow hydraulic cylinder single-action (spring return)	-	1
Induction heater with demagnetization and temperature probe	-	1
Freezer	for temperatures of -30 up to -70 °C	1
Dial gauge with lever gage	Gage: 1/100 mm or more precisely	1
Load swivel	M12	4
Vacuum cleaner	-	1
Flashlight	-	1
Torque wrench	6 – 600 Nm	1

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## 12.5 Records and forms

### 12.5.1 Record log of type testing

Type testing according to test plan: TSA024563




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Type test plan and type test protocol are supplied separately (are not part of this operating manual).

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### 12.5.2 Product monitoring

We are bound by law to continue to observe the product beyond its delivery.

Particularly on:

- Recurring faults
- Inappropriate, unsafe operation
- Accidents that occurred
- Other abnormal operating behaviours

These details are of great interest to us and serve as guiding principles for adjustments that should be made.




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We ask you to inform us of any malfunctions, damage, accidents, etc. This will enable us to improve our products if necessary and to further increase their operational safety and reliability.

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## 14 FURTHER DOCUMENTS

For further technical information see the following documents.

### 14.1 Drawings

Outline drawing .....	<a href="#">TSA024288</a>
Dimension drawing for final inspection .....	<a href="#">TSA024568</a>
Adjustment instruction .....	<a href="#">TSA024862</a>

### 14.2 Applicable documents

Operating Manual Traction Motor .....	<a href="#">TSA025068</a>
Operating Manual of gear coupling (ZK 242-R2-BD) .....	<a href="#">KWN31690</a>
Service manual for KWD gear coupling .....	<a href="#">KWN31284</a>
Oil and debris check in the Traction Gearbox .....	<a href="#">TSA009129</a>
Evaluation of the leak-tightness of Traction Gearbox .....	<a href="#">TSA018153</a>
Assembly instruction of reaction rod .....	( <sup>1</sup> )
Maintenance Manual of spherical bearing .....	<a href="#">GMT64306911</a>

### 14.3 Corrosion protection

Coating regulation for corrosion protection via paint coating and lacquer coating .....	<a href="#">TSA000075</a>
Coating Restoration and Repair .....	<a href="#">TSA900099</a>

### 14.4 Safety data sheets




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The safety data sheets are subject to local regulations. These must be handled by the user and kept up to date.

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<sup>1</sup> Follows with next revision