

Service Manual

Rear Axle

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Hüttlinger Straße 18-20
D-73453 Abtsgmuend
Germany

Phone +49 (0) 73 66 / 81-32
Fax +49 (0) 73 66 / 81-69
service@kessler-axles.com
www.kessler-axles.com

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.

Table of contents

1	Safety	1
1.1	Structure of warning notices	1
1.2	Explanation warning notices and notices	1
1.3	Explanation symbols and pictograms	2
1.4	Basic warning notices	5
1.5	Basic safety instructions	8
2	Axle Overview	10
3	Repair	11
3.1	Correct disassembly	11
3.2	Correct assembly	11
3.3	Hub assembly	12
3.3.1	Preconditions	12
3.3.2	Overview of parts	13
3.3.3	Customer service tools hub assembly	15
3.3.4	Disassembly hub assembly	16
3.3.5	Assembly hub assembly	18
3.4	Service brake	31
3.4.1	Overview of parts	33
3.4.2	Connections wet multiple disk brake	35
3.4.3	Disassembly wet multiple disk brake	35
3.4.4	Assembly wet multiple disk brake	37
3.4.5	Air gap setting with piston adjustment	40
3.4.6	Assembly wet multiple disk brake on the axle	40
3.5	Test the cooling oil chamber of the service brake for leak tightness	41
3.5.1	Preconditions	41
3.5.2	Approach	41
3.6	Bleeding the wet multiple disk brake	41
3.7	Assembling the face seal	43
3.8	Differential and carrier assembly	48
3.8.1	Preconditions	48
3.8.2	Overview of parts	49
3.8.3	Customer service tools drive	51
3.8.4	Disassembly differential and carrier assembly	52
3.8.5	Assembly differential and carrier assembly	54
4	Maintenance	76
4.1	Lubricants and lubrication intervals	76

4.2	Operating Fluids.....	76
4.2.1	Oils.....	77
4.3	Oil change.....	79
4.3.1	Inspection of screw plugs with magnet.....	80
4.3.2	Oil drain.....	81
4.3.3	Oil filling and filling level.....	83
4.4	Maintenance intervals.....	85
4.5	Checking the screwed connections, safeguards, formation of corrosion and on load-bearing components.....	86
4.6	Checking gaskets.....	86
4.7	Controlling of breather.....	86
4.8	Checking of the lining thickness on parking brake.....	86
4.9	Wheel bearing adjustment.....	87
4.10	Wet multiple disk brake regulations.....	92
4.11	Lining wear measurement of wet multiple disk brakes.....	93
5	Ordering spare parts.....	95
5.1	Guarantee.....	95
5.2	Required specifications for ordering spare parts.....	95
5.3	Type plate.....	95
5.4	Necessary consultation with KESSLER.....	96
6	Storage.....	97
6.1	Standard conservation.....	97
6.2	Conditions for storage with standard conservation.....	97
6.3	Measures for longer storage periods.....	97
6.4	Measures before startup after storage.....	98
6.5	Responsibility during storage.....	98
7	Disposal.....	99
8	Important information.....	100
8.1	Auxiliary materials: Adhesives, sealing compounds, grease, and assembly pastes.....	100
8.1.1	Use of auxiliary materials.....	100
8.1.2	Handling auxiliary materials.....	101
8.2	Tightening torques.....	102
8.2.1	Tightening torque wheel nut.....	102
8.2.2	Tightening torques for standard metric threads.....	103
8.2.3	Tightening torques for metric fine threads.....	104
8.2.4	Tightening torques for galvanized screws and nuts.....	104
8.2.5	Tightening torque for screw plugs.....	105
8.3	Units.....	107

9	Supplier documents	108
9.1	NoSPIN.....	108
9.2	Knott - FSG90, FSG110, TM6397	108

1 Safety

1.1 Structure of warning notices



SIGNAL WORD

Type and source of the danger

Consequences if ignored

➤ Measure

1.2 Explanation warning notices and notices

⚠ DANGER	
	<p>Indicates a direct danger.</p> <p>If not avoided, death or serious injury will result.</p>
⚠ WARNING	
	<p>Indicates a possibly dangerous situation.</p> <p>If not avoided, death or serious injury may possibly result.</p>
⚠ CAUTION	
	<p>Indicates a possibly dangerous situation.</p> <p>If not avoided, injury may possibly result.</p>
NOTICE	
Indicates situations where material damage can occur.	
	<p>NOTE</p> <p>Indicates important information, application tips, and useful notes for proper working practices.</p>

1.3 Explanation symbols and pictograms



Use safety gloves.



Use safety goggles.



Use protective clothing.



General warning sign that draws attention to potential dangers.



Warning of loose, tipping and falling parts.



Warning of moving parts.



Warning of spring-off and spring-loaded parts.



Warning of loose parts.



Warning against danger of burns.



Warning when working between moving parts.



Warning of dangerous, electrical voltage.



Warning of rotating parts.



Warning of vehicle movement.



Warning against suspended load.



Warning of flying parts.





Warning of independently, uncontrolled loosened parts.





Warning against uncontrolled movements of parts with large dead weight.


1.4 Basic warning notices


⚠ CAUTION	
	<p>During all machining work on metal parts, during which there is a danger of splinters (abrasive cutting, deburring, cleaning with compressed air, etc.), flying metal parts</p> <p>Risk of injury</p> <ul style="list-style-type: none"> ➤ Wear protective goggles


⚠ CAUTION	
	<p>During all work on sharp-edged and hot parts, with operating materials, there is a danger to hands</p> <p>Danger of injuries</p> <ul style="list-style-type: none"> ➤ Wear protective gloves



⚠ CAUTION	
	<p>It is prohibited to wear loose clothing and long open hair when working on axles, transmissions, wheel gears and non drive wheels!</p> <p>Risk of injury</p> <ul style="list-style-type: none"> ➤ Wear suitable protective clothing


⚠ WARNING	
	<p>Failure to observe the safety signs on KESSLER product.</p> <p>Sources of danger are not recognized</p> <ul style="list-style-type: none"> ➤ Safety signs must always be in legible condition.

⚠ WARNING	
	<p>Only tools and equipment of the highest quality may be used; tools and equipment must be undamaged and electrical equipment must be approved for use in the respective country.</p> <p>Injuries of the mechanic</p> <ul style="list-style-type: none"> ➤ Never use improvised tools / devices.

⚠ WARNING	
	<p>For repair welding, the materials involved must be known so that a correct condition (strength, joint, etc.) is present after welding. Repair welding generates heat and current flow, which can damage surrounding parts of the KESSLER product.</p> <p>The operational safety of the KESSLER product is not guaranteed.</p> <p>Risk of injury to the fitter and third parties.</p> <ul style="list-style-type: none"> ➤ Repair welding is only permitted after consultation with KESSLER!

⚠ WARNING	
	<p>Movement / rotation of different parts can result in the danger of injury to limbs.</p> <p>Danger of being crushed</p> <ul style="list-style-type: none"> ➤ Never reach between moving parts with your hands

⚠ WARNING	
 	<p>Work on an axle, a transmission, a wheel gear and a non drive wheel is allowed only if the temperature of the respective component permits.</p> <p>Burn hazard</p> <ul style="list-style-type: none"> ➤ Make sure that the oil has cooled before draining it ➤ Make sure that rotating parts have cooled before starting to remove them ➤ Wear fireproof gloves

⚠ WARNING	
	<p>Due to the unforeseeable dead weight of the single parts (e.g. wheel hub) or complete axles, transmissions, wheel gears or non drive wheels it is possible that they can fall or tip over during assembly work.</p> <p>Serious injuries of the mechanic</p> <ul style="list-style-type: none"> ➤ Always use suitable, undamaged and tested cranes and load attachment gear for the respective load. ➤ Never work or stand under suspended loads ➤ Secure parts with a lashing strap and/or support ➤ Wear safety shoes

⚠ DANGER

Subassemblies with spring applied elements (brakes / brake cylinders) are under very high spring tensions. Parts may suddenly come loose and be ejected when working on these subassemblies.

Serious or fatal injuries of the mechanic

- Opening the subassemblies is prohibited.
- In case it becomes necessary to open subassemblies, the respective safety, repair, and maintenance instructions of the suppliers must be observed.

⚠ DANGER

Comply with tightening torque for wheel nuts.e. If the wheel nuts are not tightened properly, the rim screw connection loosens and also the wheel.

Serious or fatal injuries of the mechanic and third parties

- Retighten wheel nuts after assembly and maintenance and after a short operating period!
- Observe maintenances intervals for wheel nuts in the manual!

⚠ DANGER

When work is being performed on the service brake, its braking effect is disabled.

Rolling away of the vehicle

Serious or fatal injuries of the mechanic and third parties

- Make sure that no machine movements can take place.

NOTICE

The KESSLER product is operated / connected / repaired incorrectly

The safety of the KESSLER product is not guaranteed.

- Always observe the technical data (brake connections, tightening torques of screws and wheel locking nuts, etc.). Compliance with these specifications is very important for the safety of other people.
- For information on connections: see installation drawing
- For information on tightening torques: see "Important Information"
- For information on the drive assembly: see "Drive assembly"
- For information on the hub assembly: see "Hub assembly"
- For information on the planetary gear drive: see "Planetary gear drive"
- For information on the brakes: see "Brakes"

1.5 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.

Work on the electrical sector may only be carried out by trained technicians such as an electrician, electronics technician or persons with comparable vocational training (=qualified electrician).

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).

Protective clothing:

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.

Tools:

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

Welding:

Repair welding is only permitted after consultation with KESSLER!

Reuse of used parts:

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.

Checking:

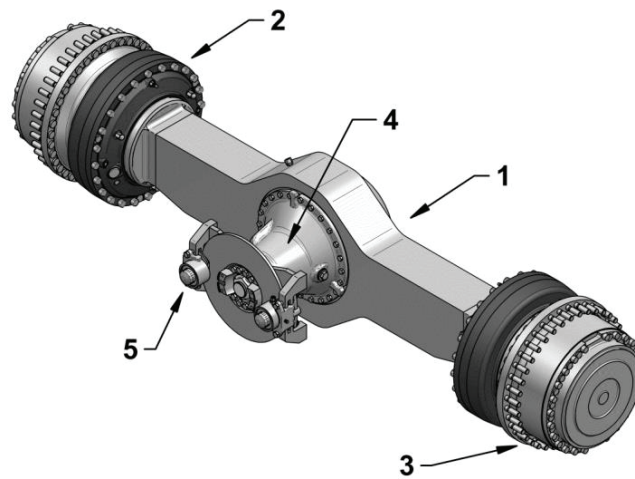
After carrying out maintenance and repair work, check that the KESSLER product functions properly.

2 Axle Overview



CHD 100

Axle 106.1859



- 1 Axle housing
- 2 Service brake
- 3 Planetary gear
- 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 KESSLER product has been disassembled from the vehicle.
- Before disassembly, the oil must be drained. [See "Oil change" on page 79](#)
- The disassembly sequence must be observed.



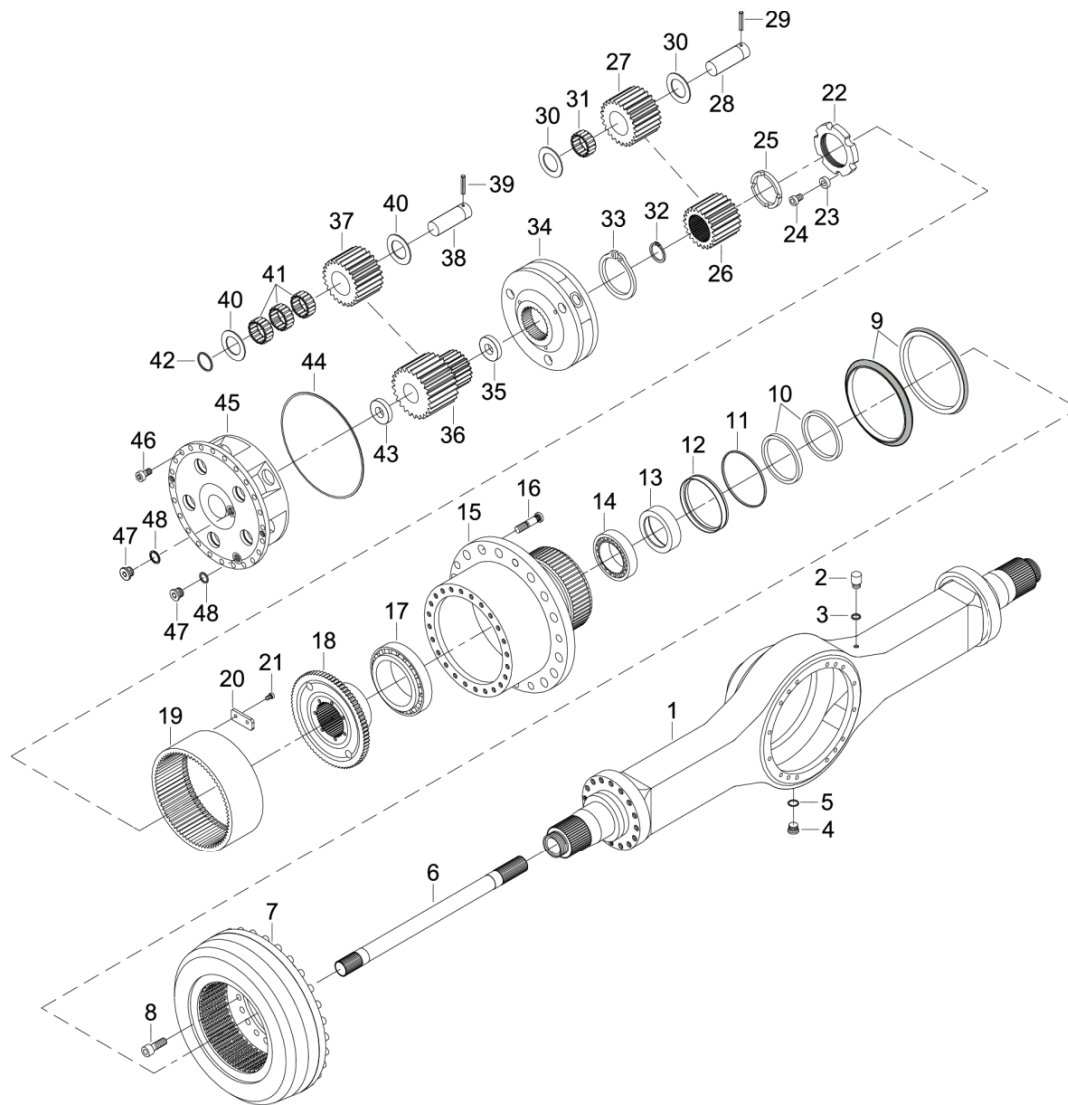
A tightening torque can deviate from the standard in individual cases, in which case the specified tightening torque must be used in the action step.



The following exploded view with numbering is only a list of the part names.

Spare parts must be ordered according to the valid spare parts list of the respective KESSLER product.

3.3.2 Overview of parts



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

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.



Wrench for wheel bearing adjustment nut

Order number: 260077



Seal ring sleeve driver for seal ring within the wheel hub

Order number: 593403
(Seal ring dimension 240x270x8,5 mm)



Centring tool for disks

Order number: 593405



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!

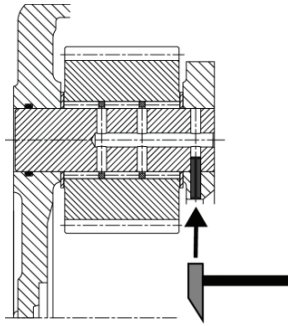
1. Disassembly planetary gear
see as well "Dismantling planetary gear"
2. Disassembly axle shaft
3. Disassembly ring gear carrier unit
4. Disassembly wheel hub



To save the centring of the disk set of the brake in case of disassembly the wheel hub, the hydraulic pressure of the brake should be released. So the disk set will be clamped (spring load effect).

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



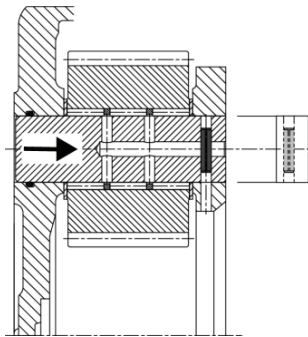
1. Knock through the dowel pin inwards until it lies in the planetary pin completely.

NOTICE

Diameter difference at the planetary pin

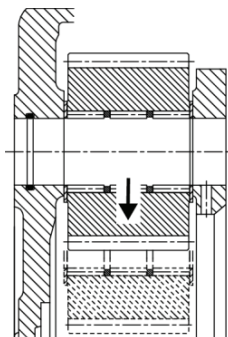
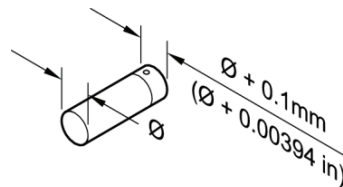
The drill hole in the planetary housing will be destroyed as a result of incorrect disassembly.

- 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.

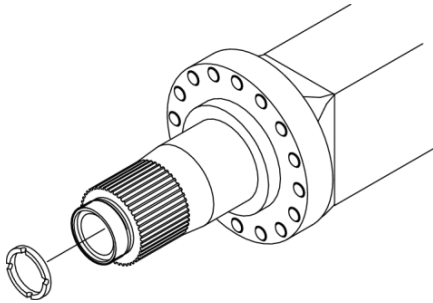
- Observe the diameter difference of 0.1 mm (0.00394 in) at the planetary pin



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



3.3.5 Assembly hub assembly

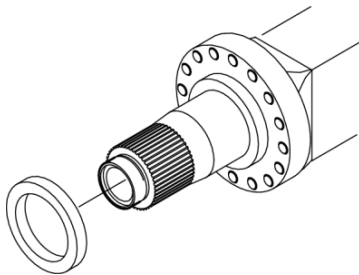
3.3.5.1 Assembly thrust ring



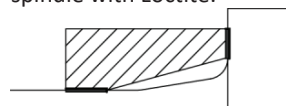
1. Press the thrust ring into the axle spindle.
 - Loctite 270

3.3.5.2 Assembly spacer ring

⚠ CAUTION	
 	<p>Hot spacer ring</p> <p>Risk of burning</p> <ul style="list-style-type: none"> ➤ Wear heat resistant gloves

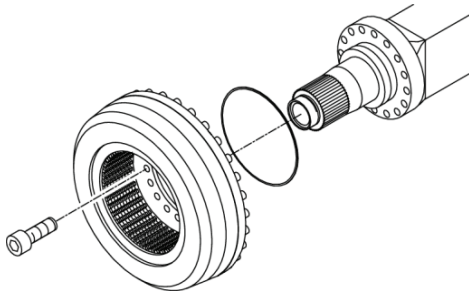


1. Corrosion check at the seat of the spacer ring.
 - Corrosion at the axle spindle is not allowed.
2. Coat the seat of the spacer ring on the axle spindle with Loctite.



- Loctite 572
3. Uniformly heat the spacer ring in an oven to approximately 100°C (212°F) 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.
 - Loctite 262
 - Tightening torque: [See "Tightening torques for standard metric threads" on page 103.](#)

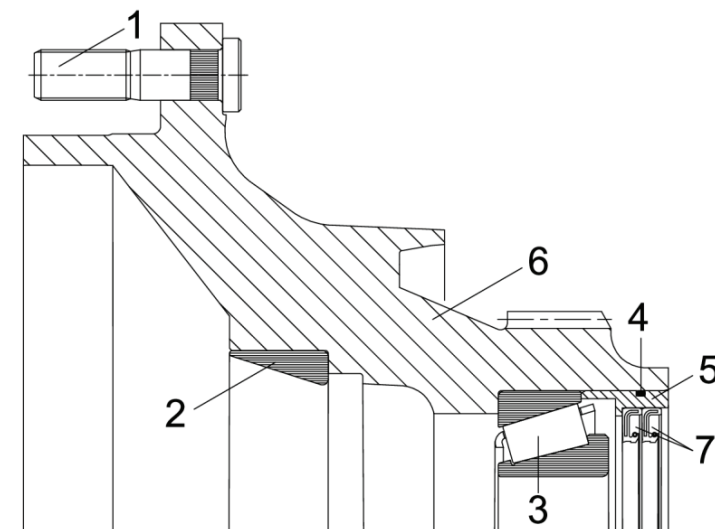
3.3.5.4 Preparation wheel hub unit

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. Install the O-ring (4) into the slot of the ring (5).
5. Coat the ring (5) with Loctite on the contact surface with the wheel hub .
 - Loctite 572
6. Press the ring (5) into the wheel hub (6).
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 2/3 full with roller bearing grease.

3.3.5.5 Assembly wheel hub unit

⚠ CAUTION	
 	<p>Sharp edges in the face seal</p> <p>Risk of cutting</p> <ul style="list-style-type: none"> ➤ Wear protective gloves



1. Insert the face seal into the wheel hub and into the brake unit.
 - Customer service tool: installation tool for face seal
 - [See "Assembling the face seal" on page 43](#)

⚠ CAUTION

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

Risk of squashing

Risk of injury

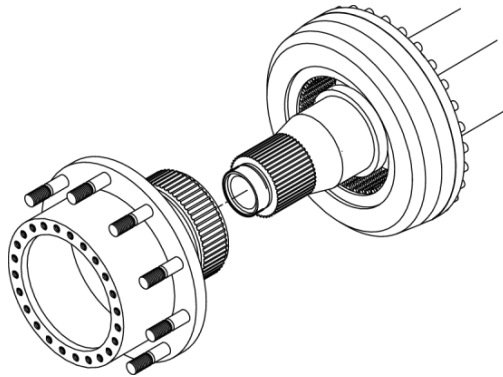
- Safeguard the wheel hub unit, also after assembly, with suitable lifting tackle against falling down, until the wheel bearing adjustment nut has been tightened.

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.

**Assembly wheel hub:**

2. Adjust the disks of the wet multiple disk brake.
 - Customer service tool: centring tool for disks.
3. Actuate the brake.
 - Fixation of the disks.
4. Slide on the pre-assembled wheel hub parallel onto the axle spindle with help of a suitable lifting equipment.
5. 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

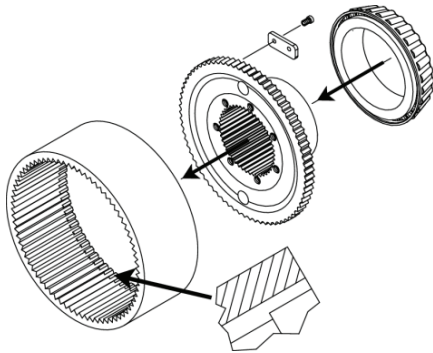


NOTICE

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 (212°F) 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 105](#)

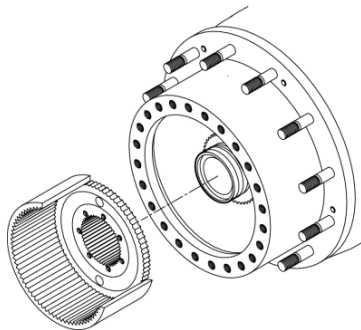
3.3.5.7 Assembly ring gear carrier unit**⚠ CAUTION**

After assembly of the ring gear carrier unit it can tip over uncontrolled under its own weight and fall down.

Risk of squashing


Risk of injury

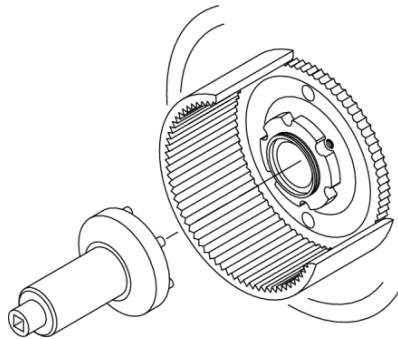
- Safeguard the ring gear carrier unit, also after assembly, with suitable lifting tackle against falling down, until the wheel bearing adjustment nut has been tightened.



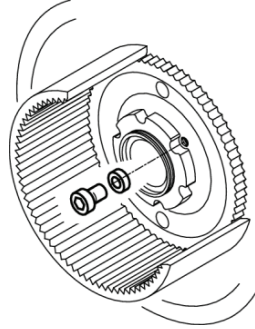
1. Slide on the prepared ring gear carrier onto the axle spindle.
 - Seen from the axle assembly side, one of the oil compensation drill holes must be at the bottom.

3.3.5.8 Wheel bearing adjustment

⚠ DANGER	
	<p>Faulty mounting and incorrect securing of the wheel bearing adjustment nut. The wheel along with the complete hub assembly comes off of the axle.</p> <p>Serious or fatal injuries of the mechanic and third parties</p> <p>Accident risk</p> <p>➤ In any case, tighten and secure the wheel bearing adjustment nut as described!</p>

**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: 850 Nm (627 ft lbf)
 - Tightening torque for used bearings: 650-700 Nm (479-516 ft lbf)
 - If it is not possible to lock in this position, the wheel bearing adjustment nut must turned forward to the next possible locking position.

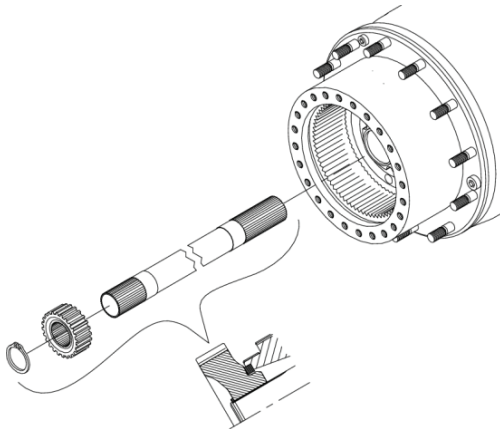
**Locking wheel bearing adjustment nut:**

5. Lock the wheel bearing adjustment nut with a screw.
 - Hexagon socket screw
 - Screw locking: Loctite 270
 - Tightening torque: 72 Nm (53 ft lbf)

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 41.](#)

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.

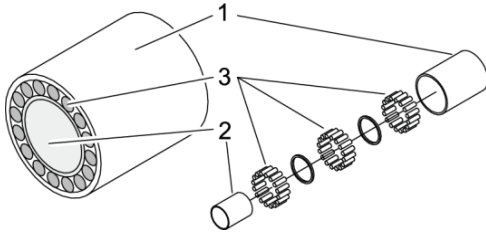
3.3.5.11 Preparation planetary gear drive

Assembly procedure of full complement roller set cageless



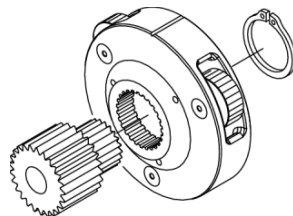
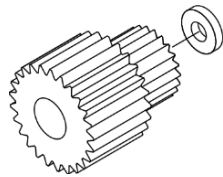
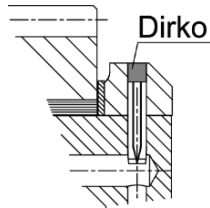
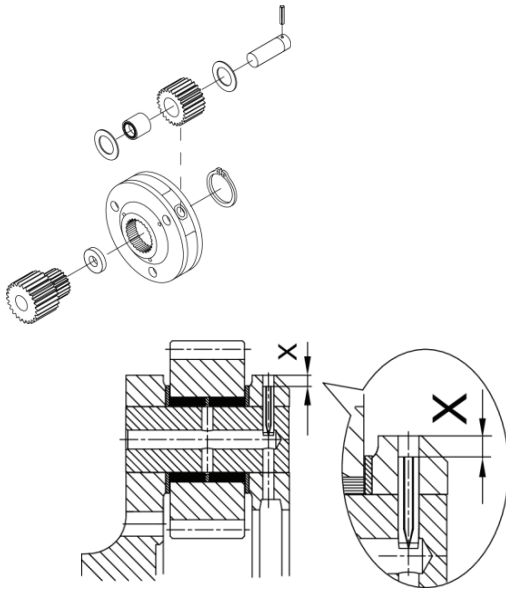
Full complement needle bearings are available in versions with cage and without cage.

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.



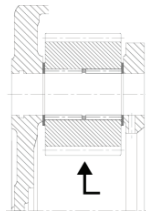
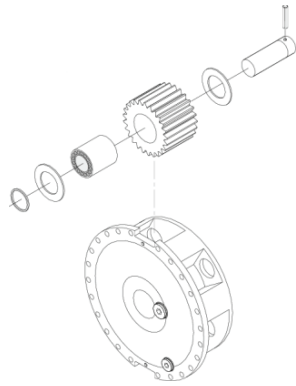
- 1 Outer mounting bushing
- 2 Inner mounting bushing
- 3 Needles/Full complement roller set

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.



Preparation inner planetary gear drive assembly:

1. Assembly planetary gear bearing.
 - When full complement roller set regard correct mounting.
2. Assemble the planetary gears with aligned planetary pins (position of the security hole) in the planetary housing.
3. Secure every planetary pin with a dowel pin.
4. Drive in the dowel pins to specified dimension X.
 - Dimension X = (is equal) 6 mm (0.23622 in)
5. Seal the outside of the dowel pins holes with sealant.
 - Sealant: Dirko grey
6. Apply the contact surface in the sun gear of the thrust ring with Loctite.
 - Loctite 270
7. Press the thrust ring into the sun gear.
8. Install the sun gear of the outer planetary gear drive assembly into the inner planetary gear drive assembly.
9. Secure the sun gear with the circlip.

**Preparation outer planetary gear drive assembly:**

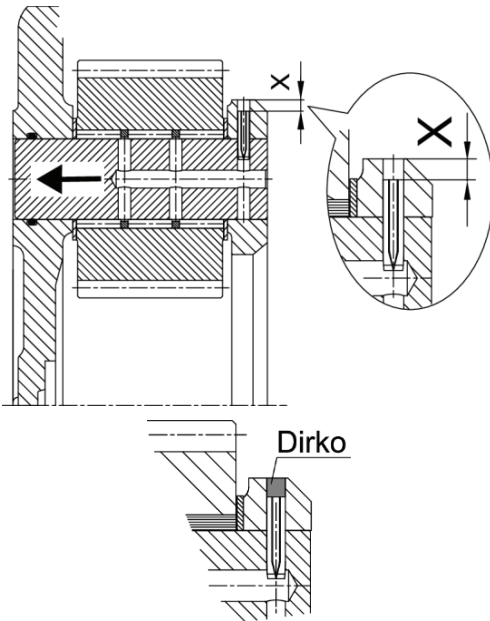
10. Assembly planetary gear bearing.
 - When full complement roller set regard correct mounting.
11. Position the planetary housing horizontally with its open side on top.
12. Insert the bottom thrust washer.
13. Place the planetary gear together with bearing on the bottom thrust washer.
14. Insert the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

NOTICE

Difference at the planetary pin.

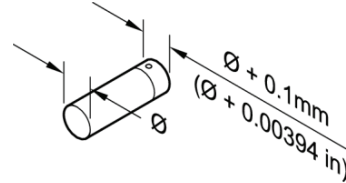
The drill hole in the planetary housing will be destroyed as a result of incorrect disassembly.

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



15. Lightly oil the O-ring and insert it in the groove of the planetary housing.

16. 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 (see arrow).
- Observe the diameter difference of 0.1 mm (0.00394 in) at the planetary pin

17. Secure every planetary pin with a dowel pin.

18. Drive in the dowel pins to specified dimension X.

- Dimension X = 8 mm (0.31496 in)

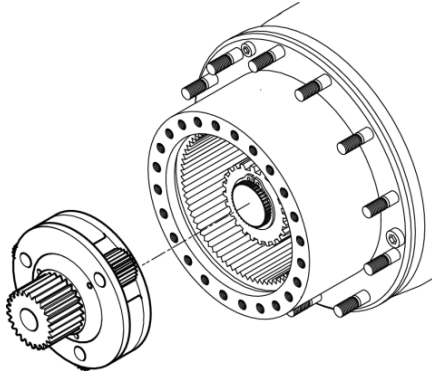
19. Seal the outside of the dowel pins holes with sealant.

- Sealant: Dirko grey



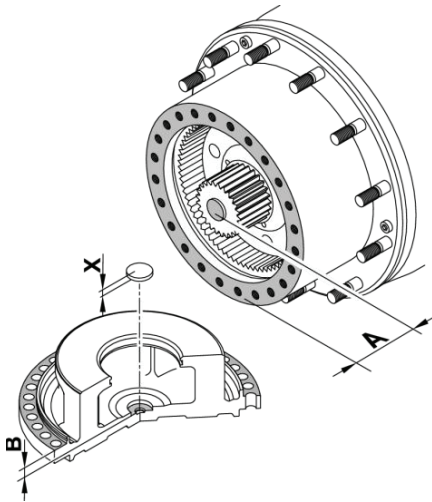
Thoroughly clean the outside of the planetary housing after assembly of the axle in order to prevent apparent leakage.

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.

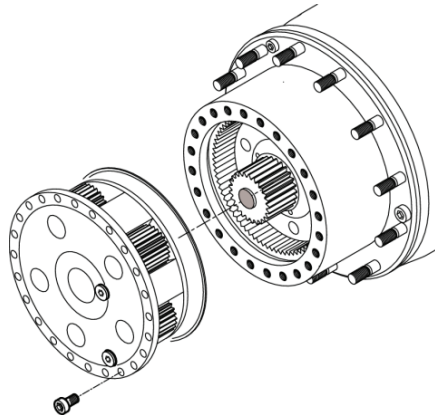
3.3.5.13 Adjustment axial play



The axial clearance between sun gear and thrust washer in the planetary housing must be 0.5-0.9 mm (0.01969-0.03543 in).

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 (0.5-0.9 mm)
(0.01969-0.03543 in)
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!
 - Tightening torque: [see "Tightening torques for standard metric threads" on page 103](#)

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.

Serious injuries of the mechanic and third parties

- Check the grooves
- Check the running areas
- In case of damage a new part must be used!

⚠ CAUTION



After loosening the brake screws, the brake can tip over uncontrolled under its own weight and fall down.

Risk of squashing

Risk of injury

- 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 5550**

Wet multiple disk brake



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

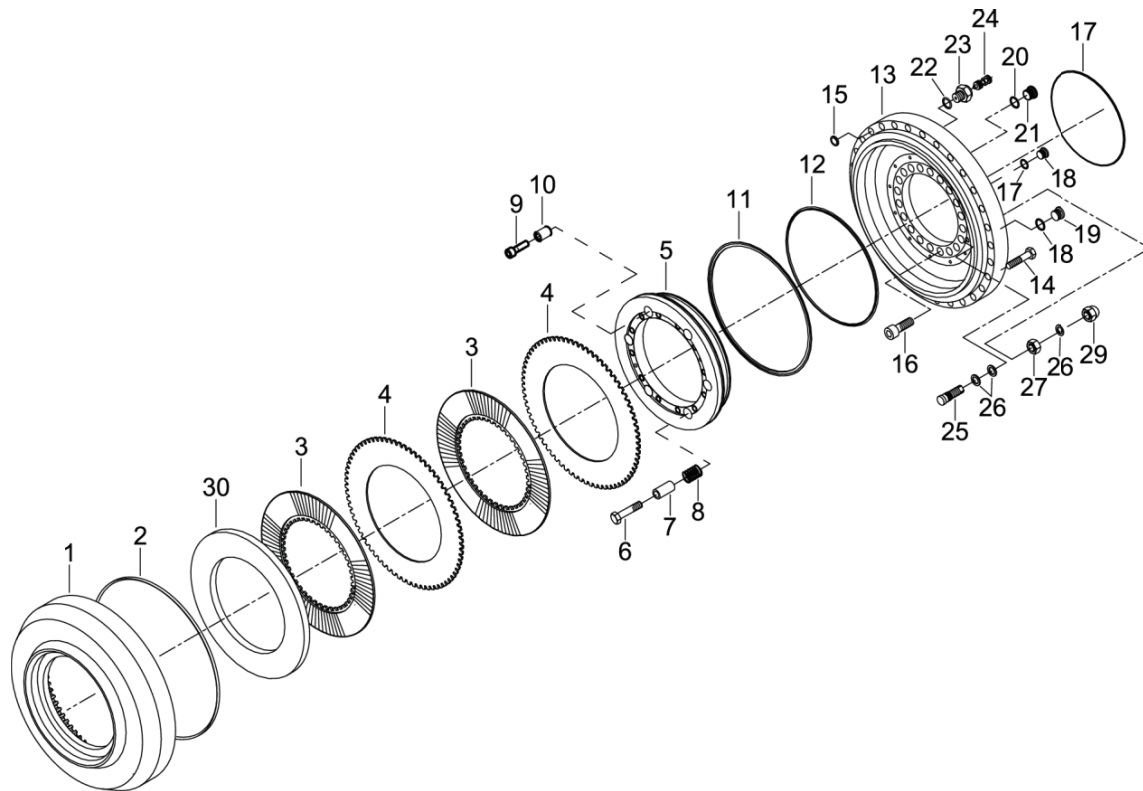


A tightening torque can deviate from the standard in individual cases, in which case the specified tightening torque must be used in the action step.



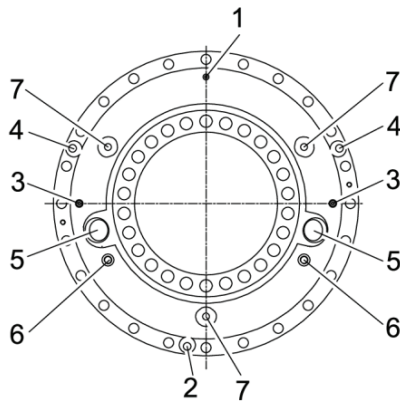
The following exploded view with numbering is only a list of the part names.

Spare parts must be ordered according to the valid spare parts list of the respective KESSLER product.



- | | |
|------------------------|--------------------|
| 1 Brake carrier | 16 Screw |
| 2 O-ring | 17 O-ring |
| 3 Inner disks | 18 Sealing ring |
| 4 Outer disks | 19 Screw plug |
| 5 Piston | 20 Sealing ring |
| 6 Screw | 21 Screw plug |
| 7 Pipe | 22 Sealing ring |
| 8 Spring | 23 Bleeding socket |
| 9 Hexagon socket screw | 24 Bleeder |
| 10 Bushing | 25 Bolt |
| 11 Gasket kit | 26 O-ring |
| 12 Gasket kit | 27 Nut |
| 13 Brake carrier | 28 O-ring |
| 14 Screw | 29 Cap nut |
| 15 O-ring | 30 Disk |

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 79.](#)
- 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!

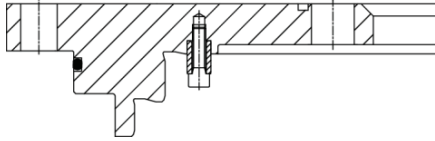
- Facilitates assembly.
- Warranty that connections, anti-twist device etc. correspond to the initial state after assembly.



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

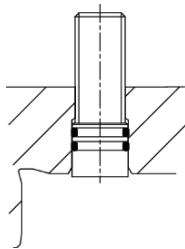
1. Remove the connections of the wet multiple disk brake.
>> If there is still the face seal within the brake, pull off carefully.
2. Mark the position of the connections relative to the axle housing.
3. Loosen the screws and pull the brake off the axle.
>> Use a suitable hoist device.
4. Disassembly 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



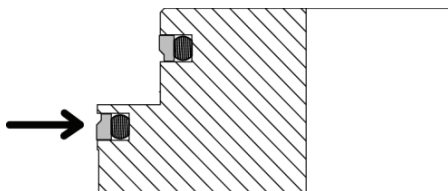
Prepare the brake carrier / Assembly anti-twist device:

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 (53 ft lbf)
4. Lightly grease the O-ring and insert it into the groove of the brake carrier without twists and loops.



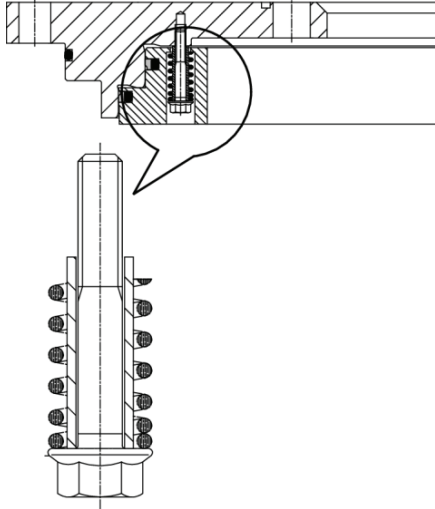
Prepare and installation of the piston adjustment screws:

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".

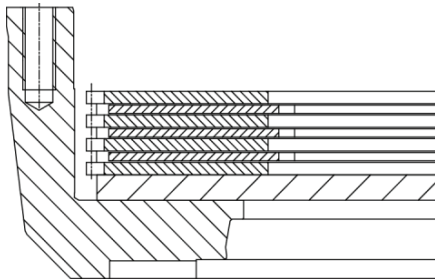


Assembly piston sealing rings:

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 243
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 tightened 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 with disk, pipe and compression spring and screw it through the piston into the brake carrier.
 - Tightening torque: 18 Nm (13 ft lbf)

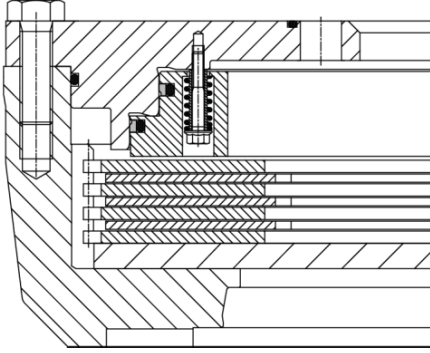
**Prepare the brake housing:**

17. Insert the disk into the brake housing.
18. Insert the disks alternately into the brake housing.
 - Start with an outer disk.
 - The upper disk must always be an outer disk!



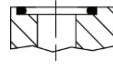
Number of inner disks = 5

Number of outer disks = 6



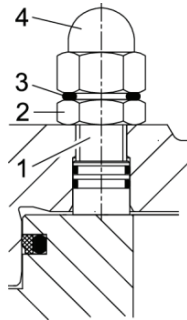
Assembly of brake carrier and brake housing:

19. 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.
20. Place the brake carrier, screwed together with the piston, onto the brake housing and align it.
21. 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!
22. 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: 610 Nm (449 ft lbf)
23. Screw in the bleeder with screw socket.
- [see "Connections wet multiple disk brake" on page 35](#)
24. Screw in the screw plugs with gaskets.
- [see "Connections wet multiple disk brake" on page 35](#)
25. 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

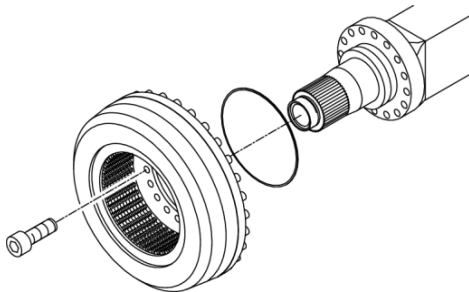


1. With **the brake being applied** screw in the installed piston adjustment screws (1) until contact at the piston.
2. Subsequently screw out the piston adjustment screws (1) according to the nominal air gap and release the brake.
 - specified value for the clearance: see below
3. Screw on and tighten 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 5550 is $3 +0,5/-0,1$ mm ($0.11811 +0.01969/-0.00394$ in).

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 41](#)



Bleed the brake before resuming operation!

See ["Bleeding the wet multiple disk brake" on page 41.](#)

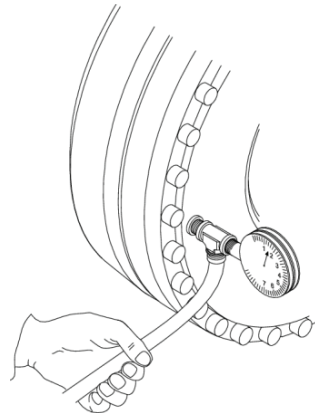
3.5 Test the cooling oil chamber of the service brake for leak tightness

3.5.1 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.

3.5.2 Approach



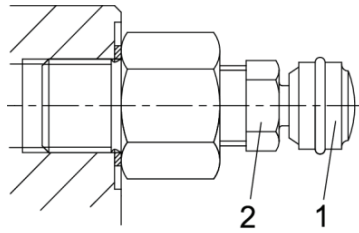
Brake with external cooling:

1. Connect a manometer with a stopcock.
2. Apply 1.5 bar (21.7 psi) 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 (1.45 psi) 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.

3.6 Bleeding the wet multiple disk brake

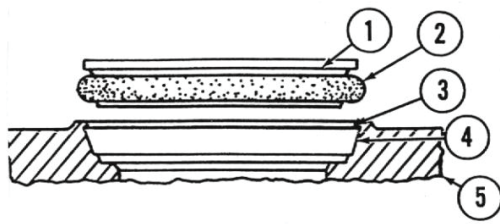
Once the brake was released, the brake system must be bled before resuming operation.

⚠ CAUTION	
	<p>Oil and bleeder valve are pressurized.</p> <p>Injury due to parts being ejected</p> <ul style="list-style-type: none"> ➤ 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).

3.7 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.

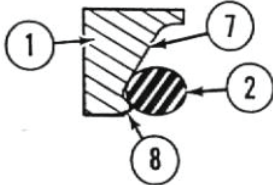
Assembly procedure:

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.

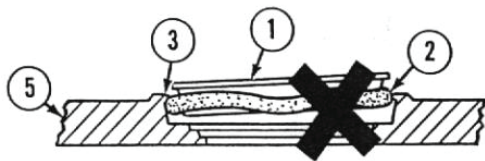
Correct seating of the toroidal sealing ring:

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.

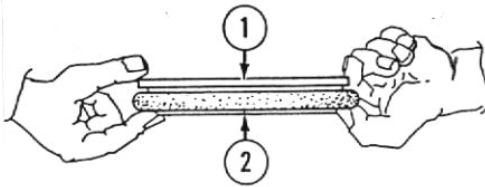
A twisted toroidal sealing ring can be returned into its correct position by carefully retracting a part of the metal ring and then allowing the toroidal sealing ring to spring back into its correct position. Other twisted toroidal sealing rings at other points can be remedied in the same manner.



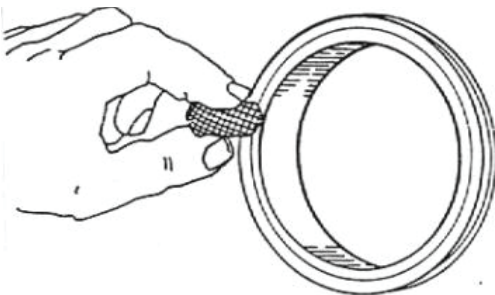
Place the toroidal sealing ring (2) onto the sealing ring (1) so that it is flush at the bottom of the angular face (7) and the safety lip (8).



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)

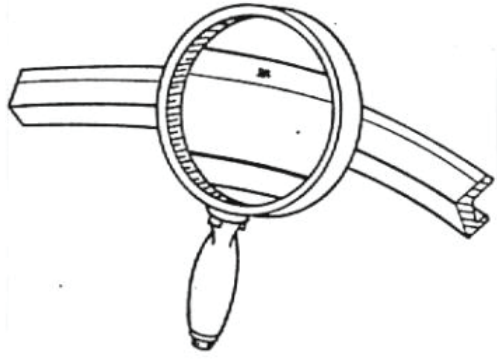


To prevent twisting the toroidal sealing ring (2), carefully remove a section of the sealing ring (1) and then allow it to spring back.

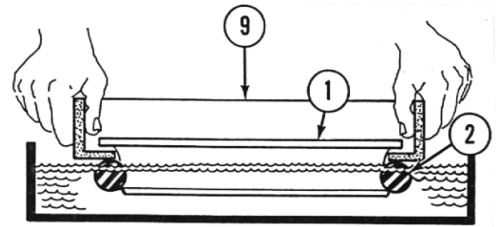


Assembly procedure:

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:



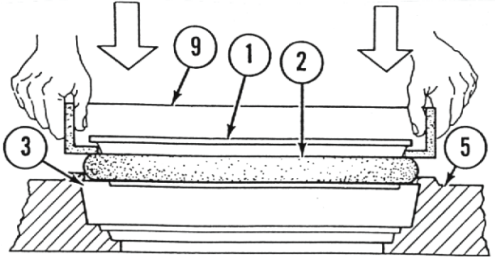
The toroidal sealing rings slips on the angular face of the safety lip.



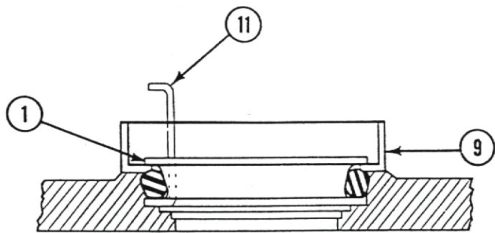
The toroidal sealing ring is jammed at the safety lip of the bearing insert.



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.

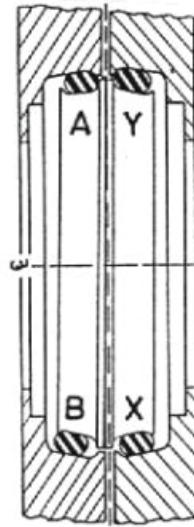
Consequences of incorrect assembly:

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.

3.8 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.



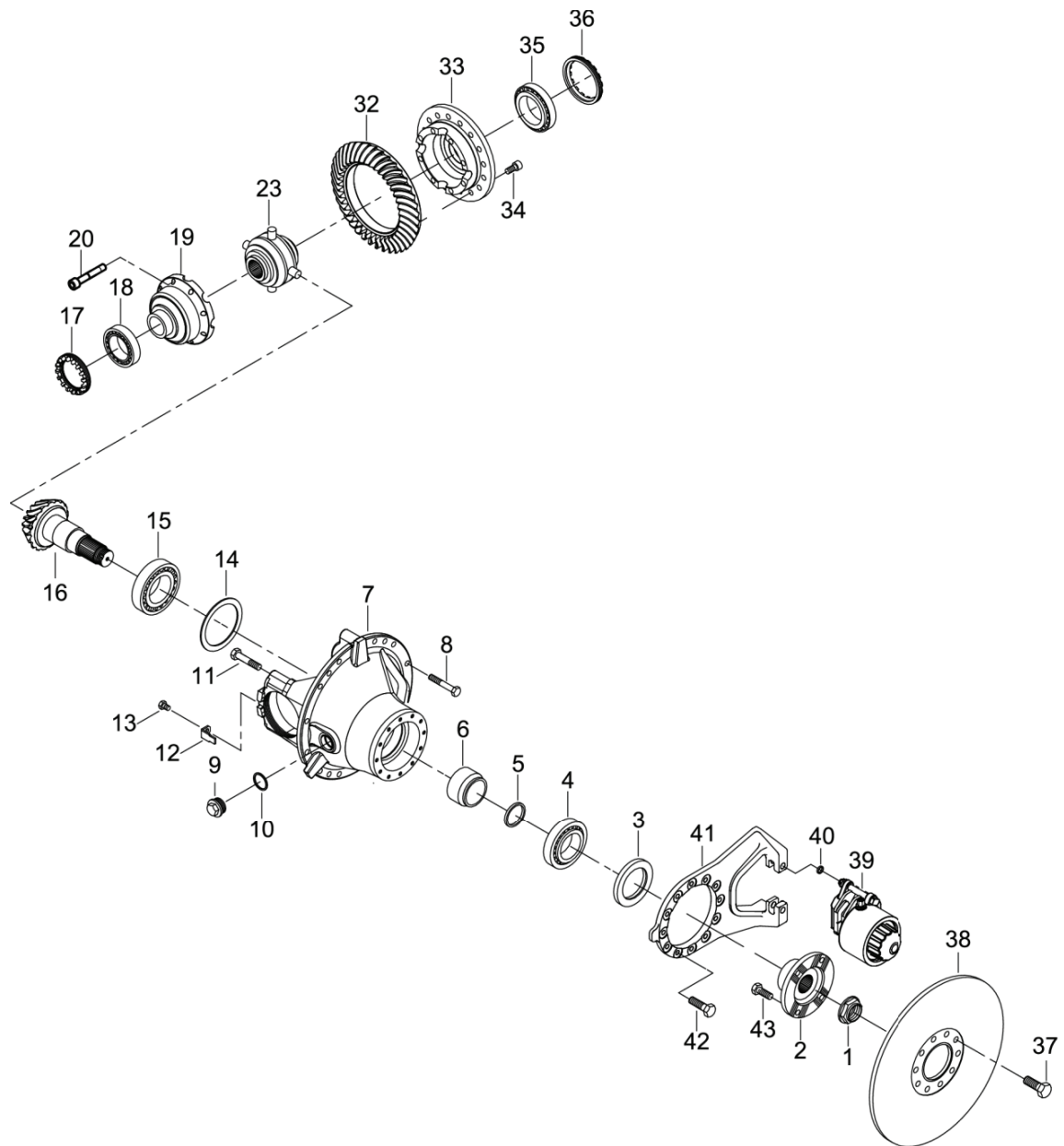
A tightening torque can deviate from the standard in individual cases, in which case the specified tightening torque must be used in the action step.



The following exploded view with numbering is only a list of the part names.

Spare parts must be ordered according to the valid spare parts list of the respective KESSLER product.

3.8.2 Overview of parts

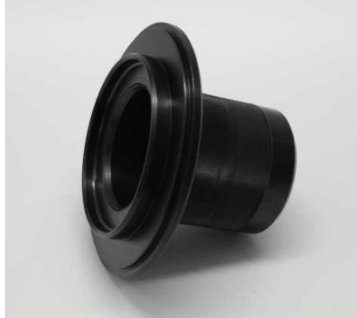


1 Lock nut	23 NoSPIN
2 Drive flange	24 --
3 Radial seal ring	25 --
4 Tapered roller bearing	26 --
5 Disk	27 --
6 Bushing	28 --
7 Differential carrier	29 --
8 Screw	30 --
9 Screw plug	31 --
10 Sealing ring	32 Ring gear
11 Screw	33 Differential housing
12 Lock plate	34 Screw
13 Screw	35 Tapered roller bearing
14 Disk	36 Bearing adjustment ring
15 Tapered roller bearing	37 Screw
16 Drive pinion	38 Brake disk
17 Bearing adjustment ring	39 Parking brake
18 Tapered roller bearing	40 O-ring
19 Differential housing	41 Brake carrier
20 Screw	42 Screw
21 --	43 Screw
22 --	

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.



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

⚠ WARNING	
	<p>The NoSPIN differential is under high spring tension. Parts may suddenly come loose and be ejected if the NoSPIN is not properly disassembled.</p> <p>Serious injuries of the mechanic</p> <ul style="list-style-type: none"> ➤ Open the screwed connection of the differential only with a suitable equipment

2. Disassembly differential - observe Manufacturer specifications for the NoSPIN see ["Supplier documents" on page 108.](#)

⚠ DANGER	
	<p>Parking brake is under spring tension. Parts may suddenly come loose and be ejected when the parking brake is opened improperly.</p> <p>Serious or fatal injuries of the mechanic</p> <ul style="list-style-type: none"> ➤ The supplier's assembly and disassembly sequence and repair instructions must be observed.

3. Dismantle the parking brake according to the instructions of the supplier see ["Supplier documents" on page 108.](#)
4. Disassembly brake disk on the drive flange
5. Loosening the lock nut on the drive flange see thereto "Loosening the lock nut"
6. Disassembly drive flange
7. Disassembly parking brake brake carrier
8. Disassembly drive pinion
9. Disassembly radial seal ring on the drive flange
10. Disassembly tapered roller bearing, bearing shells and disks from the differential carrier
11. Disassembly ring gear

3.8.4.1 Loosening the lock nut



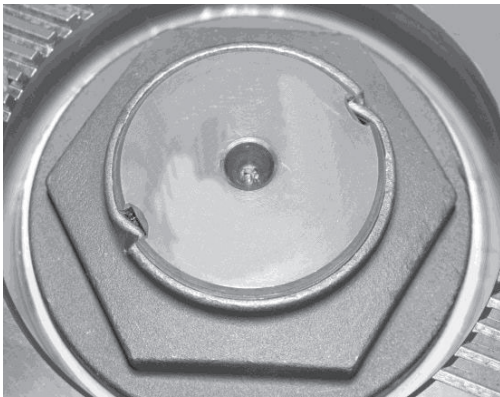
The loosening process described below applies to both safety dog!

NOTICE

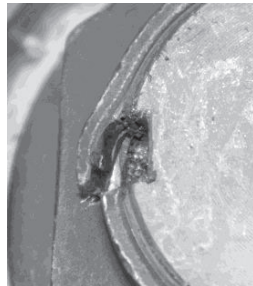
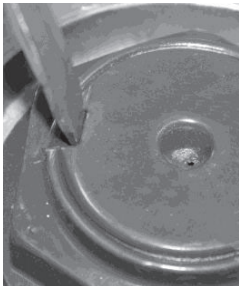
An improperly loosened safety dog of the lock nut can damage the thread of the drive pinion/shaft during unscrewing.

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

- Bend the safety dog completely upwards



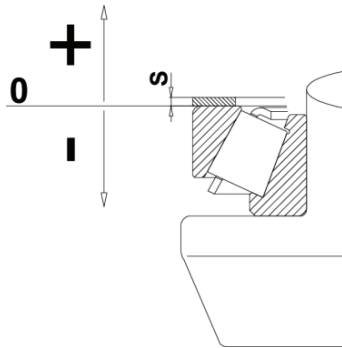
1. Locked lock nut



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 space



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

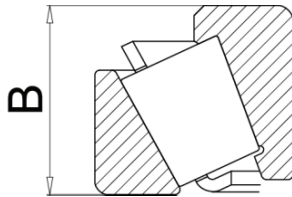
+ = deviating dimension

- = deviating dimension

Differential and carrier assembly	A 91
Theoretical adjustment disk thickness S	3.0 mm (0.11811 in)
theoretically B	56.5 mm (2.22441 in)

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
<p>With production numbers</p> <ul style="list-style-type: none"> • on drive pinion (marked on the end face) • on ring gear (marked on the face of the ring gear) 	<p>No production numbers</p> <ul style="list-style-type: none"> • on drive pinion • on ring gear
<ul style="list-style-type: none"> • The production numbers of the drive pinion and ring gear must match <p>➤ only mount in pairs!</p>	<ul style="list-style-type: none"> • indiscriminate use of drive pinion and ring gear is possible <p>➤ no pairing necessary!</p>

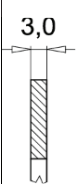
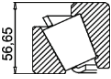

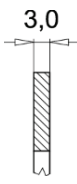
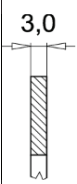


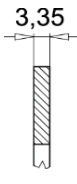
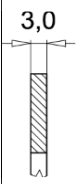


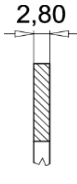
Version 1	Version 2
<p>Deviating dimension # (determined during manufacture) is marked on the face of the drive pinion. It specifies the deviation from the required dimension.</p> <p>Here the deviation # is +0,1 mm (+0,00394 in)</p>	<p>Without any marking on the face of the drive pinion, the deviation from the required dimension is 0.</p>



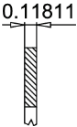
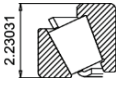

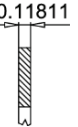
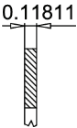
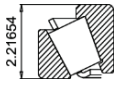

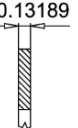
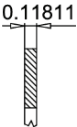
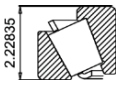

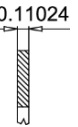
The distance between the drive pinion and the ring gear, and thereby the contact pattern, is determined by the adjustment disk. The adjustment disk equals the dimensional tolerance of the bearing and the manufacturing tolerance of the drive pinion. Therefore the exact disk thickness must always be calculated,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

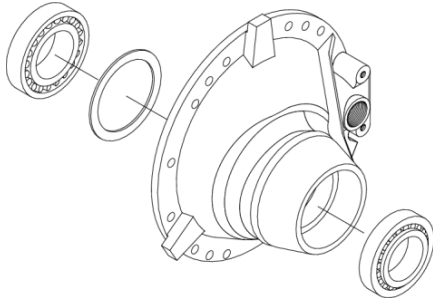
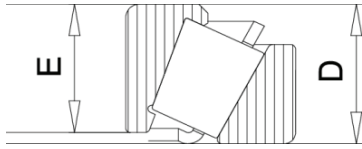
Dimensions in mm

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			
 <p>3,0</p>	 <p>56,65</p>	<p>Version 1</p> 	theor. Disk thickness	-	Deviation of the bearing	+	Deviation of the drive pinion	=	Required disk thickness	 <p>3,0</p>
	<p>Deviation from the theoretical dimension</p> <p>Over-size = +0.15</p>	<p>Deviation from the theoretical dimension</p> <p>Under-size = -0.15</p>	3.0	-	0.15	+	0.15	=	3.0	
 <p>3,0</p>	 <p>56,30</p>	<p>Version 1</p> 	theor. Disk thickness	+	Deviation of the bearing	+	Deviation of the drive pinion	=	Required disk thickness	 <p>3,35</p>
	<p>Deviation from the theoretical dimension</p> <p>Under-size = -0.20</p>	<p>Deviation from the theoretical dimension</p> <p>Under-size = -0.15</p>	3.0	+	0.20	+	0.15	=	3.35	
 <p>3,0</p>	 <p>56,60</p>	<p>Version 1</p> 	theor. Disk thickness	-	Deviation of the bearing	-	Deviation of the drive pinion	=	Required disk thickness	 <p>2,80</p>
	<p>Deviation from the theoretical dimension</p> <p>Over-size = +0.10</p>	<p>Deviation from the theoretical dimension</p> <p>Over-size = +0.10</p>	3.0	-	0.1	-	0.1	=	2.8	

Dimensions in inch

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			
 <p>0.11811</p>	 <p>2.23031</p>	Version 1  <p>-0.00591</p>	theor. Disk thickness	-	Deviation of the bearing	+	Deviation of the drive pinion	=	Required disk thickness	 <p>0.11811</p>
	Deviation from the theoretical dimension Over-size = +0.00591	Deviation from the theoretical dimension Under-size = -0.00591	$0.011811 - 0.00591 + 0.00591 = 0.11811$							
 <p>0.11811</p>	 <p>2.21654</p>	Version 1  <p>-0.00591</p>	theor. Disk thickness	+	Deviation of the bearing	+	Deviation of the drive pinion	=	Required disk thickness	 <p>0.13189</p>
	Deviation from the theoretical dimension Under-size = -0.00787	Deviation from the theoretical dimension Under-size = -0.00591	$0.011811 + 0.00787 + 0.00591 = 0.13189$							
 <p>0.11811</p>	 <p>2.22835</p>	Version 1  <p>+0.00394</p>	theor. Disk thickness	-	Deviation of the bearing	-	Deviation of the drive pinion	=	Required disk thickness	 <p>0.11024</p>
	Deviation from the theoretical dimension Over-size = +0.00394	Deviation from the theoretical dimension Over-size = +0.00394	$0.011811 - 0.00394 - 0.003934 = 0.11024$							

3.8.5.2 Assembly of drive pinion bearing



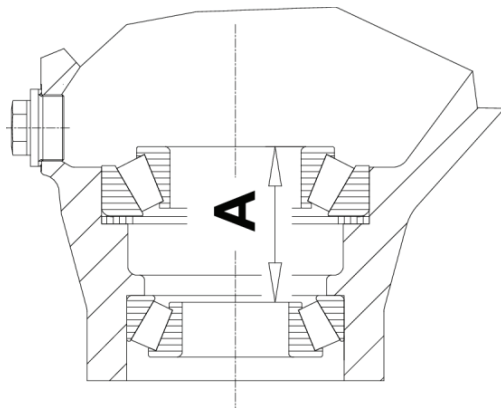
1. Measure and record the dimensions D and E from the flange-side tapered roller bearing.

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.

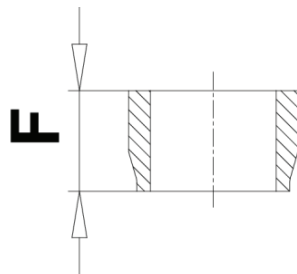
4. Evenly seat the inner bearing ring of the tapered roller bearing with the aid of a seater without tilting it.

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

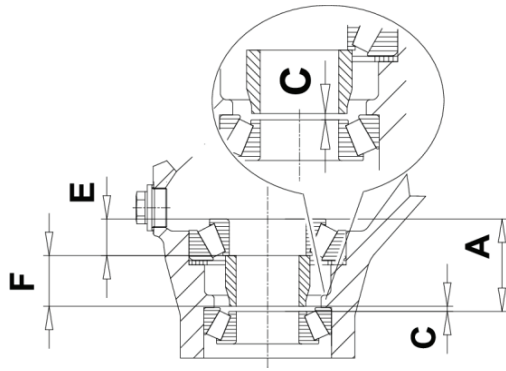


- Place the two inner rings of the taper roller bearings in their outer rings.

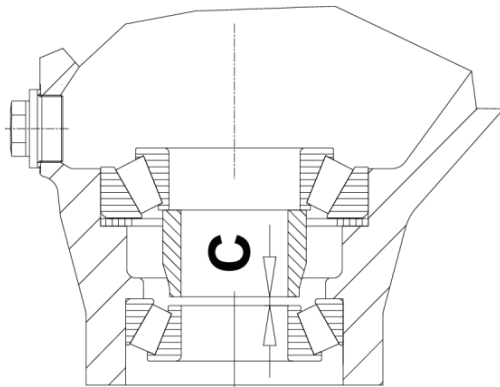
- Measure and record dimension A.



- 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

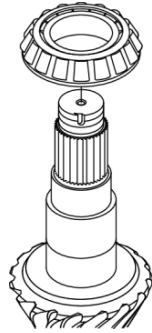


Sharp edges on the teeth

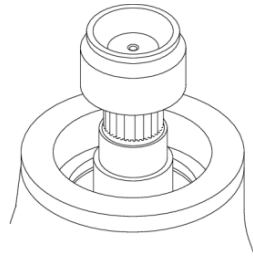
Risk of cutting

- Wear protective gloves





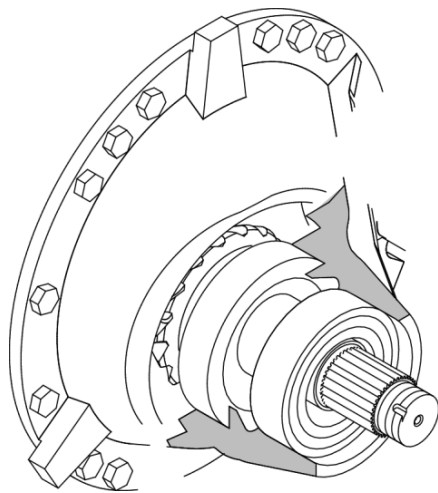
6. Drive the inner ring with the tapered roller bearing roller cage onto the drive pinion up to the stop using a sleeve.
7. Push the drive pinion with the assembled tapered roller bearing into the differential carrier.
8. Secure the drive pinion with a supporting device.



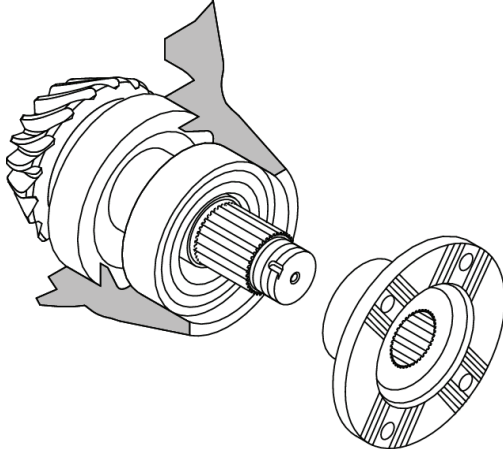
9. Assemble the bushing onto the drive pinion.



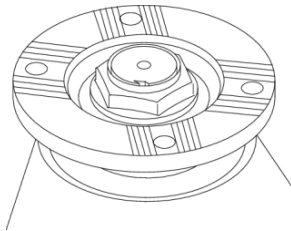
10. Place a spacer ring with the calculated thickness C on the drive pinion.



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 (774 ft lbf)



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 (1.1 - 1.85 ft lbf).
- 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 100 mm / 3.93701 in).
- If the bearing pre-load is correct: tighten the support device on the drive pinion.

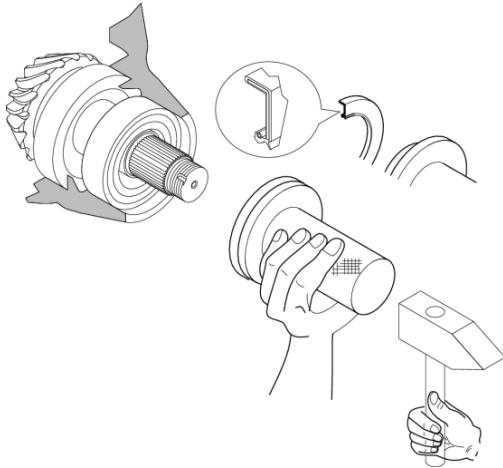
17. Loosen the lock nut and pull off the drive flange.

3.8.5.3 Assembly radial seal ring on the drive flange

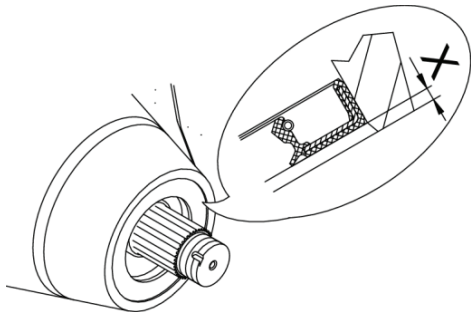
NOTICE**Incorrect installation of the radial seal ring**

Sealing of the oil cavity is not guaranteed.

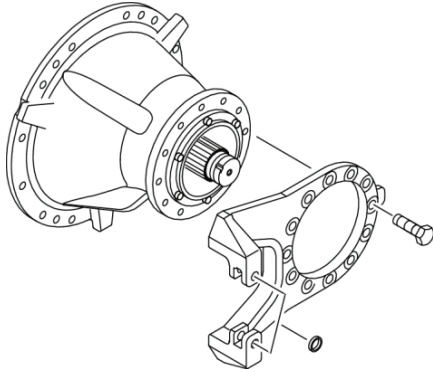
- Observe the installation position of the sealing lips of the radial seal ring!
- Do not damage the sealing lip of the radial seal ring.
- Use the special tool - sealing ring sleeve driver



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 correct position, see dimension X, below the surface of the differential carrier without tilting it.
 - Dimension X = 4 mm (0.15748 in)
4. Fill the new radial seal ring with grease up to 2/3.
 - Multi-purpose grease



3.8.5.4 Assembly parking brake brake carrier



1. Place the brake carrier for the parking brake in the relevant position on the differential carrier, screw it down and tighten.
 - Tightening torque: [see Tightening torques for standard metric threads on page 103](#)
2. Insert O-rings into the brake carrier.

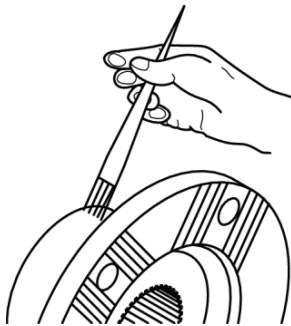
3.8.5.5 Assembly drive flange

NOTICE

Assembly of a damaged or soiled drive flange

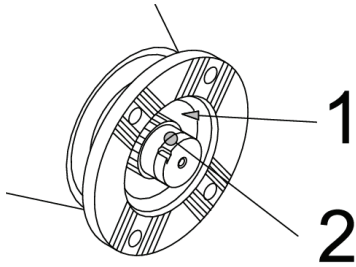
If the running surface of the drive flange is not perfect, the sealing lip of the radial seal ring will be damaged. Sealing of the oil cavity is then not guaranteed.

- 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.

3.8.5.6 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 MoS₂
3. Screw on the lock nut and tighten it.
 - Tightening torque: 1050 Nm (774 ft lbf)

3.8.5.7 Securing of the lock nut



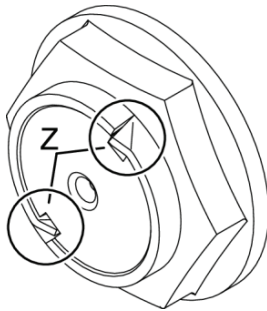
The securing process described below applies to both safety dog!

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

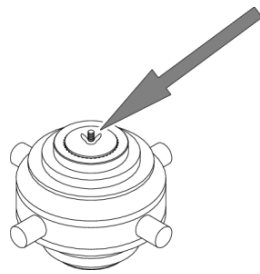


1. Bend the corner of the lock nut on the slot ground.
 - Pay attention to the loosing direction of the lock nut!
 - The brim of the striking nut has to be sheared only along the slot flank.

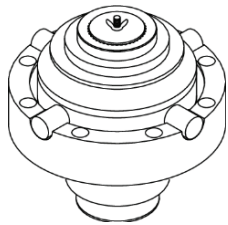
3.8.5.8 Assembly of the Differential

Manufacturer specifications for the NoSPIN can be found here ["Supplier documents" on page 108.](#)

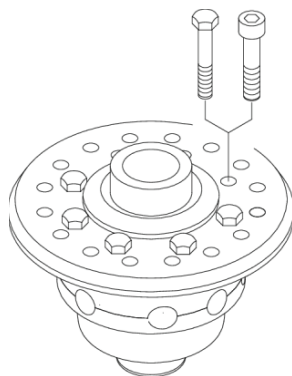
⚠ WARNING	
	<p>The NoSPIN differential is under high spring tension. By premature release of the pre-load locking device can cause parts to suddenly be released and fly off.</p> <p>Serious injuries of the mechanic</p> <ul style="list-style-type: none"> ➤ During the assembly do not loosen the pre-load locking device. ➤ Remove the pre-load locking device only after the differential housings are tightened.



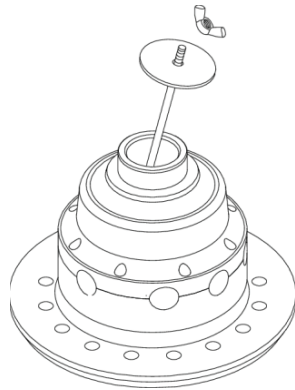
1. Pre-load locking device of the NoSPIN.
 - Retainer bolt, washer and wing nut.



2. Insert the secured NoSPIN differential into the differential housing.
 - During the assembly do not loosen the pre-load locking device.





3. Position the differential housing.
 - Observe the marking
4. Screw down the differential housing halves and tighten.
 - Clamp the differential housing in a suitable device for tightening the screws.
 - Loctite 262
 - Tightening torque: [see Tightening torques for standard metric threads on page 103](#)

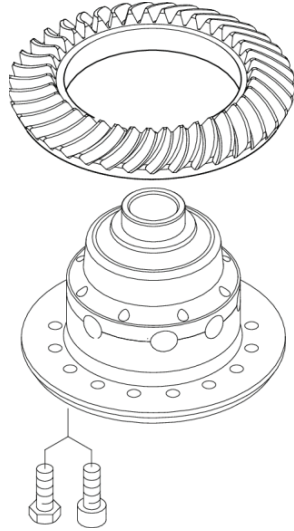


5. Loosen the wing nut.
6. Remove all parts of the pre-load locking device.

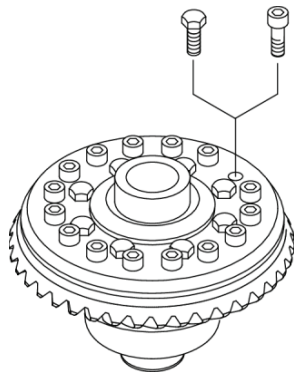
3.8.5.9 Assembly ring gear

⚠ CAUTION	
 	<p>Sharp edges on the teeth</p> <p>Risk of cutting</p> <ul style="list-style-type: none"> ➤ Wear protective gloves

Version 1	Version 2
<p>With production numbers</p> <ul style="list-style-type: none"> • on drive pinion (marked on the end face) • on ring gear (marked on the face of the ring gear) 	<p>No production numbers</p> <ul style="list-style-type: none"> • on drive pinion • on ring gear
<ul style="list-style-type: none"> • The production numbers of the drive pinion and ring gear must match ➤ only mount in pairs! 	<ul style="list-style-type: none"> • indiscriminate use of drive pinion and ring gear is possible ➤ no pairing necessary!

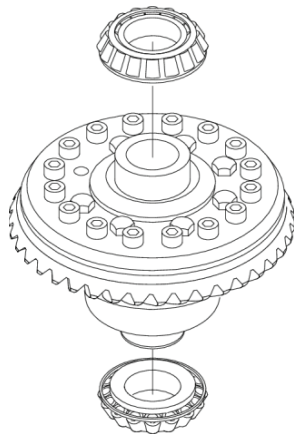


1. Place the ring gear on the differential housing and drive it in with light hammer blows around the circumference.
 - Locking the ring gear
2. Fasten the ring gear to the differential housing from the opposite side of the ring gear teeth with two screws, against falling down .



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 half.
 - Tightening torque: [see Tightening torques for standard metric threads on page 103](#)
 - Clamp the differential housing in a suitable device for tightening the screws. Do not damage the teeth of the gear wheel in the process.

3.8.5.10 Assembly tapered roller bearing onto differential housing



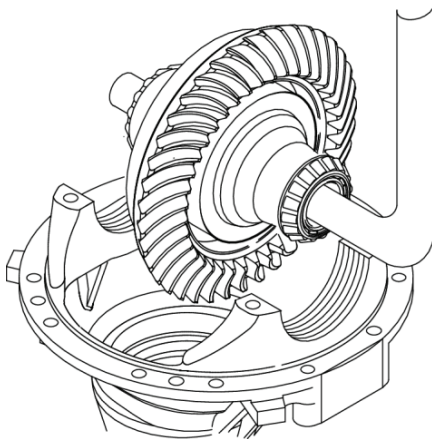
1. Press both tapered roller bearings onto the differential housing.

3.8.5.11 Installation of the pre-assembled differential

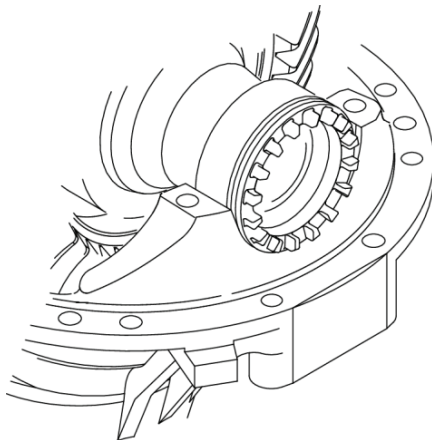
⚠ CAUTION**Moving and dropping down of parts**

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.

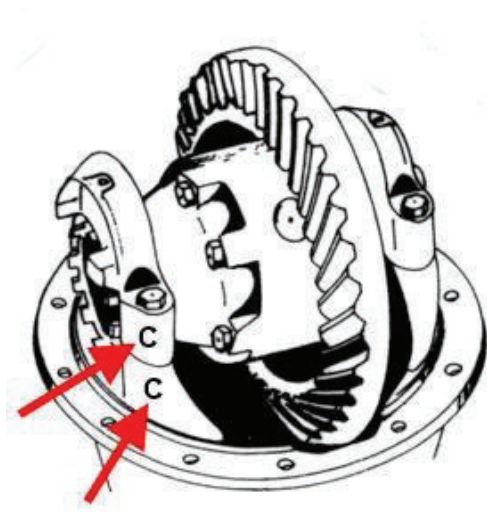


1. Carefully place the differential into the upright differential carrier with a suitable device.
 - Important: The tapered roller bearings must not be damaged in the process.



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.

3.8.5.12 Fastening bearing caps

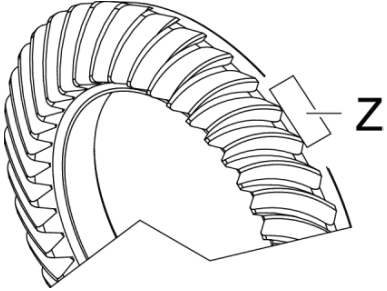
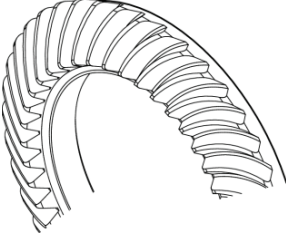


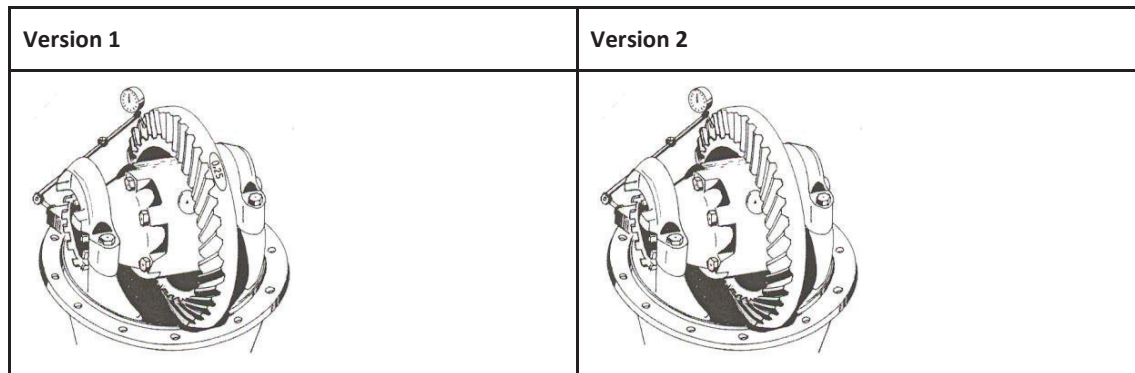
1. Place the bearing caps on the differential carrier.
 - Do not interchange the bearing caps.
 - Observe the markings of the bearing caps relative to the differential carrier.
 - The bearing caps must not be mounted skew.
2. Align the bearing caps with the bearing adjustment rings.
3. Screw down the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

3.8.5.13 Dimension of backlash



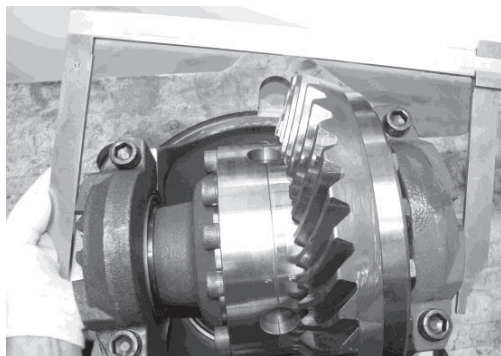
It must absolutely be checked, which version of drive pinion and ring gear is on hand.

Version 1	Version 2							
<p>The smallest allowed value is marked on the circumference of the ring gear.</p> <p>Z is 0.25 mm (0.00984 in)</p> 	<p>Is no value marked on the circumference of the ring gear, the backlash is depend on the ring gear diameter (see following table).</p>  <table border="1" data-bbox="824 1495 1360 1680"> <thead> <tr> <th>Drive description</th> <th>Ring gear diameter</th> <th>Backlash</th> </tr> </thead> <tbody> <tr> <td>Drive assembly 91</td> <td>< 410 mm (< 16.14173 in)</td> <td>0.40 mm (0.01575 in)</td> </tr> </tbody> </table>		Drive description	Ring gear diameter	Backlash	Drive assembly 91	< 410 mm (< 16.14173 in)	0.40 mm (0.01575 in)
Drive description	Ring gear diameter	Backlash						
Drive assembly 91	< 410 mm (< 16.14173 in)	0.40 mm (0.01575 in)						



1. Adjust the tooth flank play with 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.

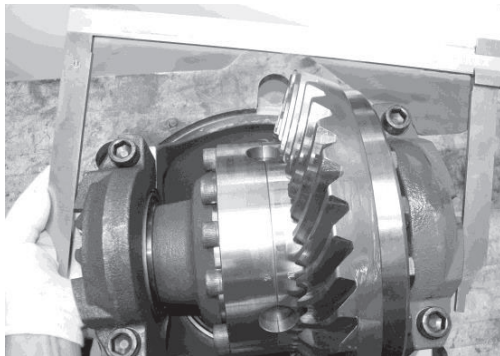
3.8.5.14 Adjustment differential



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 $\varnothing 395,8 - \varnothing 396,0$ mm ($\varnothing 15.58268 - \varnothing 15.59055$ in).



- 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 (0.00787 in).
 - The maximum permissible value of $\varnothing 396.1 - \varnothing 396.2$ mm ($\varnothing 15.59449 - \varnothing 15.59843$ in) must not be exceeded.

3.8.5.15 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
<p>With production numbers</p> <ul style="list-style-type: none"> • on drive pinion (marked on the end face) • on ring gear (marked on the face of the ring gear) 	<p>No production numbers</p> <ul style="list-style-type: none"> • on drive pinion • on ring gear
<ul style="list-style-type: none"> • The production numbers of the drive pinion and ring gear must match ➤ only mount in pairs! 	<ul style="list-style-type: none"> • 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 "[Adjustment of drive pinion space](#)" on page 54.
 - Then repeat all of the following steps until the contact pattern is correct.
 - After changing, observe the rolling resistance, see "[Adjustment of drive pinion space](#)" on page 54.

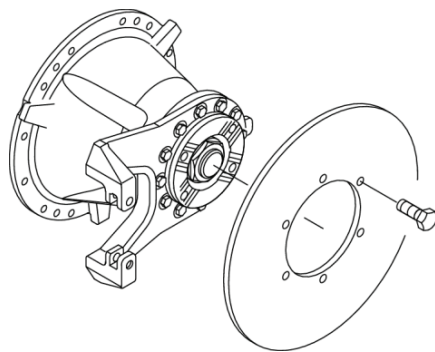
	<p>Contact pattern perfect</p>	
	<p>Contact pattern too high.</p> <p>Reduce drive pinion distance by correcting thickness of the adjustment disk.</p> <p>Adjust the backlash by moving the ring gear out.</p>	
	<p>Contact pattern too low.</p> <p>Increase drive pinion distance by correcting thickness of the adjustment disk.</p> <p>Adjust the backlash by moving the ring gear in.</p>	

3.8.5.16 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 (18 ft lbf)
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 103](#)

3.8.5.17 Assembly brake disk on the drive flange



1. Screw in the screws and tighten them.
 - Tightening torque: [see Tightening torques for standard metric threads on page 103](#)

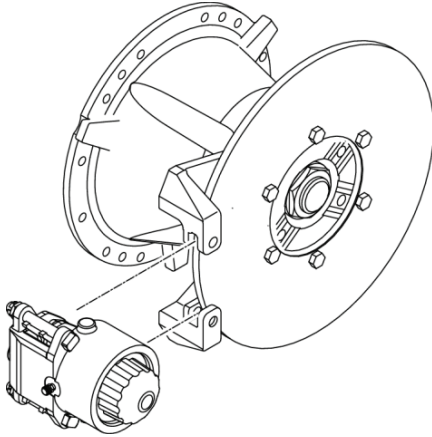
3.8.5.18 Assembly parking brake

⚠ DANGER

Parking brake is under spring tension. Parts may suddenly come loose and be ejected when the parking brake is opened improperly.

Serious or fatal injuries of the mechanic

- The supplier's assembly and disassembly sequence and repair instructions must be observed.



1. Assemble the parking brake; observe the procedure according to the instructions of the brake manufacturer for this, see "[Supplier documents](#)" on page 108.

3.8.5.19 Preparation axle housing

NOTICE**Metal shavings in the axle housing**

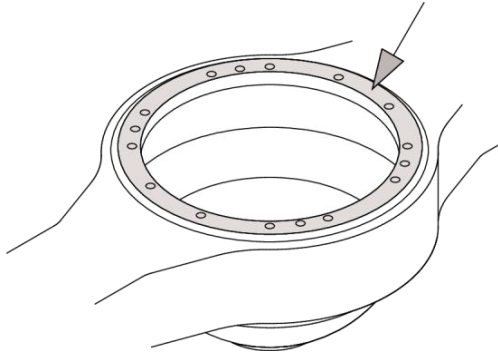
Damage to the tooth system of the differential and carrier assembly

- Completely remove shavings in the axle housing.

NOTICE**Dirt particles, grease or damage to the sealing surface of the axle housing/housing.**

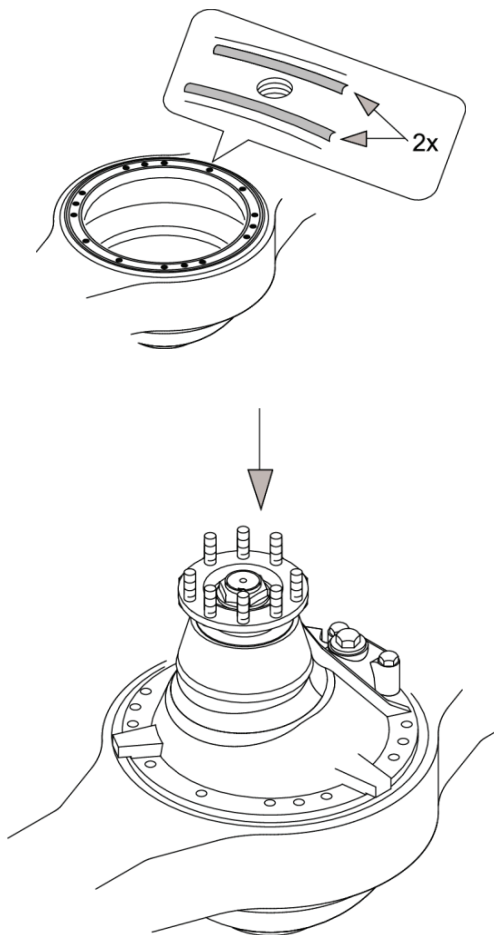
Leak in the differential and carrier assembly, oil will discharge.

- Clean and carefully inspect the sealing surface.



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

3.8.5.20 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
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 103](#)

4 Maintenance

4.1 Lubricants and lubrication intervals

Lube point	Remarks	before startup	Lubrication point h = hours of operation The value that is reached first is always valid.		
			after 100 h 1000 km (621 mi)	every 1000 h 10000 km (6214 mi)	at least 1x per year
Lubricant - Hypoid gear oil.... - specification see " Recommended types of hypoid gear oil " on page 77.					
Differential and carrier assembly Wheel hub - planetary gears Wheel bearing oil-lubricated	Oil change monthly oil level check by overflow measurement	check the oil filling	+	+	+
Lubricant - Wet multiple disk brake -with external cooling- specification see " Approved oils for brake with external cooling " on page 78.					
Wet multiple disk brake	with external cooling Oil change	check oil filling	depends on tank volume / cooling system / application		

4.2 Operating Fluids

⚠ CAUTION	
 	<p>When filling and working with operating fluids (oil, grease, coolant, ..), skin and eye contact with the operating fluid can occur.</p> <p>Operating fluids can trigger allergic reactions on skin.</p> <ul style="list-style-type: none"> ➤ Wear protective goggles and protective gloves.

4.2.1 Oils

4.2.1.1 Recommended types of hypoid gear oil

Hypoid gear oils which meet the following minimum requirements must be used as operating lubricants:

API GL-5 and API MT-1

or

SAE J2360 and API MT-1

The viscosity (SAE class) of the hypoid gear oils must be selected in each case on the basis of the given ambient temperature during use according to the following table.

Before using lubricants, we recommend that you ensure compliance of the oil qualification with the above specifications by checking product information or confirmation from your lubricant manufacturer.

Lubricant - Hypoid gear oil	
Ambient temperature when KESSLER product is used	Viscosity
	Lubricant minimum requirement Hypoid-gear oil according to API GL-5 and API MT-1 or Hypoid-gear oil according to SAE J2360 and API MT-1
from -10°C to +30°C (+14°F to +86°F)	Single-grade oils SAE 90 or Multigrade oils SAE 75W-90 / SAE 80W-90 / SAE 85W-90
permanently less than -10°C (+14°F)	Multigrade oils SAE 75W-85 / SAE 75W-90
permanently over +30°C (+86°F)	Single-grade oils SAE 140 or Multigrade oils SAE 75W-140 / SAE 80W-140 / SAE 85W-140

Grades designated by lubricant manufacturers:

- AVIA Hypoid 90 EP
- AVIA Synthogear FE 80W-90
- AVIA Hypoid 85W-140 EP
- SHELL Spirax S3 AM 80W-90
- SHELL Spirax S3 AD 80W-90
- SHELL Spirax S4 AX 80W-90
- SHELL Spirax S5 ATE 75W-90

Under no circumstances should "normal" gear oils (such as industrial gear oils) be used!

4.2.1.2 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 and jack it up if possible 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 without 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.



Differential and carrier assembly, axle housing and hub assembly have a total oil space.

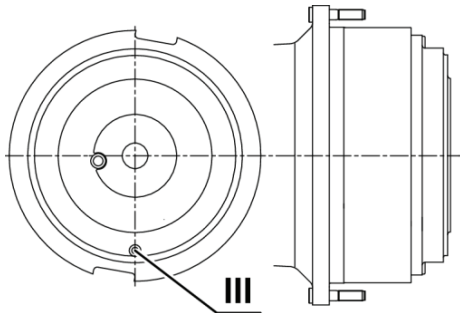
Oil drain has to take place at the complete axle.



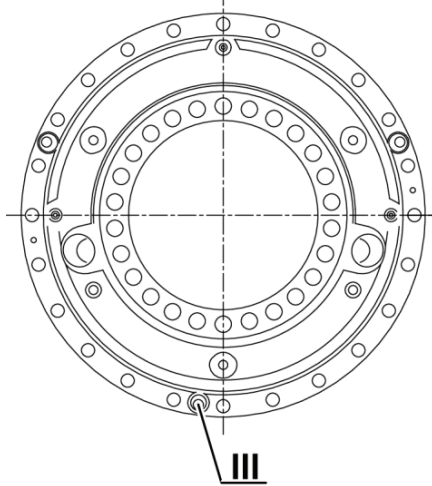
Wet multiple disk brake

Drain the extra oil.

III = oil drain point

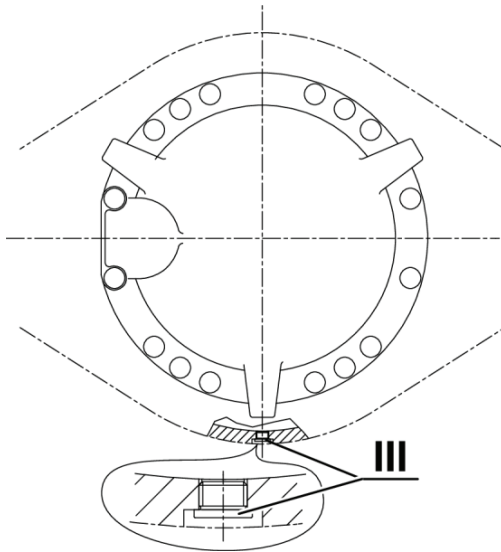
**Oil drain, hub assembly:**

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 105](#)



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 105](#)



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 105](#)

4.3.3 Oil filling and filling level



Differential and carrier assembly, axle housing and hub assembly have a total oil space.


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

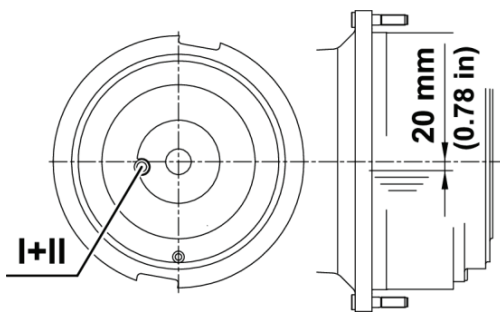
The whole axle is filled with oil from the differential and carrier assembly, axle housing and hub assembly and together.

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

I = oil filling point

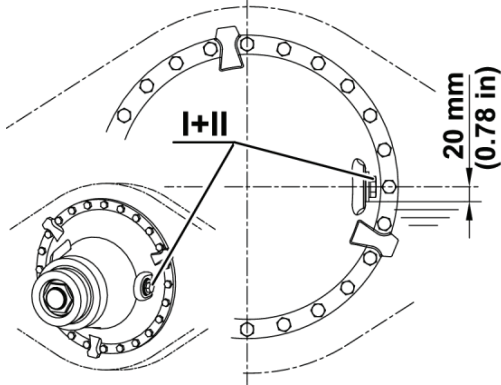
II = oil level inspection point

 = 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 76](#)
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 105](#)



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 76.
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 105



Recheck all oil levels of the KESSLER product after driving the first time.

4.4 Maintenance intervals

For safety reasons, the vehicle operator has to inspect and service all important screwed connections and safeguards at regular intervals.

Inspection and maintenance points	Remarks	Maintenance intervals				
		h = hours of operation (The value that is reached first is always valid.)				
		after 10 h 500 km (310 mi)	after 100 h 1000 km (621 mi)	every 500 h 5000 km (3107 mi)	every 1000 h 10000 km (6214 mi)	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 (31 mi) and about 200 km (124 mi)]	+	+	+		
Nuts / Axle bracket screws	Inspection and check for firm fit, if necessary retighten	+	+	+		+
Screwed connections	Check			+		
Gaskets	Check sealing points for leaks	monthly				
Screws / Drive flange	Inspection and check for firm fit, if necessary retighten	+	+	+		+
Parking brake	Check lining thickness and readjust if necessary	+	monthly			
Wet multiple disk brake	Check the lining wear					+

4.5 Checking the screwed connections, safeguards, formation of corrosion and on load-bearing components

- **Screws at housing connections, steering assembly parts, and brake parts:** If the screws can be retightened, retighten them with the correct tightening torque. If the screws can be retightened and Loctite was used on the screw connection, the Loctite connection will break, then reassembly is necessary! 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!

4.6 Checking gaskets

- Check sealing points for leaks. If this is not ensured see Repair instructions.


4.7 Controlling of breather


- Kessler does not stipulate exact intervals for the maintenance of the breather.
- The function of the breather must always be guaranteed.
- The breather must be free of damage, paint and dirt.
- A leaky breather must be replaced.

4.8 Checking of the lining thickness on parking brake

- Lining thickness must be checked with a visual inspection, see ["Supplier documents" on page 108](#).

4.9 Wheel bearing adjustment

⚠ DANGER	
	<p>Faulty mounting and incorrect securing of the wheel bearing adjustment nut. The wheel along with the complete hub assembly comes off of the axle.</p> <p>Serious or fatal injuries of the mechanic and third parties</p> <p>Accident risk</p> <p>➤ In any case, tighten and secure the wheel bearing adjustment nut as described!</p>

⚠ CAUTION	
	<p>When loosening the threaded connection, the planetary gear can tip over uncontrolled due to its own weight and fall down.</p> <p>Danger of being crushed</p> <p>Risk of injury</p> <p>➤ Secure the planetary gear against falling with suitable lashing gear during disassembly.</p>

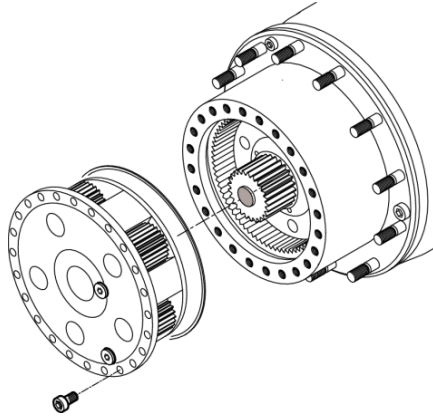
The wheel bearing is checked by retightening the wheel bearing adjustment nut.

- 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.

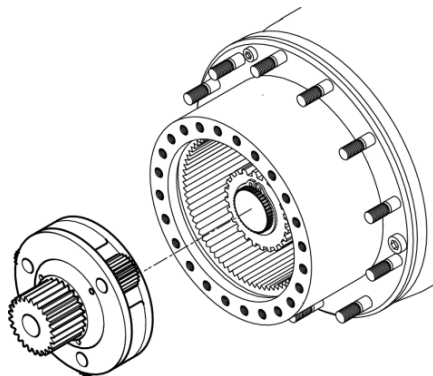


Wrench for wheel bearing adjustment nut

Order number: 260077

**Disassembly of planetary gear:**

1. Drain the oil.
 - See **"Oil change" on page 79.**
2. Loosen and remove mounting bolts.
3. Carefully pull off the outer planetary gear.

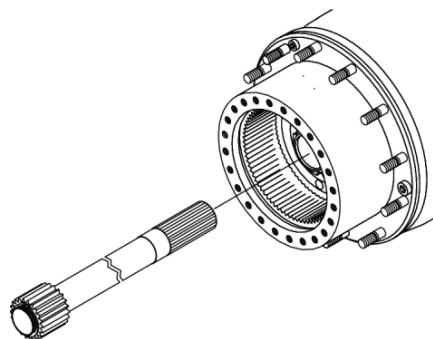


4. Take out inner planetary stage.

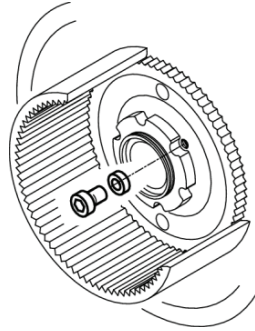


Observe the length of the axle shaft!

Mount the dismantled axle shaft again onto the same position on the axle.

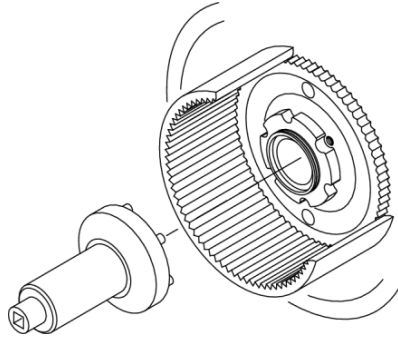
**Disassembly of axle shaft with assembled sun gear:**

5. Pull out the axle shaft, complete with assembled sun gear.
 - Do not tilt it in the axle spindle!



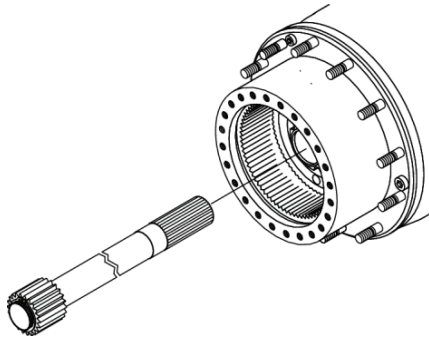
Loosening the wheel bearing adjustment nut:

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



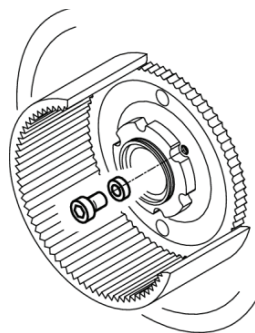
Checking/Retightening the wheel bearing adjustment nut:

7. 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: 650-700 Nm (479-516 ft lbf)
 - 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.



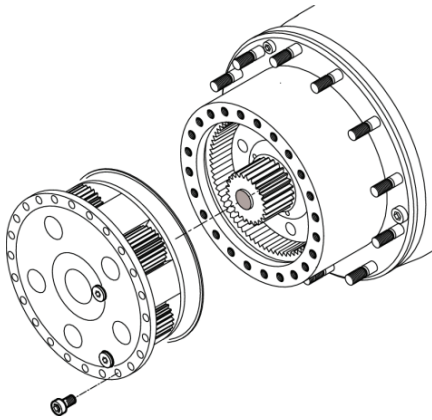
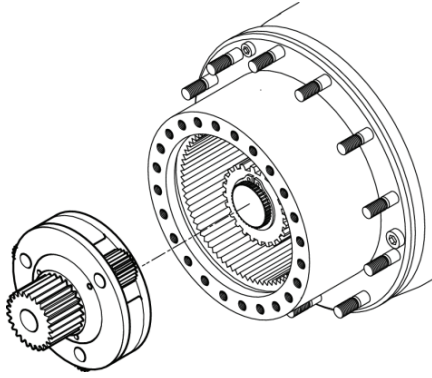
Assembly of the axle shaft with assembled sun gear:

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 / ring gear carrier.
2. Push the axle shaft into the axle spindle until the sun gear is in contact with the circlip and the thrust washer.
3. Seen from the assembly side at the vehicle, one of the oil compensation drill holes must be at the bottom.



Securing the wheel bearing adjustment nut:

4. Secure the wheel bearing adjustment nut with a screw.
 - Fit the ring onto the screw.
 - Screw securing: Loctite 270
 - Tightening torque: 72 Nm (53 ft lbf)

**Assembly of planetary gear:**

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

6. 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.
7. Push the outer planetary gear drive assembly into the ring gear and onto the sun gear.
8. 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 103**
9. Top up with oil.
 - see **"Oil change" on page 79.**

4.10 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:

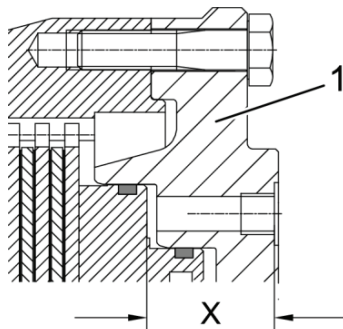
- When starting up the vehicle, drive carefully to bring the brakes to the operational temperature.
- Drive carefully to get used to the brake effect.

4.11 Lining wear measurement of wet multiple disk brakes

⚠ DANGER	
	<p>When work is being performed on the service brake, its braking effect is disabled.</p> <p>Rolling away of the vehicle Serious or fatal injuries of the mechanic and third parties</p> <ul style="list-style-type: none"> ➤ Make sure that no machine movements can take place.
⚠ CAUTION	
	<p>Hot brakes and hot cooling oil</p> <p>Risk of burning</p> <ul style="list-style-type: none"> ➤ 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 79](#)
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) 5550, the maximum permissible wear rate is 2.5 mm (0.09843 in).

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, transmissions, 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

- If there are any questions, please contact KESSLER.
- In the event of major repairs or overhauls, it would be appropriate to send the entire KESSLER product to KESSLER.
- If there are necessary repairs, repair instructions can be requested from 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:
 - Make sure the correct oil quality is used for filling, see "[Lubricants and lubrication intervals](#)" on page [76](#).
 - **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 ("[Lubricants and lubrication intervals](#)" page 76) to correct oil level ("[Oil change](#)" page 79)).
- 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, ...). Possible surface corrosion on the brake contact surface of the brake disks is a normal und harmless phenomenon. Surface corrosion on the brake disks will be removed automatically by the first brake operations during vehicle commissioning.
- 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.
- Electronical components must be taken out of operation according to regulations, ensure that no voltages are present.
- Drain and remove all operating fluids (oils, coolants, lubricants) and dispose of properly, [see "Operating Fluids" on page 76.](#)
- 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



If a screw is used covering with a securing (for example: Precote covering), more Loctite must not apply.

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	Bonding	LOCTITE	480	black
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

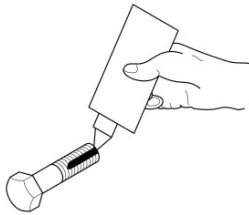
8.1.2 Handling auxiliary materials

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

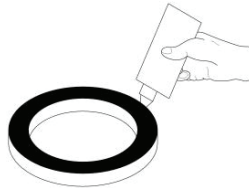
- The surfaces or screws and threaded boreholes to be cemented need to be free of paint, grease, and oil (washed).
- The Loctite adhesives applied cure under the following conditions:
 - Absence of air
 - Metal contact
 - Warmth
- Only a short time may pass between pre-assembly and controlled tightening (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



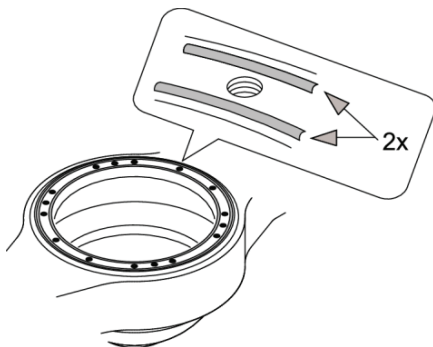
sealing surface: ensure sufficient coating



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:



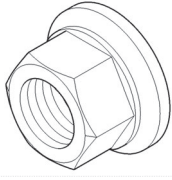
on sealing surface: 2 beads

8.2 Tightening torques

Friction: $\mu = 0.14$

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

8.2.1 Tightening torque wheel nut

Wheel nut with flat washer	Size	- Phosphor blackened -
	M 20 x 1,5	470 Nm (347 ft lbf)
	M 22 x 1.5	650 Nm (479 ft lbf)

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 (2 ft lbf)		4.4 Nm (3.2 ft lbf)		5.1 Nm (3.5 ft lbf)	
M 5	5.9 Nm (4 ft lbf)		8.7 Nm (6 ft lbf)		10 Nm (7 ft lbf)	
M 6	10 Nm (7 ft lbf)		15 Nm (11 ft lbf)		18 Nm (13 ft lbf)	
M 8	25 Nm (18 ft lbf)		36 Nm (26 ft lbf)		43 Nm (31.5 ft lbf)	
M 10	49 Nm (36 ft lbf)		72 Nm (53 ft lbf)		84 Nm (62 ft lbf)	
M 12	85 Nm (62.5 ft lbf)		125 Nm (92 ft lbf)		145 Nm (107 ft lbf)	
M 14	135 Nm (99.5 ft lbf)		200 Nm (147 ft lbf)		235 Nm (173 ft lbf)	
M 16	210 Nm (155 ft lbf)		310 Nm (228 ft lbf)		365 Nm (269 ft lbf)	
M 18	300 Nm (221 ft lbf)		430 Nm (317 ft lbf)		500 Nm (369 ft lbf)	
M 20	425 Nm (313 ft lbf)		610 Nm (450 ft lbf)		710 Nm (524 ft lbf)	
M 22	580 Nm (428 ft lbf)		830 Nm (612 ft lbf)		970 Nm (715 ft lbf)	
M 24	730 Nm (538 ft lbf)		1050 Nm (774 ft lbf)		1220 Nm (900 ft lbf)	
M 27	1100 Nm (811 ft lbf)		1550 Nm (1143 ft lbf)		1800 Nm (1328 ft lbf)	
M 30	1450 Nm (1069 ft lbf)		2100 Nm (1549 ft lbf)		2450 Nm (1807 ft lbf)	

8.2.3 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 (20 ft lbf)		39 Nm (29 ft lbf)		46 Nm (34 ft lbf)	
M 10 x 1	55 Nm (40.5 ft lbf)		81 Nm (60 ft lbf)		95 Nm (70 ft lbf)	
M 10 x 1.25	52 Nm (38 ft lbf)		76 Nm (56 ft lbf)		90 Nm (66 ft lbf)	
M 12 x 1.25	93 Nm (68.5 ft lbf)		135 Nm (99.5 ft lbf)		160 Nm (118 ft lbf)	
M 12 x 1.5	89 Nm (66 ft lbf)		130 Nm (96 ft lbf)		155 Nm (114 ft lbf)	
M 14 x 1.5	145 Nm (107 ft lbf)		215 Nm (158.5 ft lbf)		255 Nm (188 ft lbf)	
M 16 x 1.5	225 Nm (166 ft lbf)		330 Nm (243 ft lbf)		390 Nm (288 ft lbf)	
M 18 x 1.5	340 Nm (251 ft lbf)		485 Nm (358 ft lbf)		570 Nm (420 ft lbf)	
M 20 x 1.5	475 Nm (350 ft lbf)		680 Nm (501.5 ft lbf)		790 Nm (583 ft lbf)	
M 22 x 1.5	650 Nm (479 ft lbf)		920 Nm (678.5 ft lbf)		1050 Nm (774 ft lbf)	

8.2.4 Tightening torques for galvanized screws and nuts

Observe the reduced tightening torques for galvanized screws and nuts!

8.2.5 Tightening torque for screw plugs

Screw plugs with metric thread			
Thread size	Tightening torque (reference values for screw plugs with copper ring)	Tightening torque (reference values for screw plugs with ED seal) ED is equal to elastomer seal	Tightening torque (reference values for screw plugs with O-ring)
M 10 x 1	--	12 Nm (approx. 9 ft lbf)	--
M 12 x 1,5	--	25 Nm (approx. 18 ft lbf)	--
M 14 x 1,5	ca. 45 Nm (approx. 33 ft lbf)	35 Nm (approx. 25.5 ft lbf)	45 Nm (approx. 33 ft lbf)
M 16 x 1,5	ca. 60 Nm (approx. 44 ft lbf)	50 Nm (approx. 37 ft lbf)	--
M 18 x 1,5	--	65 Nm (approx. 48 ft lbf)	--
M 22 x 1,5	ca. 100 Nm (approx. 74 ft lbf)	90 Nm (approx. 66 ft lbf)	100 Nm (approx. 74 ft lbf)
M 24 x 1,5	ca. 120 Nm (approx. 88.5 ft lbf)	95 Nm (approx. 70 ft lbf)	--
M 30 x 1,5	ca. 160 Nm (approx. 118 ft lbf)	120 Nm (approx 88.5 ft lbf)	--
M 36 x 1,5	ca. 210 Nm (approx. 155 ft lbf)	--	--
M 42 x 1,5	ca. 260 Nm (approx. 192 ft lbf)	230 Nm (approx. 169.5 ft lbf)	--
M 45 x 1,5	ca. 280 Nm (approx. 206.5 ft lbf)	230 Nm (approx. 169.5 ft lbf)	--

Screw plugs with inch thread			
Thread size	Tightening torque (reference values for screw plugs with copper ring)	Tightening torque (reference values for screw plugs with ED seal) ED is equal to elastomer seal	Tightening torque (reference values for screw plugs with O-ring)
9/16-18 UN(F)	--	--	34 Nm (25 ft lbf)
1 1/16-12 UN	--	--	140 Nm (103 ft lbf)
G 1/2	50 Nm (37 ft lbf)	80 Nm (59 ft lbf)	--
G 3/4	80 Nm (59 ft lbf)	140 Nm (103 ft lbf)	--

8.3 Units

Conversation table

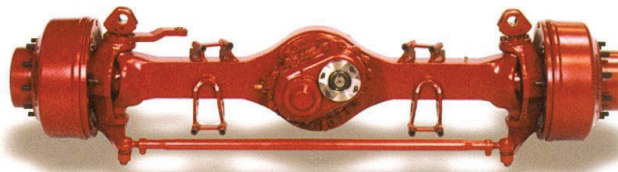
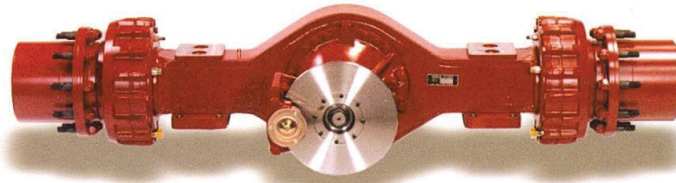
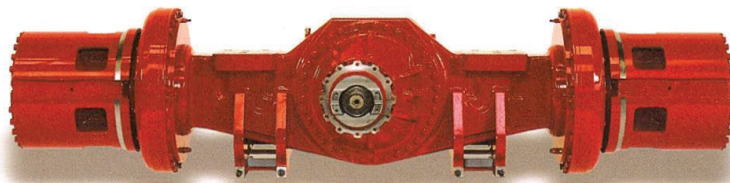
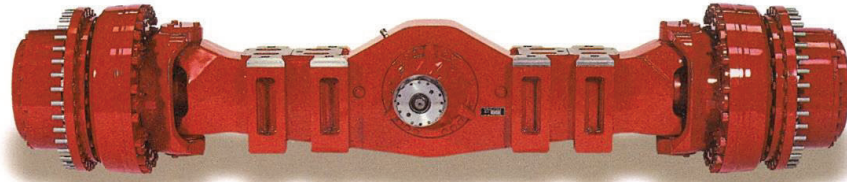
System		System		Examples for conversation		
metric	abbr. metric	imperial	abbr. imperial		is equal to	
millimeter	mm	inch	in	1 mm	=	0.0394 in
				1 in	=	25.4 mm
meter	m	foot	ft	1m	=	3.28084 ft
				1 ft	=	0.3048 m
kilometer	km	mile (land mile)	mi	1 km	=	0.621371 mi
				1 mi	=	1.609344 km
kilometer per hours	km/h	miles per hour	mph	1 km/h	=	0.621371 mph
				1 mph	=	1.60934 km/h
kilogram	kg	pounds	lb	1 kg	=	2.205 lb
				1 lb	=	0.453592 kg
Newton meter	Nm	foot-pound force	ft lbf	1 Nm	=	0.737562 ft lbf
				1 ft lbf	=	1.356 Nm
pressure	bar	pound per square inch	psi	1 bar	=	14.5 psi
				1 psi	=	0.070 bar
milliliter	ml	fluid ounces	fl oz (US)	1 ml	=	0.03381 floz
				1 fl oz (US)	=	29.6 ml
liter	l	US Gallon	US gal	1 l	=	0.264172 US gal
				1 US gal	=	3.785 l
Celsius	°C	Fahrenheit	°F	0° C	=	+ 32.8 °F
				+ 1 °C	=	+ 33.8 °F
				0 °F	=	- 17,78 °C
				+ 1 °F	=	- 17,22 °C

9 Supplier documents

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

9.1 [NoSPIN](#)

9.2 [Knott - FSG90, FSG110, TM6397](#)



Kessler & Co. GmbH & Co.KG
Huettlinger Straße 18-20
D-73453 Abtsgmuend
Germany

KESSLER+CO

Phone +49 (0) 73 66/81-32
Fax +49 (0) 73 66/81-69
service@kessler-axles.com
www.kessler-axles.de



Automatic Positive Locking Traction Differential

OWNER'S MANUAL

With warnings and precautions on back cover

Tractech has been a leading manufacturer of premium quality traction-adding differentials for over 50 years. Each step in our manufacturing process, from design to final assembly and inspection reflects the highest industry standards

This manual is intended to help provide safe and trouble free operation of NoSPIN/Detroit Locker differentials for the life of the product. We strongly recommend that all who come in contact with the products read this manual thoroughly.

GENERAL INFORMATION AND RECOMMENDATIONS

To Contact Tractech Inc.	Telephone:	(586) 759-3850 U.S.A.
	FAX:	(586) 759-1645 U.S.A.
	Web Site:	www.tractech.com
	Office Hours:	7:30 - 4:30 (FT) Mon. - Fri.
	General Assistance:	Customer Service Dept.
	Technical Assistance:	Engineering Dept.
	Warranty Assistance:	Customer Service Dept.
	Printed Matter:	Marketing Department

Glossary	To assist the reader in understanding the language in this manual a Glossary is included.
Limited Warranty	The complete Tractech Limited Warranty appears on page 22 Owners of NoSPIN/Detroit Locker differentials are encouraged to read this warranty carefully before putting the vehicle into service.
Technical Bulletins	Tractech has published several Technical Bulletins which are helpful supplements to the information presented throughout this manual Copies are available by writing to the Marketing Dept.
Application Approval	It is essential that NoSPIN/Detroit Locker differentials be used only in applications approved by Tractech Engineering. Read page 3 carefully and follow the stated guidelines.
Model Lists	Refer only to approved Tractech model lists when ordering or specifying the products. Copies are available by writing to the Marketing Dept - Web page www.tractech.com .
Vehicle Performance	The performance of a vehicle equipped with a NoSPIN/Detroit Locker differential is somewhat different from that of a vehicle equipped with a conventional differential. Read page 4 carefully to assure proper understanding of the characteristics of the product.
Installation	Before installing NoSPIN/Detroit Locker differentials, read pages 7-11 Note: Tractech recommends that a competent driveline mechanic perform the installation in that tools of the trade are required. Note: The vehicle/axle manufacturer's instructions for installing a conventional differential must be consulted when disassembling and reassembling axle components and when making all final adjustments.
Maintenance	Refer to pages 13-16 for important information regarding proper maintenance of your NoSPIN/Detroit Locker differential. Carefully follow the recommended lubrication, service and inspection procedures.
Trouble Shooting	Information on pages 17-18 will help owners and operators of NoSPIN equipped vehicles diagnose and correct problems related to vehicle performance.

TABLE OF CONTENTS

PREFACE, GENERAL INFORMATION AND RECOMMENDATIONS	1
APPLICATION	3
VEHICLE PERFORMANCE	4
EXPLODED VIEWS OF REPRESENTATIVE ASSEMBLIES	5
OPERATION	6
INSTALLATION	7-11
TESTS FOR PROPER INSTALLATION AND OPERATION	12
MAINTENANCE	13-16
TROUBLE SHOOTING	17-18
NEW IMPROVED DETROIT LOCKER™ SPECIAL INSTRUCTIONS	19
NEW DETROIT C-LOCKER FOR C-CLIP AXLES - SPECIAL INSTRUCTIONS	20
GLOSSARY	21
LIMITED WARRANTY AND EXCLUSIONS	22
WARNING, PRECAUTIONS	23
INSTRUCTIONS TO AXLE MANUFACTURER AND CHASSIS ASSEMBLY PLANT	24

APPLICATION APPROVAL

Over the past 50 years, the NoSPIN differential has been successfully utilized by a variety of on/off road vehicle/axle manufacturers. Traditional applications are Medium/Heavy Truck, Construction, Mining, Forestry, Agricultural, Military and Specialty Vehicles.

To ensure successful application of our product, Tractech Engineering requires approval for each new vehicle/axle application. The following guidelines are examples of successful NoSPIN differential application:

Applications:

- **6x4 (tandem-drive axle)** Trucks Primary location - forward rear. Both rear axles for maximum mobility if used 75% off-road.
- **4x4 Off-Road** Vehicles Farm tractors (articulated & rigid) front axle. Also rear axle for maximum traction. (Consult Tractech Engineering.)
- **Farm Tractors** (straight frame with front-wheel-drive) -front axle only (cannot be used in rear axle with individual wheel brakes).
- **Loader** - One axle only, either front or rear.
- **Trencher** - One or both axles.
- **Front drive axles** of Light Trucks. While successful in specialty vehicles, this application must be reviewed and approved by Tractech Engineering.

It is important when considering the use of a traction device to review key vehicle parameters i.e., loading, geometry, power requirements, duty cycles (miles/hours) etc.

The following marginal applications must be reviewed with Tractech Engineering Application Approval Form No. 7003 is required. Successful field testing must be performed by the customer prior to production approval by Tractech.

Examples are:

Transit Buses- NoSPIN should not be used when operated in cities where sharp turns are required continually changing lanes, as in leaving bus stops to avoid parked vehicles.

Transit buses utilized in non city operations are an acceptable application. School busses have also proven to be another successful application for NoSPIN.

- **Yard Tractors** (Spotters)
- **Light-duty Pickup Trucks** - Equipped with fifth wheels to pull "gooseneck" trailers in pickup and delivery operations unless equipped with automatic transmission.
- **Small Fork Lift Trucks** -with short wheelbase and high turn angle capability utilized inside buildings on smooth surfaces.
- Highway Tractors - with less than 120" wheelbase (see page 4 for details).

CAUTION:

ANY INCREASE IN THE SIZE OF THE VEHICLE'S ENGINE, TIRES, WEIGHT, ETC., MAY PROHIBIT USE OF A NoSPIN DIFFERENTIAL IN A HERETOFORE APPROVED APPLICATION. ANY SUCH MODIFICATION SHOULD BE REVIEWED BY TRACTECH ENGINEERING BEFORE CONTINUING TO USE THE PRODUCT.

THE NoSPIN DIFFERENTIAL DOES NOT INCREASE THE LOAD-CARRYING CAPACITY OR PAYLOAD RATING OF THE VEHICLE OR VEHICLE COMBINATION.

• **Model Lists**

Refer only to approved Tractech model lists when ordering or specifying NoSPIN/Detroit Locker differentials. Copies are available by writing to the Marketing Dept.

*1995 Tractech inc.

*NoSpin, Detroit Locker, Improved Detroit Locker and Detroit C-Locker are registered Trademarks of Tractech Inc.

VEHICLE PERFORMANCE

The performance of a vehicle equipped with a NoSPIN/Detroit Locker differential is somewhat different from that of a vehicle equipped with a conventional differential. For example:

When turning a corner, the sound of component disengagement and re-engagement may be audible, and the transfer of driving torque from both wheels to one wheel may be noticeable.

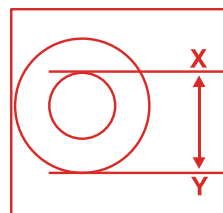
When going from drive (acceleration) to coast (deceleration) in a turn, a "metallic" sound may be heard as torque flow is reversed (inside wheel engaged during acceleration; outside wheel engaged during deceleration).

These characteristics are normal because of backlash designed into the NoSPIN differential, which is of a fixed amount (1 to 2 inches of rotation at the tire tread).

Backlash or slack between the driving and driven clutch teeth is an inherent part of the NoSPIN and necessary to permit automatic operation when driving in forward and reverse. The total backlash in the driveline is increased by the amount of the reduction between the ring gear and pinion. If the ring gear-pinion ratio is 5 to 1, the total backlash in the driveline with the NoSPIN would be about 30°. This in turn is increased by clearances between planetary gear, sliding splines and the ring and pinion gear. We feel that the total driveline slack can amount to as much as 1/4th turn of the driveline without being abnormal, but if it exceeds 1/4 turn, other parts in the drivetrain could be checked. Further clarification of operational and performance characteristics is available through Technical Bulletin No. 81 -1044. A copy is available by writing to our Marketing Dept.

Anything that improperly causes a difference in individual wheel speeds, such as mismatched tire diameters due to differences in tire wear or tire pressure, or unbalanced loading of the vehicle (especially cargo vehicles, or vehicles operated on a side slope) can cause the NoSPIN differential to deliver power to only one side of the vehicle and thus cause steering problems.

The diameter of the tires can be adjusted by varying the air pressure of the tires.
Match the distance from the top of each tire rim to the pavement.



When negotiating a turn (outside wheel disengaged), the inside wheel under conditions of poor traction may receive excessive torque, which could cause it to break traction momentarily until its speed is equal to the outside wheel. This will result in re-engagement of the outside wheel thus allowing both wheels to be driven. This condition is most noticeable with lightly loaded axles.

Certain vehicles equipped with NoSPIN differentials, such as short wheelbase trucks (e.g., under 120" wheelbase) and four wheel drive trucks with a NoSPIN differential in the front steering axle, can experience "understeer" when negotiating a turn under power. Releasing the accelerator will reduce the torque and improve steering.

Use extreme caution when accelerating or decelerating on slippery or unstable surfaces. Vehicles/axles equipped with traction differentials are inherently more sensitive to side-slip than vehicles equipped with conventional differentials. Stability can be retained if side-slip occurs by decelerating (Letting off the accelerator) CAUTION: DO NOT APPLY THE BRAKE. TO DO SO MAY RESULT IN LOSS OF VEHICLE CONTROL.

Braking capacity is reduced when a NoSPIN differential equipped vehicle makes a turn while coasting downhill in that the inside wheel is then disconnected from the driveline. Operating in low gear will allow the engine to act as a retarder and will improve braking capacity.

If the vehicle is stationary on a dry surface, easier steering can be achieved by moving the vehicle slightly in either forward or reverse. (Assure that proper steering pressure is maintained.)

NOTE:

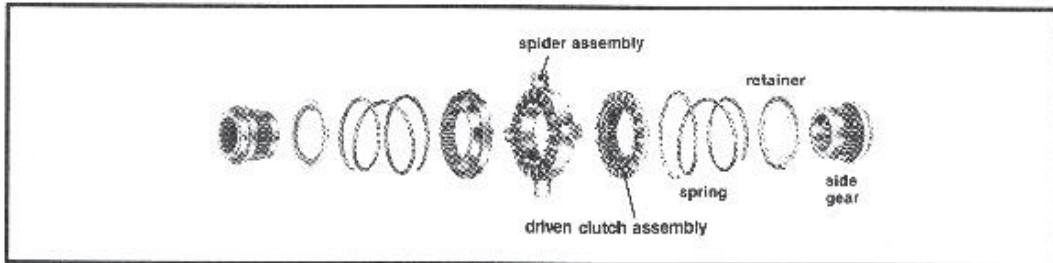
If placing limited-slip differentials in Rockwell, Eaton or-Dana axles with NoSPIN differentials, also replace the differential case halves with the axle manufacturer's standard differential case halves NoSPIN differentials are designed to fit standard differential case halves. NoSPIN differentials will not fit properly into limited-slip differential case halves.

THE NoSPIN DIFFERENTIAL DOES NOT INCREASE THE LOAD-CARRYING CAPACITY OR PAYLOAD RATING OF THE VEHICLE OR VEHICLE COMBINATION.

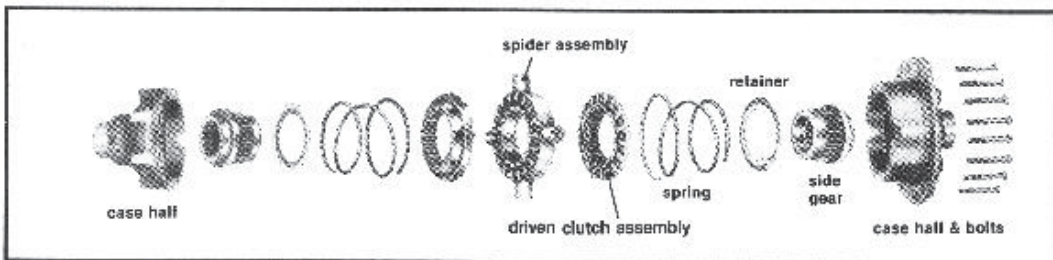
IMPORTANT! READ THE CAUTIONARY NOTICES REFERENCED ON THE BACK COVER.

EXPLODED VIEWS OF REPRESENTATIVE ASSEMBLIES

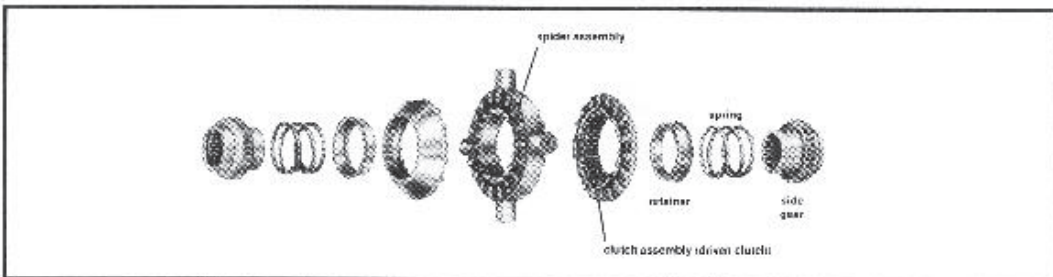
The following exploded views of NoSPIN differentials (there are five "styles")* illustrate the various components that make up the complete assembly. Certain components differ slightly in appearance between style, but their function - and the function of each of the five style NoSPIN differentials - is the same



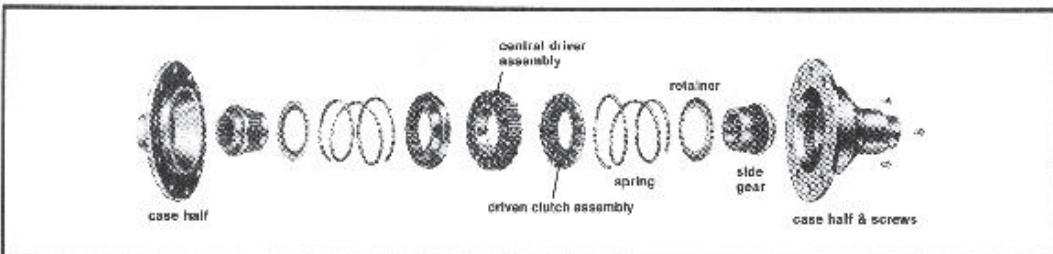
NoSPIN differential with spider assembly and external springs and retainers; fits support case in vehicle.



NoSPIN differential with spider assembly and external springs and retainers; supplied with support case.



NoSPIN differential with spider assembly and internal springs and retainers; fits support case in vehicle.



Assembly style not shown:

New IMPROVED Detroit Locker. See page 19

Models with central driver, external springs and retainers, without support case.

Copies of style not shown are available by writing to the Marketing Dept.

OPERATION

The NoSPIN differential powers both wheels. Yet freely permits wheel speed differentiation when required.

Prime functions

1. Assures 100% of the available torque and increases drawbar pull.
2. Prevents wheel spin and power loss when one wheel loses traction.
3. Compensates for differences in wheel travel when turning or operating on uneven surfaces.

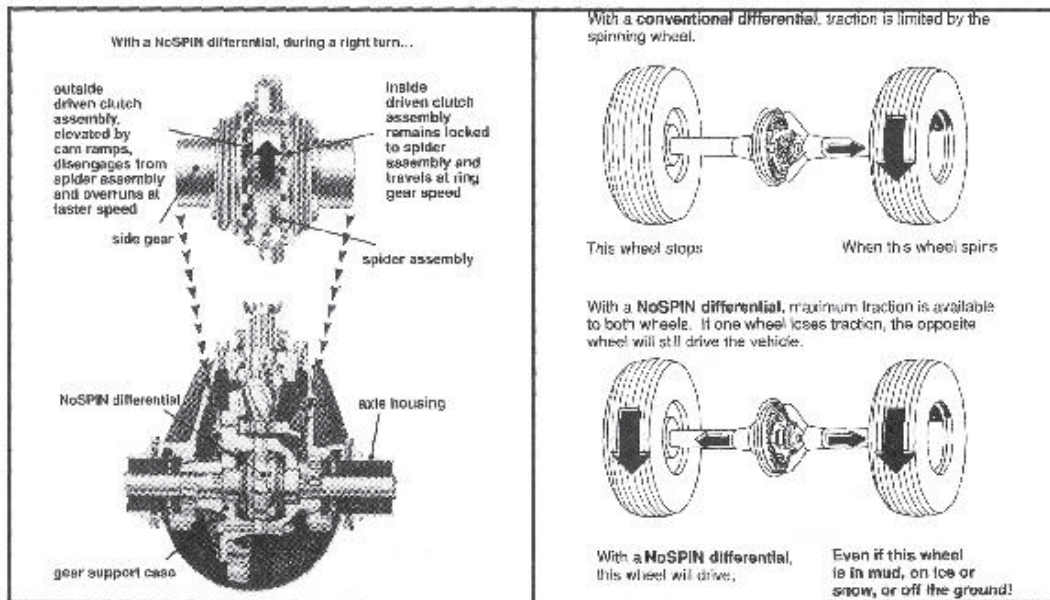
The drive axle illustrated below (Fig. 1) is equipped with a NoSPIN differential. Note that there are no spider gears, but rather two drive members, called driven clutch assemblies. They mate with a spider assembly which is driven by the ring gear through the differential support case.

As long as the vehicle is operated in a straight forward or reverse direction over a smooth surface, the driven clutch assemblies remain locked to the spider assembly.

The NoSPIN differential allows the vehicle to perform as if the axle half-shafts had been welded - the axle is completely locked. This means both wheels turn at the same speed. If one wheel loses traction or leaves the ground, the opposite wheel, which still has traction, continues to drive the vehicle until traction is regained by both wheels. There can be no one wheel spinout. (Fig. 2)

When the vehicle turns a corner, or when one wheel passes over an obstruction, the outside wheel, or the wheel passing over the obstruction, must travel a greater distance and therefore faster than the other wheel. When this occurs, the NoSPIN differential automatically allows for the necessary difference in wheel speed.

During a turn (Fig. 1), the inside driven clutch remains completely engaged with the spider and continues to drive the vehicle. The outside driven clutch automatically disengages from the spider, allowing the outer wheel to turn freely in the turn. When the vehicle completes the turn, the outside driven clutch automatically reengages the spider, as both wheels again travel at the same speed.



INSTALLATION

Refer only to an approved Tractech model list when ordering or specifying the product. Copies are available by writing to the Marketing Department.

It is essential that NoSPIN/Detroit Locker differentials be used only in applications approved by Tractech Engineering. Read pages 3-4 carefully and follow the approved guidelines.

The installation procedure presented on pages 7-11 applies to all NoSPIN differentials (except 'R' Model NoSPIN Differentials). However, the procedure will differ slightly depending upon the specific vehicle. Therefore it is essential to consult the vehicle/axle manufacturer's instructions for installing a differential.

Most NoSPIN/Detroit Locker differentials are designed to fit directly into the standard differential support case in the vehicle. Where it is not possible to fit the standard support case manufactured by the vehicle/axle maker, the NoSPIN differential is supplied with a case manufactured by Tractech. Therefore, two sets of installation instructions are provided.

NoSPIN differentials are easily installed in the field. However, it is recommended that a competent driveline mechanic do the work in that tools of the trade are required.

The NoSPIN differential is designed to fit the components in the axle. No machining is required. The procedure is the same as it is for installing the original differential. A competent mechanic can install the NoSPIN in the same time required to replace the original differential. Caution: It is recommended every safety precaution be practiced while performing the work when disassembling and reassembling axle components and when making all final adjustments.



**Installation Instructions:
NoSPIN/Detroit Locker Differentials Supplied Without a Support Case**

INSTALLATION

Disassembly: (Steps 1-5)

Step 1

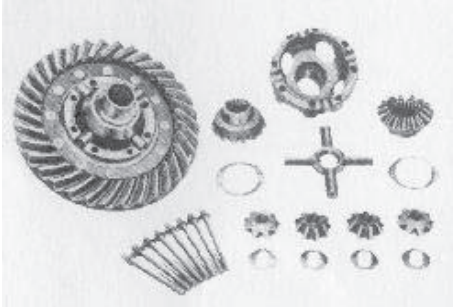
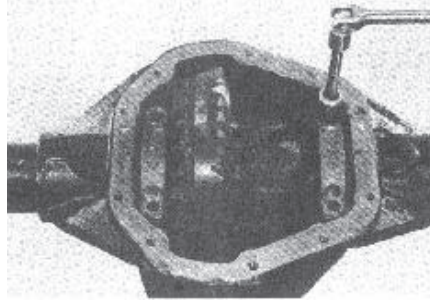
Refer to the vehicle/axle manufacturer's recommendations for removing the differential assembly from the axle. Ensure that all safety precautions are implemented.

Step 2

Following the procedure recommended by the vehicle or axle manufacturer, remove the ring gear and differential case assembly from the axle carrier.

CAUTION:

Do not use heat to disassemble drive axles. To do so can destroy heat treat properties, weaken or distort axle components or result in a mishap which can cause injury, even death.



Step 3

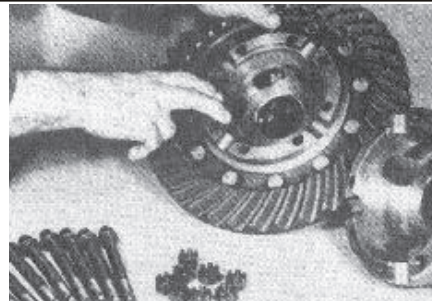
Mark the differential case halves so they may be reassembled in their original position. Open the case. Remove and store the original differential components. Retain the original differential case, ring gear, and differential case bolts. Do not remove bearing cone assemblies from the case halves; do not remove the ring gear from the case half.

Step 4

Wash the differential case, ring gear, differential case bolts and bearing assemblies using a non-flammable, non-toxic cleaning solvent that will not etch, scratch or oxidize the components. Rinse in clean solvent and dry. Inspect for damage, wear or corrosion. *Replace if necessary with identical, axle/vehicle manufacturer approved components.*

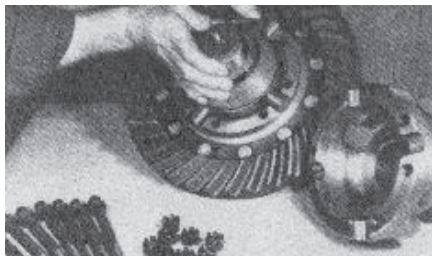
NOTE:

Be sure all thrust washers have been removed from the differential case. Failure to do so will cause the NoSPIN differential to malfunction.



Step 5

Clean and examine the splined ends of the axle shafts. Remove any roughness or burrs with a tile or stone. Examine the shafts for straightness, cracks or other damage. Replace if necessary. Make sure splines on axle match the splines on NoSPIN differential side gear.



Step 6

Position the NoSPIN differential assembly in the case half which is attached to the ring gear.

CAUTION:

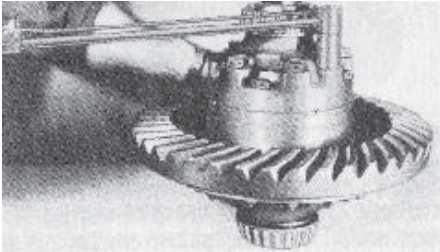
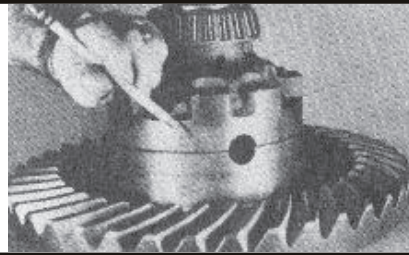
Do not remove the retainer bolt, nut and washers at this time. To do so will release the compressed springs, which can cause injury.

Step 7

Position the remaining differential case half over the NoSPIN differential.

NOTE:

Be sure both case halves are in the original (marked) position.

**Step 8**

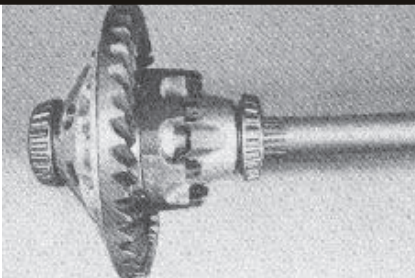
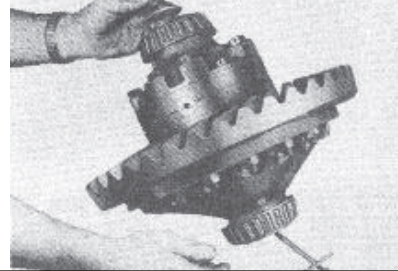
Using a torque wrench, tighten the differential case bolts securely to the torque limit recommended by the vehicle/axle manufacturer's instructions. Assure that there is a tight fit between the spider trunnions and the case.

NOTE:

A loose fit between the spider and the case can cause malfunction of the NoSPIN Differential.

Step 9

Remove the retainer bolt, nut and washers. (Retain for future service work.)

**Step 10**

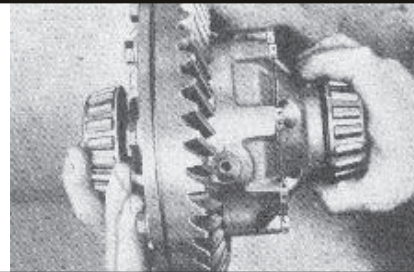
Insert axle shafts into splined side gears of the NoSPIN differential. The shafts should slide in freely but fit correctly.

Step 11

Install the differential and ring gear assembly in the axle housing. Complete the reassembly of associated components as recommended by the vehicle/axle manufacturer's instructions.

NOTE:

Contamination, such as metal particles in the differential case, can cause the differential to malfunction. Be sure the axle housing is clean before proceeding.

**Step 12**

Refill the axle housing with lubricant recommended for differentials by the vehicle/axle manufacturer.

Step 13

Apply Caution Label to instrument panel in full view of operator or mechanic. If you did not receive this label, contact Tractech's Marketing Department.

Step 14

Follow the test procedures outlined on page 12 to assure proper installation and operation of the NoSPIN differential.

NOTE:

If the NoSpin differential is disassembled, be sure to reassemble both clutch assemblies to the spider assembly with the 'slot' in each holdout ring over the long tooth of the spider.

INSTALLATION

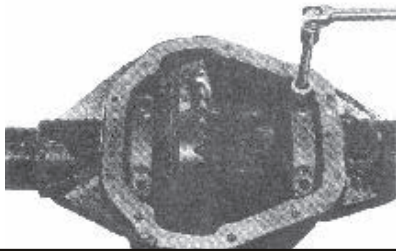
Installation Instructions for NoSPIN/Detroit Locker Differentials - *Supplied with a Support Case*



Disassembly: (Steps 1-5)

Step 1

Refer to the vehicle/axle manufacturer's recommendations for removing the differential assembly from the axle. Ensure that all safety precautions are implemented.

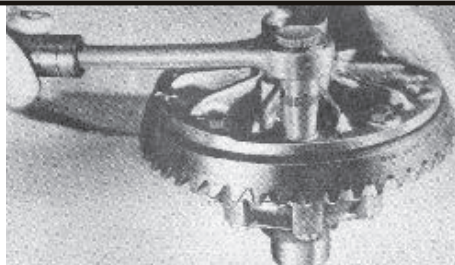


Step 2 Following the procedure recommended by the vehicle or axle manufacturer, remove the ring gear and differential case assembly from the axle carrier.

CAUTION:
Do not use heat to disassemble drive axles. To do so can destroy heat treat properties, weaken or distort axle components or result in a mishap which can cause injury, even death.

Step 3

Using the proper bearing puller, carefully remove the bearing cone assemblies from the original differential case. *Replace bearings if worn or damaged during disassembly.* If shims are used behind the bearing cone assemblies, record the amount of shim pack under each bearing.



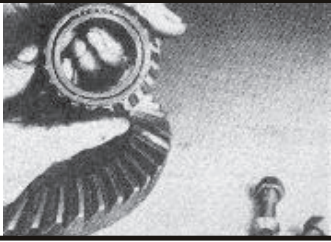
Step 4

Remove the ring gear from the original differential case. Record the dimension from the ring gear flange face to the nearest bearing shoulder. Record the dimension from one bearing face to the other.

Step 5

Store the original differential and case for use if the NoSPIN differential requires service. Protect parts from damage or Corrosion.



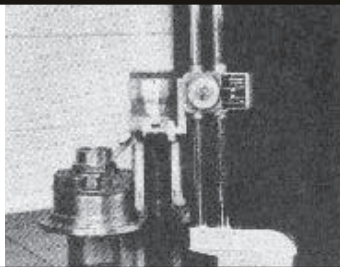
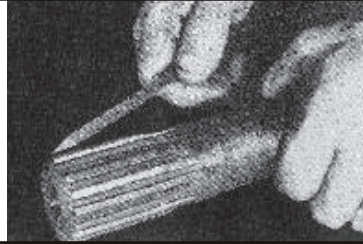


Step 6

Wash the ring gear, ring gear bolts, shims, and bearing races using a nonflammable, non-toxic cleaning solvent that will not etch, scratch or oxidize the parts. Rinse in clean solvent and dry. Inspect for damage, wear or corrosion. Replace if necessary with identical axle/vehicle manufacturer approved components.

Step 7

Clean and examine the splined ends of the axle shafts. Remove any roughness or burrs with a file or stone. Examine the shafts for straightness, cracks or other damage. Replace if necessary. Make sure splines on axle match splines on NoSPIN differential side gear.

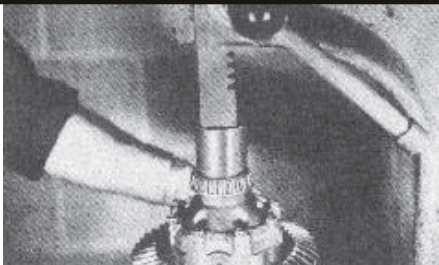
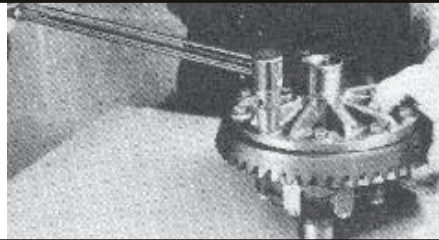


Step 8

If shims are used behind the bearing cone assemblies, measure the NoSPIN differential support case from the ring gear flange face to the nearest bearing shoulder and from one bearing shoulder to the other. Adjust the shim pack at each bearing journal to the dimension recorded previously from the original differential case.

Step 9

Using a torque wrench, bolt the ring gear to the NoSPIN differential and case assembly. Tighten the ring gear bolts securely to the torque limit recommended by the vehicle/axle manufacturer.

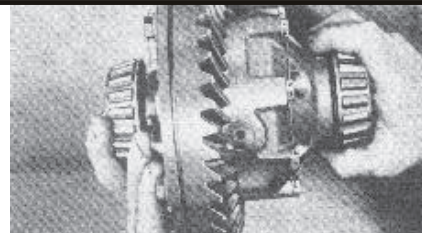


Step 10

Using an Arbor press with an arbor of the correct size, press the bearing cone and roller assemblies onto the hubs of the NoSPIN differential support case until they are properly and squarely seated.

Step 11

Install the differential and ring gear assembly in the axle housing. Complete the reassembly of associated components as recommended by the vehicle/axle manufacturer's instructions. Note: Contamination, such as metal particles in the differential case, can cause the differential to malfunction. Be sure the axle housing is clean before Proceeding.



Step 12

Refill the axle housing with lubricant recommended for differentials by the vehicle/axle manufacturer.

Step 13

Apply Caution Label to instrument panel in full view of operator or mechanic. If you did not receive this label, contact Tractech's Marketing Department.

Step 14

Follow the test procedures outlined on page 12 to assure proper installation and operation of the NoSPIN differential.

NOTE: if the NoSPIN differential is disassembled, be sure to reassemble both clutch assemblies to the spider assembly with the 'slot' in each holdout ring over the long tooth of the spider.

TEST FOR PROPER INSTALLATION AND OPERATION

INSTALLATION TEST

Step 1

With the engine turned off, raise NoSPIN equipped driving axle(s) until all wheels are out of contact with any surface. Place the transmission in gear or park so that the driveshaft is locked and does not rotate.

NOTE: Test for forward disengagement:

Step 2

With two people, rotate both wheels rearward, as far as possible to lock both wheels.

Step 3

With the left wheel securely held in the rearward direction, rotate the right wheel slowly forward. A faint indexing or clicking sound should be heard as the NoSPIN disengages on the right side.

Step 4

With the right wheel slowly rotating forward, the left wheel should be rotated slightly forward. This will lock both wheels.

Step 5

Again, rotate both wheels rearward, as far as possible to lock both wheels.

Step 6

With the right wheel securely held in the rearward direction, rotate the left wheel slowly forward. A faint indexing or clicking sound should be heard as the NoSPIN is disengaged on the left side.

Step 7

With the left wheel slowly rotating forward, the right wheel should be rotated slightly forward. This will lock both wheels.

Repeat steps 2-7 except, test for *reverse disengagement*. If the above steps are completed successfully and rotating wheels disengage easily by hand, rotate freely and evenly, lock both wheels when required, and produce a faint indexing or clicking sound, then the NoSPIN is properly installed and is functioning correctly.

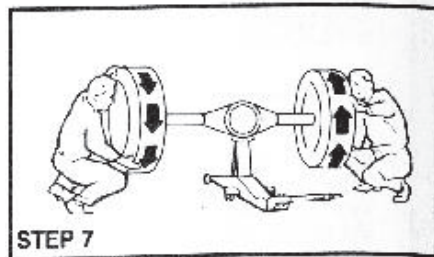
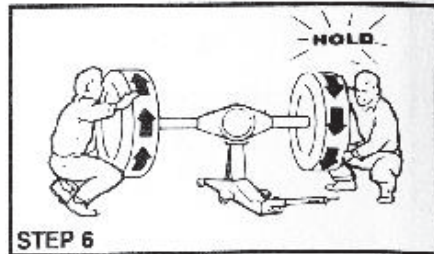
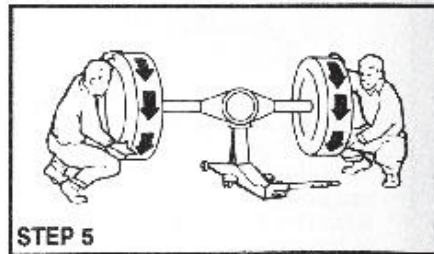
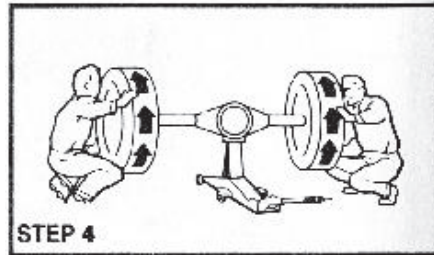
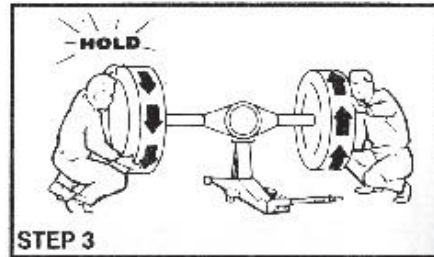
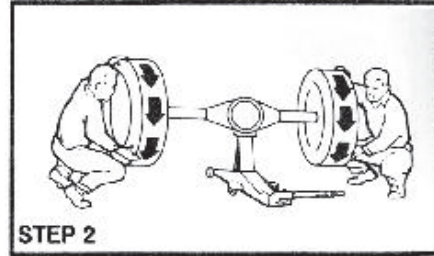
IF EITHER WHEEL DOES NOT ROTATE FREELY IN EITHER DIRECTION or does not lock both wheels as required, recheck the installation of the NoSPIN in the axle. Also check hand and foot brakes for possible drag caused by improper adjustment. Be sure that all thrust washers have been removed from the standard differential support case.

To check normal NoSPIN operation, drive the vehicle on a flat surface with good traction, in a right or left circle in forward and reverse to be sure that the outside wheel is free to overrun (i.e. that the outside tire does not scuff). A clicking or indexing sound may be heard. The sound of gear re-engagement may also be heard upon completion of the turn. This is normal.

OPERATION TEST

Check to see that both wheels of each NoSPIN differential equipped axle are driving. Make this test under load, so that engine torque is applied through the NoSPIN differential with the wheels on the ground. One way to achieve this load is to drive up against a solid obstruction (on loose dirt or gravel, if possible) and attempt to spin both wheels together. Perform this test in forward and reverse. (Exercise caution when performing this test to avoid damage to vehicle or obstruction.)

CAUTION: DO NOT OPERATE THE VEHICLE IF BOTH WHEELS OF A NoSPIN/DETROIT LOCKER EQUIPPED AXLE ARE NOT DRIVING. POWER TO ONLY ONE WHEEL CAN CAUSE SERIOUS STEERING PROBLEMS AND LOSS OF VEHICLE CONTROL AND RESULT IN A MISHAP WHICH CAN CAUSE PROPERTY DAMAGE, INJURY, EVEN DEATH.



MAINTENANCE

Caution:

When servicing any driveline components of a NoSPIN differential equipped axle, ensure that the engine is switched off and all wheels are free of the ground to prevent the vehicle from moving. Axles equipped with NoSPIN/Detroit Locker differentials deliver power to both wheels - even when only one wheel is on the ground. Failure to observe these cautionary measures may cause the vehicle to move which can result in a mishap which can cause property damage, personal injury, even death.

Caution Label:

Vehicles equipped with NoSPIN differentials should be identified by a Caution label mounted on the instrument panel.

Lubrication:

All NoSPIN differentials are designed to operate in those lubricants recommended by the vehicle/axle manufacturer. No special lubricant is needed. For very cold weather applications, use the lightest oil the axle manufacturer will allow to overcome possible sluggish re-engagement of the driven clutch assemblies.

Routine Inspection

Carefully follow the recommended lubrication, preventative maintenance and inspection procedures of the vehicle/axle manufacturer as part of all NoSPIN differential preventative maintenance. Except for testing for proper operation, and a possible change in the way brake adjustments are made (as explained below), maintenance, inspection and lubrication requirements of NoSPIN differential equipped vehicles are the same as for vehicles with standard differentials.

Check for Proper Operation of NoSPIN Differential

At 90 day intervals, the drive axles should be raised and the NoSPIN differential checked (see page 12) to be sure it is operating properly. This test will also determine if both axle shafts are intact.

Adjustments

No adjustments or alterations should be made to the NoSPIN differential. Refer to the vehicle/axle manufacturer's instructions for adjustments to other components in the axle. When making brake adjustments, the wheels on both sides of the vehicle must be raised and the transmission placed in neutral so that the ring gear and opposite wheels are free to rotate with the wheels on the side being adjusted.

Servicing NoSPIN Differentials

Any decision to disassemble the axle for inspection should be made only after performing the installation and operation tests stated on page 12 and after consulting the vehicle/axle manufacturer's manual and determining that the NoSPIN differential, or some other axle component, is not working properly. Review the "Trouble shooting" section on pages 17-18 to determine whether the situation requires removal of the NoSPIN differential from the vehicle.

Removal of the NoSPIN Differential From the Axle

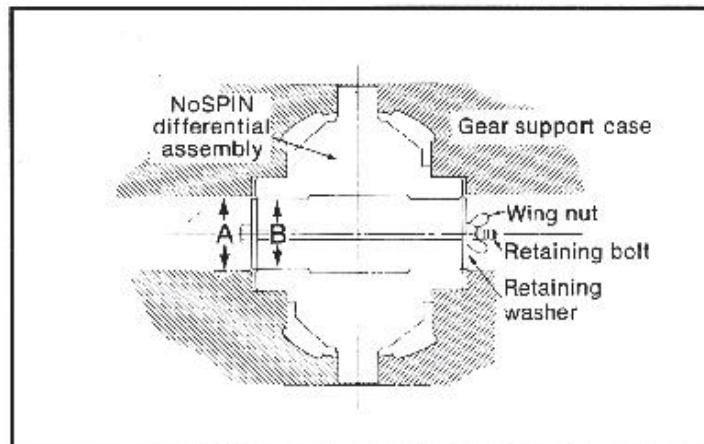
Refer to the vehicle/axle manufacturer's instructions. The procedure for removing the NoSPIN differential case and ring gear assembly is the same as for the original differential. It is not necessary to remove the ring gear from the differential case half unless the standard support case is being replaced or the NoSPIN differential was supplied with a case manufactured by Tractech.

Retaining Bolt

A retaining bolt, washers and wing nut are useful to keep the NoSPIN differential assembly intact when removing it from the differential case and when reinstalling it in the axle housing.

CAUTION:

FAILURE TO USE A RETAINING BOLT OR SOME OTHER RESTRAINING MEANS WHEN SEPARATING THE DIFFERENTIAL CASE HALVES CAN CAUSE INJURY IN THAT NoSPIN DIFFERENTIALS HAVE COMPRESSED SPRINGS.



The bolt washers and wing nut used to retain the NoSPIN differential assembly when it was shipped from the factory as illustrated on page 13, are best for this purpose. You will note that the retaining washers must be small enough to pass through the case ends (dimension "A"), yet large enough to restrain the two side gears (dimension "B") and the balance of the NoSPIN differential assembly when all parts are assembled and the springs are compressed.

Disassembly of the NoSPIN Differential

1. Mark the differential case halves so they can be reassembled in their original position when repair or inspection is completed.
2. Insert the NoSPIN differential retaining bolt and washer assembly. Thread the nut fingertight against the washer (Fig 3) If a retaining bolt and washer assembly are not available, *hold the differential case firmly as the last bolts are being removed from the case halves to absorb spring pressure and prevent possible injury.*

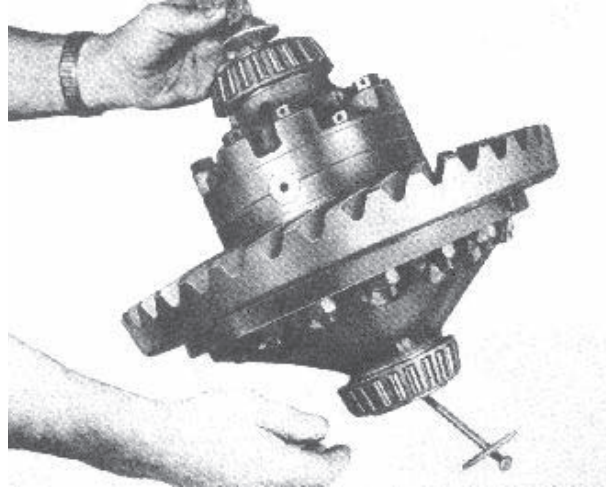


Fig. 3

3. Separate the case halves and remove the NoSPIN differential assembly.
4. Release the retaining bolt and washer assembly while firmly holding the NoSPIN differential to absorb the spring pressure.
5. Remove side gears, springs, spring retainers, driven clutch assemblies and spider assembly.

Inspection of Components

1. Wash all components thoroughly with a non-flammable solvent that will not etch, scratch or oxidize the parts. Rinse in clean solvent and dry.

2. Inspect the splines on the driven clutches. Remove any burrs or small chips with an abrasive stone or electric burr grinder. If sections of the spline are broken away, replace the components.

Inspect the teeth on the driven clutches. If wear or chipping is present, replace the component. *Check holdout rings for fractures and chipping or excessive wear of the lugs. Replace as required.*

NOTE: The holdout ring and driven clutch are serviced as an assembly.

3. Inspect the teeth on the spider and center cam. If wear or chipping is present, replace the component. *Check the center cam for free movement.*

NOTE: The spider and center cam are serviced as an assembly.

4. Inspect the splines on the side gears. Remove any burrs or small chips. If splines are broken or badly chipped, or if hub walls are fractured, replace the component. Inspect the side gear spline fit on its mating axle shaft. Be sure the splines do not bind.

5. Check the spring load at the operating height. (See chart on page 16)

6. Carefully examine the differential case. If worn or scored, the case should be replaced.

7. Examine the bearings, ring gear, ring gear bolts and nuts. Replace if necessary with new components that meet the vehicle/axle manufacturer's specifications.

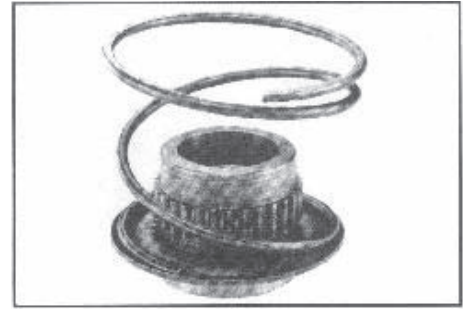
CAUTION:

If major components (e.g. spider assembly or driven clutch assemblies) show excessive wear, the complete NoSPIN differential should be replaced. If a component is replaced, mating components should also be replaced in that it is likely that they too are damaged. Use of worn or damaged components can lead to a recurrence of the original problem. NOTE: Use only Tractech approved components when repairing NoSPIN/Detroit Locker differentials.

Reassembly Procedure for NoSPIN Differentials

1. Assemble a spring retainer over the side gear splines with the retaining lip pointed up. It should seat against the side gear shoulder. Place a spring over the side gear spline and against the retainer lip with the smaller diameter of the spring against the retainer (Fig. 4).

Fig. 4



NOTE: Verify that the spring is functioning freely. Be sure the spring is not binding, that the coils do not overlap and that there is good contact between the coil and the spring retainer.

2. Assemble the two clutch assemblies to the spider assembly.

IMPORTANT:

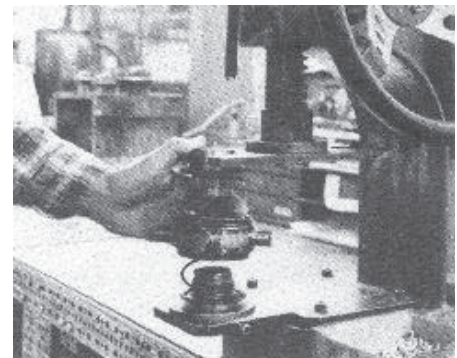
Be sure the 'slot' in each holdout ring is properly aligned over the long tooth of the spider assembly.

3. Position the spider assembly and clutch assembly on top of the spring.

4. Assemble the other retainer and spring on the other side gear as previously indicated, and position on top of the spider and clutch assembly.

5. Using a mechanical press (or other safe means) compress the springs and fasten the NoSPIN together with a retaining bolt, washers and wing nut (Fig. 5). Be sure the side gear splines are completely meshed with the clutch spline.

Fig. 5



CAUTION:

Failure to use a retaining bolt or some other restraining means when assembling the NoSPIN can cause injury in that all NoSPIN differentials have compressed springs.

6 Lay the ring gear and flanged half of the differential case on a bench with the bearing end of the case hub down and the inner case facing up. ENSURE NO THRUST WASHERS ARE INSIDE THE CASE.

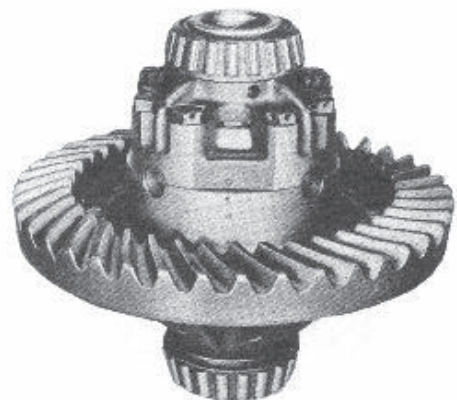
7. Install the NoSPIN differential in the flanged differential case half.

8. Mount the plain case half over the side gear. ENSURE NO THRUST WASHERS ARE INSIDE THE CASE.

9. Position the case halves firmly together with the punch marks aligned and install the case bolts.

10 Tighten case bolts to the torque specified by the vehicle/axle manufacturer. Check to be certain of a tight fit between the two case halves at all points and between the trunnion mounts in the case and the spider trunnions (Fig. 6).

Fig. 6



11. Remove the wing nut, washers and retainer bolt.

12. Follow the vehicle/axle manufacturer's instructions for reinstallation of the ring gear and differential case assembly into the axle carrier.

13. BEFORE OPERATING THE VEHICLE PERFORM INSTALLATION AND OPERATION TEST STATED ON PAGE 12 TO ENSURE CORRECT RE-ASSEMBLY OF COMPONENTS.

SPRING LOAD (in lbs. Minimum) AT OPERATING HEIGHT

Spring load should be checked at the operating height specified in the above table for an approximate reading. A dial indicator type spring tester is the best tool for this procedure. However, if one is not available, a weight equal to the load specified in the table can be placed on the spring and the height can be measured with the weight in place on the spring. Tech Data Report #80-1038 can be used to assist in making a decision as to whether the spring should be replaced.

Model Series	Part No.	Operating Height	Load (lbs. Minimum)
137S	69978	.45"	40
162S	69427	.54"	45
187S	68264	.61"	46
187S	69076	.61"	72
187S	72008	.61"	72
187S	72016	.61"	72
225S	66622	.73"	53
225S	69640	.73"	52
250S	67085	.62"	61
275S	67115	.86"	69
306S	66842	.90"	104
350S	67204	1.04"	101
400S	65461	1.41"	144
450S	64718	1.30"	162
550S	65423	1.43"	198
600S	68707	1.56"	297

TROUBLE SHOOTING

An important function of an owner/operator in the field is that, one of the many hats he is required to wear is the one labeled "trouble shooter." Trouble shooting can be a very frustrating, elusive job. However, if some basic rules are followed in a systematic order, solutions can be easily obtained. The following guidelines can be utilized for trouble shooting both on and off highway vehicle applications. However, some techniques used for on/highway vehicles are not as important for off/highway vehicles:

1. Before tearing down an axle and differential make sure you get the correct "story" from a reliable source. Then actually try the vehicle yourself, Inspect any previously remove components, Question associated failures, ask if it has occurred before. In other words, get the facts. And don't over-react.
2. Read the Trouble Shooting Section. (Enclosed)
3. Perform a Functional Check. (Enclosed)
4. Check tire rolling radii. Assure that all tires are within specifications. (This applies primarily to on/highway vehicles.)
5. If all the previous checks do not reveal the problem or offer a solution, then the NoSPIN must be removed. Upon removal, look for the following:
 - A. Contamination in the oil or on the components.
 - B. Obvious broken or worn parts.
 - C. Mis-assembly...i.e., retainers installed backwards, thrust washers left in, spring jumping over retainer, etc.
 - D. Heavy wear on spider and clutch drive teeth... i.e., Tooth rounding, 5° negative angle gone, corner chipping of teeth. (These components are usually the main areas of wear.)
 - E. Telltale signs of eccentric wear, patterns on components, indicating possible cause of shaft problems.
 - F. Check NoSPIN assembly for pair-up, hand cam, H.O.R. tension, backlash, etc.
6. After inspection of the NoSPIN and associated axle components a new unit should be installed and a complete functional check and vehicle performance check should be made.
7. If during the visual inspection a solution to the problem is not obtained, the unit should be returned to Tractech attention of the Customer Services Manager. Call first for a return authorization number.

The following chart will assist owners and operators of NoSPIN differential equipped vehicles diagnose and correct problems related to vehicle performance. Potential problems are stated on the left; possible causes for those problems are listed, by number, on the right. The explanation of these "possible causes" follows on page 18.

PROBLEM	POSSIBLE CAUSE															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hub studs shearing; rear tire scuffing; axle shaft breakage	●	●			●			●	●						●	
Steering difficulty; vehicle pulls on straight forward driving or tends to go straight when making turns	●	●	●	●	●		●		●					●	●	
No differential action; binding in turns	●			●	●	●			●						●	●
Excessive driveline noise*	●	●	●	●	●		●		●						●	
Excessive tire wear	●	●	●	●	●	●	●								●	●
Grinding noises	●			●	●			●	●	●					●	
Continuous "clicking" sound in straight forward driving	●	●	●		●											
Excessive backlash in vehicle drivetrain; engine lug or vehicle surge during turns	●					●		●		●						
Tendency to side-slip or "fishtail" on icy roads											●					
Sluggish reengagement of NoSPIN differential clutch assemblies									●			●				
Difficulty in turning vehicle from standing start	●			●	●									●	●	
Erratic operation of NoSPIN differential; premature wear or failure of NoSPIN differential components	●	●	●	●	●			●	●	●		●			●	

TROUBLE SHOOTING

* NOTE: NoSPIN differentials will emit occasional "metallic" sounds due to backlash built into the unit. This is normal! See backlash under Vehicle Performance on pages 4.

Possible Causes for Vehicular Problems

1. Improper installation; defective NoSPIN differential. Follow test procedures outlined on page 12 Correct installation or repair or replace the NoSPIN differential if the vehicle fails any step of the test procedure
2. Overloading and/or improper weight distribution. Remove excess weight and redistribute the load from side to side, according to the vehicle/axle manufacturer's instructions.
3. Unequal rolling radii of the drive wheel. A smaller rolling radius tire will cause the tire to overrun constantly when power is applied. The other tire (with the larger rolling radii) will do all the driving replace tires or adjust tire pressures until rolling radii are equal.
4. Broken axle shaft. Replace. NOTE: It is possible to operate a NoSPIN equipped vehicle on one axle shaft. However, this practice is not recommended in that serious damage can occur to other axle components.
5. Bent axle shaft or housing; axle shafts on different center lines. Replace bent axle shafts or housing or realign hub faces and bolt circles in both the differential carrier and axle housing.
6. Larger than normal steering angle; short turning radius. Vehicles designed with high turning angles may surge, have steering difficulty and cause tire wear during sharp turns. Reduce maximum turning angle and have the driver decelerate when engine surge begins.
7. Incorrect wheel alignment. Correct as required.
8. Worn or defective axle components. Check the condition of the ring gear, pinion gear, bearings, seals, etc. Replace as required.
9. Foreign matter in axle housing or improper assembly of axle components. Inspect for contamination. Check assembly of axle components.
10. Incorrect ring and pinion adjustments; worn driveline components (transmission gears, U-joints, etc). Replace or adjust components as required.
- 11 High crown in road; poor traction surface under all drive wheels. The tendency to side-slip or "fishtail" on icy roads sloping toward the curb is more pronounced when using a traction differential than when using a conventional differential. Stability can be retained when side-slip occurs by decelerating (letting off the accelerator). CAUTION: Do not apply the brake. To do so may result in loss of vehicle control.
- 12 High Viscosity Lubricant. In very low temperatures, gear lubricant can thicken and impede the normal function of the NoSPIN differential. Tractech recommends that the axle oil be changed for very cold weather operation to the lightest acceptable lubricant allowable by the axle/vehicle manufacturer Heat control devices, garaging and a warm up period may also provide relief from this problem in extreme low temperatures.
- 13 Low steering cylinder pressure, undersized steering cylinder, excessive angle of articulation, excessive vehicle weight. Correct as required.
- 14 Improper application of product. Review application guidelines on pages 3.
- 15 Insufficient front axle overrun ratio (lead) for (arm tractors (straight frame with front wheel assist power) Take physical measurement, increase to minimum of plus three (+3) percent by increasing tire pressure in front tires and/or reducing tire pressure in rear tires, within the tire manufacturer's recommendations.

NEW IMPROVED DETROIT LOCKER DIFFERENTIAL

SPECIAL INSTRUCTIONS

TO IDENTIFY

New IMPROVED Detroit Locker differential models in the 187S and 225S series' have an "L" added to the model number, such as 187SL-16A. They replace the previous model.

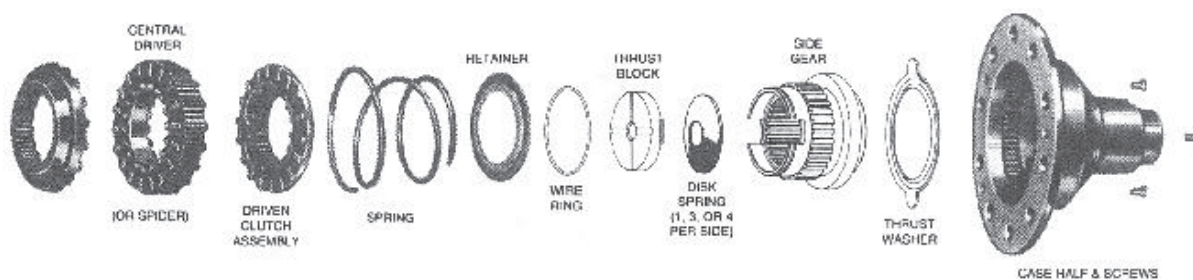
APPLICATIONS

These units are designed for light trucks including 2 wheel drive and 4 wheel drive vehicles and high performance passenger cars.

VEHICLE PERFORMANCE

Performance is similar to that of NoSPIN/Detroit Locker - equipped light trucks, pages 3-4. The new IMPROVED Detroit Locker operates in the drive - coast mode without the familiar harsh feel and sound. Everyday driving is quieter and smoother, yet maximum traction is immediately available.

EXPLODED VIEW



Note the additional parts compared to NoSPIN/Detroit locker differentials, page 5. New IMPROVED Detroit Locker models are supplied with either a spider or central driver and a support case.

OPERATION

Operation is identical to that of NoSPIN/Detroit Locker - equipped vehicles, page 6.

INSTALLATION

Installation of a new IMPROVED Detroit Locker is similar to that of a NoSPIN/Detroit Locker differential, pages 7, 10 and 11. Important: Thrust washers are supplied installed inside the support case. The instructions on pages 8, 12 and 15 to "Be sure all thrust washers have been removed" DOES NOT APPLY to the two thrust washers supplied with the new IMPROVED Detroit Locker models.

Caution: If for any reason the thrust washers supplied have been removed from the support case halves supplied, reinstall only the two thrust washers supplied by Tractech by locating the tabs in slots, with the oil groove facing you.

Caution: If for any reason the new IMPROVED Detroit Locker unit is disassembled, reinstall the disc (Belleville) springs - there will be one, three or four on each side - with the large diameter against the side gear.

Be sure to install the Caution label and this Manual in the vehicle.

TEST FOR PROPER INSTALLATION AND OPERATION

Perform this test as described on page 12.

MAINTENANCE

Follow the instructions and cautions as described on pages 13-16 except that the instruction on page 16 to "Be sure all thrust washers have been removed" DOES NOT APPLY to the thrust washers supplied with the new IMPROVED Detroit Locker models.

TROUBLE SHOOTING

The help provided on pages 17-18 apply to the new IMPROVED Detroit Locker differential.

NEW Detroit C-LOCKER™ DIFFERENTIAL

SPECIAL INSTRUCTIONS

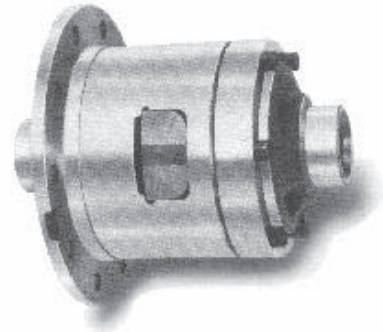
Detroit Lockers for C-Clip retained axles in the 187 and 225 series have a "C" instead of an "S" in their model number, such as 187C-145A.

APPLICATIONS

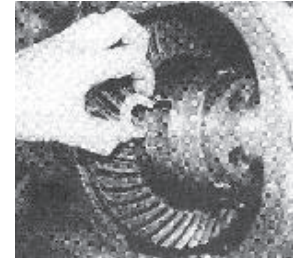
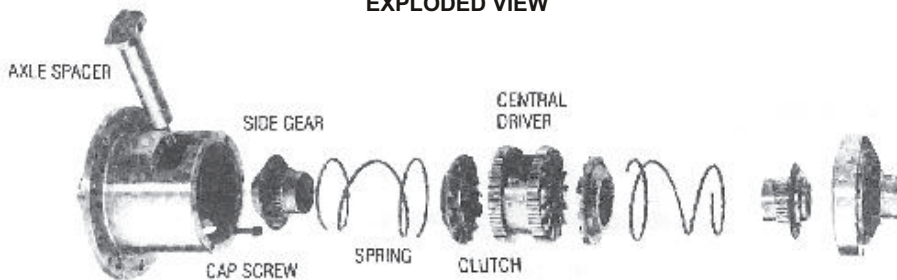
These units are designed for light trucks including 2-wheel-drive and four-wheel-drive vehicles, and high performance passenger cars.

VEHICLE PERFORMANCE

Performance is identical to that of NoSPIN/Detroit Locker - equipped vehicles, page 4.



EXPLODED VIEW



C-Clip Installation

OPERATION

Operation is identical to that of NoSPIN/Detroit Locker - equipped vehicles, page 6.

INSTALLATION

Installation of a Detroit C-Locker for differential is similar to that of a Detroit Locker differential, pages 7-11 up to Step 11. The following steps must be carried-out before proceeding to Step 12.

Step 11a Install the differential and ring gear assembly in the axle, setting pre-loaded and backlash per the vehicle manufacturers instructions. Note: Contamination, such as metal particles in the differential case, can cause the differential to malfunction. Be sure the axle housing is clean before proceeding.

Step 11b Install the C-Clip as in the conventional differential utilizing the window in the side of the differential case.

Step 11c If the plain side (the side opposite the ring-gear side) bearing cap has already been installed, it will be necessary to remove it before proceeding.

Step 11d Install the spacer pin (in plastic bag) through the case and between the ends of the axle shafts.

Step 11e Insert the long socket-head cap screw (in plastic bag) through the differential plain-side cover and thread into differential housing. The end of the screw will engage the hole in the spacer pin thus holding it in place. Torque the screw to 23-25 ft.-lbs. (31-34Nm). Note: this screw has a thread locking patch pre-applied to it. If for any reason it is removed after installation, a thread locking compound must be re-applied before reassembly.

Step 11f Install the plain-side bearing cap and torque per the vehicle manufacturer's instructions. Bearing cap bolts must have a thread locking compound applied to them.

Step 11g Complete the reassembly of the associated components as recommended by the vehicle manufacturer's instructions.

Complete Steps 12, 13, and 14 on page 9. Be sure to install Caution Label and this Manual in the vehicle.

TEST FOR PROPER INSTALLATION AND OPERATION

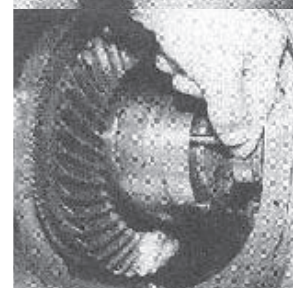
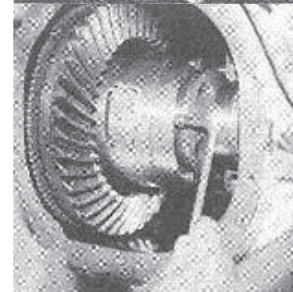
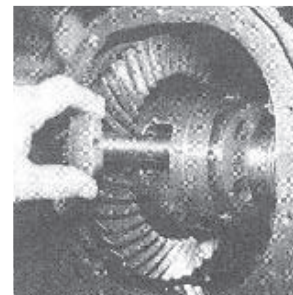
Perform this test as described on page 12.

MAINTENANCE

Follow the Instruction and Cautions as described on pages 13-16.

TROUBLE SHOOTING

The help provided on pages 17-18 apply to the Detroit C-Locker for C-Clip retained axles.



GLOSSARY

ARTICULATED - Refers to vehicles that are joined in the middle and turn around this joint, as in "articulated farm tractor."

AXLE CARRIER - The differential and ring and pinion gears are mounted on the axle carrier; the "center section" of the axle housing.

AXLE GEAR RATIO -The ratio between the number of teeth on the ring gear and the number of teeth on the pinion gear (e.g., 3.92:1.00).

AXLE HOUSING -The support member of the axle which sustains the weight of the vehicle and houses the axle carrier assembly.

BACKLASH - The designed clearance between mating components in the driveline (e.g., Gear sets, spline couplings, etc.).

CASE ASSEMBLY - The differential housing (usually consisting of two case halves; contains the differential assembly).

CASE BEARING (CARRIER BEARING) -The bearings that mount to the hubs on the differential support case.

CASE PILOT BORE - The locating diameter in the differential case from which the differential side gear is installed.

CENTER CAM - The control element of the NoSPIN differential. The center cam is used to lift the drive members from engagement by means of cam ramps.

CENTRAL DRIVER - An outer splined member (similar to the spider) having torque carrying teeth on both sides; the "center piece" of the NoSPIN differential.

CLUTCH PACK DIFFERENTIAL - A limited-slip differential which uses friction clutch plates and/or springs to partially reduce wheel spin.

DETROIT LOCKER DIFFERENTIAL - Trademark given to "light duty" NoSPIN differentials. (NoSPIN and Detroit Locker are operationally identical.) Manufactured by Tractech.

DIFFERENTIAL - Axle gear assembly which allows one axle shaft and wheel to turn slower or faster than the other when negotiating a turn.

DIFFERENTIATION - The different rate of speed between two wheels of an axle when making a turn or over uneven surfaces.

DRIVELINE - Components used to propel the vehicle driveshaft and universal joints, transmitting torque from transmission to drive axle (same as drivetrain).

DRIVEN CLUTCH - Member that is used to provide torque to another member, such as to the side gear. Each NoSPIN differential has two driven clutches.

DRIVETRAIN - A series of components which transmit power from the engine to the wheels/tires (i.e., transmission, propeller shafts, transfer case, axle, differential, shafts, etc.).

DOUBLE REDUCTION - Dual gear reduction used in rear axles.

FISHTAILING - Side slipping of the vehicle caused by traction instability.

G.C.W. - Gross Combination Weight. G.V.W. plus vehicle weight and payload of towed vehicle. G.V.W. - Gross Vehicle Weight. Total weight of vehicle and payload.

GEAR SUPPORT CASE - Case used to support the differential. Same as case assembly.

GROUND COEFFICIENT-The horizontal force required to move a body, divided by the weight of the body. The amount of friction at the ground; the "quality" of the ground surface (e.g., ice, snow, dirt, etc.).

HELICAL - "Angled" gear tooth form.

HOLDOUT RING - Ring which assembles to NoSPIN differential clutch; maintains clutch disengagement in a turning mode.

INDEXING - A passing of one member over another, causing a slight audible sound from their contact (usually associated with NoSPIN differential).

INPUT TORQUE- Measurement of available power.

LEAD RATIO - On unequal wheeled four wheel drive tractors the transmission is so geared that any difference in road speed of the two axles results in a faster speed for the front wheels (lead or overrun), this prevents the front wheels from being pushed.

LIMITED-SLIP DIFFERENTIAL - A differential which utilizes some means of partially reducing, but not totally eliminating, individual wheel spin (e.g., clutches, springs, biasing pinion gears, etc.).

LOCKING DIFFERENTIAL- A differential that provides a locked axle condition. Can be manual or automatic, as in hydraulic locking differential or NoSPIN differential.

MACHINED SPLINES - Splines that have been manufactured by shaping, hobbing, broaching, or slotting.

NoSPIN DIFFERENTIAL -Trademark of automatic, positive-locking differential. Manufactured by Tractech.

OVERRUN RATIO - On unequal wheeled four wheel drive tractors the transmission is so geared that any difference in road speed of the two axles results in a faster speed for the front wheels (overrun or lead), this prevents the front wheels from being pushed.

PARALLEL SPLINES - Series of parallel keys cut along the axle shaft which mate with corresponding slots in the differential side gear.

PAYLOAD - Actual weight of useful cargo carried by vehicle.

PINION (INPUT) GEAR - The gear that is directly connected to the driveshaft which propels the differential and ring gear and provides power to the axle.

PLANETARY AXLE - Axle having a gearset arrangement in a concentric pattern; consisting of a sun gear surrounded by pinion gears which mesh with an annulus ring gear. This gearset provides torque multiplication in a reduced area on the same center line as the axle shaft usually located on the hub ends of axle.

PRE-LOAD - Differential bearing adjustment achieved by adding or subtracting shims.

R.P.M. - Revolutions Per Minute. Term used to define rotation.

RING GEAR - The gear that is attached to the differential case and driven by the pinion gear.

ROLLED SPLINES - Splines that are manufactured by use of rolling dies to form the spline configuration.

SHIM - "Spacer" used to achieve differential bearing adjustment.

SIDE GEAR - The gear that is mounted in the differential case; has the axle shaft splined to it; driven by the pinion gear.

SINGLE SPEED - Axle or transfer case having a single gear ratio.

SHOCKLOAD - A force caused by sudden impact.

SPIDER -The "center piece" of a standard, clutch pack or NoSPIN differential; having a spider-like shape.

SPIDER CROSS - Two or four armed member used to mount the standard differential pinion gears.

SPIDER GEAR(S) - Bevel pinion gears that are mounted on spider cross that drive the side gears of standard or clutch type differentials.

SPLINES - "Teeth" on axles that mate with "teeth" (splines) on differential side gear.

SNAP RING - A circular expandable ring that is used to retain two members together, as the snap ring in a NoSPIN differential that retains the spider and center cam.

STANDARD DIFFERENTIAL - Open or conventional differential with no means of traction control.

TAG AXLE (TANDEM) - Non-powered rear axle which follows drive axle. Provides additional load carrying capacity and distribution.

TAPERED SPLINES - Cone shaped spline configuration.

THRUST BLOCKS - Support mechanism used to prevent ring and pinion gear deflection.

THRUST WASHER - Used in conventional differential to reduce wear to the support case.

TORQUE - Force having a twisting or turning effect. Also used in conjunction with the term "power."

TRUNNION - Journals allowing pivoting or turning, such as on a spider cross. On a NoSPIN differential, the arm (there are four) which supports the differential in the case assembly.

TWO-SPEED - Axle or transfer case having two selective gear ratios.

UNDERSTEER - The condition of steering when making a turn that causes the vehicle to go straight rather than turn freely.

WHEELBASE - Distance between center lines of front and rear axles or to the center line of tandem axles.

TRACTECH DIFFERENTIAL LIMITED WARRANTY, AND LIMITATIONS

Tractech (TRACTECH) expressly warrants each TRACTECH product or part to be free from defects in materials and workmanship under NORMAL USE AND SERVICE.

A. Differentials

1. In new vehicles

a. For licensed vehicles, when not used in competition of any type, for the lesser of: 1) the same period (of time, mileage or hours of use) as the other drive axle parts are warranted by the axle manufacturer in that vehicle or 2) one year from date of delivery or 100,000 miles of differential use by the first user; or

b. For non-licensed vehicles, for the same period (of time, mileage or hours of use) as the other drive axle parts are warranted by the axle manufacturer in that vehicle.

2. In used vehicles

a. For licensed vehicles, when not used in competition of any type, for the earlier of 100,000 miles of differential use or one year from the date of delivery to the first user; or

b. For non-licensed vehicles, for the same period (of time, mileage, or hours of use) remaining, if any, as the other drive axle parts are warranted by the axle manufacturer in the vehicle.

3. For vehicles used in competition of any type, for 30 days from the date of delivery to the first user.

B. Clutches and Brakes For six (6) months from date of delivery.

There exist specific MANUALS for each TRACTECH differential indicating the appropriate application, operation inspection and maintenance criteria. IT IS MOST IMPORTANT THAT ANY SELECTOR, PURCHASER, INSTALLER, MAINTAINER OR USER CAREFULLY READ the relevant MANUAL before any application is selected or any operation or maintenance is attempted.

Also TRACTECH strongly encourages each designer, prospective customer or user to submit an application approval request using TRACTECH Differential Application form 7003, Clutch Application form 3003, or Brake Application form 8003 as applicable.

NORMAL USE AND SERVICE means that:

A. The product or part will be applied, installed, operated, inspected and maintained in accordance with the TRACTECH Operation and Maintenance Manual, and Owner's Manuals for the specific product;

B. The maintenance of the product must meet or exceed the level specified by the vehicle or equipment manufacturer for the TRACTECH product or similar product; and

C. The product will be applied and operated within the boundaries of any written TRACTECH APPLICATION APPROVAL by the TRACTECH Engineering Department.

EXCLUSIONS

THE FOREGOING WARRANTY IS EXCLUSIVE, AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED (WHETHER ORAL OR WRITTEN), INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. No person, including any dealer or representative of TRACTECH, except the President of TRACTECH, is authorized to make any representation or warranty concerning TRACTECH products on behalf of TRACTECH or to assume for TRACTECH any obligation not contained in this warranty, including a warranty of fitness for any particular purpose. This warranty gives you specific legal rights and you may also have other rights which vary from state to state. ANY IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, TO THE EXTENT THE SAME CANNOT BE DISCLAIMED UNDER APPLICABLE LAW ARE LIMITED IN DURATION TO THE EXPRESS WARRANTIES SET FORTH ABOVE EXCEPT IN THOSE STATES THAT DO NOT ALLOW TIME LIMITATIONS ON IMPLIED WARRANTIES. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY PURPOSE WHEN THE PRODUCT IS PUT TO AN INDUSTRIAL, COMMERCIAL OR RENTAL USE.

In no event does any warranty, express or implied, apply to loss, harm or damage to the extent caused by any or all of the following; wear to or failure of other drive train parts; freight damage; use of components, parts and/or accessories not obtained from or approved by TRACTECH or which do not meet TRACTECH quality and performance specifications; improper installation, maintenance, repair, misuse, or abuse, normal wear of moving parts or components affected by moving parts; and/or unauthorized alterations or Modifications.

TRACTECH SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES (i.e. Broken ring & pinion, axles, bearings, differential covers, towing & labor charges) OR EXPENSE ARISING DIRECTLY OR INDIRECTLY FROM A DEFECT IN PRODUCTS MANUFACTURED OR SOLD BY IT OR FROM THE USE OF ANY SUCH DEFECTIVE PRODUCT, INCLUDING BUT NOT LIMITED TO DAMAGES, EXCEPT TO THE EXTENT THAT EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES IS PROHIBITED BY APPLICABLE LAW.

TRACTECH RESERVES THE RIGHT TO MAKE CHANGES IN DESIGN AND OTHER CHANGES, MODIFICATIONS, ALTERATIONS OR IMPROVEMENTS TO ANY OF ITS PRODUCTS WITHOUT THERE RESULTING ANY OBLIGATION UPON TRACTECH TO FURNISH OR INSTALL THE SAME UPON ANY PRODUCTS PREVIOUSLY SOLD AND DELIVERED OR PRODUCTS THEN IN PROCESS, MANUFACTURE OR DISTRIBUTION.

LIMITATION OF REMEDIES

At TRACTECH'S option, TRACTECH will credit the buyer's account for the purchase price of, or repair or replace without charge for materials, any TRACTECH product that failed within the warranty period that is finally determined by TRACTECH to have been defective in material or workmanship.

Any suit or action arising out of or relating to this Warranty, or the breach thereof, must be commenced within one (1) year after the cause of action has accrued. The foregoing shall not limit the time within which any suit or action must be brought to collect an amount agreed to be paid by the buyer or to enforce a judgement for or to collect any such amount.

It is expressly agreed that the liability of TRACTECH is limited, and TRACTECH does not function as an insurer. All buyers of TRACTECH products waive subrogation on all claims covered under their own or any other insurance.

If TRACTECH should be found liable to anyone on any theory (except breach of any express warranty, where the exclusive remedy is as set forth above), the liability of TRACTECH shall not exceed the purchase price of the involved TRACTECH product (or service) when sold (or when service is performed) by TRACTECH to the first buyer. THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER REMEDIES, EXPRESS OR IMPLIED, regardless of theory, cause or origin of any loss, harm or damage resulting directly or indirectly to any person, organization, entity or property, including without limitation: the performance or non-performance of any obligation set forth in this Warranty; breach of any agreement (oral or written including specifications) between TRACTECH and its customer or the buyer; negligence, active, passive or otherwise, of TRACTECH or any of its distributors, agents or employees; breach of any warranty or covenant implied or imposed by law; misrepresentation; and/or strict liability.

The sole purpose of the stipulated exclusive remedies shall be to provide the buyer with a credit or replacement for, or the repair of, defective products or services in the manner provided herein. The exclusive remedies shall not be deemed to have failed of their essential purpose so long as TRACTECH is willing to credit the buyer's account for the purchase price of, provided replacement for, or repair, the defective products or services in the manner prescribed herein.

ADJUSTMENTS

When adjustment is sought under this Warranty, a claim should be made within six (6) months of the date of failure, as follows:

A. Users in North America

1. If the product or part was purchased installed by the original equipment manufacturer (or its dealer), follow the manufacturer's procedures for warranty claims; or

2. If the product or part was purchased through a distributor of TRACTECH products, have the distributor write or phone TRACTECH Customer Service Department and ask for an Authorization to Return Material number. Supply the distributor with all requested information. Have the distributor ship the entire product (freight prepaid) to our Warren, Michigan factory. Evaluation of claims take 4-6 weeks from the time the unit is received.

B. OEM's in North America Contact TRACTECH to receive a written Authorization to Return Material with number.

Then return material to TRACTECH (freight prepaid) and include a copy of Authorization to Return Material and reason for return.

NOTE: At the option of TRACTECH, material may not need to be returned, but written confirmation must be obtained prior to TRACTECH'S approval of a credit memo.

C. Outside North America

Follow the procedure in Paragraph A or B immediately above but do not return product or part. You will be contacted regarding your claim.



Automatic Positive Locking Traction Differential

OWNER'S MANUAL

Warnings & Precautions

Mechanic:

Any increase in the size of the vehicle's engine, tires, weight, etc., may prohibit use of a NoSPIN/Detroit Locker differential in a heretofore approved application. Any such modifications should be reviewed by Tractech Engineering before continuing to use the product.

Do not use heat to disassemble drive axles. To do so can destroy heat treat properties and weaken or distort axle components.

Turn the engine off and raise all driving wheels of a NoSPIN/Detroit Locker differential equipped axle when servicing wheels, brakes, axles or tires to prevent the vehicle from moving. Axles equipped with NoSPIN/Detroit Locker differentials deliver power to both wheels - even when only one wheel is on the ground.

NoSPIN/Detroit Locker differentials have compressed springs. Use a retaining bolt or some other restraining means when separating the differential case halves. (See pages 13-14) Do not lift the heavier (75 lbs. or over) units by the retaining bolt, as the washers may collapse or the threads may strip.

When repairing NoSPIN/Detroit Locker differentials, if major components show excessive wear, the complete differential should be replaced. If a component is replaced, mating components should also be replaced in that it is likely that they too are damaged. Use of worn or damaged components can lead to a recurrence of the original problem. (See page 15) Note: Use only Tractech approved components when repairing NoSPIN/Detroit Locker differentials.

Operator:

All NoSPIN/Detroit Locker differential equipped vehicles must be identified by a Caution Label, mounted on the instrument panel. Contact Tractech if this label was not received.

Do not operate the vehicle if both wheels of a NoSPIN/Detroit Locker differential equipped axle are not driving. Power to only one wheel can cause serious steering problems. Perform the installation and operation tests illustrated on page 12 before putting the vehicle into service.

Use extreme caution when accelerating or decelerating on slippery or unstable surfaces. Vehicles/axles equipped with traction differentials are inherently more sensitive to side-slip.

Distribute the load evenly side-to-side; do not exceed the vehicle's rated payload capacity; keep the diameter of the tires equal. Failure to observe these measures can create a difference in individual wheel speeds which can cause the NoSPIN/Detroit Locker differential to deliver power to only one side of the vehicle and thus cause steering problems.

Turn the engine off and raise all driving wheels of a NoSPIN/Detroit Locker differential equipped axle when changing tires to prevent the vehicle from moving. Axles equipped with NoSPIN/Detroit Locker differentials deliver power to both wheels - even when only one wheel is on the ground.

Operate in low gear when coasting downhill into a turn. Braking capacity is reduced when a NoSPIN/Detroit Locker differential equipped vehicle makes a turn while coasting downhill.

IMPORTANT! RE-READ THE WARNING NOTICES REFERENCED ABOVE. IN ADDITION TO THE CONSEQUENCES NOTED FAILURE TO OBSERVE ANY OR ALL OF THESE MEASURES, CAN CAUSE PART FAILURE OR RESULT IN A MISHAP WHICH CAN CAUSE PROPERTY DAMAGE, PERSONAL INJURY, EVEN DEATH

Axle Manufacture

Attach this envelope axle assemblies equipped with NoSPIN/Detroit Locker differentials.

Chassis Assembly Plant

Attach the enclosed Caution label to the instrument panel of NoSPIN/Detroit Locker differential equipped vehicles in plain view of operator or mechanic Place this manual in glove compartment of the vehicle.



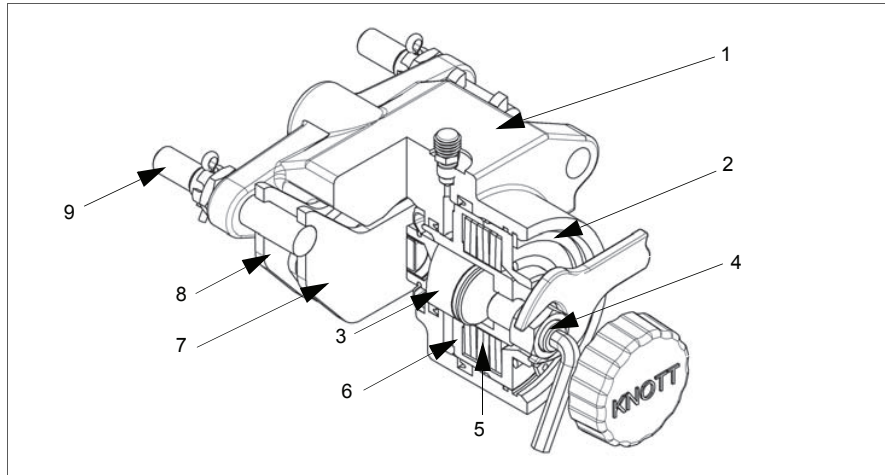
11445 Stephens Drive P.O. Box 882
Warren, Michigan 48090 U.S.A.
PHONE - 586-759-3850 FAX - 586-759-1645

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.

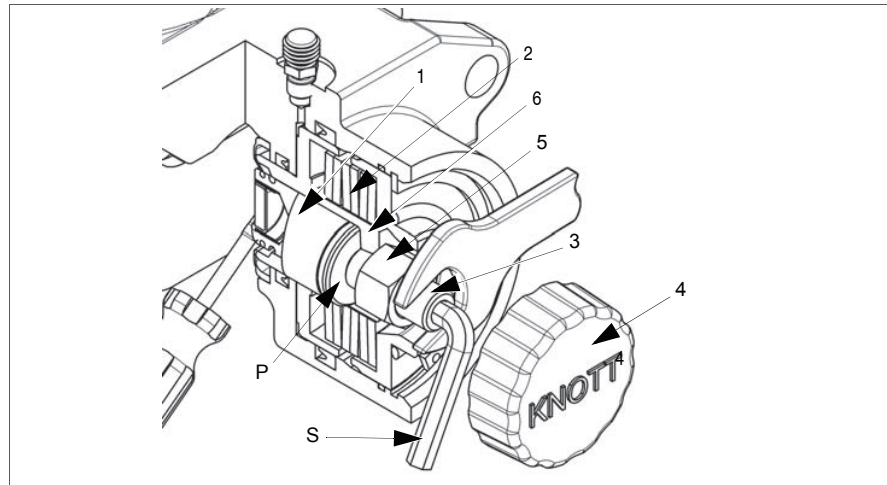
2. Mounting and basic setting regulations

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 possibilities

- 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 (50+10 Nm).
4. Mount the screw cap and tighten as far as possible manually.
5. 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 (50+10 Nm).
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.

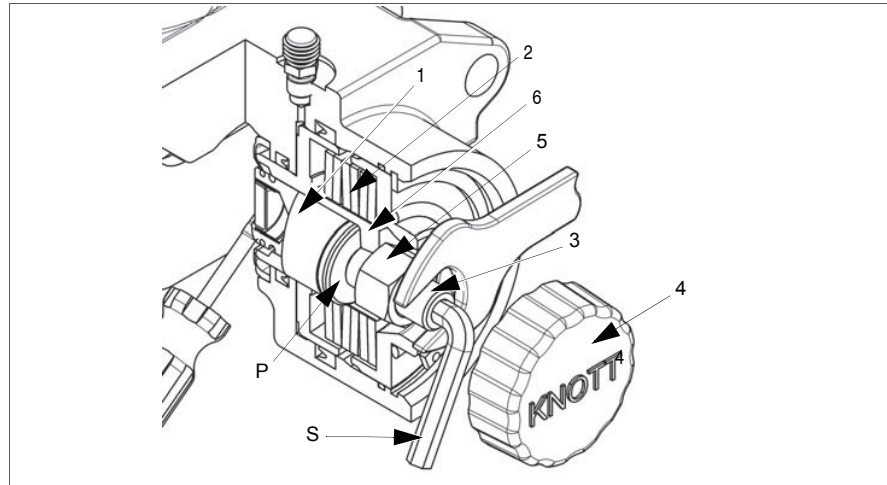
3. Emergency release of the parking brake

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

Bild 3-1:

Adjusting and assembly possibilities

- 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

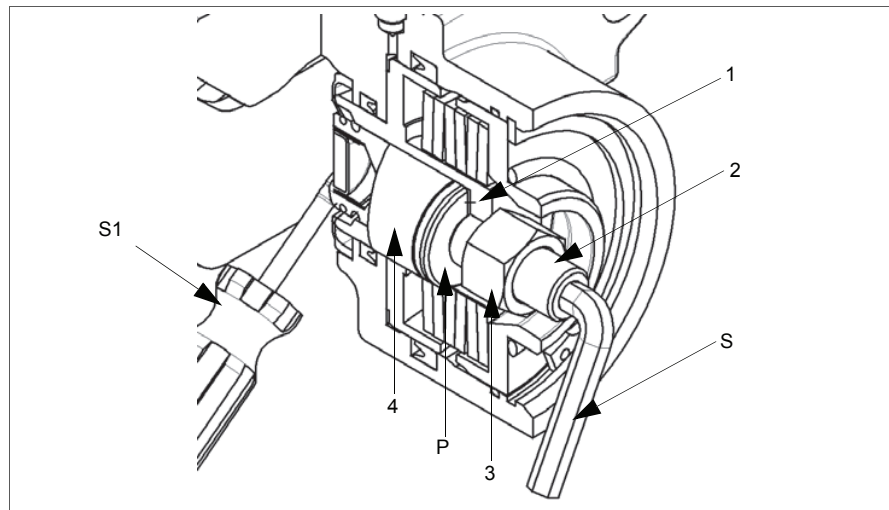
The brake pads themselves are maintenance free. All that is required here is a check for damaged parts, as well as inspection to ensure that the brake disk remains easy running.

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. residual 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



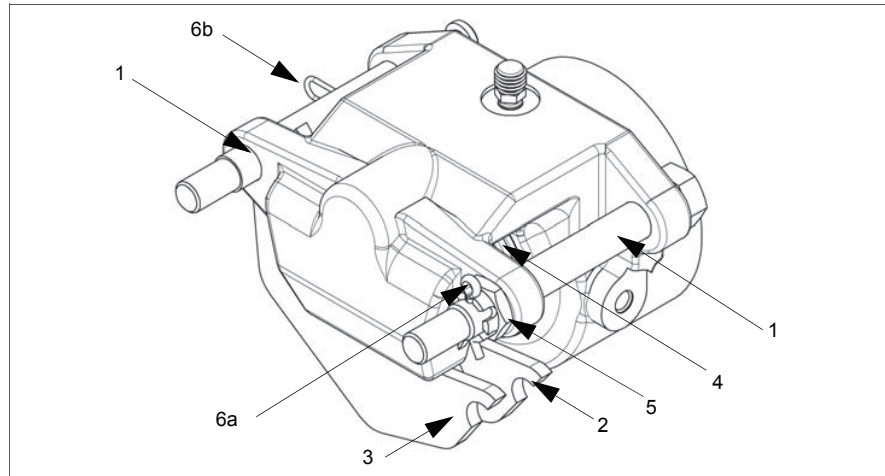
Note:

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 disk. 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 too short, it must be unscrewed to remove the brake. Before the pressure hose can be released the brake must be emergency 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:

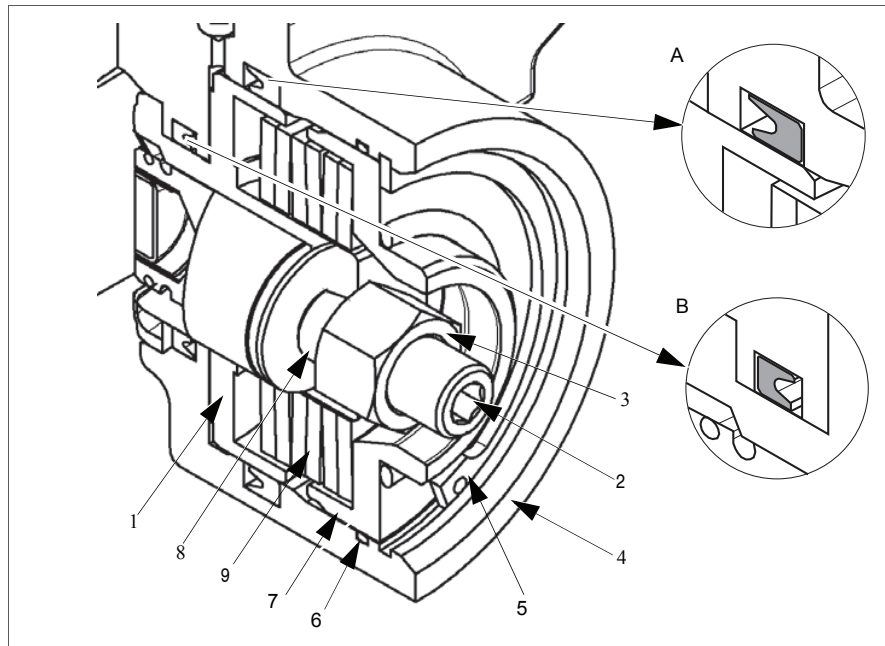
After mounting new brake lining plates or their repair, the brake must be correctly set in accordance with the instructions „Adjusting regulations“.

4.2. Changing the seal

Bild 4-3:

Change of the seals!

- 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 springs 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