Service Manual
Front Axle

wagner
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Preface

Axles, gearboxes, wheel gears and wheel ends produced by Kessler & Co. GmbH & Co.KG (hereinafter referred to as KESSLER) are designed and produced according to the current state of the art and generally recognized safety regulations.

The documentation describes the state of the art at the time when the documentation was written. It was written to the best of the author's knowledge, KESSLER accepts no liability, however, for possible errors regarding illustrations and descriptions.

This documentation is not subject to revision. Subject to change without notice.

Due to the constant further development and technical improvements of our products, the illustrations may differ in the following work steps or vary from the actual product/components. Drawings, graphics and photos are often not true to scale.

Claims for damage and consequential costs due to work carried out unprofessionally or improperly by third parties are ruled out.

For repair and modification works spare parts only manufactured by KESSLER may be used. Prescribed standards must be complied with in general.

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1 Safety

1.1 Structure of warning notices

SIGNAL WORD

Type and source of the danger

Consequences if ignored

➢ Measure

1.2 Explanation of the usual warning notices and symbols

⚠ DANGER	
	**Indicates a direct danger.** If not avoided, death or serious injury will result.

⚠ WARNING	
	**Indicates a possibly dangerous situation.** If not avoided, death or serious injury may possibly result.

⚠ CAUTION	
	**Indicates a possibly dangerous situation.** If not avoided, injury may possibly result.

NOTICE	
	Indicates situations where material damage can occur.

NOTE
Indicates important information, application tips, and useful notes for proper working practices.

General warning sign that draws attention to potential dangers.

Warning against danger of burns or cut injuries. Protective gloves must be worn.

1.3 Basic safety instructions

The following safety instructions must be read and observed before work is started on KESSLER products.

Product safety

Axles, gearboxes, drive assemblies, wheel gears, and wheel ends produced by KESSLER (referred to as KESSLER products in the following) are developed, designed and manufactured according to German and European technical regulations.

Work on Kessler products may only be carried out in compliance with the technical rules and safety regulations valid at the operating site.

- Valid health, work, and fire-protection regulations
- Laws, directives, and safety regulations

Organizational and personnel matters

Fundamental principles: axles, gearboxes, drive assemblies, wheel gears, and wheel ends produced by KESSLER may only be put into operation in a technically fault-free condition, when used as intended and being mindful of safety and danger while observing the instructions. Remove defects immediately, especially those which might adversely affect safety. The operation of defective and improperly maintained, repaired or retrofitted axles, gearboxes, drive assemblies, wheel gears and wheel ends is not permitted under any circumstances! Carry out all activities in a responsible and safety-oriented manner. Furthermore, all markings and labels on axles, gearboxes, wheel gears, and wheel ends of KESSLER must be legible.

Scope of validity: The documentation is valid for all persons who work on KESSLER products. Before work is carried out on the vehicle, the documentation must be read completely and closely observed. If there are questions or something cannot be understood, KESSLER must be consulted.
The documentation should be stored near the KESSLER products and be accessible for the personnel at any time. The documentation is part of the KESSLER products and must be available in its entirety during the entire service life.

Competences: Work on KESSLER products may only be carried out by trained technicians such as motor vehicle mechanics or persons with comparable vocational training.

Product-specific dangers

Transport, installation, maintenance, repair, and conversion work: Activities between or on moving subassemblies must be avoided as there is a danger of crushing or shearing.

The unpredictable own weight of KESSLER products or individual parts can cause them to fall or tip over unexpectedly.

- Employ only suitable, undamaged, and approved cranes and slinging means for the load in question.
- Do not stand under suspended loads.
- Secure parts with tension belts and/or suitable supports.
- Wear safety shoes.

All maintenance specifications in KESSLER's documentation must be observed.

All work must be carried out at a clean workplace.

The instructions in this documentation assume that the KESSLER product has been disassembled and is fixed onto a device for further processing. Read the vehicle manufacturer's instructions on how to dismantle the KESSLER products from the vehicle.

Work on a KESSLER product may only be carried out when permissible by the temperature of the respective component.

- Make sure that oil has cooled down before draining it.
- Make sure that rotating parts have cooled down before starting disassembly.
- Wear fire-proof gloves.

Brake: When working on the brake it must be ensured that no unintended machine movement can occur when the brake mechanism is disengaged.

The brake is a safety component of the first order; improper work on it may cause the brake to fail.

Rim and tire: Never stand directly in front of the rim when air is released or during inflation. Parts may suddenly come loose and be ejected due to the inner pressure of the tire.

The air needs to be released completely from the tire beforehand when disassembling versions with clamped rim fixation. Be sure to observe the tightening torques and maintenance of the wheel nuts and clamps.

Lubricants and auxiliary materials: Be sure to observe the manufacturer's safety data sheets when handling lubricants and auxiliary materials (e.g. oils and greases).

Oils and greases can trigger allergic reactions on skin. For this reason, appropriate protective clothing must be worn.

Loose-fitting clothing and long loose hair is prohibited when working on KESSLER products!

When metal parts are being machined where there is a risk of shattering (grinding, deburring, cleaning with compressed air, etc.), bits of metal may be flung out that can injure the eyes. For this reason, safety goggles must always be worn.

KESSLER offers customer service tools that make working on axles, gearboxes, wheel gears, and wheel ends easier and safer.

Repair welding is only permitted after consultation with KESSLER!

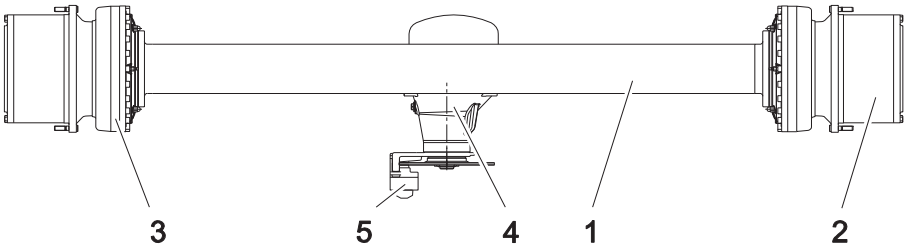
Before reassembling used parts, they must be checked for damage, fault-free contact surfaces and wear. In particular, check that there are no chips or other foreign bodies in the axles, gearboxes, wheel gears, and wheel ends.

After carrying out maintenance and repair work, check that the product functions properly.

2 Axle Overview

L90 Log Stacker

Axle 111.0934.2



1 Axle housing

2 Hub assembly

3 Service brake

4 Drive assembly

5 Parking brake

3 Repair

After working on axles, gearboxes, wheel gears and wheel ends all assembly groups need to be checked for leaks.

The display of components in the following images is simplified!
Deviations may occur in

- form
- scale
- position of add-on parts, connections and holes
- number of bearings, disks, etc.

3.1 Correct disassembly

- Drain oil before disassembly and check for metal particles.
- Before disassembly, always mark the matching parts.
- Never use a hard object to loosen tightly inter-fitted parts. Use suitable extractor devices to disassemble rolling bearings, drive flanges and similar.
- Before disassembly, check the bearings for damages and replace them if necessary.
- During disassembly, always replace all sealing rings.
- Clean or replace corroded components.
- Do not place parts on soiled surfaces.

3.2 Correct assembly

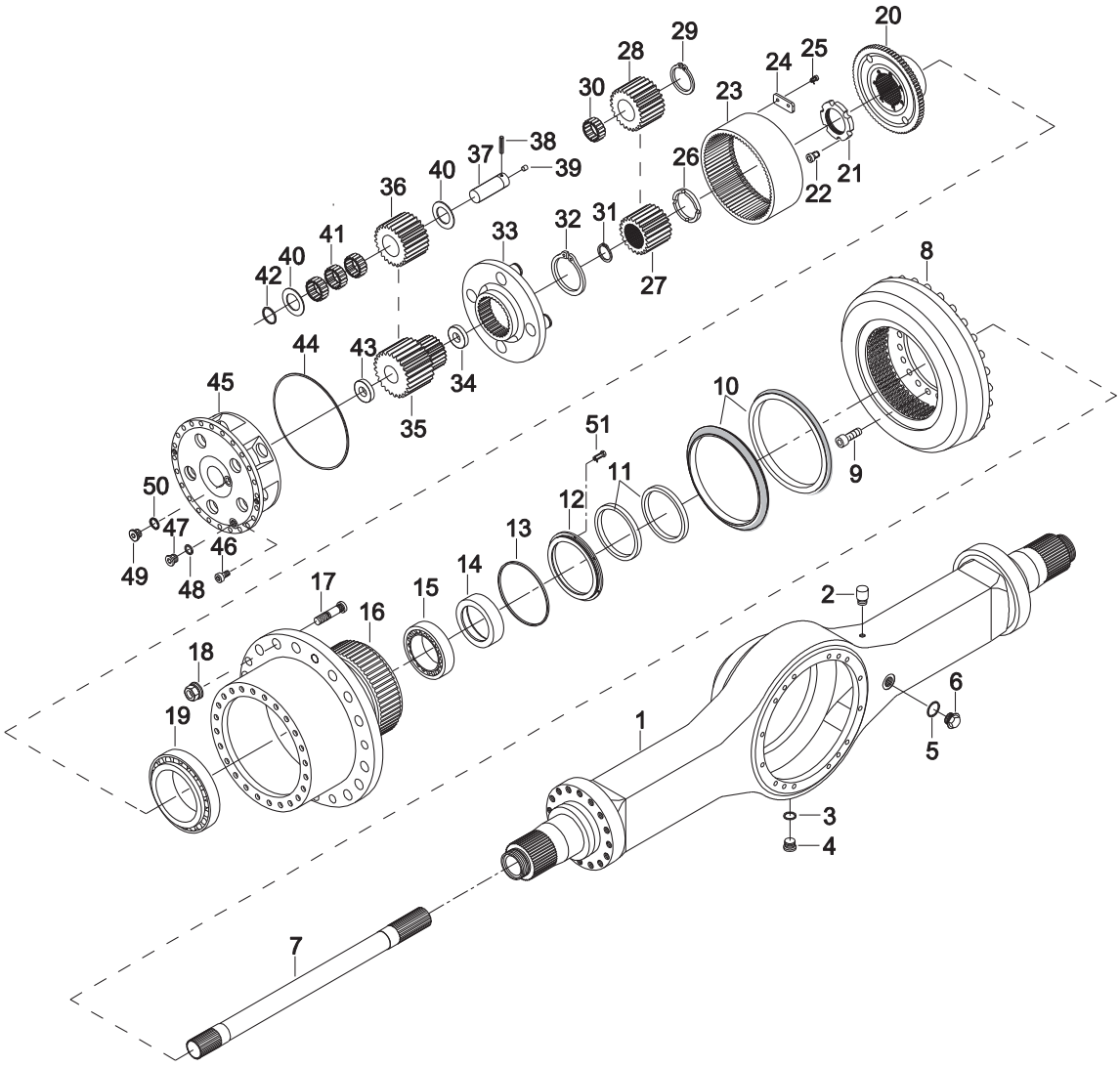
- Clean parts before assembly.
- Lubricate bearings running in oil during assembly.
- When assembling radial seal rings, ensure sufficient coverage in the housing hole. Ensure that the radial seal ring lies flat. Loctite may not come into contact with the sealing lip!
- Fill radial seal rings, especially sealing rings with a dust lip, with grease.
- Do not use force to hammer in universal joints and axle shafts. They must remain adjustable.
- Preserve sealing ring contact surfaces on flanges, shafts etc. with Castrol Rustilo DWX 32 before installation.
- Fill in oil after assembly!

3.3 Hub assembly

3.3.1 Preconditions

- The KESSLERproduct has been disassembled from the vehicle.
- Before disassembly, the oil must be drained. See Oil change on page 62
- The disassembly sequence must be observed.

3.3.2 Overview of parts



1 Axle housing
2 Breather
3 Sealing ring
4 Screw plug
5 Sealing ring
6 Screw plug
7 Axle shaft
8 Wet multiple disk brake
9 Screw
10 Face seal
11 Radial seal ring
12 Ring
13 O-ring
14 Spacer ring
15 Tapered roller bearing
16 Wheel hub
17 Wheel stud
18 Wheel nut
19 Tapered roller bearing
20 Ring gear carrier
21 Wheel bearing adjustment nut
22 Screw
23 Ring gear
24 Lock plate
25 Screw
26 Thrust ring
27 Sun gear
28 Planetary gear
29 Circlip
30 Needle bearing
31 Circlip
32 Circlip
33 Planetary carrier
34 Thrust washer
35 Sun gear
36 Planetary gear
37 Planetary pin
38 Spring-type straight pin
39 Cover
40 Disk
41 Needle bearing
42 O-ring
43 Thrust washer
44 O-ring
45 Planetary housing
46 Screw
47 Screw plug
48 Sealing ring
49 Screw plug
50 Sealing ring
51 Screw

3.3.3 Customer service tools hub assembly

The following tool list is an overview of required service tools for disassembly and assembly. It does not claim to be completely.

On request, you will receive a complete list when ordering the spare part list.

Wrench for wheel bearing adjustment nut

Order number: 598938

Seal ring sleeve driver for seal ring within the wheel hub

Order number: 260102
(Seal ring dimension 260x280x10)

Centring tool for disks

Order number: 260103

Installation tool for face seal

Order number: 593406

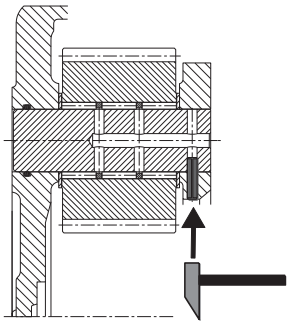
3.3.4 Disassembly hub assembly

Removal and disassembly is carried out in the reverse order to assembly. This is described in detail and is also valid for disassembly.

Observe the safety instructions!

1. Disassembly planetary gear
   see as well "Dismantling planetary gear"
2. Disassembly axle shaft
3. Disassembly ring gear carrier unit
4. Disassembly wheel hub
5. Disassembly wet multiple disk brake (if necessary)
6. Disassembly spacer ring (if necessary)
7. Disassembly thrust ring (if necessary)

3.3.4.1 Dismantling planetary unit



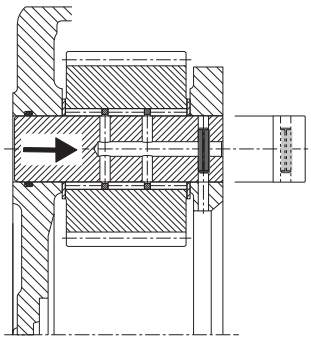
1. Knock through the dowel pin inwards until it lies in the planetary pin completely.

NOTICE

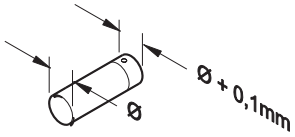
Diameter difference of 0.1 mm at the planetary pin

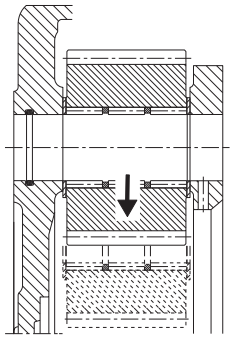
The drill hole in the planetary housing will be destructed as a result of incorrect disassembly.

- ➢ The planetary pin may only be pressed through in the direction of the arrow.
- ➢ Observe the position of the locking drill hole.



2. Press out the planetary pin in the direction of the arrow.

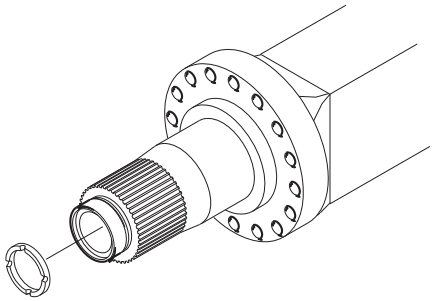




3. Take out the planetary gears with thrust washers and bearings.
4. Remove O-rings from planetary housing.

3.3.5 Assembly hub assembly

3.3.5.1 Assembly thrust ring



1. Press the thrust ring into the axle spindle.
   - ➢ Loctite 270

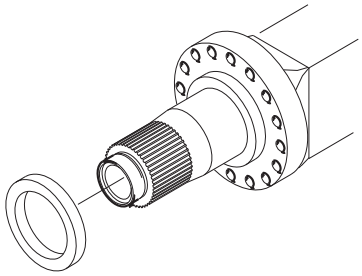
3.3.5.2 Assembly spacer ring

⚠ CAUTION

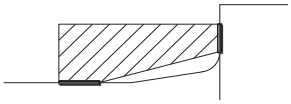
Hot spacer ring

Risk of burning

- ➢ Wear heat resistant gloves

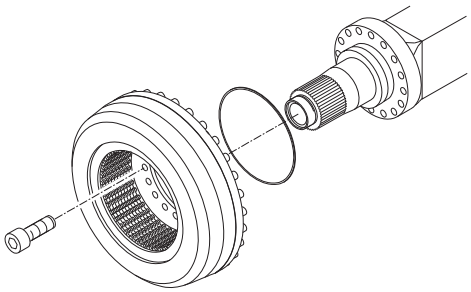


1. Corrosion check at the seat of the spacer ring.
   - ➢ Corrosion at the axle spindle is not allowed.
2. Coat the seat of the spacer ring on the axle spindle with Loctite.



   - ➢ Loctite 572
3. Uniformly heat the spacer ring in an oven to approximately 100°C and push it up to the contact surface on the axle spindle.
4. Remove Loctite residues after cool-down.
5. Coat the sealing ring running area on the spacer ring with oil before assembly.

3.3.5.3 Assembly brake unit onto axle



1. Safeguard the brake unit against falling down until it has been screwed down to the axle housing.
2. Lightly oil the O-ring and insert it in the groove of the brake carrier/axle spindle or steering knuckle without twists and loops.
3. Push on the multiple disk brake.
   - ➢ Observe the correct position of the connections!
4. Screw the multiple disk brake.
   - ➢ Tightening torque: See "Tightening torques for standard metric threads" on page 83.

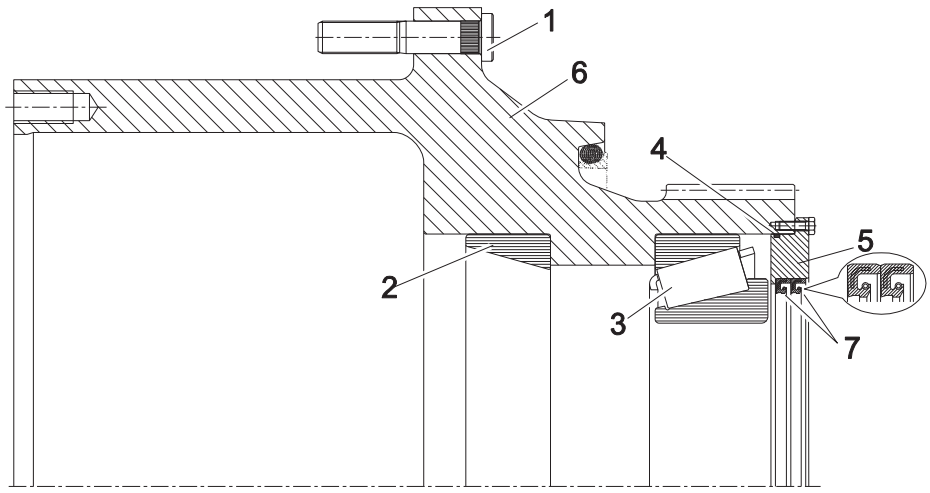
3.3.5.4 Preparation wheel hub unit

NOTICE

Incorrect installation of the radial seal ring

Sealing of the oil cavity is not guaranteed.

- ➢ Observe the installation position of the sealing lips of the radial seal ring!
- ➢ Do not damage the sealing lip of the radial seal ring.
- ➢ Use the special tool - sealing ring sleeve driver



1. Install the wheel studs (1).
2. Press in bearing shells (2+3).
   - ➢ Do not knock them in!
3. Insert the bearing (3).
4. Insert the O-ring (4) into the slot of the ring (5).

5. Coat the ring (5) with Loctite.
   - ➢ Loctite 572
6. Insert the ring (5) into the wheel hub (6) and screw it.
   - ➢ Loctite 270
   - ➢ Tightening torque: 10 Nm
7. Coat radial seal rings (7) with Loctite.
   - ➢ **Rubberized outer sheath:** Loctite 572
8. Press the radial seal rings (7) into the wheel hub (6).
   - ➢ Customer service tool: Seal ring sleeve driver
9. Fill the radial seal rings (7) 2/3 full with roller bearing grease.

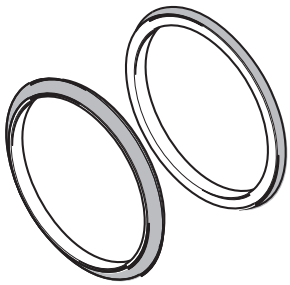
3.3.5.5 Assembly wheel hub unit

⚠ CAUTION

Sharp edges in the face seal

Risk of cutting

- ➢ Wear protective gloves



1. Insert the face seal into the wheel hub and into the brake unit.
   - ➢ Costumer service tool: installation tool for face seal
   - ➢ See "Assembling the face seal" on page 30

⚠ CAUTION

After assembly of the wheel hub unit it can tip over uncontrolled under its own weight and fall down.

Risk of squashing

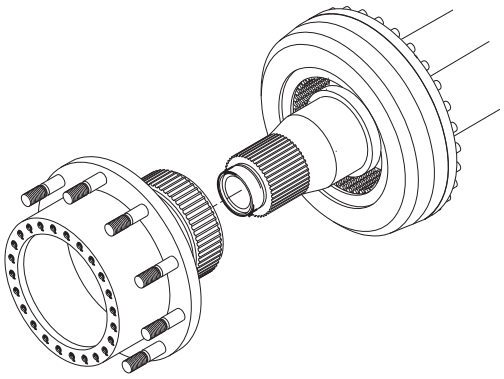
- ➢ Safeguard the wheel hub unit, also after assembly, with suitable lifting tackle against falling down, until the wheel bearing adjustment nut has been tightened.

NOTICE

Careless sliding on of the wheel hub unit damages the radial seal rings.

In case of damage to the radial seal rings sealing of the oil cavity is not guaranteed.

- ➢ Slide on the wheel hub unit parallel and very carefully.



Adjusting the disks of the brake (if necessary):

2. Actuate the brake with air pressure.
   - ➢ Releasing of the disks.
3. Adjust the disks of the wet multiple disk brake.
   - ➢ Customer service tool: centring tool for disks.
4. Release the brake.
   - ➢ Fixation of the disks.

Assembly wheel hub:

5. Slide on the pre-assembled wheel hub parallel onto the axle spindle with help of a suitable lifting equipment.
6. Fix the wheel hub in this position until assembly of the wheel bearing adjustment nut is finished.

3.3.5.6 Preparation ring gear carrier unit

⚠ CAUTION

Sharp edges on the teeth

Risk of cutting

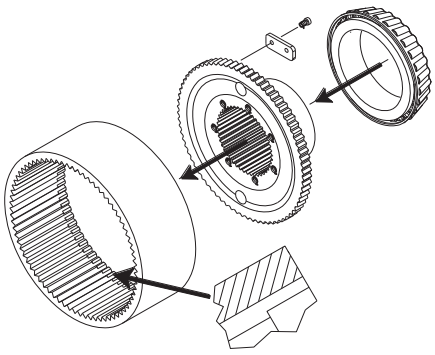
- ➢ Wear protective gloves

NOTICE

Due to a milled tooth system in the ring gear, there is only one installation direction.

The toothing system of the ring gear and the ring gear carrier will be damaged as a result of incorrect assembly.

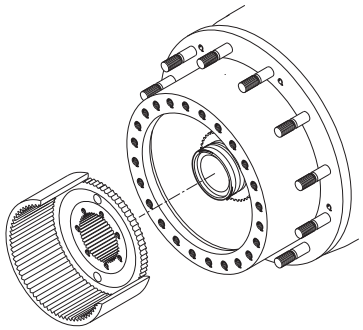
- ➢ The ring gear and the ring gear carrier may only be assembled as shown.



1. Heat the tapered roller bearing inner ring to approximately 100°C and slide onto the ring gear carrier up to the contact point.
2. Allow to cool down.
3. Place the ring gear on the ring gear carrier.
4. Fasten all lock plates with screws.
   - ➢ Loctite 270
   - ➢ Tightening torque: see Tightening torque for screw plugs on page 84

3.3.5.7 Assembly ring gear carrier unit

⚠ CAUTION	
	**After assembly of the ring gear carrier unit it can tip over uncontrolled under its own weight and fall down.** Risk of squashing ➢ Safeguard the ring gear carrier unit, also after assembly, with suitable lifting tackle against falling down, until the wheel bearing adjustment nut has been tightened.



1. Slide on the prepared ring gear carrier onto the axle spindle.
   ➢ Seen from the axle assembly side, one of the oil compensation drill holes must be at the bottom.

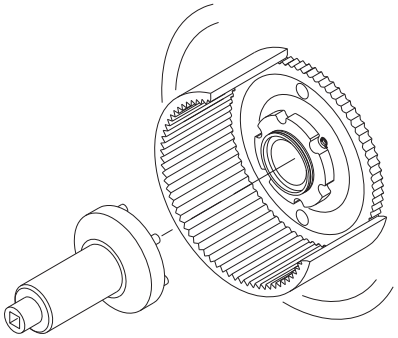
3.3.5.8 Wheel bearing adjustment

⚠ DANGER

Faulty mounting and incorrect securing of the wheel bearing adjustment nut

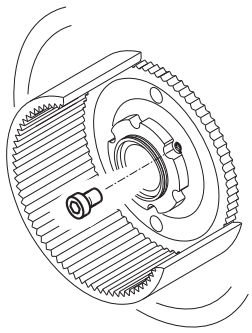
The wheel along with the complete hub assembly comes off of the axle.

➢ In any case, tighten and secure the wheel bearing adjustment nut as described!



Assembly wheel bearing adjustment nut:

1. Completely coat the contact surface and the thread of the wheel bearing adjustment nut with assembly paste.
   - ➢ Assembly paste with solid lubricants
2. Screw on the wheel bearing adjustment nut and tighten with 1.5 to 2 times of the specified tightening torque (see below).
   - ➢ Customer service tool: Wrench for wheel bearing adjustment nut
   - ➢ Lightly knock on the wheel hub with a plastic hammer and turn it several times during tightening.
3. Loosen the wheel bearing adjustment nut again (loose it approximately 180°).
4. Tighten the wheel bearing adjustment nut.
   - ➢ Turn the wheel hub repeatedly during tightening.
   - ➢ Tightening torque for new bearings: 1000 Nm
   - ➢ Tightening torque for used bearings: 750 Nm
   - ➢ If it is not possible to lock in this position, the wheel bearing adjustment nut must turned forward to the next possible locking position.



Locking wheel bearing adjustment nut:

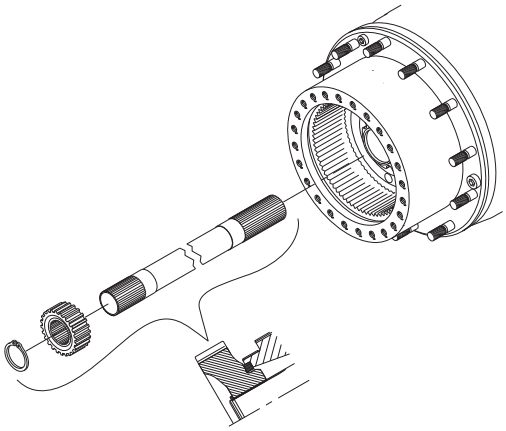
5. Lock the wheel bearing adjustment nut with a screw.
   - ➢ Hexagon socket screw
   - ➢ Screw locking: Loctite 270
   - ➢ Tightening torque: 125 Nm

3.3.5.9 Leak test of the cooling oil cavity of the brake unit

After adjustment of the wheel bearings a leak test of the multiple disk brake must be performed – see Test the cooling oil chamber of the service brake for leak tightness on page 35.

If this test is not satisfactory, the hub assembly must again be disassembled and checked for leakage.

3.3.5.10 Preparation and assembly axle shaft



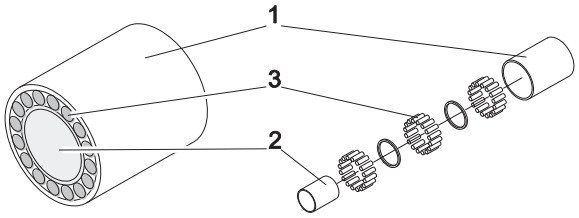
1. Push the axle shaft into the axle spindle.
   - ➢ It must be possible to easily slide the axle shaft (by hand) in the inner profile of the differential.
2. Push the sun gear of the inner planetary unit onto the axle shaft.
3. Mount the circlip.
4. Push the axle shaft into the axle spindle until the sun gear is in contact with the circlip and the thrust washer.

3.3.5.11 Preparation planetary gear drive

Assembly procedure of full complement roller set cageless

Full complement needle bearings are available in versions with cage and without cage.

In version without a cage the individual needles are not held and will fall out due to incorrect assembly. Therefore observe on the special assembly process, as described below.

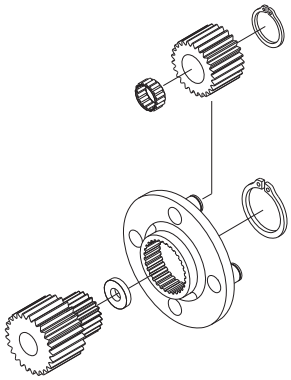


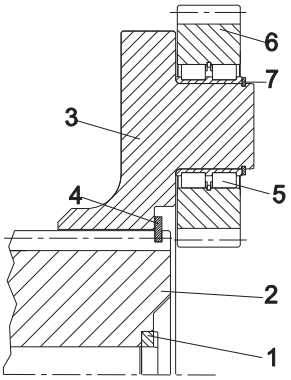
1 Outer mounting bushing

2 Inner mounting bushing

3 Needles/Full complement roller set

1. Install the needle bearing with mounting bushings into the planetary gear.
   - ➢ Thereby the outer mounting bushing is pressed out.
2. Insert the planetary gear with thrust disks into the planetary housing.
3. Align and press in the planetary pin.
   - ➢ Thereby the inner mounting bushing is pressed out.





Assembly of sun gear:

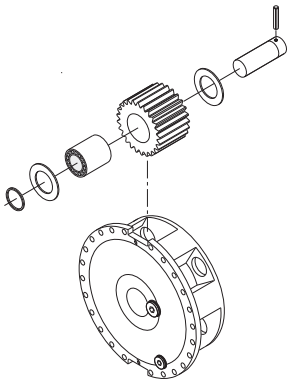
1. Press the thrust ring (1) into the sun gear. (2)
   - ➢ Loctite 270
2. Install the sun gear (2) of the outer planetary gear drive assembly into the planetary carrier (3) of the inner gear drive assembly.
3. Secure the sun gear with the circlip (4).

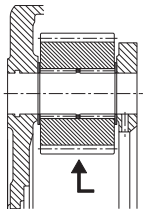
Prepare the planetary gear:

4. Place the needle bearing (5) with the plastic bushing onto the planetary gear (6).
5. Push in the needle bearing (5) until the snap ring is snapping into the slot of the planetary gear (6).
   - ➢ The plastic bushing will be stripped while pushing the needle bearing.

Assembly of planetary gear:

6. Press the planetary gear (6) together with the needle bearing (5) onto the pin of the planetary carrier (3).
   - ➢ press only on the needle bearing inner ring
7. Install the circlip (7).





Preparation outer planetary gear drive assembly:

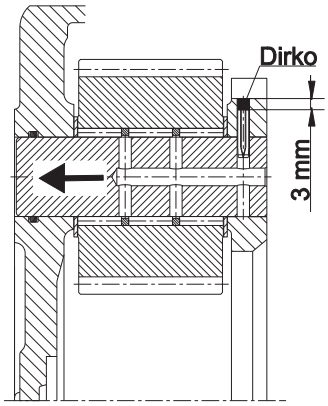
8. Assembly planetary gear bearing.
   - ➢ When full complement roller set regard correct mounting.
9. Position the planetary housing horizontally with its open side on top.
10. Insert the bottom thrust washer.
11. Place the planetary gear together with bearing on the bottom thrust washer.
12. Insert the top thrust washer.

NOTICE

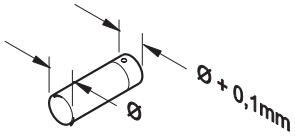
Difference of 0.1 mm at the planetary pin.

The drill hole in the planetary housing will be destructed as a result of incorrect disassembly.

- ➢ The planetary pin may only be pressed in in the direction of the arrow.
- ➢ Observe the position of the locking drill hole.



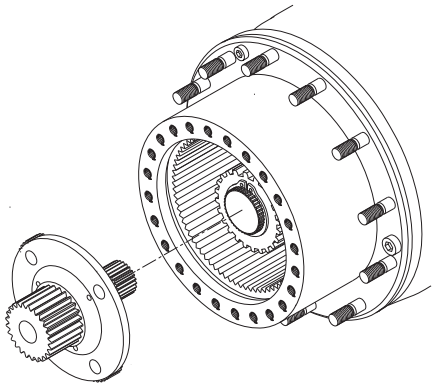
13. Lightly oil the O-ring and insert it in the groove of the planetary housing.
14. Press in the planetary pin in the direction of the arrow.



   - ➢ Ensure a lined-up position of the locking drill hole in the planetary pin and in the planetary housing.
15. Secure every planetary pin with a dowel pin.
   - ➢ The dowel pins have to pressed in 3 mm.
16. On the outside seal the drilling for the dowel pins with DIRKO grey.

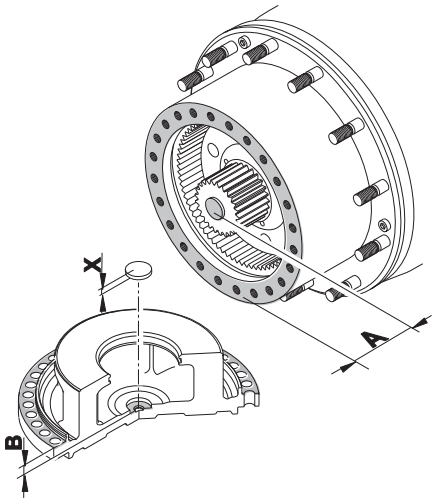
Thoroughly clean the outside of the planetary housing after assembly of the axle in order to prevent apparent leakage.

3.3.5.12 Assembly inner planetary gear drive assembly



1. Push the inner planetary gear drive assembly into the ring gear and onto the sun gear.
   - **Tip:** Turning the drive flange eases the assembly of the planetary gear drive onto the sun gear.

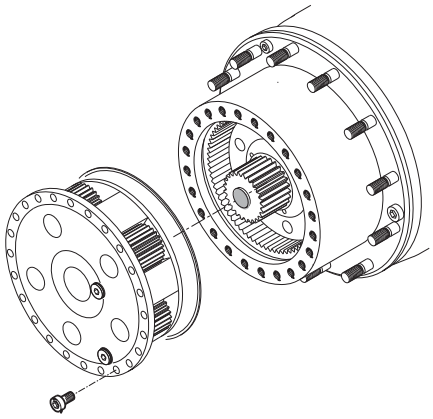
3.3.5.13 Adjustment axial play



The axial clearance between sun gear and thrust washer in the planetary housing must be 0.5-2mm.

1. Measure distances.
   - Dimension A = … (see grey areas)
   - Dimension B = … (see grey areas)
2. Calculate the required thickness of the thrust washer.
   - Required thickness X = A + B - axial clearance (0.5-2mm)
3. Mount the correctly dimensioned thrust washer into the planetary housing.
   - Loctite 270

3.3.5.14 Assembly outer planetary gear drive assembly



1. Mount the O-ring into the planetary housing.
   - ➢ Sealing of the contact surfaces between planetary housing and wheel hub
   - ➢ Multi-purpose grease prevents the O-ring from falling out during assembly.
2. Push the prepared outer planetary gear drive assembly into the ring gear and onto the sun gear.
3. Align the holes to each other and screw the planetary housing with the wheel hub.
   - ➢ The oil drainage screw must be in the lower position!
   - ➢ Loctite 262
   - ➢ Tightening torque: **see Tightening torques for standard metric threads on page 83**

3.4 Service brake

Brake damage results in brake failure. Brake damage is caused for instance through leakage. The safety instructions in this chapter must absolutely be followed in order to avoid brake damage!

⚠ WARNING	
	**Scratching of brake parts as a result of careless disassembly / assembly.** Leak tightness of the brake is no longer guaranteed if the grooves or the running area are damaged. ➢ Check the grooves ➢ Check the running areas ➢ In case of damage a new part must be sued!

⚠ CAUTION	
	**After loosening the brake screws, the brake can tip over uncontrolled under its own weight and fall down.** Risk of squashing ➢ Safeguard the brake against falling with suitable lifting equipment.

NOTICE	
	**Contamination of the running, centering or contact areas with dirt particles or grease.** Leak tightness of the brake is not guaranteed if the areas are not clean. ➢ Thorough cleaning of all areas ➢ Meticulous control of the areas

NOTICE	
	**Improper assembly** Leak tightness of the brake is not guaranteed. ➢ Observe the correct sequence and alignment of the sealing parts during assembly. ➢ Mount the O-rings without twists and loops.

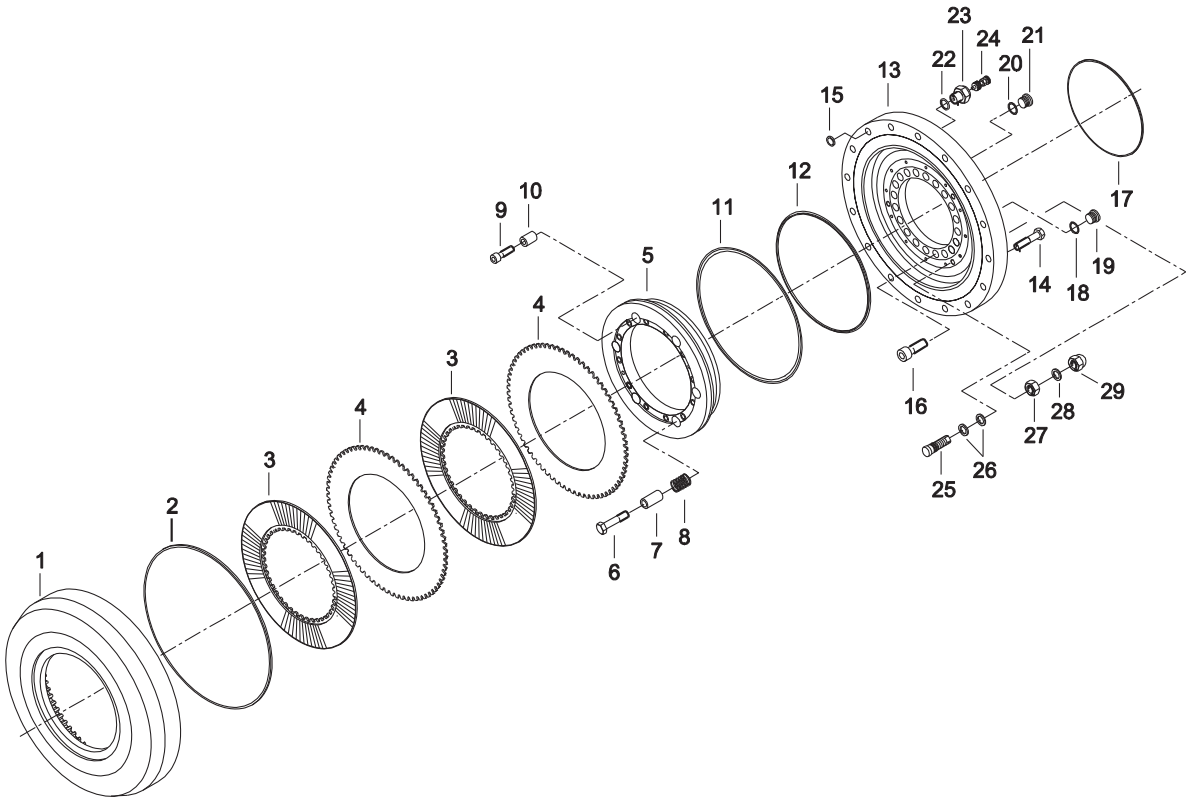
NOTICE	
	**In case of contact with water the brake lining is loosen itself from the disk.** Impairment up to failure of brake performance ➢ The disks may not come into contact with water.

3.4.1 Overview of parts

Type: **NLB 8550**

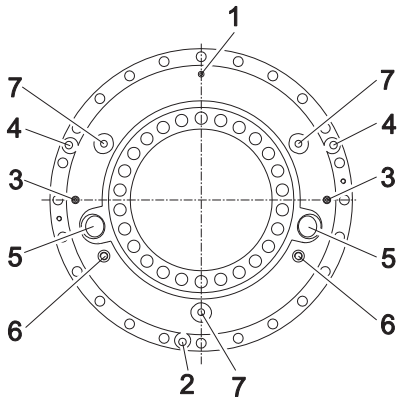
Wet multiple disk brake

The presentation of the parts and number of disks on the illustrations are not binding!



1 Brake carrier
2 O-ring
3 Inner disks
4 Outer disks
5 Piston
6 Screw
7 Pipe
8 Spring
9 Hexagon socket screw
10 Bushing
11 Gasket kit
12 Gasket kit
13 Brake carrier
14 Screw
15 O-ring
16 Screw
17 O-ring
18 Sealing ring
19 Screw plug
20 Sealing ring
21 Screw plug
22 Sealing ring
23 Bleeding socket
24 Bleeder
25 Bolt
26 O-ring
27 Nut
28 O-ring
29 Cap nut

3.4.2 Connections wet multiple disk brake



1 Bleeder
2 Oil drain plug
3 Hydraulic line „P“
4 Cooling oil inlet „C“
5 Cooling oil outlet
6 Wear inspection hole
7 Piston adjustment

3.4.3 Disassembly wet multiple disk brake

- When working on the brake make sure that no unintended machine movement happens by repealing the braking effect.
- The wear rate of the wet multiple disk brake must be measured and recorded before disassembly.
- Before disassembly of the wet multiple disk brake, the oil must be drained. **see Oil change on page 62.**
- Dirt and wear particles may not be allowed to enter the brake or the grooves of the gaskets during disassembly of a wet multiple disk brake. All parts which are affected by the assembly, for instance the brake carrier, the brake housing, ... must also be cleaned on the outside surfaces.
- The planetary gear drive and the wheel hub must be disassembled before disassembly of the wet multiple disk brake.

Removal and disassembly is carried out in the reverse order to assembly. This is described in detail and is also valid for disassembly.

Observe the safety instructions!

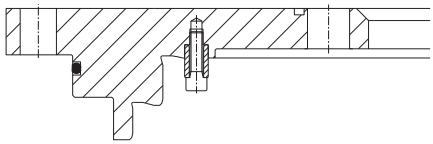
It is strongly recommended to mark the position of all parts to each other!

- Facilitates assembly.
- Warranty that connections, anti-twist device etc. correspond to the initial state after assembly.

In case of repair and modification work on the brake, new gaskets must be used as a matter of principle!

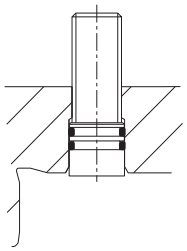
1. Remove the connections of the wet multiple disk brake.
   >> If there is still the face seal within the brake, pull off carefully.
2. Mark the position of the connections relative to the axle housing.
3. Loosen the screws and pull the brake off the axle.
   >> Use a suitable hoist device.
4. Disassembly brake carrier
5. Disassembly piston
6. Dismantling piston and gaskets
7. Remove anti-twist device from brake carrier (if necessary)
8. Remove the disks from housing

3.4.4 Assembly wet multiple disk brake



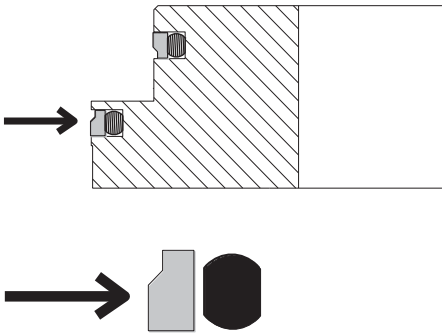
Prepare the brake carrier / Assembly anti-twist device:

1. Coat the top of the screw with Loctite.
   - Loctite 262
2. Push the hexagon socket screw into the bushing.
3. Screw in the anti-twist device of the piston.
   - The position was marked during disassembly and can be located as well at "Connections wet multiple disk brake".
   - Tightening torque: 72 Nm
4. Lightly grease the O-ring and insert it into the groove of the brake carrier without twists and loops.



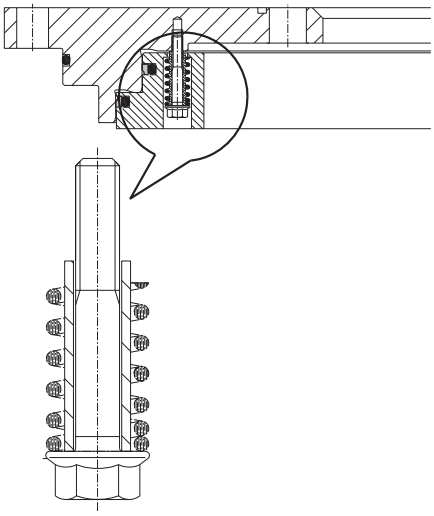
Prepare and installation of the piston adjustment screws:

5. Install the piston adjustment screws with the O-rings already fitted and lightly greased fully into the brake carrier.
   - The position was marked during disassembly and can be located as well at "Connections wet multiple disk brake".



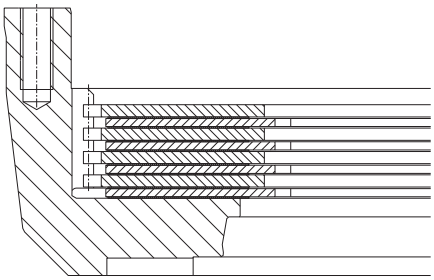
Assembly piston sealing rings:

6. Place the piston on the flat surface of the large diameter.
7. Oil the O-rings directly before assembly.
   - Do not use any used O-rings again!
8. Insert both gaskets (consisting of O-ring and profile ring) into the grooves of the piston.
   - **NOTICE:** Install the profile rings with small diameter to pressure side!
   - see arrow in graphics
   - When using a dual acting profile ring there is no special mounting direction.



Assembly piston in brake carrier:

9. Screw in auxiliary screws for easier handling.
10. Coat the piston ring running area of the brake carrier with oil.
11. Coat the threads of the brake carrier with Loctite.
    - ➢ Loctite 262
12. Insert the piston into the brake carrier.
    - ➢ Observe the correct position of the piston relative to the brake carrier!
    - ➢ See the prior marking from disassembly.
13. Press the piston uniformly into the brake carrier without tilting.
    - ➢ Some clamps which are thightened alternately ease this procedure.
14. Align the piston with the threads in the brake carrier.
15. Remove the auxiliary screws from the piston.
16. Put together hexagon screw, pipe and compression spring and screw it through the piston into the brake carrier.
    - ➢ Tightening torque: 10 Nm

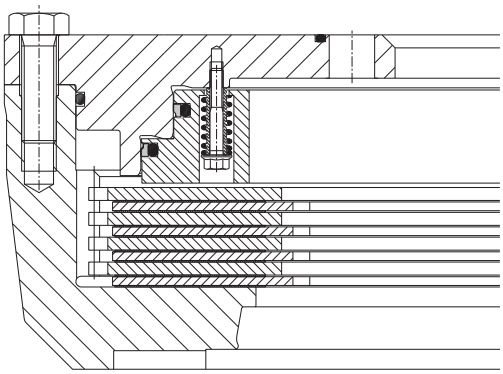


Prepare the brake housing:

17. Insert the disks alternatively into the brake housing, starting with the inner disk.
    - ➢ Align the toothing of the inner disks with each other.
    - ➢ **Note:** The last disk must always be an outer disk (= steel disk) because the piston presses against it during the braking operation.

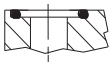
Number of inner disks = 8

Number of outer disks = 8



Assembly of brake carrier and brake housing:

18. If there are countersinks at the bores of the brake carrier or brake housing, grease the countersinks and insert O-rings.



    - O-rings stick because of the grease and are secured against falling-down during assembly with the brake housing.

19. Place the brake carrier, screwed together with the piston, onto the brake housing and align it.

20. Insert the brake carrier.

    - Observe the alignment of the drill holes to each other.
    - The big O-ring in the outer diameter may not be sheared or damaged during assembly!
    - The small O-rings may not fall down!

21. Screw together both parts.

    - Seal the screws to the left and right side of the oil drain point and cooling oil inlet points „C“ with Loctite 262.
    - Tightening torque: 310 Nm

22. Screw in the bleeder with screw socket.

    - see "Connections wet multiple disk brake" on page 24

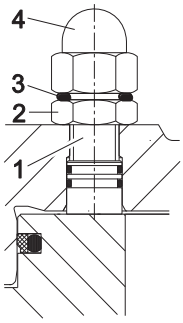
23. Screw in the screw plugs with gaskets.

    - see "Connections wet multiple disk brake" on page 24

24. Test the brake for leak tightness with the maximum operating pressure.

    - **Recommended test medium:**
      engine oil SAE 10 W according to MIL-L2104

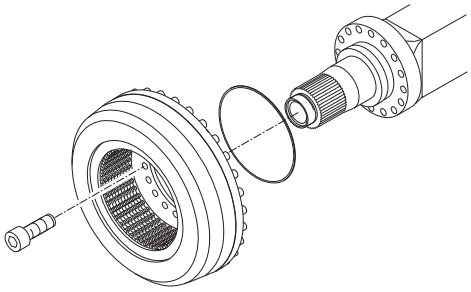
3.4.5 Air gap setting with piston adjustment



1. With **the brake being applied** screw in the installed piston adjustment screws (1) until contact at the piston.
2. Subsequently screw out the piston adjustment screws (1) according to the nominal air gap and release the brake.
   - ➢ specified value for the clearance: see below
3. Screw on and tighten the counternuts (2).
   - ➢ During this the piston adjustment screws must not be turned.
4. Attach the O-rings (3).
5. Screw on and tighten the cap nuts (4).
   - ➢ During this hold the counternuts (2).

The specified value for the clearance of the wet multiple disk brake 5460 is 3 +0.5/-0.1 mm.

3.4.6 Assembly wet multiple disk brake on the axle



1. Safeguard the brake unit against falling down until it has been screwed down to the axle housing.
2. The exact assembly of the brake unit is described in the related chapter of hub assembly.

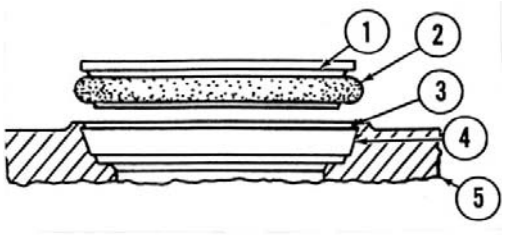
After assembly brake unit onto the axle test the cooling oil chamber of the brake unit for leak tightness.

See **"Test the cooling oil chamber of the service brake for leak tightness" on page 35**

Bleed the brake before resuming operation!

See **"Bleeding the wet multiple disk brake" on page 36.**

3.5 Assembling the face seal



1 Sealing ring
2 Rubber round section seal
3 Bearing insert safety lip
4 Sloping bearing insert
5 Seal housing

The sealing rings, rubber toroidal sealing rings and the bearing inserts must be completely clean without grease, fibers or dust particles!

Clean with a rapidly evaporating solvent which does not leave behind residues and which is compatible with the toroidal sealing rings.

- We recommend Isopropanol.

Solvents other than Isopropanol may leave behind residues at the toroidal sealing rings or the angular faces, so that the toroidal sealing rings are unable to correctly roll in their seat. Leakage may then occur due to irregular load distribution.

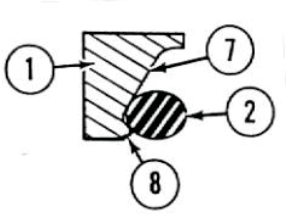
Assembly procedure:

1. Wipe the rings and bearing inserts with a lint-free cloth previously soaked in solvent or with paper towels.
2. After wiping down all parts, position the toroidal sealing rings on the metal sealing rings so that they are flush with the lower edge of the metal ring.
3. Ensure that the toroidal rings are not twisted
   - ➢ by using the line on the external diameter of the toroidal sealing rings to check for correct seating.

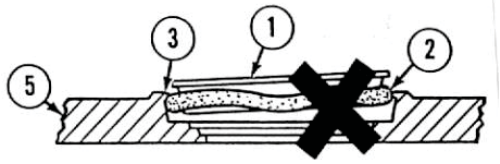
Correct seating of the toroidal sealing ring:

Twisted toroidal sealing rings cause irregular load distribution on the sealing surface, so that oil leakage or penetration of dirt into the rings may occur.

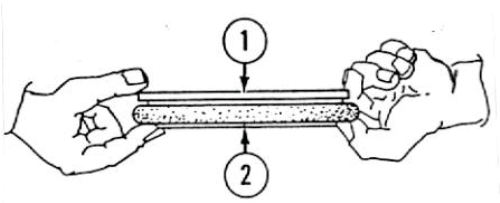
A twisted toroidal sealing ring can be returned into its correct position by carefully retracting a part of the metal ring and then allowing the toroidal sealing ring to spring back into its correct position. Other twisted toroidal sealing rings at other points can be remedied in the same manner.



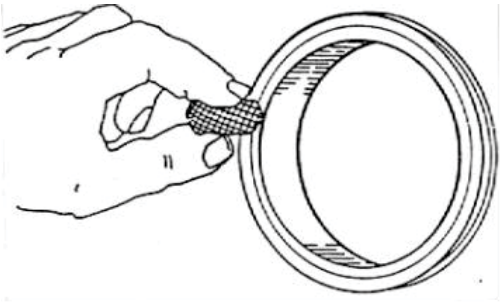
Place the toroidal sealing ring (2) onto the sealing ring (1) so that it is flush at the bottom of the angular face (7) and the safety lip (8).



The toroidal sealing ring (2) may twist during insertion if it is dry, or if there are burrs on the safety lip (3) of the bearing insert (5)

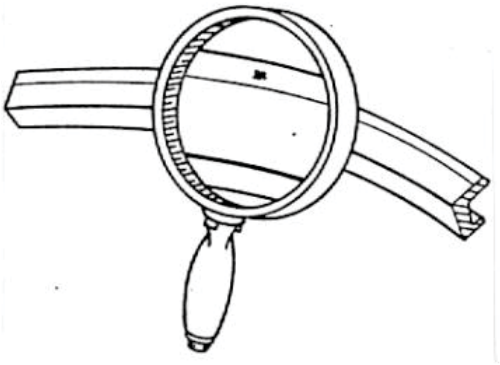


To prevent twisting the toroidal sealing ring (2), carefully remove a section of the sealing ring (1) and then allow it to spring back.

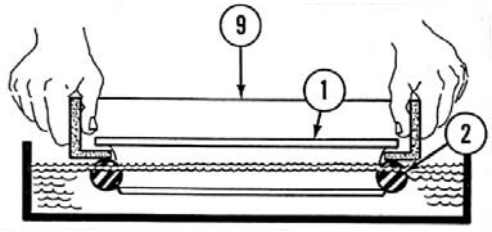


Assembly procedure:

4. Before insertion, apply and evenly distribute a small amount of clean oil to the sealing surface with a spout, a disposable cloth or with clean fingers.
   - ➢ Carefully ensure that no oil comes into contact with the rubber toroidal sealing ring.



5. Ensure that there is no visible dirt on the sealing surfaces.
   - Even the smallest fibers can separate the sealing surfaces and cause leaks.



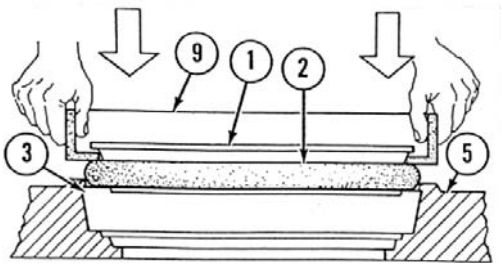
6. Place the insertion tool (9) onto the sealing ring (1) with the previously positioned toroidal sealing ring (2).
7. Immerse both rings together into a container filled with Isopropanol until all surfaces of the toroidal sealing ring are moistened.
   - Lubricating this ring with Isopropanol is imperative, so that it is able to evenly glide along the safety lip and the sealing ring into the bearing insert radius.
   - Insufficient lubrication may cause uneven load distribution, so that the toroidal sealing rings may twist or the sealing rings may tilt.

Difficulties during the installation of the toroidal sealing ring:

The toroidal sealing rings slips on the angular face of the safety lip.

The toroidal sealing ring is jammed at the safety lip of the bearing insert.

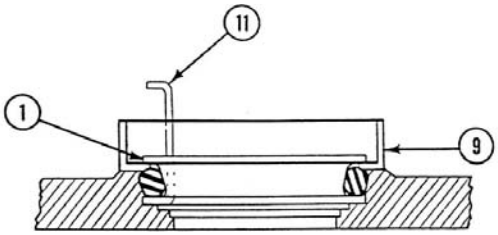
The toroidal sealing ring slips on the angular face of the seal.



Assembly procedure:

8. After moistening the surface of the toroidal sealing ring (2) with Isopropanol, use the insertion tool (9) to press the sealing ring (1) and the toroidal sealing ring (2) straight against the bearing insert, as shown.
9. Use a rapid and even motion to press the toroidal sealing ring (2) under the safety lip (3) of the bearing insert (5).
10. Remove the insertion tool.
11. Check that the housing surface is in parallel position to the gliding surface.
    - The O-ring may not undulate in the locating bore or protrude from the bore in form of a loop.

12. Wait for approximately one minute after insertion, until the Isopropanol is dry.
13. Then bring the two sealing halves into their final installation position.
    - During this waiting period, excess solvent may evaporate, so that the toroidal sealing rings roll into the bearing inserts and do not slip when the surface load is increased.
    - Uneven load distribution and therefore leakage may occur while the toroidal sealing rings slip into the bearing insert.



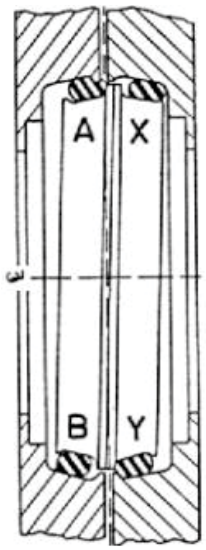
However, the seal can be adjusted with slight manual pressure or with a home-made adjustment hook.

14. Press down the ring with the insertion tool (9) or remove with the hook (11).
    - Do not apply direct pressure onto the sealing ring (1) if minor corrections are required.

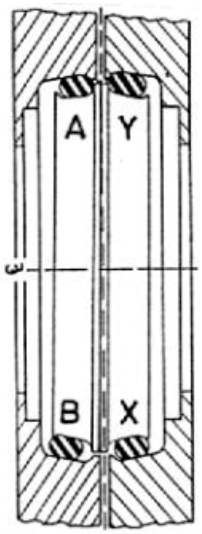
Consequences of incorrect assembly:

Points “A” and “B” remain stationary in their position. Points “X” and “Y” rotate by 180°.
This results in high pressure at points “A”/”Y” and seizing. During rotation, points “B”/”X” are only minimally loaded, which could result in leaks.

Original installation position



Shifted by 180°



Leakage check:

After the unit to be sealed has been assembled, you can conduct a leakage check to ensure that the seal is correctly installed.

We recommend conducting the check with negative pressure and not with overpressure to achieve more accurate results. There is a general opinion that this test is easily conducted in combination with filling the lubricant during underpressure.
We recommend filling the housing with oil up to the specified level and then turning it slowly by several rotations to allow the seals to settle.
The underpressure test enables the detection of major seal damages such as broken sealing rings or notched toroidal sealing rings created during the last stage of the assembly process. As the face seals are not designed to seal in air, checks in accordance with this method may result in small leaks.

The optimal performance of face seals can be expected if compliance to these guidelines and recommendations is ensured.

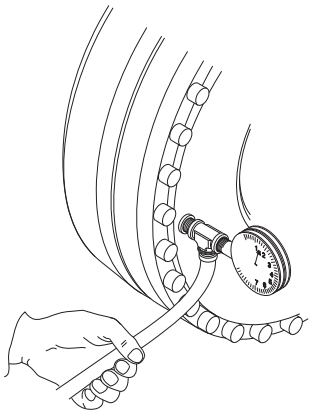
3.6 Test the cooling oil chamber of the service brake for leak tightness

3.6.1 Preconditions

Brake with external cooling:

- The test for leak tightness of the cooling oil chamber is only performed after assembly of the brake and the wheel hub with face seal and adjustment of the wheel bearing on the axle.
- All connections to the vehicle system are disconnected and sealed with plug screws.

3.6.2 Approach



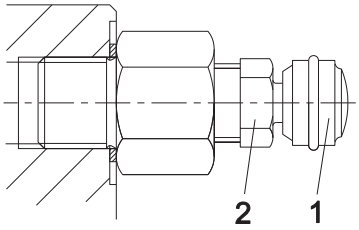
Brake with external cooling:

1. Connect a manometer with a stopcock.
2. Apply 1.5 bar compressed air to the hub assembly.
3. Turn the hub assembly several times.
4. After 10 minutes a pressure drop of up to 0.1 bar is allowed.
   - ➢ If the pressure drop is larger, the cause must be found and, if necessary, the brake disassembled.
   - ➢ Leakage spray helps to localize the leakage point.

3.7 Bleeding the wet multiple disk brake

Once the brake was released, the brake system must be bleed before resuming operation.

⚠ CAUTION	
	**Oil and bleeder valve are pressurized.** Injury due to parts being ejected ➢ Only trained technicians may bleed the brakes.



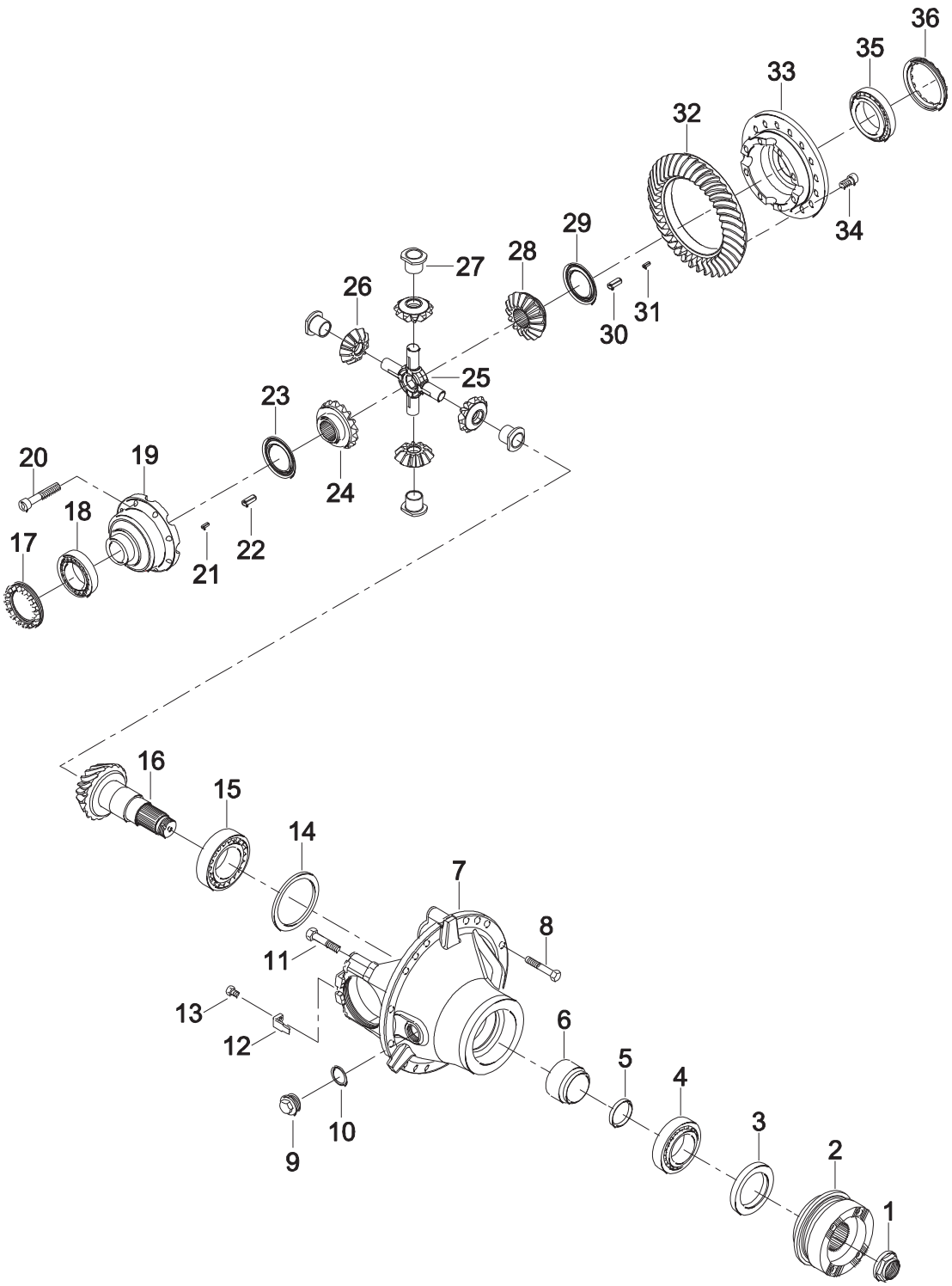
1. Make sure that no machine movements can take place.
2. Pressurize the brake.
   ➢ The brake closes.
3. Remove the protection cap (1) of the bleeder valve (2).
4. Slide the hose onto the bleeder valve.
5. Open the bleeder valve slowly by no more than 1/4 of a rotation.
   ➢ Oil-air mixture escapes through the hose.
6. Once only oil seeps out, close the bleeder valve again properly.
7. Pull off the hose.
8. Place the protection cap (1) onto the bleeder valve (2).

3.8 Differential and carrier assembly

3.8.1 Preconditions

- The differential and carrier assembly needs only to be disassembled from the axle housing for repair and modification work. For work on the hub assembly of an axle, the differential and carrier assembly can remain assembled in the axle housing.
- The oil of the complete axle must be drained before the differential and carrier assembly is disassembled.
- Mark the position of the differential and carrier assembly relative to the axle housing before disassembly.
- The axle shaft/universal joint must be disassembled in order to be able to disassemble the differential and carrier assembly from the axle. The measures required to do this are described in "Repair hub assembly".
- In the following description it is assumed that the differential and carrier assembly has been disassembled and mounted on a device for performing further work.

3.8.2 Overview of parts



1 Lock nut
2 Drive flange
3 Radial seal ring
4 Tapered roller bearing
5 Disk
6 Bushing
7 Differential carrier
8 Hexagon screw
9 Screw plug
10 Sealing ring
11 Hexagon screw
12 Lock plate
13 Hexagon screw
14 Disk
15 Tapered roller bearing
16 Drive pinion
17 Bearing adjustment ring
18 Tapered roller bearing
19 Differential housing
20 Hexagon socket screw
21 Spring-type straight pin
22 Spring-type straight pin
23 Disk
24 Differential side gear
25 Differential spider
26 Differential pinion
27 Bushing
28 Differential side gear
29 Disk
30 Spring-type straight pin
31 Spring-type straihgt pin
32 Ring gear
33 Differential housing
34 Hexagon screw
35 Tapered roller bearing
36 Bearing adjustment ring

3.8.3 Customer service tools drive

The following tool list is an overview of required service tools for disassembly and assembly. It does not claim to be completely.

On request, you will receive a complete list when ordering the spare part list.

Seal ring sleeve driver

Order number: 593402

Spanner for bearing adjustment ring (differential bearing)

Order number: 593404 (thread M162)

3.8.4 Disassembly differential and carrier assembly

Removal and disassembly is carried out in the reverse order to assembly. This is described in detail and is also valid for disassembly.

Observe the safety instructions!

The sequence below describes the disassembly of the above assembly unit.

1. Disassembly differential and carrier assembly
2. Disassembly differential
3. Loosening the lock nut on the drive flange
   see thereto "Loosening the lock nut"
4. Disassembly drive flange
5. Disassembly drive pinion
6. Disassembly radial seal ring on the drive flange
7. Disassembly tapered roller bearing, bearing shells and disks from the differential carrier
8. Disassembly ring gear
9. Disassemble differential

3.8.4.1 Loosening the lock nut

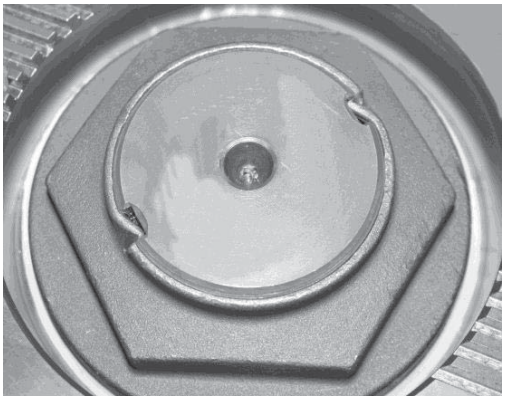
The loosening process described below applies to both safety dog!

NOTICE

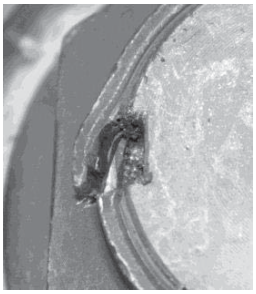
An improperly loosened safety dog of the lock nut can damage the thread of the drive pinion during unscrewing.

If the thread of the drive pinion has been damaged, a new lock nut cannot be screwed on again and the differential and carrier assembly must be disassembled completely.

➢ Bend the safety dog completely upwards



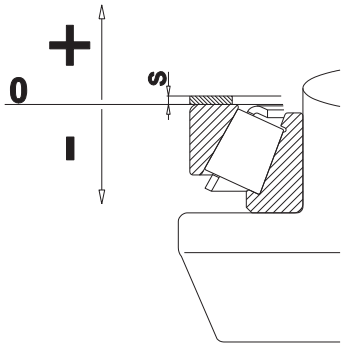
1. Locked lock nut



2. Apply a suitable flat chisel to the groove between the pinion and the locking plate and open the lock nut lock.
3. Bend the safety dog completely upwards.

3.8.5 Assembly differential and carrier assembly

3.8.5.1 Adjustment of drive pinion distance



In order to achieve the correct flank contact, the axial position of the drive pinion must be adjusted with the aid of the adjustment disk. The required thickness for the initial installation is determined by means of measurement (see table with examples of calculation).

Decrease or increase the thickness of the adjustment disk accordingly, so that the deviation is compensated.

0 = theoretical zero

S = adjustment disk thickness

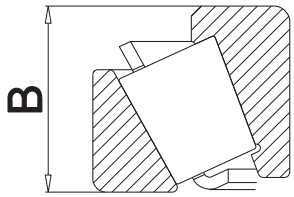
+ = devaiting dimension

- = devaiting dimension

Differential and carrier assembly	**A 91**
Theoretical adjustment disk thickness S	3.0
theoretically B	56.5

The dimensions in the table are theoretical dimensions.

The final thickness of the adjustment disk can only be observed when the contact pattern in the assembled differential and carrier assembly is checked.



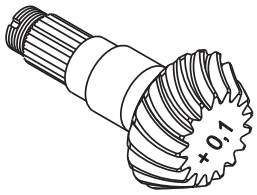
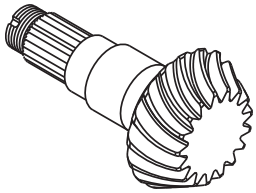
B = width of the tapered roller bearing

Note down the deviation from the required dimension

Different manufacturing procedures of drive pinions result in version 1 or version 2.

It is only possible to achieve an optimal contact pattern, if the different versions get regarded.

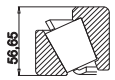
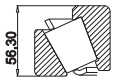
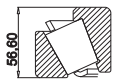
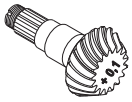
Version 1	Version 2
With production numbers • on drive pinion (marked on the end face) • on ring gear (marked on the face of the ring gear)	**No production numbers** • on drive pinion • on ring gear
• The production numbers of the drive pinion and ring gear **must** match ➢ **only mount in pairs!**	• **indiscriminate** use of drive pinion and ring gear is possible ➢ **no pairing necessary!**

Version 1	Version 2
	
Deviating dimension (determined during manufacture) is marked on the face of the drive pinion. It specifies the deviation from the required dimension. Here the deviation is +0.1 mm	Without any marking on the face of the drive pinion, the deviation from the required dimension is 0.

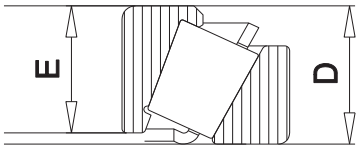
The distance between the drive pinion and the ring gear, and thereby the contact pattern, is determined by the adjustment disk. The adjustment disk equals the dimensional tolerance of the bearing and the manufacturing tolerance of the drive pinion. Therefore the exact disk thickness must always be calculated, based on the relevant dimensions.

- In case of an over-size of the bearing, the over-size is subtracted from the theoretical disk thickness.
- In case of an under-size of the bearing, the under-size is added to the theoretical disk thickness.
- In case of an over-size of the drive pinion, the over-size is subtracted from the theoretical disk thickness.
- In case of an under-size of the drive pinion, the under-size is added to the theoretical disk thickness.

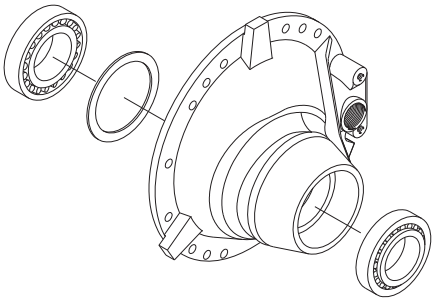
Dimensions in mm

theor. Adjusting disk thickness S	Measured bearing width	Deviation on the drive pinion	Calculation of the required adjusting disk thickness	Required adjusting disk thickness S
3,0		Version 1 	theor. Disk thickness - Deviation of the bearing + Deviation of the drive pinion = Required disk thickness	3,0
	Deviation from the theoretical dimension Over-size = +0.15	Deviation from the theoretical dimension Under-size = -0.15	3.0 - 0.15 + 0.15 = 3.0	
3,0		Version 1 	theor. Disk thickness + Deviation of the bearing + Deviation of the drive pinion = Required disk thickness	3,35
	Deviation from the theoretical dimension Under-size = -0.20	Deviation from the theoretical dimension Under-size = -0.15	3.0 + 0.20 + 0.15 = 3.35	
3,0		Version 1 	theor. Disk thickness - Deviation of the bearing - Deviation of the drive pinion = Required disk thickness	2,80
	Deviation from the theoretical dimension Over-size = +0.10	Deviation from the theoretical dimension Over-size = +0.10	3.0 - 0.1 - 0.1 = 2.8	

3.8.5.2 Assembly of drive pinion bearing

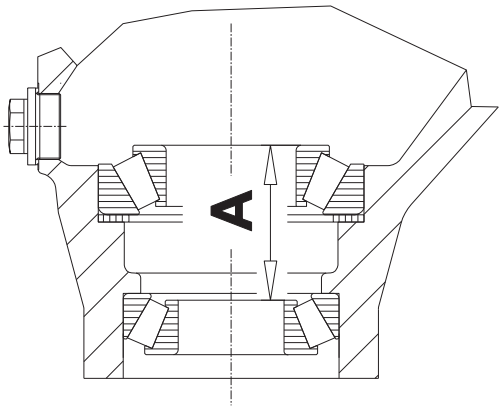


1. Measure and record the dimensions D and E from the flange-side tapered roller bearing.

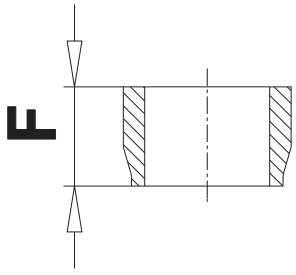


2. Evenly seat the inner bearing ring of the tapered roller bearing with the aid of a seater without tilting it.
3. Insert the adjustment disk with the theoretically determined thickness S into the differential carrier.
4. Evenly seat the inner bearing ring of the tapered roller bearing with the aid of a seater without tilting it.

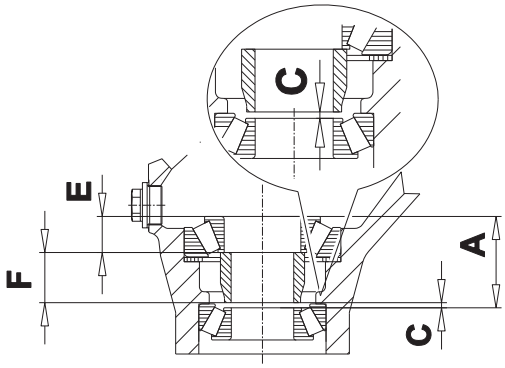
5. Calculate the required thickness of the spacer ring, dimension C.



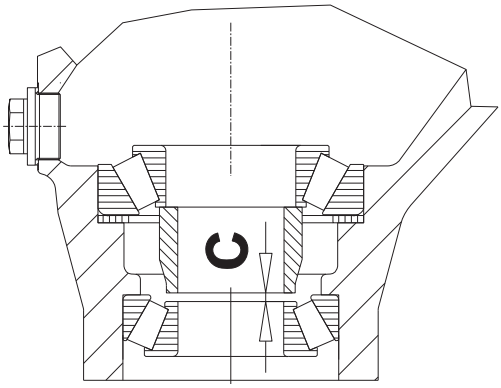
- Place the two inner rings of the taper roller bearings in their outer rings.
- Measure and record dimension A.



- Measure and record dimension F of the bushing.



- Overview of all required components.



- The required thickness of the spacer ring results from:

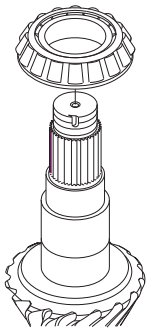
C = A – E – F

⚠ CAUTION

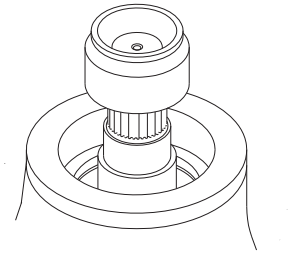
Sharp edges on the teeth

Risk of cutting

➢ Wear protective gloves

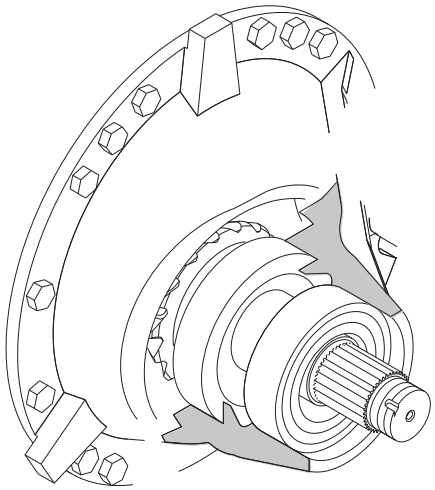


6. Drive the inner ring with the tapered roller bearing roller cage onto the drive pinion up to the stop using a sleeve.
7. Push the drive pinion with the assembled tapered roller bearing into the differential carrier.
8. Secure the drive pinion with a supporting device.

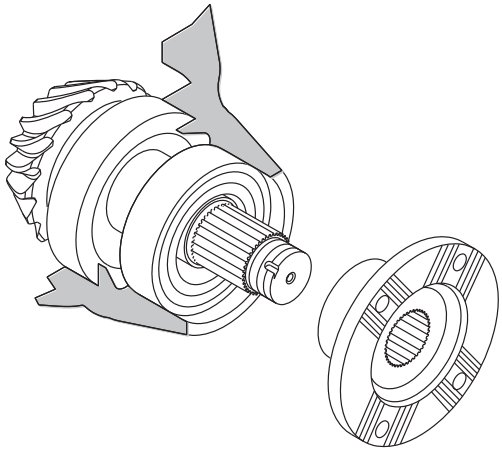


9. Assemble the bushing onto the drive pinion.

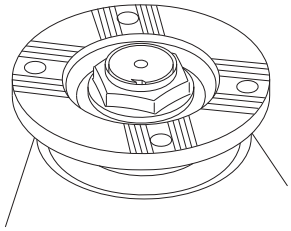
10. Place a spacer ring with the calculated thickness C on the drive pinion.



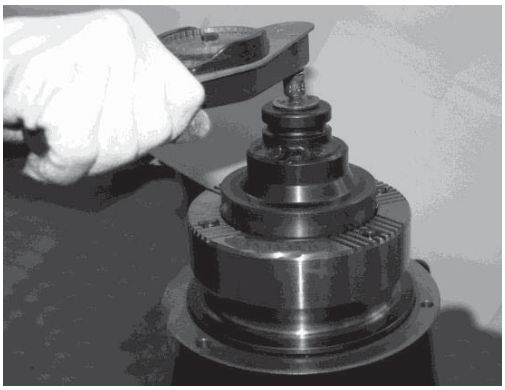
11. Drive the inner ring with the tapered roller bearing roller cage onto the drive pinion up to the stop using a sleeve.



12. Push the drive flange onto the drive pinion.



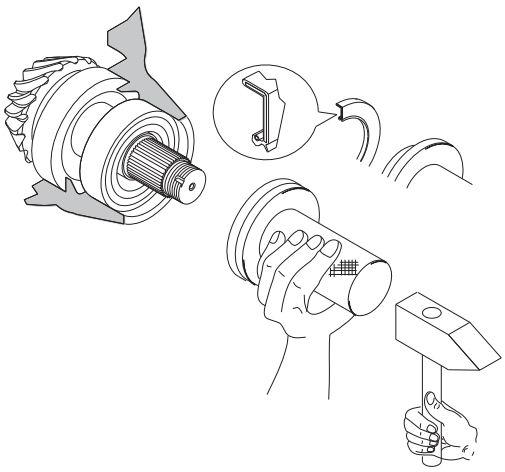
13. Screw on the lock nut and tighten it.
    - ➢ Tightening torque: 1050 Nm



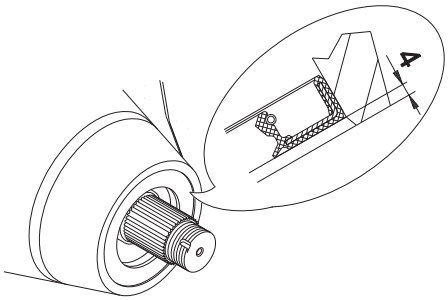
14. Secure the differential carrier on a suitable device.
15. Loosen the support on the drive pinion so that the drive pinion can turn freely.
16. Measure the bearing pre-load with a torque wrench with a drag indicator.
    - ➢ The bearing pre-load must be 1.5 – 2.5 Nm.
    - ➢ In case of a deviation of the bearing pre-load: correct the bearing pre-load by changing the thickness C of the spacer ring. For example: if the bearing pre-load is too low, reduce the ring thickness C marginally (in the range of hundredth mm).
    - ➢ If the bearing pre-load is correct: tighten the support device on the drive pinion.
17. Loosen the lock nut and pull off the drive flange.

3.8.5.3 Assembly radial seal ring on the drive flange

NOTICE	
	**Incorrect installation of the radial seal ring** Sealing of the oil cavity is not guaranteed. ➢ Observe the installation position of the sealing lips of the radial seal ring! ➢ Do not damage the sealing lip of the radial seal ring. ➢ Use the special tool - sealing ring sleeve driver

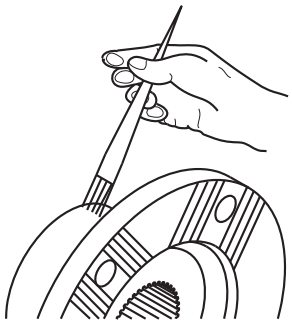


1. Coat radial seal ring with Loctite.
   - ➢ Loctite 572
2. Place the prepared radial seal ring onto the sealing ring sleeve driver.
   - ➢ Customer service tool: Sealing ring sleeve driver
3. Evenly knock in the radial seal ring up to a position of 4 mm below the surface of the differential carrier without tilting it.
4. Fill the new radial seal ring with grease up to 2/3.
   - ➢ Multi-purpose grease



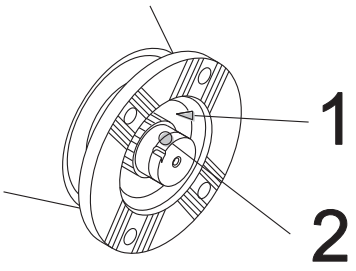
3.8.5.4 Assembly drive flange

NOTICE	
	**Assembly of a damaged or soiled drive flange** If the running surface of the drive flange is not perfect, the sealing lip of the radial seal ring will be damaged. Sealing of the oil cavity is then not guaranteed. ➢ Precise control of the running surface of the drive flange. It must be undamaged and clean.



1. Lightly cover the surface of the drive flange with clean oil.
   - ➢ Oil type: same as the transmission oil that is being used.
2. Mount the drive flange with light turning movements.

3.8.5.5 Assembly lock nut

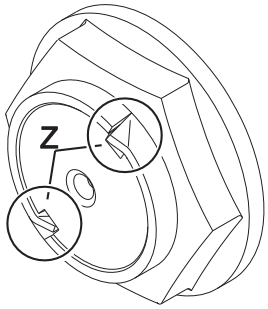


1. Seal the contact surface between the lock nut and the drive flange 1 with sealant.
   - ➢ Sealant: Dirko grey
2. Coat the thread 2 of the drive pinion with assembly paste.
   - ➢ Assembly paste: assembly paste with MoS_2
3. Screw on the lock nut and tighten it.
   - ➢ Tightening torque: 1050 Nm

3.8.5.6 Securing of the lock nut

The securing process described below applies to both safety dog!

NOTICE	
	An improperly secured lock nut can open independently. Drive flange dissolves ➢ Bended safety dog must fully rest on the bottom of the groove.

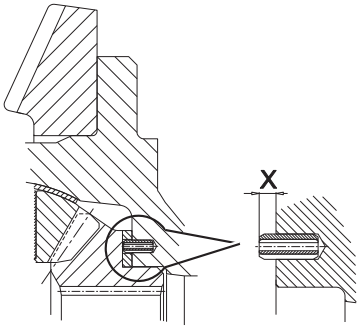


Extension Z

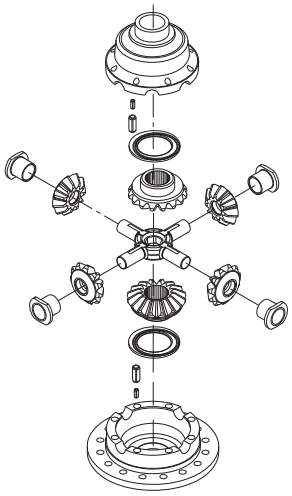
1. Bend the corner of the lock nut on the slot ground.
   - ➢ Pay attention to the loosing direction of the lock nut!
   - ➢ The brim of the striking nut has to be sheared only along the slot flank.

3.8.5.7 Assembly of the Differential

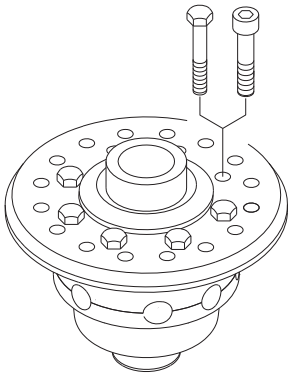
NOTICE	
	Insufficient lubrication inside the differential on the tooth system and internal parts Tooth system and disks run dry. ➢ All bevel wheels and thrust washers must be thoroughly oiled during assembly.



1. Pay attention of the standout of the spring-type straight pins.
   - ➢ X = 4.2 - 4.5 mm



2. Mount in both differential housings the spring-type straight pins.
   - ➢ small spring-type straight pin into large spring-type straight pin
   - ➢ The slot of the outer spring-type straight pin must point radially outwards.
3. Insert the side gear and disk into the differential housing.
4. Install the spider with threaded differential pinion and bushings.
5. Install the other differential side gear and disk.

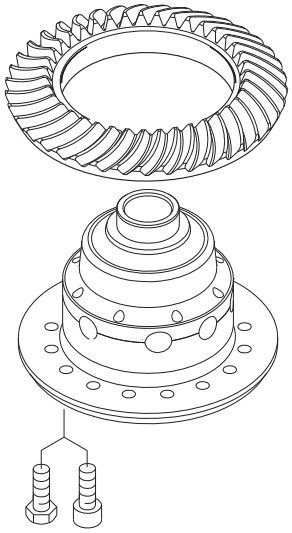


6. Position the differential housing.
   - ➢ Observe the marking, if it is existing.
7. Screw down the differential housing halves and tighten.
   - ➢ Clamp the differential housing in a suitable device for tightening the screws.
   - ➢ Loctite 262
   - ➢ Anzugsmoment: **see Tightening torques for standard metric threads on page 83**
8. Test the differential side gears for smooth running.

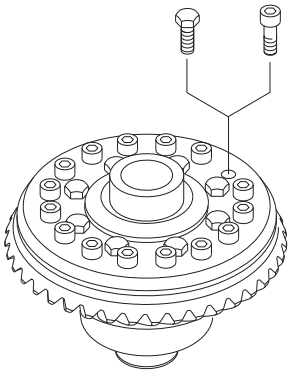
3.8.5.8 Assembly ring gear

⚠ CAUTION	
	**Sharp edges on the teeth** Risk of cutting ➢ Wear protective gloves

Version 1	Version 2
With production numbers • on drive pinion (marked on the end face) • on ring gear (marked on the face of the ring gear)	**No production numbers** • on drive pinion • on ring gear
• The production numbers of the drive pinion and ring gear **must** match ➢ **only mount in pairs!**	• **indiscriminate** use of drive pinion and ring gear is possible ➢ **no pairing necessary!**

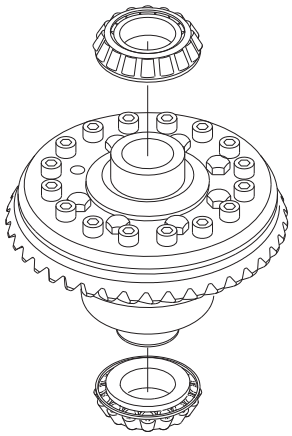


1. Place the ring gear on the differential housing and drive it in with light hammer blows around the circumference.
   - ➢ Locking the ring gear
2. Fasten the ring gear to the differential housing from the opposite side of the ring gear teeth with two screws, against falling down .



3. Turn the differential.
4. Coat the screws, inclusive securing screws, with Loctite.
   - ➢ Loctite 262
   - ➢ First tighten two diagonally opposite screws.
5. Torque down the ring gear to the differential housing halve.
   - ➢ Tightening torque: **see Tightening torques for standard metric threads on page 83**
   - ➢ Clamp the differential housing in a suitable device for tightening the screws. Do not damage the teeth of the gear wheel in the process.

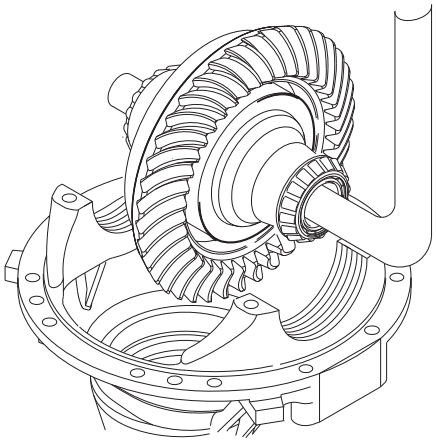
3.8.5.9 Assembly tapered roller bearing onto differential housing



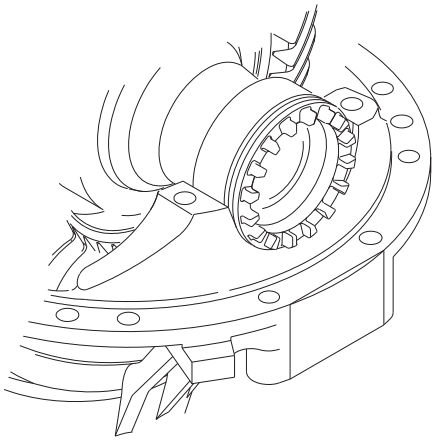
1. Press both tapered roller bearings onto the differential housing.

3.8.5.10 Installation of the pre-assembled differential

⚠ CAUTION	
	**Moving and dropping down of parts** Risk of injury ➢ Attach the part securely to the lifting device. ➢ Move the parts carefully and slowly. ➢ Do not perform a jerky and premature release of the lifting device.

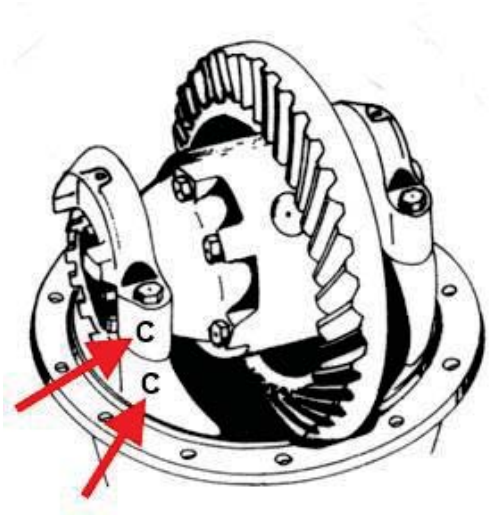


1. Carefully place the differential into the upright differential carrier with a suitable device.
   - ➢ Important: The tapered roller bearings must not be damaged in the process.



2. Push the outer bearing rings onto the assembled tapered roller bearings on the differential.
3. Carefully insert the bearing adjustment rings into the thread from above.
   - ➢ Important: The bearing adjustment rings must not be seated skew.
4. Position the differential by turning the bearing adjustment rings in such a way, that no tooth flank play remains at the narrowest position between the ring gear and the drive pinion.
   - ➢ The bearing adjustment rings must only slightly touch the drive pinion and must not press against the tapered roller bearings.

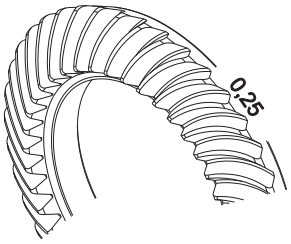
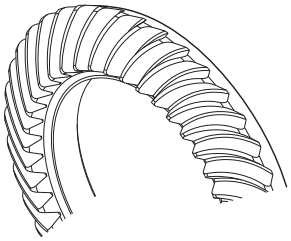
3.8.5.11 Fastening bearing caps

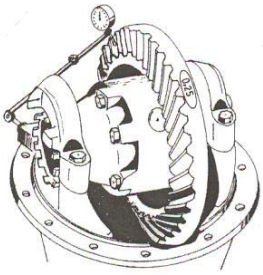
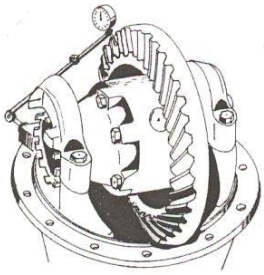


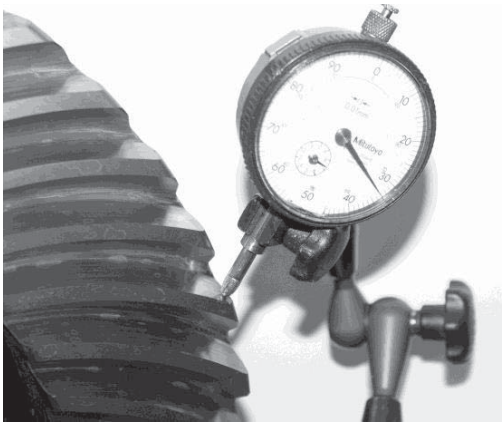
1. Place the bearing caps on the differential carrier.
   - ➢ Do not interchange the bearing caps.
   - ➢ Observe the markings of the bearing caps relative to the differential carrier.
   - ➢ The bearing caps must not be mounted skew.
2. Align the bearing caps with the bearing adjustment rings.
3. Screw down the bearing caps hand-tight.
   - ➢ Loctite 262

3.8.5.12 Dimension of backlash

It must absolutely be checked, which version of drive pinion and ring gear is on hand.

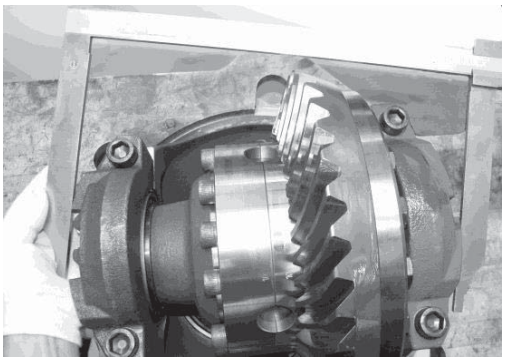
Version 1	**Version 2**
The smallest admissible value at the closest place is marked on the circumference of the ring gear. 	Is no value marked on the circumference of the ring gear, the backlash is depend on the ring gear diameter (see following table).  **Drive description** / **Ring gear diameter** / **Backlash** Drive assembly 91 / < 410 / 0,40

Version 1	**Version 2**
	

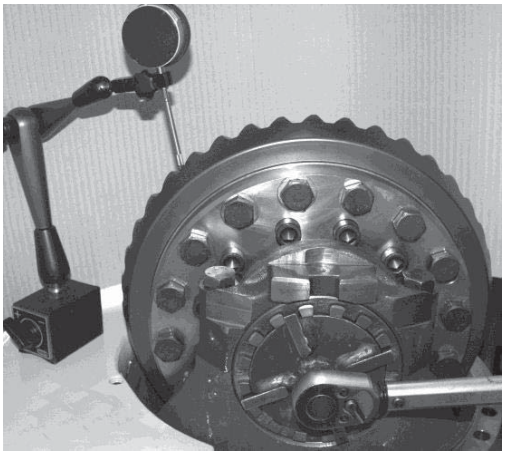


1. Adjust the tooth flank play whit the bearing adjustment rings.
   - ➢ Hold down the drive pinion at the drive flange.
2. Fasten the dial gage to the differential carrier and position it against the ring gear.
3. Measure the tooth flank play between the ring gear and the drive pinion by carefully turning the ring gear forwards and backwards.
4. The tooth flank play must be measured at every second tooth and for two rotations of the ring gear, because the play may not be less than the minimum value at any place.

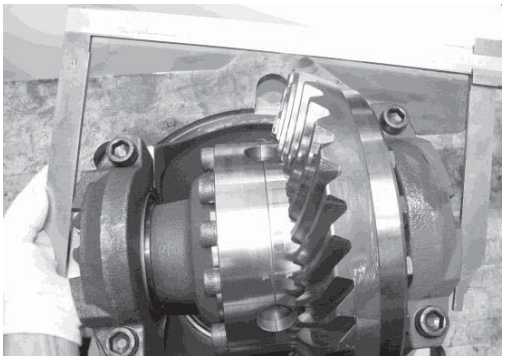
3.8.5.13 Adjustment differential



1. Measure the rear centering diameter of the differential and carrier assembly before adjusting the rolling resistance of the tapered roller bearings.
   - ➢ Starting value of the dimension of the bearing caps must be between ø395,8 mm – ø396,0 mm.



   - ➢ Continuously check the tooth flank play with the dial gage.
2. Adjust the rolling resistance of the tapered roller bearings and the tooth flank play at the differential by means of reciprocal tightening of the bearing adjustment rings.
   - ➢ Customer service tool: Spanner for bearing adjustment ring
3. The tooth flank play must be measured at every second tooth and for two rotations of the ring gear, because the play may not be less than the minimum value at any place.
   - ➢ The tooth flank play must now correspond to the minimum allowed value at the narrowest position.



4. The bearing pre-load must be increased by reciprocal tightening of the bearing adjustment rings until the bearing cap dimension has increased by 0.2 mm.
   - ➢ The maximum permissible value of ø396.1 mm und ø396.2 mm must not be exceeded.

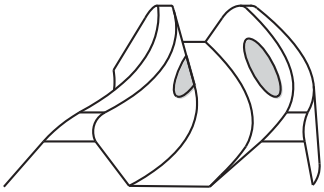
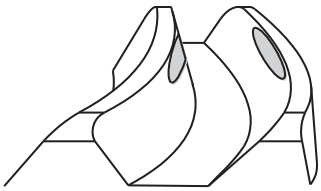
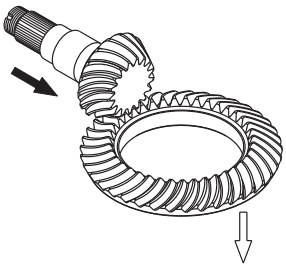
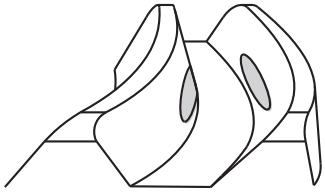
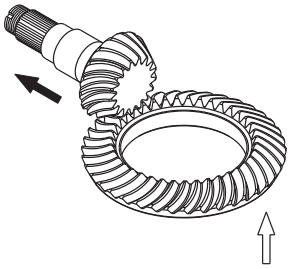
3.8.5.14 Contact pattern adjustment for bevel wheel tooth system

It must absolutely be checked, which version of drive pinion and ring gear is on hand.

Version 1	Version 2
With production numbers • on drive pinion (marked on the end face) • on ring gear (marked on the face of the ring gear)	**No production numbers** • on drive pinion • on ring gear
• The production numbers of the drive pinion and ring gear **must** match ➢ **only mount in pairs!**	• **indiscriminate** use of drive pinion and ring gear is possible ➢ **no pairing necessary!**

Contact pattern adjustment of the tooth system:

1. Coat the teeth of the ring gear on both sides with contact paste.
2. Then turn repeatedly until contact points of the drive pinion with the coated teeth become evident.
3. Compare contact pattern / pressure points with the illustrations in the following table.
4. If the **contact pattern is not correct**, the drive - pinion distance must be changed with a different adjustment disk. See "Fehler! Verweisquelle konnte nicht gefunden werden." **on page** Fehler! Textmarke nicht definiert..
   - ➢ Then repeat all of the following steps until the contact pattern is correct.
   - ➢ After changing, observe the rolling resistance, see "Fehler! Verweisquelle konnte nicht gefunden werden." **on page** Fehler! Textmarke nicht definiert..

	**Contact pattern perfect**	
	**Too high contact pattern** Reduce the drive pinion distance by means of decreasing the thickness of the adjustment disk. Re-adjust the tooth flank play by moving the ring gear away.	
	**Too low contact pattern** Increase the drive pinion distance by means of increasing the thickness of the adjustment disk. Re-adjust the tooth flank play by moving the ring gear in.	

3.8.5.15 Locking the bearing adjustment rings

1. Coat the hexagon screw with Loctite.
   - ➢ Loctite 262
2. Fasten the lock plate with the hexagon screw to the bearing cap.
3. Tighten the hexagon screws.
   - ➢ Tightening torque: 25 Nm
4. Bend the lock plate towards the bearing adjustment ring.
5. Torque down the screws on the bearing caps.
   - ➢ Tightening torque: **see Tightening torques for standard metric threads on page 83**

3.8.5.16 Preparation axle housing

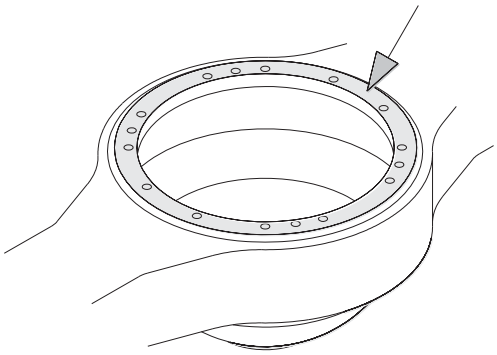
NOTICE

Metal shavings in the axle housing

Damage to the tooth system of the differential and carrier assembly

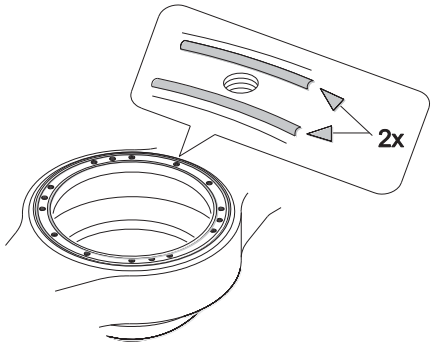
- ➢ Completely remove shavings in the axle housing.

NOTICE	
	**Dirt particles, grease or damage to the sealing surface of the axle housing.** Leak in the differential and carrier assembly, oil will discharge. ➢ Clean and carefully inspect the sealing surface.

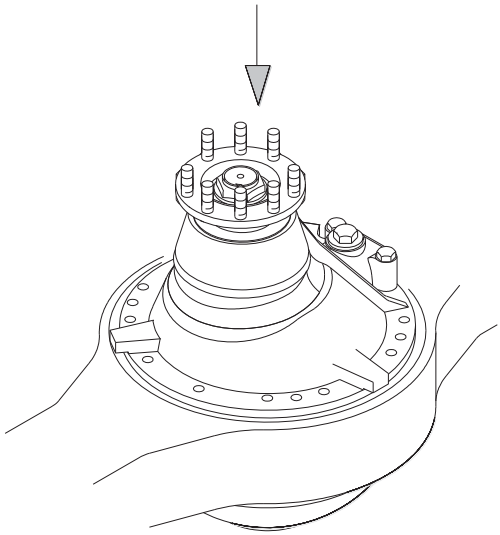


1. Clean sealing surfaces on the axle housing and on the differential and carrier assembly.

3.8.5.17 Assembly of the differential and carrier assembly onto the axle housing



1. Apply 2 beads Loctite on sealing surface of the axle housing directly before assembly.
   - ➢ Loctite 5926 resp. 209 125
2. Mount the complete drive assembly with axle housing being placed in a horizontal position, screw in and tighten.
   - ➢ It may be necessary to activate the differential lock for assembly the differential and carrier assembly.
   - ➢ Loctite 262
   - ➢ Tightening torque: **see Tightening torques for standard metric threads on page 83**



4 Maintenance

4.1 Lubricants and lubrication intervals

Lube point	Lubricant	Remarks	Lubrication intervals (The value that is reached first is always valid.)			
			after 100 hours of-operation 1000 km	every 500 hours of-operation 5000 km	every 1000 hours of-operation 10,000 km	at least 1 x per year
Differential and carrier assembly	Hypoid gear oil acc. to MIL-L2105 B/API GL5 Hypoid gear oil in multi-grade characteristic acc. to MIL-L2105 C/D/API GL5 SAE 90 o. multi-grade oils with normal outdoor temperatures SAE 75 W - 90; SAE 75 W - 85 at outdoor temperatures under -10 °C SAE 140 o. multi-grade oils with outdoor temperatures over +30 °C	Oil change monthly oil level check by overflow measurement	+		+	+
Wheel hub – planetary gear			+		+	+
Interaxle differential			+		+	+
Drop gear assembly / Gearbox			+		+	+
Wheel bearing oil-lubricated			+		+	+
Wet multiple disk brake	see "Approved oils for brake with external cooling" on page 61	with external cooling: Oil change	depends on tank volume / cooling system / application			

4.2 Oils

4.2.1 Recommended types of hypoid gear oil

For KESSLER axles, gear oil types with the specification MIL-L 2105 B/API GL 5 or MIL-L 2105 C/D/API GL 5 have to be used!

- ADDINOL - gear oil GH 85 W 90
- AGIP - Rotra MP / Rotra MP DB
- ARAL - gear oil Hyp 90
- AVIA - gear oil Hypoid 90 EP
- BP - multipurpose gear oil EP SAE 90
- ELF - Tranself type B 90 / Tranself type B 80 W - 90
- ESSO - gear oil GX - D 90
- FINA - Pontonic MP SAE 85 W - 90
- FUCHS - Renogear Hypoid 90
- MOBIL - HD 90 - A
- SHELL - Spirax MB 90 / HD 90
- TEXACO - Multigear EP SAE 85 W / 90

4.2.2 Approved oils for brake with external cooling

Actuation fluid:

NOTICE	
	**Use only mineral oil as actuation fluid. Brake fluids are not permitted!**

Selection of mineral oils:

- Motor oil
  - API SE / CD
  - MIL – L 46152C / MIL – L 2104 C or D
- AFT C - 3 or Dexron ®
- Hydraulic oil HLP DIN 51524 part 2

Viscosity class depending on ambient temperature:

- for temperate climate: ISO VG 22 – 32
- for extremely cold climate: ISO VG 15
- for extremely warm climate: ISO VG 46

Cooling fluid:

NOTICE	
	**Only oils with LS additives that are approved by the vehicle manufacturer according to the KESSLER WN 85601 may be used.** ➢ e.g. 3 - 6% Lubrizol LZ 9990 A or LZ 6279

The cooling fluid can also be used as actuation fluid.

4.3 Oil change

During changing the oil, always follow the stated measures:

- Place vehicle in horizontal position so that complete draining of oil is possible and clean oil can be filled to the correct level.
- Make sure that oil has cooled down before draining it.
- Always replace gaskets of the screw plugs with new gaskets. The gaskets are mostly copper rings.
- Pay attention to the specific notes.
- The precise position of the lube point can deviate from the illustration. The relevant lube point can be found on the KESSLER product on hand.
- Pay attention to the given activity sequence.

4.3.1 Inspection of screw plugs with magnet

Each oil change requires a check of the magnetic screw plugs. After opening the oil drain plug, the adherent material must be assessed and acted on the information listed below.

During the first operating hours, a larger build-up of metal particles is normal for reasons of the running-in period of new parts. The information below is valid from the 3rd oil change.

Rating 1

Black mud/paste - fine, not shining metallic powder <u>without</u> chips and metal fractions

- Normal wear
- No indication of a problem
- Clean magnet / continue oil change / component can return to operation

Rating 2

Fine chips and coarser metallic powder - slightly shiny

- Check the wheel bearing for play
- A close monitoring with regular oil change is necessary
- Optionally determine the trend with oil analyses
- Clean magnet / oil change is absolutely necessary

Rating 3

Larger shiny chips and splitters

- Check the bearings and gear parts for damages
- Check the parts before continue operation

4.3.2 Oil drain

⚠ CAUTION

Hot oil

Burn hazard

➢ Make sure that oil has cooled down before draining it.

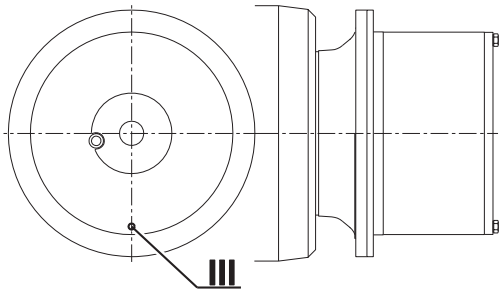
The axle has a total oil space.

Oil drain has to take place at the complete axle.

Wet multiple disk brake

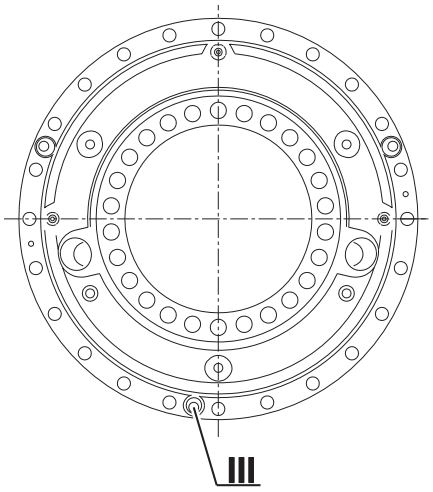
Drain the extra oil.

III = oil drain point



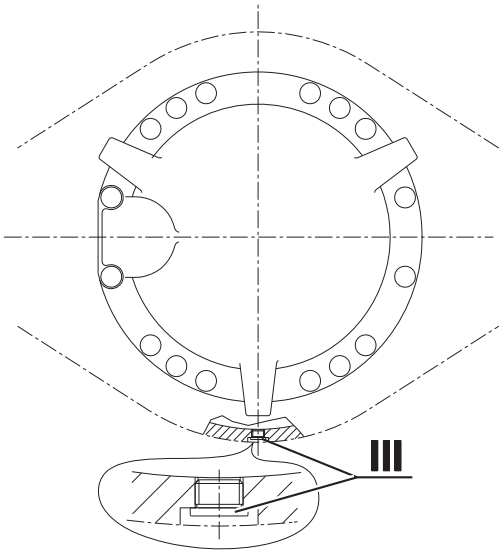
Oil drain, hub assembly:

1. Clean drainage point and oil drain plug.
2. Rotate the hub assembly until the oil drain plug is at the bottom position (6 o'clock position).
3. Open the oil drain plug and allow oil to drain.
   - ➢ Collect the oil in a suitable container.
   - ➢ Dispose of the oil in an environmentally friendly manner.
4. Clean borehole and oil drain plug.
5. Screw oil drain plug back in.
   - ➢ Tightening torque: see " Tightening torque for screw plugs" on page 84



Oil drain, wet multiple disk brake:

1. Clean drainage point and oil drain plug.
2. Open the oil drain plug and allow oil to drain.
   - ➢ Collect the oil in a suitable container.
   - ➢ Dispose of the oil in an environmentally friendly manner.
3. Clean borehole and oil drain plug.
4. Screw oil drain plug back in.
   - ➢ Tightening torque: see " Tightening torque for screw plugs" on page 84



Oil drain, differential and carrier assembly/axle housing:

1. Clean drainage point and oil drain plug.
2. Open the oil drain plug and allow oil to drain.
   - ➢ Collect the oil in a suitable container.
   - ➢ Dispose of the oil in an environmentally friendly manner.
3. Clean borehole and oil drain plug.
4. Screw oil drain plug back in.
   - ➢ Tightening torque: see " Tightening torque for screw plugs" on page 84

4.3.3 Oil filling and filling level

The axle has a total oil space.

All oil drain plugs have to be closed before filling with oil.

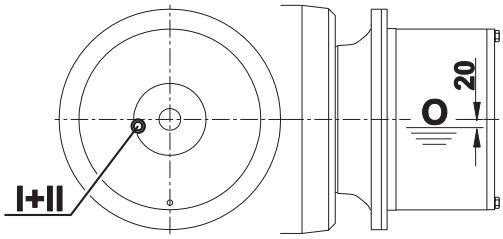
The whole axle is filled with oil from the hub assembly and differential and carrier assembly / axle housing together.

The oil level is specified at the respective component (hub assembly – differential and carrier assembly / axle housing).

I = oil filling point

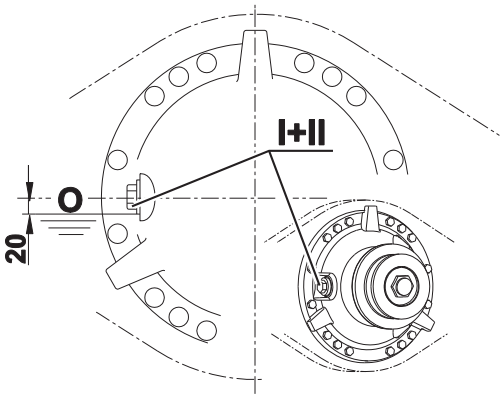
II = oil level inspection point

O = oil level



Oil filling and oil level on hub assembly:

1. Clean filling point and oil filling plug.
2. Turn hub assembly into position.
   - ➢ The oil drain plug has to be at the bottom.
3. Open the oil filling plug.
4. Fill hub assembly with clean oil until the oil level reaches the filling bore (= inspection bore).
   - ➢ Overflow check
   - ➢ Oil in accordance with the specified lubricants. **see "Lubricants and lubrication intervals" on page 59**
5. After a few minutes, check the oil level again at the filling bores.
   - ➢ Keep filling the hub assembly with oil until the oil level remains constant.
6. Clean borehole and oil filling plug.
7. Screw oil filling plug back in.
   - ➢ Tightening torque: **see " Tightening torque for screw plugs" on page 84**



Oil filling and oil level on differential and carrier assembly/axle housing:

1. Clean filling point and oil filling plug.
2. Open oil filling plug.
3. Fill axle and differential and carrier assembly with clean oil until the oil level reaches the filling bore (= inspection bore).
   - ➢ Overflow check
   - ➢ Oil in accordance with the specified lubricants. **See "Lubricants and lubrication intervals" on page 59.**
4. After a few minutes, check the oil level again at the filling bores.
   - ➢ Keep filling the axle until the oil level remains constant.
5. Clean borehole and oil filling plug.
6. Screw oil filling plug back in.
   - ➢ Tightening torque: **see " Tightening torque for screw plugs" on page 84**

Recheck the oil level of the KESSLER product after driving the first time.

4.4 Checking the screwed connections, safeguards, and formation of corrosion

- **Screws at housing connections, steering assembly parts, and brake parts:** If the screws can be retightened, the Loctite connection breaks. Remounting is necessary then! Secure screwed connections and join connections according to specifications, in case of any doubt, please consult KESSLER.
- **Corrosion and cracks** on load-bearing components (e.g. axle spindle) are not permissible for reasons of operational reliability and sealing.
  Replace any load-bearing components with cracks!
- **Cracks on steering assembly parts** are not permissible for reasons of operational reliability.
  Replace any steering assembly components with cracks!

4.5 Maintenance intervals

Inspection and maintenance-points	Remarks	Maintenance intervals (The value that is reached first is always valid.)				
		after 50 hours of-operation 500 km	after 100 hours of-operation 1000 km	every 500 hours of-operation 5000 km	every 1000 hours of-operation 10000 km	at least 1 x per year
Wheel bearing	Check and readjust		+			+
Wheel nuts	Check and retighten with torque wrench (following a tire change, after about 50 km and about 200 km)	+	+	+		
Nuts / Axle bracket-screws	Check and retighten (check for firm fit)	+	+	+		+
Screwed-connections (e.g. differential and carrier assembly)	Check			+		
Gaskets	Check sealing points for leaks	monthly				
Screws / Drive flange	Check and retighten (check for firm fit)	+	+	+		+
Parking brake	Check lining thickness and readjust if necessary	+	monthly			
Wet multiple disk brake	Check the lining wear					+

4.6 Checking of the lining thickness on parking brake

- Lining thickness must be checked with a visual inspection, see "Supplier documents" on page 86.

4.7 Wheel bearing adjustment

⚠ DANGER	
	**Faulty mounting and incorrect securing of the wheel bearing adjustment nut** The wheel along with the complete hub assembly comes off of the axle. ➢ In any case, tighten and secure the wheel bearing adjustment nut as described!

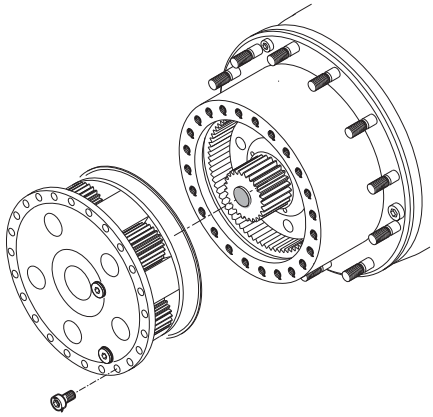
⚠ CAUTION	
	**When loosening the threaded connection, the planetary gear can tip over uncontrolled due to its own weight and fall down.** Danger of being crushed ➢ Secure the planetary gear against falling with suitable lashing gear during disassembly.

The wheel bearing is checked by retightening the wheel bearing adjustment nut.

- On oil-filled hub assemblies the oil must be drained off.
- On hub assemblies with drum brake the brake drum must be disassembled/mounted if necessary. See supplier's requirements.
- On hub assemblies with planetary gears, the planetary gear and, if necessary, the sun gear are disassembled/mounted.
- On hub assemblies without planetary gears, these steps are omitted. Only the cover is disassembled/mounted.
- The steps loosening / checking / retightening / securing the wheel bearing adjustment nut always remain the same, regardless of the axle type.

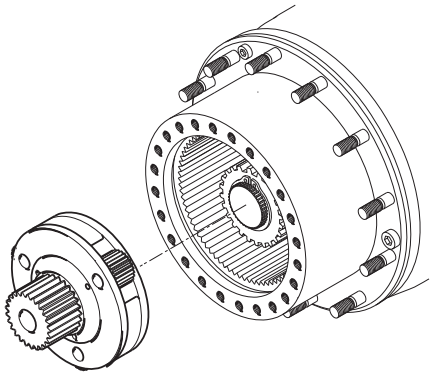
Wrench for wheel bearing adjustment nut

Order number: 598938

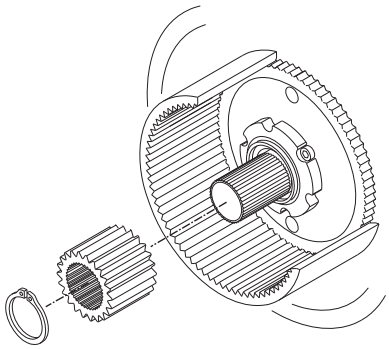


Disassembly of planetary gear:

1. Drain the oil.
   - ➢ See **"Oil change" on page 62.**
2. Loosen and remove mounting bolts.
3. Carefully pull off the outer planetary gear.

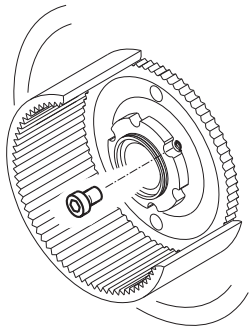


4. Take out inner planetary stage.



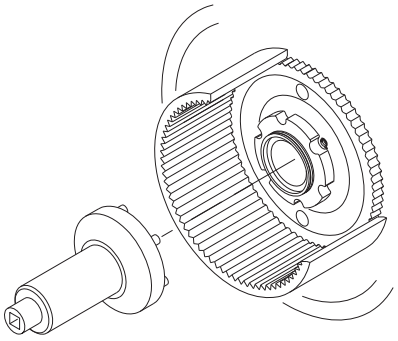
Disassembly of sun gear:

5. Remove circlip.
6. Pull sun gear from the universal joint or the axle shaft.



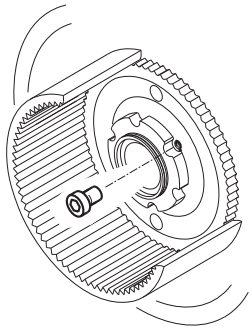
Loosening the wheel bearing adjustment nut:

7. Loosen the securing screw of the wheel bearing adjustment nut, clean it and deposit safely.



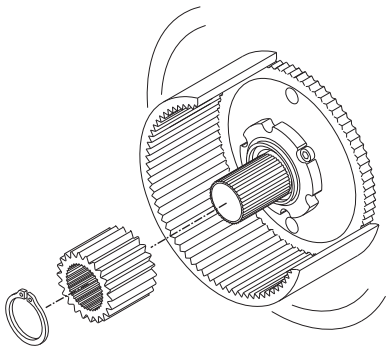
Checking/Retightening the wheel bearing adjustment nut:

8. Put the customer service tool on the wheel bearing adjustment nut and tighten to the specified tightening torque.
   - Customer service tool: Wrench for wheel bearing adjustment nut (see above)
   - Tightening torque for used bearings: 750 Nm
   - Rotate the wheel hub several times while tightening.
   - If it is not possible to secure at this position, the wheel bearing adjustment nut needs to be turned forward to the next possible position for securing.



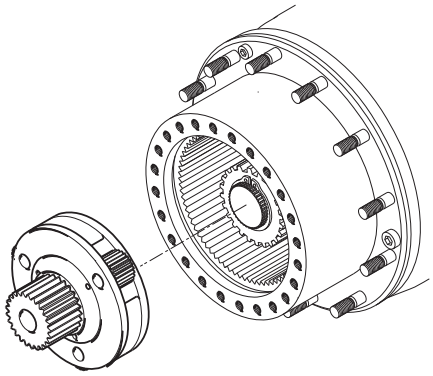
Securing the wheel bearing adjustment nut:

9. Secure the wheel bearing adjustment nut with a screw.
   - Hexagon socket screw
   - Screw securing: Loctite 270
   - Tightening torque: 125 Nm



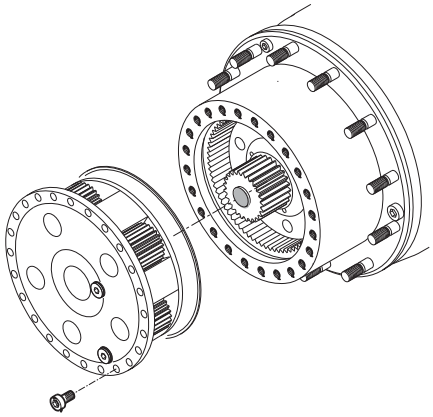
Assembly of sun gear:

10. Slide sun gear onto the universal joint or the axle shaft.
    - Bevel of the sun gear is in sliding direction.
11. Mount the circlip.
12. Slide the universal joint or the axle shaft to the inside until circlip contacts the sun gear and the sun gear contacts the thrust ring.
13. Rotate the hub assembly until one of the oil compensating holes of the ring gear carrier is at the bottom position!



Assembly of planetary gear:

14. Push the inner planetary gear drive assembly into the ring gear and onto the sun gear.



15. Insert the O-ring into the planetary housing.
    - ➢ Sealing of the contact surface between planetary housing and wheel hub
    - ➢ Multi-purpose grease prevents the O-ring from falling out during assembly.
16. Push the outer planetary gear drive assembly into the ring gear and onto the sun gear.
17. Align the holes to each other and screw the planetary housing with the wheel hub.
    - ➢ The oil drain plug has to be at the bottom!
    - ➢ Tightening torque: **see Tightening torques for standard metric threads on page 83**
18. Top up with oil.
    - ➢ see **"Oil change" on page 62.**

4.8 Wet multiple disk brake regulations

General:

- Vehicles that are approved for public roads must comply with the ordinances, standards, and regulations of the respective countries. Brake components need to be checked at regular intervals and, if necessary, be repaired or replaced. The regulations of the brake manufacturer must be observed for this.
- Vehicles that are not authorized need to be inspected by an expert in accordance with the respective accident prevention regulations at least once a year.
- If there are indications of thermal overload, consult a brake specialist or the manufacturer.

Replacing the brake lining:

- Worn, burned, or glazed lining disks need to be replaced.
- If this is not observed, the general operating license of the vehicle will be void. Any claims for possible damage will not be acknowledged as well.

Running-in instructions for wet multiple disk brakes:

- When starting up the vehicle, drive carefully to bring the brakes to the operational temperature.
- Drive carefully to get used to the brake effect.

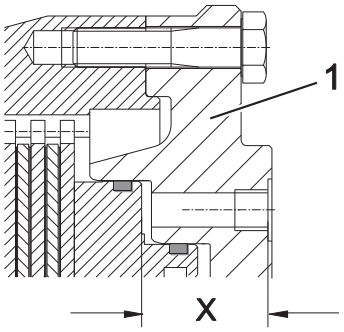
4.9 Lining wear measurement of wet multiple disk brakes

⚠ WARNING	
	**When work is being performed on the brake, its braking effect is disabled.** Rolling away of the vehicle ➢ Make sure that no machine movements can take place.

⚠ CAUTION	
	**Hot brakes and hot cooling oil** Burns ➢ The amount of wear rate may be measured only when the vehicle is cold.

Checking the wear rate by comparing the imprinted value (= measurement with new disks) and the value to be measured (= measurement with used brake).

The reference dimension (= measurement with new disks) is imprinted below the wear inspection hole.

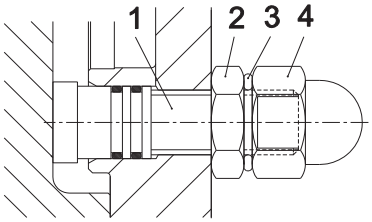


1 Brake carrier

1. Disconnect the supply and return lines of the cooling oil from the brake.
2. Drain the oil from the brake. see "Oil change" on page 62
3. Measure dimension X through the wear inspection hole when the brake is actuated.
   - ➢ **Important:** Measurement needs to be taken from the countersink.
4. Make a note of dimension X.
5. Calculate the difference between the imprinted value with the measured value.
   - ➢ If the difference lies within the permissible tolerance, the brake can continue to be used.
   - ➢ If the difference is greater than the permissible wear rate, consult KESSLER.
6. Check the cooling oil level in the vehicle.

For Wet multiple disk brake (NLB) 8550, the maximum permissible wear rate is 4.0 mm.

4.10 Readjust the clearance



1. With the brake being applied remove cap nuts (4), O-rings (3), and lock nuts (2).
2. Screw in the adjusting screws (1) all the way at the piston.
3. Turn back the adjusting screws (1) according to the set value of the clearance.
   - ➢ Set value of the clearance: see below
4. Screw on and tighten the lock nuts (2).
   - ➢ Do not turn the adjusting screws (1) when doing so.
5. Add the O-rings (3).
6. Screw on the cap nuts (4) and tighten loosely.
   - ➢ Hold the lock nuts (2) while doing so.

The specified value for the clearance of the wet multiple disk brake 8550 is 3.5 +0.5/- 0.1 mm.

5 Ordering spare parts

5.1 Guarantee

KESSLER provides a warranty only for the supplied original spare parts.
Please note that use of spare parts that are not original may negatively modify the specified design characteristics of the axles, gearboxes, drive assemblies, wheel gears, and wheel ends and thus adversely affect the safety.

KESSLER accepts no liability for damage caused by use of non-original spare parts and accessories. Please note that special manufacturing and supply specifications exist for proprietary and third-party parts and that we always offer spare parts according to the latest statutory standards.

5.2 Required specifications for ordering spare parts

The following specifications are needed for ordering KESSLER spare parts:

- Part number (no. of the installation drawing) >>see type plate
- Serial number >>see type plate
- Manufacturer of the vehicle
- Name of the spare part
- Spare part number (drawing or DIN no.)
- Quantity
- Shipping mode

5.3 Type plate

The type plate is usually located near the differential and carrier assembly on the side of the oil filling plug.

The axle serial number is imprinted additionally on the axle housing next to the type plate.

5.4 Necessary consultation with KESSLER

- In the event of uncertainty, contact KESSLER.
- In the event of major repairs or overhauls, it would be appropriate to send the entire axle to KESSLER.

6 Storage

6.1 Standard conservation

Standard conservation of the delivered KESSLER products is sufficient for:

- 18 months - with dry storage in closed rooms
- 12 months - with storage without water ingress
- 3 months - with storage in the open air (breather has to be closed)

6.2 Conditions for storage with standard conservation

Inadmissible and necessary conditions for storage of KESSLER products with standard conservation:

- Open air storage is not permissible in harbor areas (salt water)!
- If the packaging is damaged, renew the packaging!

6.3 Measures for longer storage periods

The following measures are necessary for longer storage periods:

- Oil leaks and water ingress are not permissible; the breather needs to be replaced by a screw plug with sealant.
- Fill units and multiple disk brake with oil.
- Filling volume: 80% of the axle housing volume / hub assembly volume / brake volume / drive assembly volume / gearbox volume.
- Oils to be used:
  - Axle housing / Hub assembly / Drive Assembly / Gearbox: Hypoid gear oil SAE 90 API GL5
  - Multiple disk brake: Shell SPIRAX TXM (Donax TD)

    Attention: Do not overfill due to build-up of pressure during temperature fluctuations.
- Apply additional corrosion protection onto uncoated surfaces (for example: rim unit, steering cylinders, brake disks, drive flange, …).

6.4 Measures before startup after storage

The following measures need to be taken prior to startup of the KESSLER product:

- Remove storage oil and fill KESSLER product with suitable oil to correct oil level.
  Refer to "Oil change" on page 62.
- Check running surfaces of the sealing rings for corrosion. Check sealing points for leaks immediately after startup. If this is not ensured, replace the sealing rings as well.
- Remove corrosion protection completely from uncoated surfaces at startup (e.g. rim unit, steering cylinder, brake disks, drive flanges, …).
- The rim unit needs to be clean and grease-free so that frictional adhesion to the rim is ensured and loosening of rims is avoided.
- Check load-bearing components for corrosion, in particular if stored over several years.

6.5 Responsibility during storage

- The operator has the responsibility for proper storage of KESSLER products and, if applicable, additional necessary corrosion protection measures.

7 Disposal

KESSLER products consist of various materials that can be reused after disposal and must be disposed of separately. The following steps have to be taken.

- Put the vehicle out of operation before starting disassembly.
- Secure the steering assembly parts so that movements are no longer possible.
- Depressurize pressure connections.
- Drain and remove all operating fluids (coolants, lubricants) and dispose of properly.
  See "Oil change" on page 62.
- Attach KESSLER product to a suitable hoisting device and disassemble from vehicle.
- Dismantle KESSLER product into individual subassemblies and components.
  NOTICE! Dismantling of spring applied subassemblies (e.g. brakes) is not permitted. For this process, the respective safety regulations of the manufacturer must be observed.
- Separate individual parts according to type of material and dispose of according to national and local ordinances as well as valid regulations for the protection of the environment.

8 Important information

8.1 Auxiliary materials: Adhesives, sealing compounds, grease, and assembly pastes

8.1.1 Use of auxiliary materials

Type	Application	Product	Type	Color
Adhesive	Screw securing light	LOCTITE	243	Blue
Adhesive	Screw securing medium	LOCTITE	262	Red
Adhesive	Screw securing very tight	LOCTITE	270	Green
Adhesive	Friction increase in joint faces	LOCTITE	270	Green
Adhesive	Surface sealing	LOCTITE	510	Orange
Adhesive	Special sealing	LOCTITE	572	White
Adhesive	Sealing with wide gap	LOCTITE	638	Light green
Adhesive	Surface sealing	LOCTITE	5926 or 209 125	Blue
Sealing compound	Elastic sealing	Dirko	Grey	Gray
Assembly paste with MoS_2	Prevents stick-slip	LIQUI MOLY	LM 48	Gray
Multi-purpose grease	Adhesive lubricant	FUCHS	RENOLIT AS	Yellow transparent
Multi-purpose grease lithium soap-based	Bearing lubrication - worked penetration in accordance with NLGI 2	FUCHS	RENOLIT MP150	Yellow transparent
Special grease	Gear-shifting	Klüber	Mircolube GL261	yellow, almost transparent
Assembly-Gel	Elastomer components	Klüber	S06-100	transparent

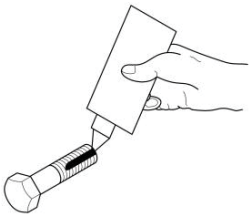
8.1.2 Handling auxiliary materials

Handling of Loctite 243 / 262 / 270 / 510 / 572 / 638

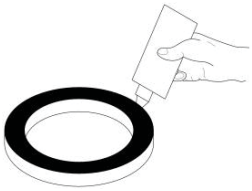
- The surfaces or screws and threaded boreholes to be cemented need to be free of paint, grease, and oil (washed).
- The Loctite adhesives applied cure under the following conditions:
  - Absence of air
  - Metal contact
  - Warmth
- Only a short time may pass between pre-assembly and controlled tightening (5 - 10 minutes).
- Parts prepared with Loctite intended for cementing can be exposed to air for up to 1 hour.
  Exception: Parts made of nonferrous metal may rest for no more than one minute.
- Allow loaded connections to cure for at least 24 hours.

Loctite amount:

For screws: 1 bead



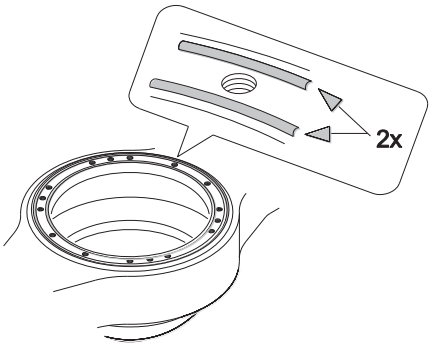
sealing surface: ensure sufficient coating



Handling of Loctite 5926

- The surfaces or screws and threaded boreholes to be cemented need to be free of paint, grease, and oil (washed).
- The Loctite adhesives applied cure under the following conditions:
  - moisture curing begins immediately after the product is exposed to the atmosphere
- Parts to be assembled should be mated within a few minutes after the product is dispensed.

Loctite amount:



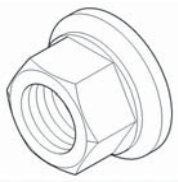
on sealing surface: 2 beads

8.2 Tightening torques

Friction: μ = 0.14

The tolerance of the tightening torques is ±5 %
(provided that a manual torque wrench is used).

8.2.1 Tightening torque wheel nut

Wheel nut with flat washer	Size	- Phosphor blackened -
	M 22 x 1.5	650 Nm

8.2.2 Tightening torques for standard metric threads

Thread size	Screw	Nut	Screw	Nut	Screw	Nut
	8.8	8	10.9	10	12.9	12
M 4	3.0 Nm		4.4 Nm		5.1 Nm	
M 5	5.9 Nm		8.7 Nm		10 Nm	
M 6	10 Nm		15 Nm		18 Nm	
M 8	25 Nm		36 Nm		43 Nm	
M 10	49 Nm		72 Nm		84 Nm	
M 12	85 Nm		125 Nm		145 Nm	
M 14	135 Nm		200 Nm		235 Nm	
M 16	210 Nm		310 Nm		365 Nm	
M 18	300 Nm		430 Nm		500 Nm	
M 20	425 Nm		610 Nm		710 Nm	
M 22	580 Nm		830 Nm		970 Nm	
M 24	730 Nm		1050 Nm		1220 Nm	
M 27	1100 Nm		1550 Nm		1800 Nm	
M 30	1450 Nm		2100 Nm		2450 Nm	

8.2.3 Tightening torques for galvanized screws and nuts

Observe the reduced tightening torques for galvanized screws and nuts!

8.2.4 Tightening torques for metric fine threads

Thread size	Screw	Nut	Screw	Nut	Screw	Nut
	8.8	8	10.9	10	12.9	12
M 8 x 1	27 Nm		39 Nm		46 Nm	
M 10 x 1	55 Nm		81 Nm		95 Nm	
M 10 x 1.25	52 Nm		76 Nm		90 Nm	
M 12 x 1.25	93 Nm		135 Nm		160 Nm	
M 12 x 1.5	89 Nm		130 Nm		155 Nm	
M 14 x 1.5	145 Nm		215 Nm		255 Nm	
M 16 x 1.5	225 Nm		330 Nm		390 Nm	
M 18 x 1.5	340 Nm		485 Nm		570 Nm	
M 20 x 1.5	475 Nm		680 Nm		790 Nm	
M 22 x 1.5	650 Nm		920 Nm		1050 Nm	

8.2.5 Tightening torque for screw plugs

Thread size	Tightening torque (reference values for screws with copper ring)	Tightening torque (sealing plug with O-ring)
M 14 x 1.5	approx. 45 Nm (33 lbf x ft)	45 Nm (33 lbf x ft)
M 16 x 1.5	approx. 60 Nm (44 lbf x ft)	--
M 22 x 1.5	approx. 100 Nm (74 lbf x ft)	100 Nm (74 lbf x ft)
M 24 x 1.5	approx. 120 Nm (89 lbf x ft)	--
M 30 x 1.5	approx. 160 Nm (118 lbf x ft)	--
M 42 x 1.5	approx. 260 Nm (192 lbf x ft)	--
M 45 x 1.5	approx. 280 Nm (207 lbf x ft)	--
9/16-18 UN(F)	--	34 Nm (25 lbf x ft)

8.3 Units

Conversion table

25.40 mm	=	1 in. (inch)
1 mm	=	0.0394 in. (inch)
1 kg (kilogram)	=	2.205 lbs (pounds)
9.81 Nm (1 kpm)	=	7.233 lbf x ft (pound force foot)
1.356 Nm (0.138 kpm)	=	1 lbf x ft (pound force foot)
1 bar (1.02 kp/cm^2)	=	14.5 psi (pound force per square inch lbf/in^2)
0.070 bar (0.071 kp/cm^2)	=	1 psi (lbf/in^2)
1 liter	=	0.264 gallon (imp.)
4.456 liters	=	1 gallon (imp.)
1 liter	=	0.220 gallon (US)
3.785 liters	=	1 gallon (US)
1609.344 m	=	1 mile (land mile)
0°C (Celsius)	=	+32°F (Fahrenheit)
1°C (Celsius)	=	+33,8°F (Fahrenheit)
0°C (Celsius)	=	273.15 Kelvin
1°C (Celsius)	=	274.15 Kelvin

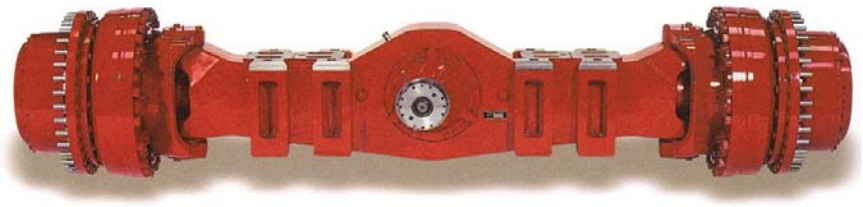
Description of the legal units

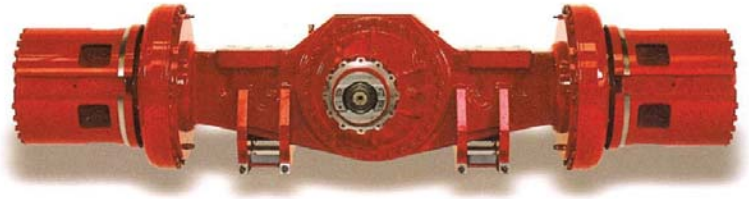
Term	Symbol	New	Old	Conversion	Remarks
Moment of torque	T	Nm (Newton meter)	kpm	1 kpm = 9.81 Nm	T (Nm) = F (N) x r (m)
Moment of force	M	Nm (Newton meter)	kpm	1 kpm = 9.81 Nm	M (Nm) = F (N) x r (m)
Pressure	p	bar	atm (gauge)	1.02 atm = 1.02 kp/cm = 1 bar = 750 torr	---

9 Supplier documents

An overview follows with links to data sheets and supplier documentation:

9.1 Knott - FSG90, FSG110, TM6397





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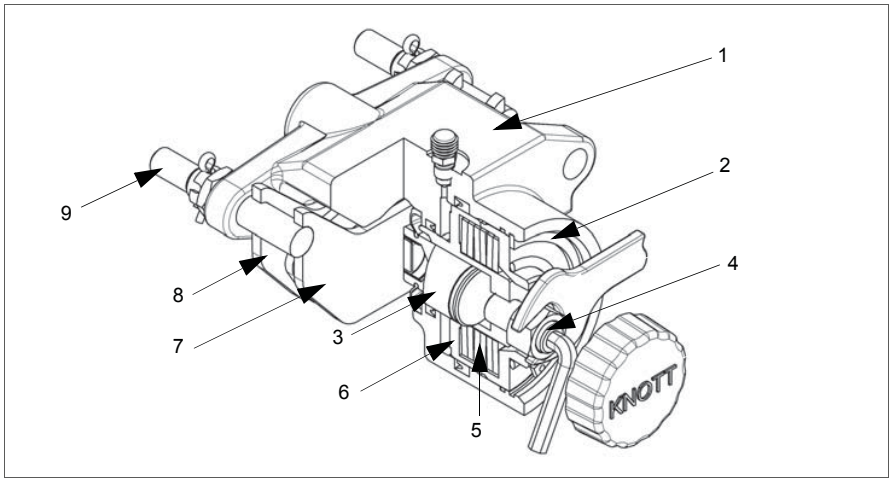
1. Construction and funktion

Bild 1-1:
Parts of the brake

1 housing
2 pressure ring
3 thrust bolt
4 adjusting screw
5 bank of cup springs
6 piston
7 lining pad
8 lining pad
9 gliding bolt



The two identical brake pads and slide freely on the guide bolt, which is fastened in the housing. The guide bolts are guided in an additional brake anchor plate which in turn is screwed onto the vehicle, i.e. its axle.

On actuation, the brake generates a clamping force at the brake lining pads, which cause a tangential force/braking moment to be generated at the brake disk, the extent of which depends on the coefficients of friction generated by the linings.

The clamping force is generated by the bank of cup springs, during which the piston is moved together with the adjusting screw, the thrust bolt and the brake pad towards the brake disk.

When the brake pad comes into contact with the brake disk, the reaction force shifts the housing onto the guide bolts until the brake pad) is also pressed against the brake disk.

The brake is released by complete pre-tensioning of the bank of cup springs. During this process, through application of the necessary release pressure after overcoming the cup spring force, the piston must move back until it comes to rest against the pressure ring.

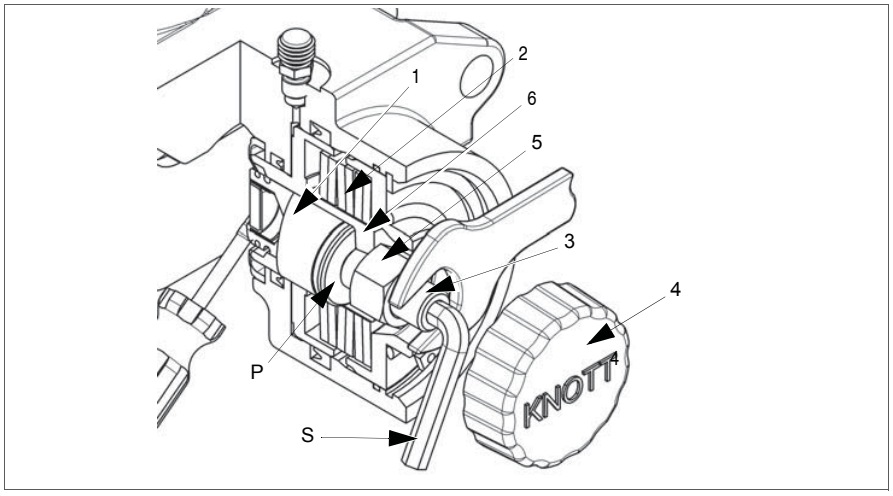
The clamping force diminishes with wear of the brake lining and brake disk. The brake must be adjusted at the latest at the times indicated by the adjusting specification below.

2. Mounting and basic setting regulations

Basic brake setting is required after mounting new brake lining plates or brake disks, as well as during all repair stages and in the event of insufficient braking performance.

Bild 2-1:
Adjusting and assembly possibilties

1 thrust bolt
2 bank of cup springs
3 adjusting screw
4 screw cap
5 lock nut
6 piston
P even surface
S socket wrench



Note:

All mounting and basic setting work must be carried out on the brake when cold.

2.1. Mounting the brake

1. Stand the vehicle on an even surface and secure against rolling away.
2. Release the screw cap.
3. Release the lock nut (size 24 or 30) and turn the adjusting screw anticlockwise using a size 8 or 10 socket wrench until the pressure bolt comes to rest against the even surface of the piston. In this status, the brake can be mounted onto the brake disk and fastened.
4. Mount the pressure connection again.

Apply the necessary release pressure to the brake until the bank of cup springs is completely pre-tensioned
Following carry out the below described basic setting regulation.

2.2. Basic setting regulation

1. Turn the adjusting screw manually clockwise until both brake pads make contact with the brake disk. Then it is not longer possible to turn the adjusting screw without exerting a major amount of force.
2. Turn the adjusting screw anticlockwise in order to set the following rated clearances:

type	adjusting srew	clearance (mm)		turns
FSG90	M16 (SW 8)	min.	0,5	1/4
		clearance	1,0	1/2
		max.	1,5	3/4
FSG110	M20 (SW 10)	min.	1,0	2/5
		clearance	2,0	4/5
		max.	3,0	1 1/5

3. Hold the adjusting screw in position with a hexagonal socket wrench and lock with lock nut.
4. Mount the screw cap and tighten as far as possible manually.
5. Stellen Sie den Druckanschluß gemäß der Vorschrift der Achs- bzw. Getriebehersteller her. Mount the pressure connection in accordance with the instructions of the axle / gear manufacturer.

For bleeding the piston chamber use the socket spanner size 13 for the bleeding valve.

2.3. Adjusting regulations

During this adjusting process, the parking brake must be released, i.e. the bank of cup springs must be completely pre-tensioned.

1. Stand the vehicle on an even surface and secure against rolling away.
2. Release the parking brake by using the required release pressure.
3. Release the screw cap and unscrew.
4. Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually clockwise until the two brake pads make contact with the brake disk.
5. Turn the adjusting screw anti-clockwise and set the clearance specified in the above table.
6. Hold the adjusting screw in position with the hexagonal socket wrench and lock with the lock nut.
7. Mount the screw cap and tighten as far as possible manually.

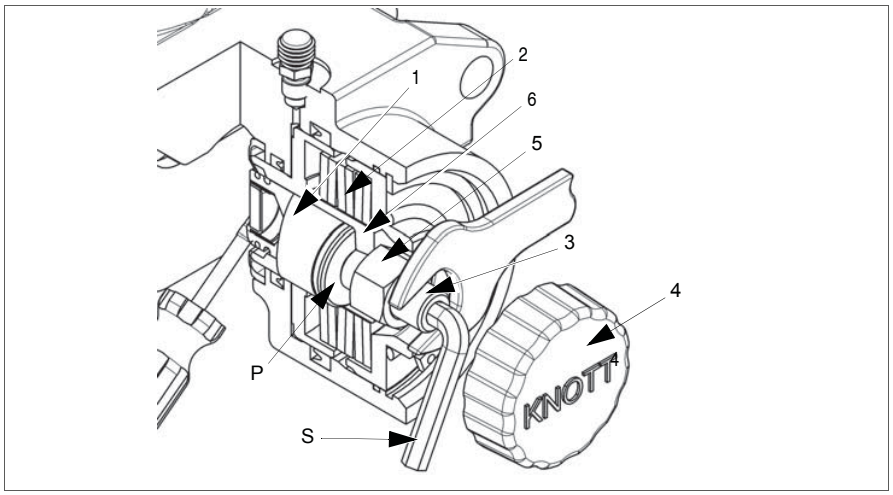
Actuate the brake valve several times and check the braking efficiency of the parking brake on a slope.

3. Emergency release of the parking brake

After the failure of the pressure release the parking brake by using following manual procedure:

Bild 3-1:
Adjusting and assembly possibilties

1 thrust bolt
2 bank of cup springs
3 adjusting screw
4 screw cap
5 lock nut
6 piston
P even surface
S socket wrenchl



1. The vehicle has to be secured against rolling away.
2. Release the screw cap and unscrew.
3. Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually counter-clockwise until the brake disc is free.

Caution!

For the emergency release is an actuation torque of 40 Nm respectively 70 Nm required .

4. Mount the lock nut and the screw cap and tighten both as far as possible manually. (Protection against dirt

Caution!

Now, the vehicle do not have any brake function. The vehicle must be secured against moving away with proper means. Before putting the vehicle into operation again, the brake has to be adjusted again. Res. „Assembly and basic setting regulations“.

4. Maintenance and repair work

4.1. Maintenance and exchange of brake pads

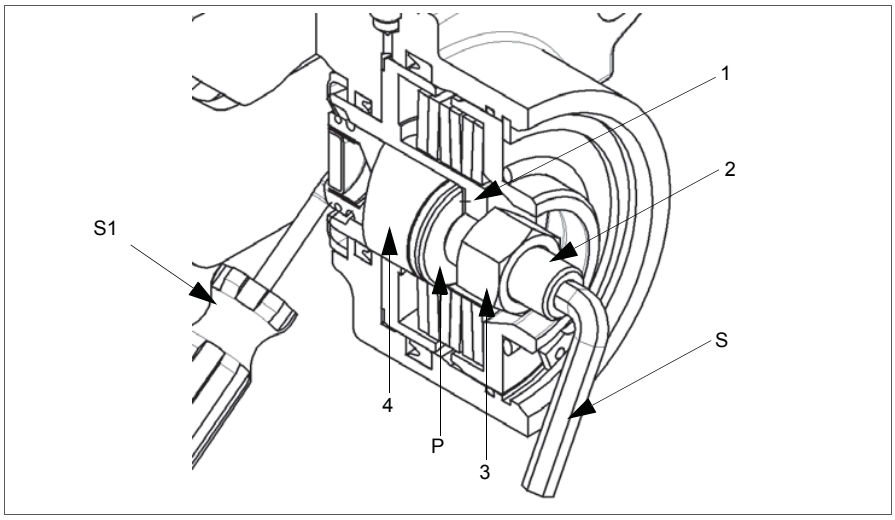
The brake pads themselves are maintenance free. All that is required here is a check for damaged parts, as well as inspection to ensure that the brake disk remains easy running.

The thickness of the brake lining must be subjected to a visual inspection at regular intervals, which depend on vehicle usage, but every six months at the latest. In the event of a minimal residual lining thickness, these intervals must be reduced accordingly in order to avoid major damage to the brake or disk:

– FSG 90:
  min. residual thickness 1,0 mm per lining pad (6 mm carrier plate thickness).
– FSG 100:
  min. esidual thickness 2.0 mm per lining pad (8 mm carrier plate thickness).

Bild 4-1:
Extending the lining pads

1 piston
2 adjusting screw
3 lock nut
4 thrust bolt
S socket wrench
S1 screwdriver
P inside of the piston



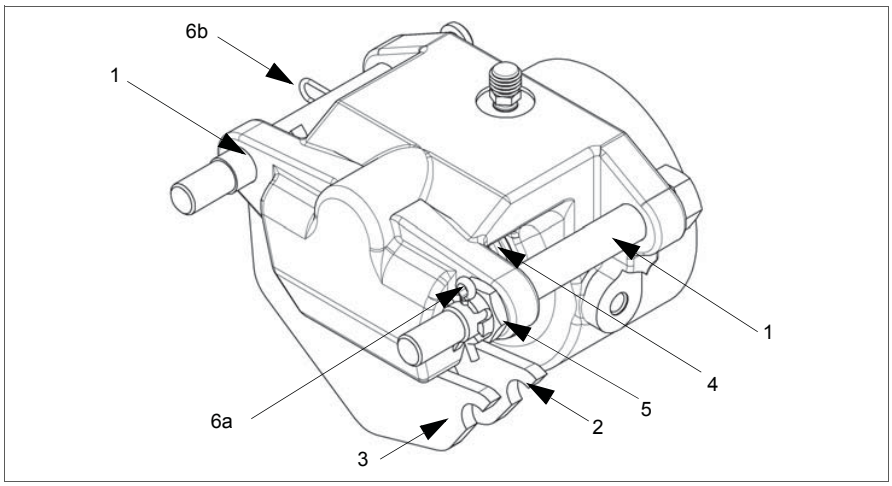
Note:

Only Knott original spare lining plates may be used. If any other spare parts are used, no warranty claims will be accepted either for the brakes or their functional characteristics

1. Stand the vehicle on an even surface and secure against rolling away.
2. Release the parking brake by applying the required release pressure
3. Release the screw cap and unscrew.
4. Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually clockwise until it lies flush with the inside of the piston.
5. Press back the thrust bolt using a suitable screwdriver until it has contact with the piston.

Bild 4-2:
Exchanging the lining pads

1 guide bolt
2 lining pad
3 lining pad
4 permanent magnet
5 castellated nut
6a safety splint
6b safety clip



6. Depending on the free space available, release one of the two guide bolts, removing the safety splint, unscrewing the castellated nut and pulling the guide bolt out of the brake anchor plate. Now, the brake lining pads can be removed tangentially to the brake disk.

Note:

In the event of minimal clearance, i.e. it is not possible for space reasons to exchange the brake lining plate in accordance with these instructions, the brake must be removed completely. To do this, pull both guide bolts out of the brake anchor plate.

Caution!

Check the pressure hose. If the pressure hose is to short, it must be unscrewed to remove the brake. Before the pressure hose can be released the brake must be emergancy released.

7. Exchange the brake pads and insert the guide bolts into the brake anchor plate.If you have removed the complete brake you have to amount the brake on both guide bolt again, now.
8. Check both permanent magnets if they still have sufficient magnetic force to hold the brake lining plates.
   Should this not be the case, the permanent magnets must also be changed by using a suitable screw driver.
9. Secure the guide bolt with the castellated nut and the safety splint res. safety clip.

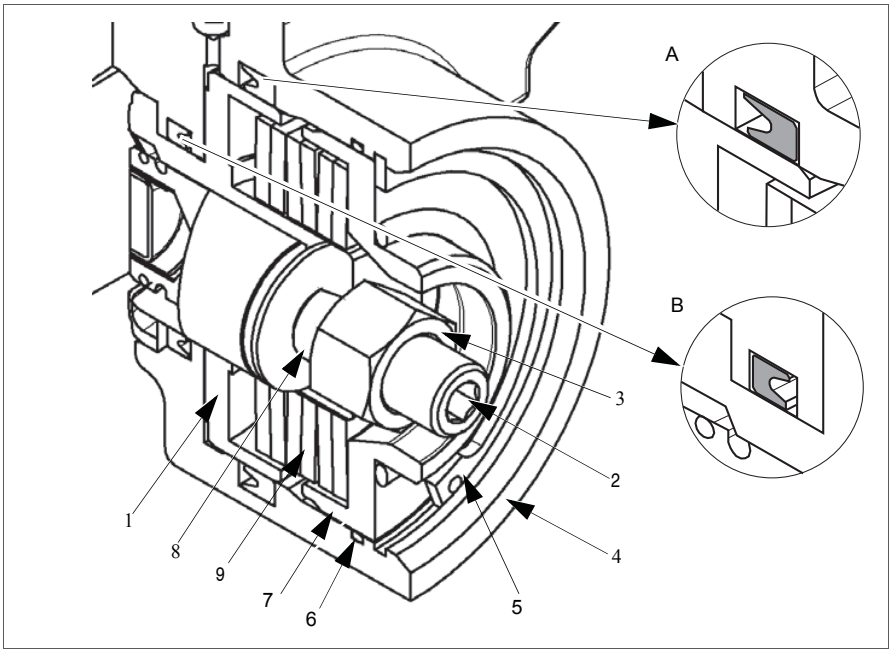
Note:

After mounting new brake lining plates or their repair, the brake must be correctly set in accordance with the instructions „Adjusting regulations“.

4.2. Changing the seal

Bild 4-3:
Change of the sealsl

1 piston
2 adjusting screw
3 lock nut
4 housing
5 circlip
6 seal
7 guide bolt
8 thrust bolt
9 bank of cup spring
A detail of the seal
B detail of the seal



Faulty seals must be exchanged in accordance with the instructions below:

1. Stand the vehicle on an even surface and secure against rolling away.
2. Release the parking brake by applying the necessary release pressure.
3. Release the screw cap and unscrew.
4. Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually counter clockwise until the adjuster screw is flush with the inner side of the piston.
5. Push back the thrust bolt until it has contact with the piston. Following actuate the hand brake valve. (no pressure must be in the piston chamber). The bank of cup springs is now completely depressurized.
6. Unscrew the pressure hose and remove the brake.
7. Release the circlip and remove the pressure ring of the housing.
8. Release the bank of cup spings and the piston.

Caution!

Pay attention to the mounting direction of the seal rings, otherwise leaks can occur.

Use for mounting the new seal rings a suitable mounting needle with rounded edge. Be careful,

9. Change all seals and mount the parts of the brake in other way round order. By mounting the piston, the sliding and sealing surfaces must be greased lightly using lubricating grease to DIN 51825.
   The dust protection cap is fitted with a vulcanized-in steel ring which is used to press it through the locating hole. For exchanging, "lever out" the ring using a suitable tool. The new dust protection cap must be pressed in with the aid of a suitable mounting ring and screw clamps or a lever press.

Mount the brake in accordance with the above procedure into the vehicle / at the axle.

4.3. General

Any discovered defects or damage to parts not listed here must naturally be repaired or replaced using original parts.

For any other information not contained in these instructions or for more detailed instructions, please contact the vehicle or brake manufacturer