Introduction

Axles, transmissions, wheel gears and non drive wheels from Kessler & Co. GmbH & Co.KG (hereinafter referred to as KESSLER) are designed and manufactured in accordance with the state of the art and the recognised technical safety regulations.

This documentation describes the state of the art at the time the documentation was created. Although the documentation was created with great care KESSLER accepts no liability for any errors with respect to the depiction and description.

This documentation is not subject to revision service. We reserve the right to make modifications without prior notice.

Due to continuous developments and technical improvements of our products, the depictions in the following work steps may deviate or differ from the actual product / component. Drawings, graphics, pictures and photos are generally not true-to-scale.

This manual was developed for technicians who have been trained by KESSLER for the repair and servicing of KESSLER axles, transmissions, wheel gears and non drive wheels.
The manual must be stored where it is available to the technicians at all times.

The company will not be liable for damages and consequential costs resulting from improperly executed work by third parties. This also applies if spare parts other than those specified by KESSLER are used.

KESSLER offers customer service tools that make working on axles, transmissions, wheel gears and non drive wheels easier and safer.
General information

Axles, transmissions, wheel gears and non drive wheels from KESSLER may be used only in technically flawless condition and as specified, in a safety- and hazard-conscious manner and in compliance with the manual. Defects, especially those that could impair safety, must be remedied immediately. It is likewise prohibited to use defective or improperly serviced, repaired or modified axles, transmissions and non drive wheels.

In addition to and having priority over the warning and safety information in this manual, the applicable national safety and environmental regulations also apply.

Maintenance, repairs or modifications may be performed only by trained specialists. The manual must be read prior to starting maintenance, repairs or modifications. In case of ambiguities and uncertainty, always consult KESSLER.

When performing maintenance and repairs, comply with the safety regulations and the statutory requirements for preventing injuries and damage to the product. Persons who perform these tasks are obligated to become familiar with and comply with these regulations. These persons are responsible for the occupational safety.

After conducting maintenance and repairs, the product must be inspected to ensure that it is functioning properly. In case of major repairs and overhauls it is recommended to send the entire components (axle, gear, wheel gear and non drive wheel) to KESSLER.

All maintenance instructions in the KESSLER manual must be complied with.

Assembly and disassembly must be carried out in a clean work area. Use special tools from KESSLER for the work. Before reinstalling used parts, they must be inspected for damage, undamaged contact surfaces and wear. It is especially important to ensure that no chips or other foreign objects remain in the axles, transmissions, wheel gears and non drive wheels.

To remove the components (axle, gear, wheel gear and non drive wheel) from the vehicle, read the instructions of the vehicle manufacturer. The following descriptions assume that the component has been removed and mounted on a mounting device for further processing.
Safety

**Explanation of the warning information and symbols appearing in the Service Manual**

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>![DANGER icon]</td>
</tr>
<tr>
<td><strong>Highest danger level</strong></td>
</tr>
<tr>
<td>There is immediate danger of death or severe injury in case of failure to comply with this safety notice.</td>
</tr>
<tr>
<td>➢ this arrow indicates the absolutely necessary measures for preventing the specific danger</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>WARNING</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>![WARNING icon]</td>
</tr>
<tr>
<td><strong>Second highest danger level</strong></td>
</tr>
<tr>
<td>There is possible danger of death or severe injury in case of failure to comply with this safety notice.</td>
</tr>
<tr>
<td>➢ this arrow indicates the absolutely necessary measures for preventing the specific danger</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CAUTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>![CAUTION icon]</td>
</tr>
<tr>
<td><strong>Third highest danger level</strong></td>
</tr>
<tr>
<td>There is danger of minor injury or property damage in case of failure to comply with this safety notice.</td>
</tr>
<tr>
<td>➢ this arrow indicates the absolutely necessary measures for preventing the specific danger</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>NOTICE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>![NOTICE icon]</td>
</tr>
<tr>
<td>Failure to observe this will result in dangers to the machine and its functions.</td>
</tr>
</tbody>
</table>

**Information**

Offers additional information to facilitate working.
Special types of danger

⚠️ DANGER ⚠️
When working on brakes, make sure that releasing the braking force cannot result in unintentional movement of the machine.

⚠️ DANGER ⚠️
When working on assemblies with spring actuator elements, such as: brakes and brake cylinders, whether service brake or parking brake. The assemblies are under spring tension.
Improper opening can cause parts to suddenly be released and fly off.
- In such cases, always comply with the safety, repair and maintenance instructions of the suppliers.

⚠️ DANGER ⚠️
Special care is necessary when working on wet multiple disk brakes. They are under high spring tension.
Improper installation and/or removal of the brake can cause parts to suddenly be released and fly off.
- Do not pre-tension and release the tension on the springs by means of the brake housing screw connections!
- Open the screw connection of this brake only using a suitable press or mounting device
- Preferably, installation/removal should be carried out by KESSLER

⚠️ DANGER ⚠️
Never remain directly in front of the wheel rim during deflation or inflation.
The pressure inside the tyre could cause parts to suddenly be released and fly off.

⚠️ DANGER ⚠️
When removing and mounting wheels on vehicles with clamped rims there is a danger that the tyre pressure can cause damaged parts of the rim to become released explosively when removing the clamped rim, which can cause severe or fatal injuries to the mechanic.
- Completely deflate the tyre before performing any task
- Never remain directly in front of the wheel rim during deflation or inflation of tyres
Comply with tightening torque for wheel nuts.
- Retighten wheel nuts after a short operating period!

**Basic safety information**

**WARNING**
Comply with the safety signs on the axle.
- They must be kept in legible condition at all times.

**WARNING**
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.
- Never use improvised devices.
- Use only original tools from KESSLER.

**WARNING**
Due to the unforeseeable dead weight of the single parts (e.g. wheel hub) or complete axles, transmissions, wheel gears or wheel ends it is possible that they can fall or tip over during assembly work.
- 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

**WARNING**
Movement / rotation of different parts can result in the danger of injury to limbs.
- Never reach between moving parts with your hands
**WARNING**

Welding repairs are permitted only in coordination with KESSLER!

**WARNING**

Work on an axle, a transmission, a wheel gear and a wheel end is allowed only if the temperature of the respective component permits.
- 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

**CAUTION**

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 can cause eye injuries.
- Wear protective goggles

**CAUTION**

It is prohibited to wear loose clothing and long open hair when working on axles, transmissions, wheel gears and wheel ends! Oils and greases can cause allergic skin reactions.
- Wear suitable protective clothing

**NOTICE**

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”
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2. Lubrication intervals and maintenance instructions

3. General instructions for correct assembly and disassembly
   Service tools

4. Assembly drive assembly

5. Assembly hub assembly

6. Assembly planetary gear drive

7. Assembly service brake

8. Assembly parking brake
Important remarks

Checking of screw connections, safety devices and corrosion

For safety reasons, the vehicle operator must check and service all important screw connections and safety devices at regular intervals.

- Wheel nuts

- Nuts of axle mounting bolts

- Tightening screws on housing joints and steering components will break the Loctite bond, which means the screws have to be reinstalled! Secure screw connections and joints in accordance with specifications; in case of doubt, contact Kessler & Co. GmbH & Co.KG.

- Corrosion and cracks on support components (e.g. the axle spindle) are not permissible for reasons of operational safety and leaks. Supporting components with cracks must be replaced!

- Cracks on steering components are not permissible for reasons of operational safety. Steering components with cracks must be replaced!

Check of brakes

- Inspect brake lining and brake drum / brake disc regularly as well as wear of brake system parts.

- Inspect the free movement of brake system rods.

- In case of signs of excessive heating, consult a brake specialist or the manufacturer.
Important remarks

Service instructions

- Assembly and disassembly may be carried out only by trained specialists.

- Repair welding is permissible only after consulting Kessler & Co. GmbH & Co.KG!

- To remove the axle from the vehicle, read the instructions in the vehicle manufacture’s manuals. The following descriptions assume that the axle has been removed and mounted on a jig for further processing.

- Always comply with the safety regulations for your country. There is no guarantee that they correspond to the instructions in this manual.
Important remarks

Instructions for ordering spare parts

Warranty

Kessler & Co. GmbH & Co.KG provides a warranty only for the original delivered replacement parts. Please be aware that the use of other than original replacement parts can have a negative effect on the design properties of the axle, therefore making it unsafe.

Kessler & Co. GmbH & Co.KG will not be liable for any damages resulting from the use of other than original replacement parts and accessories. Please be aware that special production and delivery specifications exist for proprietary or third-party parts and that our replacement parts comply with the most recent standards as prescribed by law.
**Important remarks**

**Necessary to contact Kessler & Co. GmbH & Co.KG.**

- In case of questions, contact Kessler & Co. GmbH & Co.KG.

- In case of major repairs or overhaul, it is advisable to send the entire axle to Kessler & Co. GmbH & Co.KG.
General lubrication instructions

**Fill levels**

- Are checked at the level control plugs.

**Oil change**

1. Place the vehicle in a horizontal position.
2. Draining of the oil is to be accomplished only in warm condition. Clean all lubrication points before, opening them. Open the drain holes on the carrier assembly, on the wheel assemblies, and if present, on the interaxle differential and drop gear housing. On the hub assemblies, the drain plug should be turned downward.
3. Oil draining
4. Replacement of the oil draining plugs
5. Remove the oil filler plug as well as the oil level control plug on the carrier assembly, on the wheel assembly, and, if present, on the interaxle differential and drop gear housing. (See page 3 lubrication points).
6. Oil filling
7. Check the oil level at the oil level plug hole (Overflow control).
   - Wait a few minutes.
   - If the oil level falls,
   - add oil
   - until the level remains constant.
8. Clean the grease nipples before lubrication.

*Preservation of Kessler axles for an extended storage period*

- Replace the breather with a screw plug with a sealant in order to avoid water intrusion and oil leakage.
- Fill axles completely up with oil, the same applies to wet disc brakes.
- Protect machined surfaces (for example: rim surface, steering cylinder, brake disc, ....) with additional anticorrosive.

*Before putting the axle into operation*

- Drain storage oil. Fill the axle with suitable oil (see service manual Kessler & Co. GmbH & Co.KG) to the required oil level.
- Check sealing contact surfaces for corrosion. Check the seals immediately after start-up for leakage and renew them if leaking.
- Completely remove the anticorrosive machined surfaces (for example: rim surface, steering cylinder, brake disc, ....). The rim face must be cleaned from rust or grease in order to secure a correct friction tight with the rim and to prevent loosening of the rim.
- Check axle structure for corrosion, especially after several years of storage.
Lubrication points

The binding lubrication points have to be taken from the according installation drawing of the axle.

Single drive assembly

*The position is dependent from the respective axle version.

Drive assembly with throughdrive

*Version with interaxle differential.  
Fill 1.5 liter oil at *I for first - time filling and for refilling!

Drop gear D51 / D108

*II – only at version with separately oil space.

Cardan shaft intermediate bearing

I = Oil fill plug  
II = Oil level control plug  
III = Oil drain plug  
IV = Grease nipple
Lubrication points

The binding lubrication points have to be taken from the according installation drawing of the axle.

Hub assembly with planetary gear drive

Lubrication points at universal joint and brake shaft. (If not maintenance – free)

Hub assembly with wet disc brake

Tumbler bearing

I = Oil fill plug
II = Oil level control plug
III = Oil drain plug
IV = Grease nipple
# Lubricants and lubrication intervals

<table>
<thead>
<tr>
<th>Lubrication point</th>
<th>Lubricant</th>
<th>Remarks</th>
<th>Lubrication intervals 1.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive assembly</td>
<td>Hypoid – gear oil per MIL-L – 2105 B / API GL 5</td>
<td>Oilchange</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Wheel hub planetary gear drive</td>
<td>Hypoid – gear oil in multi – range characteristic per MIL-L – 2105 C / D / API GL 5 SAE 90 or multi grade oils for normal external temperature SAE 75 W – 90; SAE 75 W – 85 for external temperature lower – 10°C SAE 140 or multi grade oils for external temperature over + 30°C</td>
<td>Check oil level at control points monthly</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Interaxle differential</td>
<td></td>
<td></td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Drop gear/ Gear boxes</td>
<td></td>
<td></td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Wheel bearing oil lubricated</td>
<td></td>
<td></td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Multi disk parking brake</td>
<td>Hydraulicoil ISO VG 32</td>
<td>Oilchange wet running</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Cardan shaft intermediate bearing</td>
<td>Fuchs Renolit LX-NHU 2</td>
<td>if provided for</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Steering knuckle bearing</td>
<td>Multi – use grease lithium saponified groove penetration per NLGI 2</td>
<td>maintenance reduced</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Steering knuckle bearing</td>
<td></td>
<td>if provided for</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Universal joint</td>
<td></td>
<td>if provided for</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Track rod</td>
<td>f. e. Fuchs Renolit MP 150</td>
<td>if provided for</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Steering cylinder -ball head/ -spherical plain bearing</td>
<td></td>
<td>if provided for</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>pinion bearing</td>
<td></td>
<td>if provided for</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Brake shaft bearing</td>
<td></td>
<td>if grease lubricated</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Brake shoe bearing</td>
<td></td>
<td>Attention! 2.)</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Wheel bearing</td>
<td></td>
<td>Attention! 2.) Lightly greased at brake shoe new assembly</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td>Wet disc brake</td>
<td>see chapter -7-</td>
<td>external cooled oilchange</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
<tr>
<td></td>
<td></td>
<td>not external cooled oilchange</td>
<td>⊕  ⊕  ⊕  ⊕</td>
</tr>
</tbody>
</table>

(Bh = Hours of operation)
1.) Whichever occurs first.

2.) The bearing point is to be lightly lubricated only, to avoid the penetration of grease in the interior of the brake (use only hand operated grease gun and remove surplus grease!). Check regularly the brake shafts and if need correct the lubrication intervals (danger of overheating!)

**Important – if a noise is produced on axles with self locking differentials**

- On the axles with self locking differentials, a noise is produced if normal oils are used.
  In case of abnormal noises and in case of a jerky roll off of the tyres, use gear oil EP with additives of the “Limited Slip” type conforming to specification M 2C - 104 A.
Recommendable hypoid gear oils corresponding MIL-L 2105 B/API GL 5 resp. MIL-L 2105 C/D/API GL 5

ARAL - Gearoil Hyp 90

AVIA - Gearoil Hypoid 90 EP

BP - Multiuse - Gearoil EP SAE 90

ELF - Tranself Typ B 90 / Tranself Typ B 80 W - 90

ESSO - Gearoil GX - D 90

FINA - Pontonic MP SAE 85 W - 90

FUCHS - Renogear Hypoid 90

MOBIL - HD 90 - A

SHELL - Spirax MB 90 / HD 90

TEXACO - Multigear EP SAE 85 W / 90

AGIP - Rotra MP / Rotra MP DB

On no account use “normal” gear oils!
### General maintenance instructions

<table>
<thead>
<tr>
<th>Check - and maintenance points</th>
<th>Remarks</th>
<th>Maintenance intervals 1.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>after 50Bh</td>
</tr>
<tr>
<td>Wheel bearing</td>
<td>Inspect, if necessary readjust wheel bearing</td>
<td>⊗</td>
</tr>
<tr>
<td>Wheel nuts</td>
<td>Check and tighten with a torque wrench (after tire change after 50km and 200km)</td>
<td>⊗</td>
</tr>
<tr>
<td>Castle nuts/track rod Screws/drive flange Nuts/axle mount</td>
<td>Check and retighten (Verify the adjustment)</td>
<td>⊗</td>
</tr>
<tr>
<td>Brakes (see also chapter 7)</td>
<td>Check lining wear, if necessary readjust, control the proper operation of the brake shafts</td>
<td>⊗</td>
</tr>
<tr>
<td>Wet disc brake</td>
<td>Check lining wear</td>
<td></td>
</tr>
<tr>
<td>Wet disc brake - spring load design</td>
<td>Check lining wear</td>
<td></td>
</tr>
<tr>
<td>Steering - and trackrod lever</td>
<td>Check and retighten mounting bolts *)</td>
<td>⊗</td>
</tr>
<tr>
<td>Bolted connections (for example drive assembly)</td>
<td>Check from time to time</td>
<td>⊗</td>
</tr>
<tr>
<td>Ring gear support bolt on drive assembly</td>
<td>Readjust (if necessary)</td>
<td>⊗</td>
</tr>
<tr>
<td>Seals</td>
<td>Check from time to time</td>
<td></td>
</tr>
<tr>
<td>Differential lock</td>
<td>Check function and the automatic return in original position</td>
<td></td>
</tr>
</tbody>
</table>

(Bh = Hours of operation)

*) If the bolts are moving (Loctite brakes loose), the lever has to be mounted once more.

1.) Whichever occurs first.
• General assembly / disassembly instructions
• service tools
General instructions for correct assembly and disassembly

**General instructions for disassembly**

- The disassembly occurs made inverted to the respective assembly instruction.
- Drain oil before removing, check for presence of metal particles.
- Mark the parts to each other before dismantle.
- Never use a hard object to separate tightly fitted assemblies. To remove bearings, drive flange and similar parts, use adequate pull-off tools.
- It is recommended that the special tools according 3.6 be used for disassembly.
- Before disassembly, the destruction of bearings and other components must check, if it is necessary to destroy it.
- Systematically replace used seals, O-rings and if needed bearings on disassembly.
- Replace or clean corroded parts.
- Do not place parts on dirty surface.

**General instructions for assembly**

- Clean parts before reassembly.
- The cages of bearings rotating in oil must coat with oil at reassembly.
- During mounting of radial seal rings, pay attention that there is sufficient overlap to the housing bores. Pay attention for a plain alignment of the radial seal ring. The seal lips may never be encountered Loctite!
- Oil seal rings and particularly the anti–dust lip seals must fill with grease.
- The universal joint shafts and the axle shafts must forcibly mounted (they must slide).
- Seal ring treads on flanges, shafts and so on, must preserve with Castrol Rustilo DWX 32 before mounting.
- Refill oil after assembly!
Application of Loctite and operating supplies

**Application of Loctite and operating supplies**

<table>
<thead>
<tr>
<th>Type</th>
<th>colour</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. LOCTITE</td>
<td>243 blue</td>
<td>Lightly locked screws</td>
</tr>
<tr>
<td></td>
<td>262 red</td>
<td>Middle locked screws</td>
</tr>
<tr>
<td></td>
<td>270 green</td>
<td>Highly locked screws</td>
</tr>
<tr>
<td></td>
<td>270 green</td>
<td>Increased coefficient of friction in contact surfaces</td>
</tr>
<tr>
<td></td>
<td>510 orange</td>
<td>Surface gasket</td>
</tr>
<tr>
<td></td>
<td>572 white</td>
<td>Special gasket</td>
</tr>
<tr>
<td></td>
<td>638 light-green</td>
<td>Gluing with big width of slit</td>
</tr>
<tr>
<td></td>
<td>5926 and 209 125 blue</td>
<td>Surface gasket</td>
</tr>
<tr>
<td>2. EPPLE</td>
<td>33 grey</td>
<td>Surface gasket</td>
</tr>
<tr>
<td>3. DIRKO</td>
<td>grey</td>
<td>Elastic gasket</td>
</tr>
</tbody>
</table>

**Remarks for working up Loctite and operating supplies**

- Threads and surfaces have to be cleaned and free from colour, oil and grease before applying Loctite. Loctite will harden under following conditions:
  - Exclusion of air
  - Metal contact
  - Increased temperature
- Pre-assembly and control tightening must do in a short time (5 to 10 min.)
- The time between gluing and mounting of the parts should be shorter than 1h. Exception: parts made from nonferrous metal have to be glued within one minute.
- Assembled parts must remain unloaded for at least 24 hours.
- Loctite quantity:
  - **At screws:**
    - 1 bead
  - **At contact surfaces:**
    - Pay attention for a sufficient Loctite application!
## General instructions for correct assembly and disassembly

### Application of Loctite and operating supplies of hub assembly

<table>
<thead>
<tr>
<th>Safety blocked parts</th>
<th>Joint</th>
<th>Loctite</th>
<th>Operating supplies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacer ring</td>
<td>Contact surface</td>
<td>572</td>
<td>-</td>
</tr>
<tr>
<td>Axle spindle</td>
<td>Screws</td>
<td>262</td>
<td>-</td>
</tr>
<tr>
<td>Axle spindle</td>
<td>Contact surface</td>
<td>270</td>
<td>-</td>
</tr>
<tr>
<td>Grommet</td>
<td>in planetary housing</td>
<td>270</td>
<td>-</td>
</tr>
<tr>
<td>Disc</td>
<td>in axle spindle</td>
<td>270</td>
<td>-</td>
</tr>
<tr>
<td>Adjusting screw with nut</td>
<td>in planetary housing</td>
<td>270</td>
<td>-</td>
</tr>
<tr>
<td>Support</td>
<td>Screw</td>
<td>262</td>
<td>-</td>
</tr>
<tr>
<td>Ring gear retainer</td>
<td>Screws</td>
<td>270</td>
<td>-</td>
</tr>
<tr>
<td>Pol wheel</td>
<td>Contact surface</td>
<td>638</td>
<td>-</td>
</tr>
<tr>
<td>Steering lever Track rod</td>
<td>Screws</td>
<td>262</td>
<td>-</td>
</tr>
<tr>
<td>Track rod lever</td>
<td>Contact surface</td>
<td>270</td>
<td>-</td>
</tr>
<tr>
<td>Wheel hub cover</td>
<td>Thread</td>
<td>572</td>
<td>-</td>
</tr>
<tr>
<td>Radial seal rings</td>
<td>Contact surface</td>
<td>572</td>
<td>-</td>
</tr>
<tr>
<td>Rubber casing</td>
<td>Contact surface</td>
<td>270</td>
<td>-</td>
</tr>
<tr>
<td>Radial seal rings Steel</td>
<td>Contact surface</td>
<td>270</td>
<td>-</td>
</tr>
</tbody>
</table>

Wheel safety nut → see chapter 5 → Adjustment of wheel bearings
### Application of Loctite and operating supplies of differential and carrier assembly

<table>
<thead>
<tr>
<th>Safety blocked parts</th>
<th>Joint</th>
<th>Loctite</th>
<th>Operating supplies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive flange</td>
<td>Nut surface</td>
<td>-</td>
<td>Epple 33 alternative Dirko grey</td>
</tr>
<tr>
<td>Diff-housing</td>
<td>Screws</td>
<td>262</td>
<td>-</td>
</tr>
<tr>
<td>Shifter cylinder (Diff-lock)</td>
<td>Contact surface</td>
<td>572</td>
<td>-</td>
</tr>
<tr>
<td>Diff.carrier (Through drive)</td>
<td>Contact surface</td>
<td>510</td>
<td>-</td>
</tr>
<tr>
<td>Drop gear housing</td>
<td>Contact surface</td>
<td>510</td>
<td>-</td>
</tr>
<tr>
<td>Diff.carrier</td>
<td>Contact surface</td>
<td>-</td>
<td>Epple 33 alternative Loctite 5926 and 209125</td>
</tr>
<tr>
<td>Through drive cover</td>
<td>Contact surface</td>
<td>510</td>
<td>-</td>
</tr>
<tr>
<td>Differential strap</td>
<td>Screws</td>
<td>262</td>
<td>-</td>
</tr>
<tr>
<td>Adjustment nut screw</td>
<td>Screw</td>
<td>270</td>
<td>-</td>
</tr>
<tr>
<td>Ring gear</td>
<td>Screws</td>
<td>262</td>
<td>-</td>
</tr>
<tr>
<td>Ring gear</td>
<td>Contact surface</td>
<td>270</td>
<td>-</td>
</tr>
<tr>
<td>Ring gear support</td>
<td>Cap</td>
<td>270</td>
<td>-</td>
</tr>
<tr>
<td>Ring gear support</td>
<td>Thread</td>
<td>-</td>
<td>Epple 33 alternative Dirko grey</td>
</tr>
</tbody>
</table>
General instructions for correct assembly and disassembly

Tightening torques

*General instructions for tightening torques (Nm)*

μ = 0,14

All tightening torques are rated in Nm.

Tolerance of the tightening torques is ±5%

*(assuming a manually operated torque spanner is used)*

*Tightening torque of metric coarse-pitch thread*

<table>
<thead>
<tr>
<th>Thread</th>
<th>Screw 8.8</th>
<th>Nut 8</th>
<th>Screw 10.9</th>
<th>Nut 10</th>
<th>Screw 12.9</th>
<th>Nut 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 4</td>
<td>3,0</td>
<td>4,4</td>
<td>5,1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 5</td>
<td>5,9</td>
<td>8,7</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 6</td>
<td>10</td>
<td>15</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 8</td>
<td>25</td>
<td>36</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 10</td>
<td>49</td>
<td>72</td>
<td>84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 12</td>
<td>85</td>
<td>125</td>
<td>145</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 14</td>
<td>135</td>
<td>200</td>
<td>235</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 16</td>
<td>210</td>
<td>310</td>
<td>365</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 18</td>
<td>300</td>
<td>430</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 20</td>
<td>425</td>
<td>610</td>
<td>710</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 22</td>
<td>580</td>
<td>830</td>
<td>970</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 24</td>
<td>730</td>
<td>1050</td>
<td>1220</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 27</td>
<td>1100</td>
<td>1550</td>
<td>1800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 30</td>
<td>1450</td>
<td>2100</td>
<td>2450</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
General instructions for correct assembly and disassembly

**3.3**

**Tightening torque of metric fine pitch thread**

<table>
<thead>
<tr>
<th>Thread</th>
<th>Screw</th>
<th>Nut</th>
<th>Screw</th>
<th>Nut</th>
<th>Screw</th>
<th>Nut</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 8 x 1</td>
<td>27</td>
<td>39</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 10 x 1</td>
<td>55</td>
<td>81</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 10 x 1,25</td>
<td>52</td>
<td>76</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 12 x 1,25</td>
<td>93</td>
<td>135</td>
<td>160</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 12 x 1,5</td>
<td>89</td>
<td>130</td>
<td>155</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 14 x 1,5</td>
<td>145</td>
<td>215</td>
<td>255</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 16 x 1,5</td>
<td>225</td>
<td>330</td>
<td>390</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 18 x 1,5</td>
<td>340</td>
<td>485</td>
<td>570</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 20 x 1,5</td>
<td>475</td>
<td>680</td>
<td>790</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 22 x 1,5</td>
<td>650</td>
<td>920</td>
<td>1050</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Tightening torque for galvanized bolts and nuts!**

Regard reduced tightening torque for galvanized bolts and nuts!

**Tightening torque for brake caliper dowel screws (greased !)**

<table>
<thead>
<tr>
<th>Thread</th>
<th>Tightening torque (Screw)</th>
<th>Tightening torque (Nuts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 20 x 1,5</td>
<td>400 + 100</td>
<td></td>
</tr>
<tr>
<td>M 27 x 2</td>
<td>900 + 100</td>
<td></td>
</tr>
</tbody>
</table>

**Tightening torque of the nut for steering stop**

- 300

**Approximate value for the thightening torque for screw plug**

<table>
<thead>
<tr>
<th>Thread</th>
<th>Approximate value</th>
<th>Tightening torque (Screw plugs with O-Ring)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 14 x 1,5</td>
<td>ca. 45</td>
<td>45</td>
</tr>
<tr>
<td>M 16 x 1,5</td>
<td>ca. 60</td>
<td>-</td>
</tr>
<tr>
<td>M 22 x 1,5</td>
<td>ca. 100</td>
<td>100</td>
</tr>
<tr>
<td>M 24 x 1,5</td>
<td>ca. 120</td>
<td>-</td>
</tr>
<tr>
<td>M 30 x 1,5</td>
<td>ca. 160</td>
<td>-</td>
</tr>
<tr>
<td>M 42 x 1,5</td>
<td>ca. 260</td>
<td>-</td>
</tr>
<tr>
<td>M 45 x 1,5</td>
<td>ca. 280</td>
<td>-</td>
</tr>
</tbody>
</table>
General instructions for correct assembly and disassembly

Units

Comparison table for units

<table>
<thead>
<tr>
<th>25.40 mm</th>
<th>=</th>
<th>1 in (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mm</td>
<td>=</td>
<td>0.0394 in (inch)</td>
</tr>
<tr>
<td>1 kg (kilogram)</td>
<td>=</td>
<td>2,205 lb (pounds)</td>
</tr>
<tr>
<td>9.81 Nm (1 kpm)</td>
<td>=</td>
<td>7,233 lbf x ft (pound force foot)</td>
</tr>
<tr>
<td>1,356 Nm (0,138 kpm)</td>
<td>=</td>
<td>1 lbf x ft (pound force foot)</td>
</tr>
<tr>
<td>1 bar (1,02kp/cm²)</td>
<td>=</td>
<td>14,5 psi (pound force per square inch lbf/in²)</td>
</tr>
<tr>
<td>0,070 bar (0,071 kp/cm²)</td>
<td>=</td>
<td>1 psi (lbf/in²)</td>
</tr>
<tr>
<td>1 Litre</td>
<td>=</td>
<td>0,264 Gallon (Imp.)</td>
</tr>
<tr>
<td>4,456 Litre</td>
<td>=</td>
<td>1 Gallon (Imp.)</td>
</tr>
<tr>
<td>1 litre</td>
<td>=</td>
<td>0,220 Gallon (US)</td>
</tr>
<tr>
<td>3,785 Litre</td>
<td>=</td>
<td>1 Gallon (US)</td>
</tr>
<tr>
<td>1609,344 m</td>
<td>=</td>
<td>1 Mile (land mile)</td>
</tr>
<tr>
<td>0°C (Celsius)</td>
<td>=</td>
<td>+32°F (Fahrenheit)</td>
</tr>
<tr>
<td>1°C (Celsius)</td>
<td>=</td>
<td>+33,8°F (Fahrenheit)</td>
</tr>
<tr>
<td>0°C (Celsius)</td>
<td>=</td>
<td>273,15 Kelvin</td>
</tr>
<tr>
<td>1°C (Celsius)</td>
<td>=</td>
<td>274,15 Kelvin</td>
</tr>
</tbody>
</table>

Names of the legal units

<table>
<thead>
<tr>
<th>Term</th>
<th>Symbol</th>
<th>New</th>
<th>Old</th>
<th>Conversion</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque</td>
<td>T</td>
<td>Nm (Newton meter)</td>
<td>kpm</td>
<td>$1 \text{ kpm} = 9,81 \text{ Nm}$</td>
<td>$T \ (\text{Nm}) = \frac{F \ (\text{N}) \times r \ (\text{m})}{1}$</td>
</tr>
<tr>
<td>Moment of force</td>
<td>M</td>
<td>Nm (Newton meter)</td>
<td>kpm</td>
<td>$1 \text{ kpm} = 9,81 \text{ Nm}$</td>
<td>$M \ (\text{Nm}) = \frac{F \ (\text{N}) \times r \ (\text{m})}{1}$</td>
</tr>
<tr>
<td>Pressure</td>
<td>pü</td>
<td>bar</td>
<td>atü</td>
<td>$1.02 \text{ atü} = 1.02 \text{ kp/cm}^2$</td>
<td>$1 \text{ bar} = 750 \text{ torr}$</td>
</tr>
</tbody>
</table>
General instructions for correct assembly and disassembly

*Tightening torque wheel nut with thrust collar*

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Tightening torque</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>M22x1,5</td>
<td>650 Nm</td>
<td>--</td>
</tr>
</tbody>
</table>
Tightening torques for castle nuts and adjusting nuts

**Tightening torques for castle nuts on ball joints for track rods and ram cylinders**

<table>
<thead>
<tr>
<th>Cone size d1 (mm)</th>
<th>Thread d2 (mm)</th>
<th>Torque (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>M 20 x 1,5</td>
<td>200 - 220</td>
</tr>
<tr>
<td>30</td>
<td>M 24 x 1,5</td>
<td>280 - 300</td>
</tr>
<tr>
<td>32</td>
<td>M 27 x 1,5</td>
<td>290 - 320</td>
</tr>
<tr>
<td>38</td>
<td>M 30 x 1,5</td>
<td>340 - 360</td>
</tr>
<tr>
<td>45</td>
<td>M 39 x 1,5</td>
<td>410 - 430</td>
</tr>
</tbody>
</table>

The tightening torques of the different thread dimensions of the joints are applicable for nuts of quality S6.
**Tightening torque of the adjusting nut resp. slotted nut at flanges resp. gearwheels etc.**

<table>
<thead>
<tr>
<th>Thread d1 (mm)</th>
<th>Torque (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 24 x 1,5</td>
<td>360</td>
</tr>
<tr>
<td>M 30 x 1,5</td>
<td>450</td>
</tr>
<tr>
<td>M 36 x 1,5</td>
<td>540</td>
</tr>
<tr>
<td>M 42 x 1,5</td>
<td>850</td>
</tr>
<tr>
<td>M 45 x 1,5</td>
<td>850</td>
</tr>
<tr>
<td>M 48 x 1,5</td>
<td>850</td>
</tr>
<tr>
<td>M 52 x 1,5</td>
<td>950</td>
</tr>
<tr>
<td>M 64 x 1,5</td>
<td>1050 - 1100</td>
</tr>
</tbody>
</table>
Tools

When ordering maintenance tools, please provide

- Part number (no. of installation drawing number)

and

- Serial number → see identification plate

(The illustrations are not binding for the design)

Spanner for wheel safety nut

Spanner for splined nut (hub assembly)
Tools

When ordering maintenance tools, please provide

- Part number (no. of installation drawing number)

and

- Serial number → see identification plate

(The illustrations are not binding for the design)

- Seal ring sleeve driver
- Spanner for thread rings
  (Differential bearing)
- Spanner for counter nut
  (Planetary gear drive)
- Assembly cone for o – ring
  (Differential lock)
Tools

When ordering maintenance tools, please provide

➢ Part number (no. of installation drawing number)

and

➢ Serial number → see identification plate

(The illustrations are not binding for the design)

Centering tool for discs

Installation tool for face seal
Assembly of differential and carrier assembly

**Adjustment of contact pattern of bevel gear teeth**

**NOTICE:** search for the production numbers of the drive pinion and the ring gear.

It is only possible to achieve an optimal contact pattern, if:

<table>
<thead>
<tr>
<th>Version 1</th>
<th>Version 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production numbers</td>
<td>No production numbers</td>
</tr>
<tr>
<td>- on drive pinion (marked on the end face)</td>
<td>- on drive pinion</td>
</tr>
<tr>
<td>- on ring gear (marked on the face of the ring gear)</td>
<td>- on ring gear</td>
</tr>
</tbody>
</table>

➢ The production numbers of the drive pinion and ring gear must match – only mount in pairs!

➢ indiscriminate use of drive pinion and ring gear is possible – no pairing necessary!
### Checking the contact pattern of the gear teeth

1. Coat the teeth of the ring gear with spotting paste and then turn it several times until you can see pressure marks from the drive pinion on the coated teeth.

2. Check the contact pattern / pressure marks and compare them with the illustrations in the following table.

3. If necessary, make adjustments as shown in the table.

<table>
<thead>
<tr>
<th>Contact Pattern</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal contact pattern</td>
<td></td>
</tr>
<tr>
<td>Contact pattern too high.</td>
<td>Reduce drive pinion distance by correcting thickness of the adjustment disk. Adjust the backlash by moving the ring gear out.</td>
</tr>
<tr>
<td>Contact pattern too low.</td>
<td>Increase drive pinion distance by correcting thickness of the adjustment disk. Adjust the backlash by moving the ring gear in.</td>
</tr>
</tbody>
</table>
Assembly of differential and carrier assembly

Securing of the striking nut

NOTICE: The brim of the striking nut has to be sheared only along the slot flank and the corner has to be bended on the slot ground.

Use of Loctite and other operating supplies

- Striking nut at drive flange
  - In thread: assembly paste with MoS2 (exception: through drive pinion see enumeration 2)
  - Front side contact surface: sealing compound (Epple 33 or equivalent)

- Striking nut at through drive nut
  - On thread: Loctite 262

- Striking nut at gear wheels, bearings and so on
  - On thread: assembly paste with MoS2
Removing of the striking nut

![Figure 3](image1.png)

1. The secured striking nut.

![Figure 4](image2.png)

2. Applying an applicable flat chisel in the slot between drive pinion and securing and removing the securing of the striking nut.

![Figure 5](image3.png)

3. The loosened striking nut.

**NOTICE:** Bend away the nose completely. Otherwise, the thread of the drive pinion will be damaged. Screw the nut off.
Assembly of differential and carrier assembly

Differential and carrier assembly D 91
**Adjustment of drive pinion distance**

To obtain the proper tooth flank contact, adjust the axial position of the drive pinion with the thickness of the adjustment disc. The necessary thickness of the adjustment disc for first time assembly can be obtained by measurement (see calculation example).

The final thickness of the adjustment disc can be fixed during the checking of gear meshing at the assembled drive assembly (see page “Checking the contact pattern of the gear teeth” – 4.0.1).

<table>
<thead>
<tr>
<th>Drive assembly</th>
<th>A 91</th>
</tr>
</thead>
<tbody>
<tr>
<td>theoretical S</td>
<td>3</td>
</tr>
<tr>
<td>theoretical B</td>
<td>56,5</td>
</tr>
</tbody>
</table>

**B** = Measured width of the taper roller bearing.
Assembly of differential and carrier assembly

4.3.4

Adjustment dimension – A

Deviating dimension (defined during production) is marked on the locating face of the pinion. It indicates the deviation from the specified dimension.

Example: Deviation +0,1

Adjustment dimension – A

Without inscription on the locating face of the pinion, the deviating from the specified dimension is 0.

Example: Deviation 0

Sample calculations (dimensions in mm):

<table>
<thead>
<tr>
<th>Theor. adjustment disk thickness</th>
<th>Measured bearing width</th>
<th>Tolerance at drive pinion</th>
<th>Calculation of the required adjustment disk thickness</th>
<th>Required adjustment disk thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>theor. disk thickness - deviation from bearing + deviation from pinion = required disk thickness</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Version 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>deviation from the theoretical dimension</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+0,15</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>deviation from the theoretical dimension</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-0,15</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3,0 - 0,15 + 0,15 = 3,0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Version 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>deviation from the theoretical dimension</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-0,20</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>deviation from the theoretical dimension</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-0,15</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3,0 + 0,20 + 0,15 = 3,35</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Version 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>deviation from the theoretical dimension</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+0,10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>deviation from the theoretical dimension</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+0,10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3,0 - 0,1 - 0,1 = 2,8</td>
<td></td>
</tr>
</tbody>
</table>

Fit corresponding disc and outer rings of the taper roller bearings.
1. Insert the two outer rings of the taper roller bearings into the differential carrier.

2. Calculate the thickness C of the spacer disc.
   
a. Place the two inner rings of the taper roller bearings in their outer rings. Measure A.
   
b. Measure the dimension B of the roller bearing.
   
c. Measure the dimension D of the spacer bushing.
   
d. Thickness of the spacer disc C = A - B - D.

3. Heat the drive pinion side taper roller bearing to about 100°C and install it on the drive pinion shaft. (Drive on completely after it cools).

4. Install the spacer bushing and the spacer disc on the pinion shaft.

5. Install the drive pinion into the differential carrier. Heat the taper roller bearing inner ring at undersize to about 100°C and install it with a tube onto the drive pinion shaft.

6. Install the drive flange onto the drive pinion shaft. Tighten the safety nut according to sheet 3.5. For tightening fix the differential carrier and block the drive flange.

7. Measure the roll resistance of the bearings by using a torque wrench. If the measured value is not the prescribed 1,5 to 2,5 Nm, adjust the resistance by modification of the thickness of the spacer disc. After arriving at the adjustment of the bearing, back-off the safety nut and draw off the drive flange.

8. Install the radial seal ring with Loctite 572 applied. Fill the radial seal ring with bearing grease. Slip on the drive flange, screw on the safety nut with sealing compound between the contact surfaces. Tighten the safety nut according to sheet 3.5. Lock the nut by striking the nut brim into the slot of the pinion.
Assembly of the Differential

Before assembly all of the bevel gears and the thrust rings should be well oiled.

1. Place one differential side gear with the side gear thrust washer in the differential case.

2. Install the spider with differential gears and differential pinion thrust washers in the differential case.

3. Install the other differential side gear and side gear thrust washer. (At variants with Nospin differential install the Nospin diff. instead of the differential gears)

4. Install the other half of the differential case over the assembly and observe the alignment marks, tighten the differential case bolts. Secure with Loctite 262.

5. Check that all differential pinions can rotate easily.

6. Coat the contact surface of the ring gear with Loctite 270 and install the ring gear on the differential case by tapping lightly on the circumference. Tighten the ring gear bolts. Secure with Loctite 262.

7. Heat the two taper roller bearings to about 100°C and install them by using a sleeve.
### Dimension of backlash

Place the differential with the outer rings of the taper roller bearings on the differential carrier which is in a vertical position, with mounted drive pinion.

Mount the differential straps and align them with the thread rings.

During this operation be careful of the alignment marks on the differential straps with respect to the differential carrier. (Do not interchange the differential straps.)

---

**Backlash**

<table>
<thead>
<tr>
<th>Version 1</th>
<th>Version 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>The smallest admissible value at the closest place is marked on the circumference of the ring gear.</td>
<td>Is no value marked on the circumference of the ring gear, the backlash is depend on the ring gear diameter (see following table).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drive description</th>
<th>Ring gear diameter</th>
<th>Backlash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive assembly 91</td>
<td>&lt; 410</td>
<td>0,40</td>
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</table>
## Adjustment of backlash

<table>
<thead>
<tr>
<th>Version 1</th>
<th>Version 2</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Illustration" /></td>
<td><img src="image2.png" alt="Illustration" /></td>
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</tbody>
</table>

**Version 1**

Tighten the differential strap bolts by hand. By a counter rotation of the two thread rings, move the differential until the backlash is correct.

Therefore hold the drive pinion at the drive flange. Check the backlash by careful forwards and rearwards rotating the ring gear. Use a dial indicator.

Measure the backlash during a few times turns of the ring gear and if need correct the backlash, because of the smallest admissible value at the closest place must not be fall short of.

**Version 2**

Adjust the backlash according to sheet "Adjustment of contact pattern of bevel gear teeth".

Tighten screws of the differential straps and lock them with Loctite 262.

Adjust the bearing roll resistance trough tightening of the thread rings. Set value: 2,0 to 3,0 Nm. Check the value with a torque wrench. If measuring at the drive pinion / drive flange, take the ratio of the bevel wheel set into account.

Screw the lock plates for the thread rings and secure with Loctite 270, if need bend the lock plates.
Limited slip differential

Operating sequence

- measure dimension X of the disk set
- select the disks A and B according to the table „Disk selection based on the disk set dimension“
- insert the matching disks according to the arrangement in figure 2
- if it is necessary, the disks D109.2873.4P.5/4/3/2 can get ground to the required thickness or order the specific disks A and B according to the table “Disks and their thickness”
- check the set value (63,92 – 64,19 mm)
**Disk selection**

Disk selection based on the disk set dimension:

<table>
<thead>
<tr>
<th>Disk set dimension X</th>
<th>Disk A</th>
<th>Disk B</th>
</tr>
</thead>
<tbody>
<tr>
<td>18,45 to 18,55 mm</td>
<td>D109.2873.4P.5</td>
<td>D109.2873.4P.2</td>
</tr>
<tr>
<td>18,56 to 18,65 mm</td>
<td>D109.2873.4P.2</td>
<td>D109.2873.4P.2</td>
</tr>
<tr>
<td>18,66 to 18,75 mm</td>
<td>D109.2873.4P.5</td>
<td>D109.2873.4P.4</td>
</tr>
<tr>
<td>18,76 to 18,85 mm</td>
<td>D109.2873.4P.2</td>
<td>D109.2873.4P.4</td>
</tr>
<tr>
<td>18,86 to 18,95 mm</td>
<td>D109.2873.4P.5</td>
<td>D109.2873.4P.3</td>
</tr>
<tr>
<td>18,96 to 19,05 mm</td>
<td>D109.2873.4P.4</td>
<td>D109.2873.4P.4</td>
</tr>
<tr>
<td>19,06 to 19,15 mm</td>
<td>D109.2873.4P.6</td>
<td>D109.2873.4P.2</td>
</tr>
<tr>
<td>19,16 to 19,25 mm</td>
<td>D109.2873.4P.3</td>
<td>D109.2873.4P.4</td>
</tr>
<tr>
<td>19,26 to 19,35 mm</td>
<td>D109.2873.4P.6</td>
<td>D109.2873.4P.4</td>
</tr>
<tr>
<td>19,36 to 19,45 mm</td>
<td>D109.2873.4P.3</td>
<td>D109.2873.4P.3</td>
</tr>
<tr>
<td>19,46 to 19,55 mm</td>
<td>D109.2873.4P.6</td>
<td>D109.2873.4P.3</td>
</tr>
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</table>

Disks and their thickness:

<table>
<thead>
<tr>
<th>Disk</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>D109.2873.4P.2</td>
<td>4,2 mm</td>
</tr>
<tr>
<td>D109.2873.4P.3</td>
<td>3,8 mm</td>
</tr>
<tr>
<td>D109.2873.4P.4</td>
<td>4,0 mm</td>
</tr>
<tr>
<td>D109.2873.4P.5</td>
<td>4,3 mm</td>
</tr>
<tr>
<td>D109.2873.4P.6</td>
<td>3,7 mm</td>
</tr>
</tbody>
</table>
Assembly of differential and carrier assembly
**Assembly of differential and carrier assembly**

---

**Adjustment of contact pattern of bevel gear teeth**

*NOTICE*: search for the production numbers of the drive pinion and the ring gear.

---

**It is only possible to achieve an optimal contact pattern, if:**

---

<table>
<thead>
<tr>
<th>Version 1</th>
<th>Version 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production numbers</strong></td>
<td><strong>No production numbers</strong></td>
</tr>
<tr>
<td>• on drive pinion (marked on the end face)</td>
<td>• on drive pinion</td>
</tr>
<tr>
<td>• on ring gear (marked on the face of the ring gear)</td>
<td>• on ring gear</td>
</tr>
<tr>
<td>➢ The production numbers of the drive pinion and ring gear must match – only mount in pairs!</td>
<td>➢ indiscriminate use of drive pinion and ring gear is possible – no pairing necessary!</td>
</tr>
</tbody>
</table>
Checking the contact pattern of the gear teeth

1. Coat the teeth of the ring gear with spotting paste and then turn it several times until you can see pressure marks from the drive pinion on the coated teeth.

2. Check the contact pattern / pressure marks and compare them with the illustrations in the following table.

3. If necessary, make adjustments as shown in the table.

<table>
<thead>
<tr>
<th>Optimal contact pattern</th>
<th>Contact pattern too high.</th>
<th>Contact pattern too low.</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Optimal contact pattern" /></td>
<td>Reduce drive pinion distance by correcting thickness of the adjustment disk. Adjust the backlash by moving the ring gear out.</td>
<td>Increase drive pinion distance by correcting thickness of the adjustment disk. Adjust the backlash by moving the ring gear in.</td>
</tr>
</tbody>
</table>
Assembly of differential and carrier assembly

Securing of the striking nut

**NOTICE:** The brim of the striking nut has to be sheared only along the slot flank and the corner has to be bended on the slot ground.

![Figure 1](image1.png)

![Figure 2](image2.png)

Use of Loctite and other operating supplies

1. Striking nut at drive flange
   - In thread: assembly paste with MoS2 (exception: through drive pinion see 2.)
   - Front side contact surface: sealing compound (*Epple 33 or equivalent*)

2. Striking nut at through drive nut
   - In thread: Loctite 262

3. Striking nut at gear wheels, bearings ect.
   - Im Gewinde: Montagepaste mit MoS2
Removing of the striking nut

NOTICE: Bend away the nose and screws the nut off.

4. The secured striking nut.

5. Applying an applicable flat chisel in the slot between pinion and securing and removing the securing of the striking nut.

6. The loosened striking nut.
Differential and carrier assembly D 91
**Adjustment of drive pinion distance**

To obtain the proper tooth flank contact, adjust the axial position of the drive pinion with the thickness of the adjustment disc. The necessary thickness of the adjustment disc for first time assembly can be obtained by measurement (see calculation example).

---

The final thickness of the adjustment disc can be fixed during the checking of gear meshing at the assembled drive assembly (see page „Checking the contact pattern of the gear teeth“ – 4.0.1).

---

<table>
<thead>
<tr>
<th>Drive assembly</th>
<th>A 91</th>
</tr>
</thead>
<tbody>
<tr>
<td>theoretical S</td>
<td>3</td>
</tr>
<tr>
<td>theoretical B</td>
<td>56,5</td>
</tr>
</tbody>
</table>
Assembly of differential and carrier assembly

**Version 1**

Adjustment dimension – A

Deviating dimension (defined during production) is marked on the locating face of the pinion. It indicates the deviation from the specified dimension.

Example: Deviation +0,1

**Version 2**

Adjustment dimension – A

Without inscription on the locating face of the pinion, the deviating from the specified dimension is 0.

Example: Deviation 0

**Sample calculations (dimensions in mm):**

<table>
<thead>
<tr>
<th>Theor. adjustment disk thickness</th>
<th>Measured bearing width</th>
<th>Tolerance at drive pinion</th>
<th>Calculation of the required adjustment disk thickness</th>
<th>Required adjustment disk thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Required adjustment disk thickness</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>Theo. disk thickness - deviation from bearing + deviation from pinion = required disk thickness</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>+0,15       -0,15 + 0,15 = 3,0</td>
<td></td>
</tr>
<tr>
<td>3,2</td>
<td></td>
<td></td>
<td>+0,15       +0,20 + 0,15 = 3,35</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>+0,10       -0,1 - 0,1 = 2,8</td>
<td></td>
</tr>
</tbody>
</table>

Fit corresponding disc and outer rings of the taper roller bearings.
1. Insert the two outer rings of the taper roller bearings into the differential carrier.

2. Calculate the thickness C of the spacer disc.
   a. Place the two inner rings of the taper roller bearings in their outer rings. Measure A.
   b. Measure the dimension B of the roller bearing.
   c. Measure the dimension D of the spacer bushing.
   d. Thickness of the spacer disc C = A - B - D.

3. Heat the drive pinion side taper roller bearing to about 100°C and install it on the drive pinion shaft. (Drive on completely after it cools).

4. Install the spacer bushing and the spacer disc on the pinion shaft.

5. Install the drive pinion into the differential carrier. Heat the taper roller bearing inner ring at undersize to about 100°C and install it with a tube onto the drive pinion shaft.

6. Install the drive flange onto the drive pinion shaft. Tighten the safety nut according to sheet 3.5. For tightening fix the differential carrier and block the drive flange.

7. Measure the roll resistance of the bearings by using a torque wrench. If the measured value is not the prescribed 1,5 to 2,5 Nm, adjust the resistance by modification of the thickness of the spacer disc. After arriving at the adjustment of the bearing, back-off the safety nut and draw off the drive flange.

8. Install the radial seal ring with Loctite 572 applied. Fill the radial seal ring with bearing grease. Slip on the drive flange, screw on the safety nut with sealing compound between the contact surfaces. Tighten the safety nut according to sheet 3.5. Lock the nut by striking the nut brim into the slot of the pinion.
Before assembly all of the bevel gears and the thrust rings should be well oiled.

1. Place one differential side gear with the side gear thrust washer in the differential case.

2. Install the spider with differential gears and differential pinion thrust washers in the differential case.

3. Install the other differential side gear and side gear thrust washer. (At variants with Nospin differential install the Nospin diff. instead of the differential gears)

4. Install the other half of the differential case over the assembly and observe the alignment marks, tighten the differential case bolts. Secure with Loctite 262.

5. Check that all differential pinions can rotate easily.

6. Coat the contact surface of the ring gear with Loctite 270 and install the ring gear on the differential case by tapping lightly on the circumference. Tighten the ring gear bolts. Secure with Loctite 262.

7. Heat the two taper roller bearings to about 100°C and install them by using a sleeve.
**Dimension of backlash**

Place the differential with the outer rings of the taper roller bearing on the differential carrier which is in a vertical position, with mounted drive pinion.

Mount the differential straps and align them with the thread rings.

During this operation be careful of the alignment marks on the differential straps with respect to the differential carrier. (Do not interchange the differential straps.)

---

### Backlash

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<tr>
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<th>Version 2</th>
</tr>
</thead>
<tbody>
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</table>

<table>
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<tr>
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<th>Backlash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive assembly 91</td>
<td>&lt; 410</td>
<td>0,40</td>
</tr>
</tbody>
</table>
## Adjustment of backlash

<table>
<thead>
<tr>
<th>Version 1</th>
<th>Version 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;image&gt;</td>
<td>&lt;image&gt;</td>
</tr>
</tbody>
</table>

### Version 1

Tighten the differential strap bolts by hand. By a counter rotation of the two thread rings, move the differential until the backlash is correct.

Therefore hold the drive pinion at the drive flange. Check the backlash by careful forwards and rearwards rotating the ring gear. Use a dial indicator.

Measure the backlash during a few times turns of the ring gear and if need correct the backlash, because of the smallest admissible value at the closest place must not be fall short of.

### Version 2

Adjust the backlash according to sheet “Adjustment of contact pattern of bevel gear teeth”.

Tighten screws of the differential straps and lock them with Loctite 262.

Adjust the bearing roll resistance trough tightening of the thread rings. Set value: 2,0 to 3,0 Nm. Check the value with a torque wrench. If measuring at the drive pinion / drive flange, take the ratio of the bevel wheel set into account.

Screw the lock plates for the thread rings and secure with Loctite 270, if need bend the lock plates.
Assembly of the hub assembly
Assembly of the hub assembly

Hub assembly drive axle

Hub assembly axle 106.1564.3
## Overview of parts

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Axle housing</td>
</tr>
<tr>
<td>2</td>
<td>Breather</td>
</tr>
<tr>
<td>3</td>
<td>Sealing ring</td>
</tr>
<tr>
<td>4</td>
<td>Screw plug</td>
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<tr>
<td>5</td>
<td>Sealing ring</td>
</tr>
<tr>
<td>6</td>
<td>Axle shaft</td>
</tr>
<tr>
<td>7</td>
<td>Wet multiple disk brake</td>
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<tr>
<td>8</td>
<td>Hexagon socket screw</td>
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<tr>
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<td>O-Ring</td>
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<td>Ring</td>
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<td>Spacer ring</td>
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<td>Tapered roller bearing</td>
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<td>Wheel hub</td>
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<td>Hexagon socket screw</td>
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<td>47</td>
<td>Screw plug</td>
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<tr>
<td>48</td>
<td>Sealing ring</td>
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</table>
Assembly of the hub assembly

Hub assembly drive axle

Hub assembly
axle 106.1563.3
# Overview of parts

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<th>Part Number</th>
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<td>4</td>
<td>Screw plug</td>
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<td>Sealing ring</td>
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<tr>
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<td>Axle shaft</td>
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<td>--</td>
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<td>--</td>
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<td>Radial seal ring</td>
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<tr>
<td>42</td>
<td>O-ring</td>
</tr>
<tr>
<td>43</td>
<td>Thrust washer</td>
</tr>
<tr>
<td>44</td>
<td>O-ring</td>
</tr>
<tr>
<td>45</td>
<td>Planetary housing</td>
</tr>
<tr>
<td>46</td>
<td>Hexagon socket screw</td>
</tr>
<tr>
<td>47</td>
<td>Screw plug</td>
</tr>
<tr>
<td>48</td>
<td>Sealing ring</td>
</tr>
</tbody>
</table>
Coat the seat of the spacer ring on the steering knuckle resp. axle spindle with Loctite 572. Heat the spacer ring to about 100°C and push it by gently striking onto the steering knuckle resp. axle spindle. (The steering knuckle resp. axle spindle must be free of corrosion). Oil the seal ring tread onto the spacer ring.
Coat the contact surface of the axle housing with Epple 33 (at version through drive with Loctite 510), and mount the complete drive assembly. The axle housing being placed in a horizontal position, secure the screws with Loctite 262. Mount the pol wheel (if present) onto the axle shaft (see 5.1.7).

Engage the axle shaft into the axle housing.

The axle shaft should be able to be moved easily (by hand) in the toothing of the differential side gear.

At version with differential lock on the outside (D 71/ D 109) the differential lock must always be actuated when assemble or disassemble the axle shaft.

**Direction:**

Actuating of the differential lock is necessary to prevent the sliding sleeve to drop out of the shifter fork into the axle housing when pulling out or sliding in the axle shaft. This would entail disassembly of the axle.
• Assembly of the spacer ring (if present) see sheet 5.1.6.

• Install the brake onto the axle spindle, be careful of the brake control position and bolt it.
  At version with disc brake install the brake carrier (if present), then mount the wheel hub with the brake disc, and after this operation install the brake.

• Prepare and mount the wheel hub see chapter 5.5.
  **Attention:** Hold the wheel hub with a hoist until the outer bearing with ring gear carrier is mounted.

• Assembly of the planetary gear drive see chapter 6.

• At version with drum brake mount the brake drum.

• Assembly of the ABS - sensor installation (if present) see 5.1.7.
  **Attention:**
  At version with ABS resp. ABS - preparation (the pol wheel is mounted onto the axle shaft) the thrust ring of the sun gear in the axle spindle must be dismounted for disassembly the axle shaft.
Prepare and mount the wheel hub

**NOTICE**

At irregular assembly of the radial seal ring.

- The sealing of the oil chamber is not guaranteed.
- Observe the fitting position of the sealing lip from the radial seal ring!
- Do not damage the sealing lip.
- Use a special tool – seal ring sleeve driver.

**Prepare wheel hub**

- Install the wheel studs (1).
- Press in outer rings of taper roller bearings (2 + 3), do not hammer them.
- Install inner ring of taper roller bearing (3).
- Install the O - ring (4) into the slot of the ring (5).
- Press the ring (5) with Loctite 572 applied into the wheel hub (6).
- Press the radial seal rings (7) with Loctite 572 (rubber cage) resp. Loctite 270 (steel cage) applied into the wheel hub (6).
- Fill the radial seal rings with bearing grease.
- Install the face seal (8) into the wheel hub (6) (see 5.8).

**Mount wheel hub**

- Push the pre - assembled wheel hub (6) parallel onto the axle spindle resp. steering knuckle.
- **Important:** Be careful not to damage the radial seal rings (7).
Prepare and mount the wheel hub

NOTICE

At irregular assembly of the radial seal ring.
The sealing of the oil chamber is not guaranteed.
- Observe the fitting position of the sealing lip from the radial seal ring!
- Do not damage the sealing lip.
- Use a special tool – seal ring sleeve driver.

Prepare wheel hub

- Install the wheel studs (1).
- Press in outer rings of taper roller bearings (2 + 3), do not hammer them.
- Install inner ring of taper roller bearing (3).
- Install the O-ring (4) into the slot of the ring (5).
- Press the ring (5) with Loctite 572 applied into the wheel hub (6).
- Press the radial seal rings (7) with Loctite 572 (rubber cage) resp. Loctite 270 (steel cage) applied into the wheel hub (6).
- Fill the radial seal rings with bearing grease.

Mount wheel hub

- Push the pre-assembled wheel hub (6) parallel onto the axle spindle resp. steering knuckle.
- **Important:** Be careful not to damage the radial seal rings (7).
Assembly of the hub assembly

Adjustment of wheel bearings

**DANGER**

Wrong assembly and incorrect locking of the wheel bearing adjustment nut

- The wheel together with the complete hub assembly becomes detached from the axle.
- The wheel bearing adjustment nut must absolutely be tightened and locked as described!

### Tightening torque of the wheel safety nut

<table>
<thead>
<tr>
<th>serie</th>
<th>readjustment used bearings (Nm)</th>
<th>new bearings (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>106</td>
<td>650 to 700</td>
<td>850</td>
</tr>
</tbody>
</table>

### 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 later tightening torque.
   - Customer service tool: Wrench for wheel bearing adjustment nut
   - Lightly knock on the wheel hub with a plastic hammer and turn it repeatedly during tightening
3. Loosen the wheel bearing adjustment nut again (unscrew it approximately 180 °).
4. Tighten the wheel bearing adjustment nut.
   - Turn the wheel hub repeatedly during tightening.
   - Tightening torque see the table.
   - If it is not possible to lock in this position, the wheel bearing adjustment nut must be tightened to the next possible locking position.

### Locking wheel bearing adjustment nut

1. Lock the wheel bearing adjustment nut with a screw.
   - Screw locking: Loctite 270
   - Tightening torque: 72 Nm
Assembly of the face seal

Seal rings, torics, and housings must be clean and free of any oil film, dust, or other foreign matter. Use a solvent that evaporates quickly, leaves no residue, and is compatible with the rubber toric rings. The recommended solvent is Isopropanol. Ring and housings should be wiped with a solvent-soaked lint free cloth or paper towel.

After all components have been wiped clean, the torics should be installed on the metal seal rings so that they rest in the radius on the tail of the metal ring. Insure that the torics are not twisted by inspecting the mold flash line on the outside diameter of the toric for true circumferential tracking around the seal. Twisted torics will cause nonuniform face load that can result in leakage of lubricant and pumping of debris past the toric. If a twist is apparent, it can be eliminated by gently pulling a section of the toric radially away from the metal seal ring and letting it “snap” back. Repeating this in several places around the ring will eliminate any twist in the toric ring.

Put the toric ring (2) on seal ring (1), at the bottom of the seal ring ramp (7) and against the retaining lip (8).

The toric ring (2) can twist if it is not wet all around during installation or if there are burrs of fins on the retaining lip (3) of the housing (5).

Eliminate toric twist by gently pulling a section of the toric (2) rapidly away from the seal ring (1) and letting it “snap” back.
Assembly of the face seal

5.8.2

Place the installation tool around the seal ring and dip the seal ring into a pan of Isopropanol solvent to lubricate the toric ring. It is essential to lubricate the toric with Isopropanol so that the toric will slip past the housing retaining lip and seal uniformly in the housing nose radius. Insufficient lubrication can cause poor seal performance due to nonuniform loading (twisted torics or cocked seals). Use of solvents other than Isopropanol can leave a residue on the toric or ramps and allow the toric to slide rather than roll in seat. This can also result in poor seal performance due to nonuniform loading.

Put the installation tool (9) onto the seal ring (1) with toric ring (2). Lower the rings into a container with Isopropanol until all surfaces of the toric (2) are wet.

Toric sliding on retainer ramp.

Toric caught on housing retainer lip.

Toric sliding on seal ramp.

After dipping the seal assembly in the solvent, shake the excess solvent from the seal assembly and immediately “pop” the seal into the housing with a firm push of the installation tool. Remove the installation tool and check the seal stantout height at several places around the circumference of the ring to verify an accurate installation. If the seal does not meet the height specification, inspect the toric for twists or obvious bulges.

With all surfaces of the toric ring (2) wet with Isopropanol, use the installation tool (9) to position the seal ring (1) and the toric ring (2) squarely against the housing (5) as shown. Use sudden and even pressure to pop (push) the toric ring (2) under the retaining lip (3) of the housing (5).
Assembly of the face seal

The seal can be adjusted by gently pushing the toric into position by hand or by using a fabricated adjustment hook.

If small adjustments are necessary, do not push directly on the seal ring (1); use the installation tool (9) to push down or the adjustment tool (11) to pull up.

A thin film of light oil should be applied to the seal faces prior to assembly. Use an applicator, a disposable tissue or a clean finger to distribute the oil evenly. Be careful not to get any oil on the rubber toric rings.

Be sure there is no visible debris on either of the seal faces - even a small piece of lint can hold the seal faces apart and cause leakage.

After successful installation, wait one minute for the Isopropanol to dry before assembling the two seal halves in the final loaded position. This delay is to allow any excess solvent to dry so that the torics roll, rather than slide, in the housing as the faceload is increased. If the torics slide, this can produce a nonuniform load that can result in poor seal performance.

Results of incorrect assembly:

Point “A” and point “B” remain stationary.
Points “X” and “Y” rotate 180°.
This causes high pressure at “A”/ “Y” and possible galling.
When rotated, points “B”/ “X” has low pressure and possible leakage.
Assembly of the face seal

After the unit to be sealed is assembled, a post-assembly leakage test can be performed to insure the seal is properly installed. A vacuum check is recommended rather than a pressure check as vacuum checks are more sensitive. Many users find this an easy check to combine with a vacuum fill technique for the lubricant. It is recommended the compartment be filled to the correct level with lubricant and then rotated slowly several revolutions to seat the seals. A vacuum test will catch big seal damage such as broken seal rings or cut torics that may be caused in the last phases of assembly. The Duo-Cone seal is not designed to seal air, so some leakage can be expect using such a procedure.

Following these guidelines and recommendations should insure optimum performance from the Duo-Cone seals.
Assembly of planetary gear drive
Planetary gear drive
Assembly of the ring gear and ring gear carrier
Assembly of the sun gear

Prepare the ring gear and the ring gear carrier

Heat the taper roller bearing inner ring with cage (1) to about 100°C and install it onto the ring gear carrier (2). Place the ring gear (3) onto the ring gear carrier. Bolt the retainer (5) with the screws (4), secure the screws with Loctite 270. At PL417/510 the ring gear has to be mounted after installation of the fast planetary gear stage, reverse the ring gear has to be disassembled before disassembly of the fast planetary gear stage.

Assembly of the ring gear carrier

Install the ring gear carrier (2) with ring gear (3) into the wheel hub resp. onto the steering knuckle resp. axle spindle. The oil compensating hole in the ring gear carrier must be on the bottom. Subsequent adjust wheel bearings (see chapter 5.7).

Assembly of the thrust ring

Press the thrust ring (6) into the steering knuckle resp. axle spindle. Secure with Loctite 270.

Assembly of the sun gear

Slip the sun gear (7) onto the universal joint resp. axle shaft, install the circlip (9) and push the universal joint resp. axle shaft towards the inside until the circlip contacts to the sun gear and the sun gear contacts to the thrust ring.
Prepare planetary gear:
Install the needle bearing (10 resp. 11) into the planetary gear (12 resp. 13).

Insert the preassembled planetary gears (12 resp. 13) with needle bearings (10 resp. 11), rings (16) (if present) and thrust discs (14 resp. 15) into the planetary housing (22 resp. 23) (planetary housing in horizontal position).

Place o - ring (19) into the slot of the planetary housing (22). Because of the difference of diameter of 0,1 mm press the planetary pin (17 resp. 18) in direction of arrow. Be sure, that the bore hole of the locking pin in the planetary pin and planetary housing are aligned. After inserting, secure the planetary pin with the locking pin (20 resp. 21).
Assembly of the planetary housing

Adjustment of the axial clearance

Assembly of the planetary housing (23)

Press the thrust disc (32) into the sun gear (8), secure with Loctite 270.
Press the sun gear (8) into the planetary housing (23), secure with Loctite 270.
Install the circlip (33) into the slot of the sun gear. Insert the preassembled planetary housing (23) into the hub assembly (fix on the sun gear (7) and in the ring gear (3)).

Adjustment of the axial clearance

The axial clearance between sun gear (8) and thrust disc (27) in the planetary housing (22) must be 0.6 - 0.9 mm.

Measure distances:

Dimension A =

Dimension B =

Required disk thickness =
A - B - axial clearance (0.6 - 0.9 mm)

Mount the correctly dimensioned thrust disc (if necessary make final correction on a lathe) into the planetary housing. Secure with Loctite 270.

Assembly of the planetary housing (22)

Place o - ring (30) into the slot of the planetary housing. Install the preassembled planetary housing (22) and bolt it, secure the screws with Loctite 262.
Knock the locking pin (20 resp. 21) completely to the inner side of the planetary pin.

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

**Attention:**

Because of the difference of diameter of 0,1 mm do not press the planetary pin against the direction of arrow out of the planetary housing, to prevent damaging the bore.

Remove the planetary gears with the thrust discs and needle bearings.
Assembly:

Version 1: Install the needle bearing with mounting bushings into the planetary gear, thereby the outer mounting bushing will be stripping.

Insert the planetary gear with thrust discs into the planetary housing.

Press in the planetary pin, thereby the inner mounting bushing will remove.

Version 2: Place one thrust disc on the work bench, place on the planetary gear and insert the mounting bushing.

Insert the cylindrical rollers/needles alternately with the rings (according to the design).

Insert the planetary gear with thrust discs into the planetary housing.

Press in the planetary pin, thereby the mounting bushing will remove.

Hint: Note the passage “Assembly of the planetary gear”!

Disassembly:

At the disassembly of the planetary pin the cageless needle bearing will fall asunder, if not a mounting bushing will be pushing inwards at planetary pin removing.

Hint: Note the passage “Disassembly of the planetary gear”!
Assembly of the wet disc brake

1. Brake carrier
2. Brake housing
3. Piston
4. Inner disc
5. Outer disc
6. O – ring
7. Screw
8. Screw plug
9. Seal ring
10. Seal ring
11. Connection peace
12. Breather
13. Sealing ring
14. Sealing ring
15. Spring
16. Screw
17. Seal ring
18. Screw plug
19. O - ring
20. Face seal
21. Screw
22. Tube
23. Bushing
24. Screw
Assembly of the piston seals

Place piston with the larger diameter downwards. Note succession of the sealing parts at fitting. Install o - rings free of torsion and loops.

Assembly of o - ring and supporting ring

1. large supporting ring
2. large o - ring
3. small o - ring
4. small supporting ring

Install the supporting rings to the averting side of pressure!

Assembly of the Omegat seal kit

1. large o - ring
2. small o - ring
3. large supporting ring
4. small supporting ring

Install the PTFE - profile rings with small diameter to pressure side!
Assembly of the piston

- lubricate cylinder bore
- apply the thread holes at wet disc brakes with Loctite

<table>
<thead>
<tr>
<th>Wet disc brake (dimension X…)</th>
<th>X270 - X340</th>
<th>X460 – X550 – X650</th>
</tr>
</thead>
<tbody>
<tr>
<td>use</td>
<td>Loctite 243</td>
<td>Loctite 262</td>
</tr>
</tbody>
</table>

- install and screw the bushing (if present)
- place the piston onto the brake carrier (do not cant it!)

<table>
<thead>
<tr>
<th>Wet disc brake (dimension X…)</th>
<th>X270 - X340</th>
<th>X460 – X550 – X650</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly of the piston</td>
<td>press the piston equal by hand into the brake carrier (do not cant it!)</td>
<td>press the piston equal with mounting screws into the brake carrier (do not cant it!)</td>
</tr>
</tbody>
</table>

- if necessary adjust the piston with easy hammer taps to the thread holes
- install first the springs, then the tubes in the bore holes of the piston
- screw in the hexagon head screws with flange
Lay discs into the housing.

**Check the air gap:**

Air gap = measure A - measure B (measured without pressure)

Rated size about 0.5 mm smaller than the air gap pressurized (see table).

Install o - ring (brake housing/ brake carrier) free of torsion and loops.
## Assembly of service brake - wet disk brake

### Air gap and wear dimension

<table>
<thead>
<tr>
<th>brake type</th>
<th>air gap sL new (pressurized) (mm)</th>
<th>wear dimension (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3270</td>
<td>1,5 ± 0,7</td>
<td>1,5</td>
</tr>
<tr>
<td>3340</td>
<td>2,4 ± 0,6</td>
<td>1,5</td>
</tr>
<tr>
<td>3340-1</td>
<td>1,8 + 0,5/ - 0,1</td>
<td>1,5</td>
</tr>
<tr>
<td>4340</td>
<td>2,5 ± 0,9</td>
<td>2,0</td>
</tr>
<tr>
<td>5340</td>
<td>2,4 ± 0,9</td>
<td>2,5</td>
</tr>
<tr>
<td>6340</td>
<td>2,8 ± 0,6</td>
<td>3,0</td>
</tr>
<tr>
<td>3460</td>
<td>2,5 + 0,7/ - 0,1</td>
<td>1,5</td>
</tr>
<tr>
<td>4460</td>
<td>2,5 + 0,7/ - 0,1</td>
<td>2,0</td>
</tr>
<tr>
<td>4460-1</td>
<td>2,25 + 1/ - 0,1</td>
<td>2,0</td>
</tr>
<tr>
<td>5460</td>
<td>3,0 + 0,5/ - 0,1</td>
<td>2,5</td>
</tr>
<tr>
<td>6460</td>
<td>3,0 + 0,5/ - 0,1</td>
<td>3,0</td>
</tr>
<tr>
<td>7460</td>
<td>3,0 + 0,5/ - 0,1</td>
<td>3,5</td>
</tr>
<tr>
<td>8460</td>
<td>3,3 + 0,5/ - 0,1</td>
<td>4,0</td>
</tr>
<tr>
<td>10460</td>
<td>4,0 + 0,5/ - 0,1</td>
<td>5,0</td>
</tr>
<tr>
<td>5550</td>
<td>3,0 + 0,5/ - 0,1</td>
<td>2,5</td>
</tr>
<tr>
<td>8550</td>
<td>3,5 + 0,5/ - 0,1</td>
<td>4,0</td>
</tr>
<tr>
<td>4650-1</td>
<td>3,5 + 0,5/ - 0,1</td>
<td>2,0</td>
</tr>
<tr>
<td>6650-1</td>
<td>4,0 + 0,5/ - 0,1</td>
<td>3,0</td>
</tr>
</tbody>
</table>
Place the brake carrier onto the brake housing and bolt it. Mount breather with connection piece and seal ring, screw plugs with seal rings.

Check brake hydraulic system for leaks (see tightness checking instruction).

Install o - ring (Brake carrier/ axle spindle resp. steering knuckle) free of torsion and loops.

**Check the air gap (pressurized):**

Measure through the check hole the distance from brake carrier to the piston end face, while non actuated brake, actuate the brake and repeat the measure operation - the difference of the measured distances gives the air gap sL (pressurized), rated size sL see table.

Measure through the check hole the distance from brake carrier to the piston end face, while actuating the brake and knock the measured value with marking punches into the brake carrier.

Install the complete brake on the axle (coat the contact surface with Loctite 270).

Mount face seal see chapter 5.8.

**Alignment of the discs**

**Wet disc brake dimension X270 and X340:**

The alignment of the discs has to be made at mounting of the wheel hub by itself.

**Wet disc brake dimension X460 and X650:**

The alignment of the discs has to be made by a mounting device (see chapter 3.6). Clamp the discs by actuating the brake (hydraulic or air pressure).
Tightness checking instruction for brake hydraulic system and cooling oil room

Check brake hydraulic system for leaks

Before conducting the test, bleed the brake hydraulic system.

The pressure drop after applying 120 bar for a period of 15 minutes must not exceed 2% (leaving 117.5 bar).

Test medium: Motor oil SAE 10 W corresponding to MIL - L 2104.

Check cooling oil room for leaks

Brake with external cooling:

After assembly of the wheel hub with the face seal and adjusting of the wheel bearings check the tightness of the cooling oil room.

Install an air pressure gauge with shutoff valve.

Beload the hub assembly with 1.5 bar pressure air.

Turn the hub assembly several times.

The pressure drop after a period of 10 minutes must not exceed 0.1 bar.

Brake without external cooling:

After assembly of the planetary gear drive check the tightness of the cooling oil room.

Install an air pressure gauge with shutoff valve.

Beload the hub assembly with 0.5 bar pressure air.

Turn the hub assembly several times.

The pressure drop after a period of 15 minutes must not exceed 0.1 bar.
Permissible oil for brake with external cooling

**Actuation fluid:**

Do not use brake fluid at any time!

Use a mineral oil base hydraulic oil type fluid only!

1) Motoroil API SE/ CD
   
   MIL - L - 46152C/ MIL - L - 2104 C o. D

2) ATF C - 3 or Dexron ®

3) Hydraulicoil HLP DIN 51524 Teil 2

**Viscosity:**

For moderate climate ISO VG 22 - 32

For extremely cold climate ISO VG 15

For extremely warm climate ISO VG 46

**Cooling fluid:** like actuation fluid.

**Important:** It is necessary to use oils with LS - additives (Limited Slip), according to the recommendation of the oil supplier.

For example: 3 - 6% Lubrizol LZ 6117/ LZ 9990 A or LZ 6279

**Check measure:**

It is measured through the check hole, while actuating the brake.

The check measure, new, is marked in the housing below the hole.

Is the measured dimension bigger than the marked dimension and max. wear dimension, unconditional consult Kessler & Co.

After working at the brake, bleed the brake hydraulic system and check for tightness!
Brake design with piston adjustment screws for air gap setting

Air gap setting [nominal dimension see table on page 7.1.5 (NLB), 7.11.6 (NLB-FS) resp. 7.12.4 (NLB-FBR)]:

Assembly of the brake as described. Actuate the brake, screw in the piston adjustment screws to contact at the piston. Measure the distance from piston adjustment screws end face to countersink face of the brake carrier (see sketch) and stamp it in the near of one piston adjustment screw.

Subsequently screw out the piston adjustment screws according to the nominal air gap and release the brake. Attach the seal rings, screw on and tighten the counternuts, during this the piston adjustment screws must not be turned. Attach the seal rings, screw on and tighten the cap nuts, during this hold the counternuts.

Check lining wear:

Detach the cap nut and counternut from the piston adjustment screw (position with stamped checking dimension), actuate the brake and screw in the piston adjustment screw to contact at the piston. Measure the distance from piston adjustment screw end face to countersink face of the brake carrier (see sketch). Is the measured dimension smaller than the stamped dimension and max. wear dimension (see table on page 7.1.5, 7.11.6 resp. 7.12.4), unconditional consult Kessler & Co. Following set the piston adjustment screw in its original position according to the above description. Or, if necessary adjust the air gap.

Inspection and adjustment of the air gap:

Detach cap nuts and counter nuts. Actuate the brake, screw in the piston adjustment screws to contact at the piston. Subsequently screw out the piston adjustment screws according to the nominal air gap and release the brake. Attach the seal rings, screw on and tighten the counternuts, during this the piston adjustment screws must not be turned. Attach the seal rings, screw on and tighten the cap nuts, during this hold the counternuts.
Assembly of parking brake
Safety notes:

**WARNING!**

Before commencing work on the parking brake, ensure that no unintended machine movement can happen when the braking effect is removed.

- Danger to life! -

**DANGER!**

The parking brake is under spring tension. Parts could become loose and fly out suddenly if improper brake opening.

- Danger to life! -

Therefore release the lock nut (2) and turn the adjusting screw (3) counter – clockwise until the spring set is released before disassembly of the circlip (1)!
1. Construction and funktion

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.

![Diagram of brake assembly](image)

**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:

<table>
<thead>
<tr>
<th>type</th>
<th>adjusting screw</th>
<th>clearance (mm)</th>
<th>turns</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSG90</td>
<td>M16 (SW 8)</td>
<td>min. 0,5</td>
<td>1/4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>clearance 1,0</td>
<td>1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>max. 1,5</td>
<td>3/4</td>
</tr>
<tr>
<td>FSG110</td>
<td>M20 (SW 10)</td>
<td>min. 1,0</td>
<td>2/5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>clearance 2,0</td>
<td>4/5</td>
</tr>
<tr>
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3. Hold the adjusting screw in position with a hexagonal socket wrench and lock with lock nut.

4. Mount the screw cap and tighten as far as possible manually.

5. Stellen Sie den Druckanschluß gemäß der Vorschrift der Achs- bzw. Getriebehersteller her. Mount the pressure connection in accordance with the instructions of the axle / gear manufacturer.

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

2.3. Adjusting regulations

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

1. Stand the vehicle on an even surface and secure against rolling away.

2. Release the parking brake by using the required release pressure.

3. Release the screw cap and unscrew.

4. Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually clockwise until the two brake pads make contact with the brake disk.

5. Turn the adjusting screw anti-clockwise and set the clearance specified in the above table.

6. Hold the adjusting screw in position with the hexagonal socket wrench and lock with the lock nut.

7. Mount the screw cap and tighten as far as possible manually.

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

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

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).

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

**Note:**

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

**Caution!**

Check the pressure hose. If the pressure hose is 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 screwdriver.

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

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.
A  Network –like formation of cracks  
admissible

B  Radial shaped crack  
not admissible

C  Uneven brake surface characteristics below 1,5 mm  
admissible

D  Continuous cracks  
not admissible

E  Radial cracks max. 0,5 mm (width)  
admissible
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

<table>
<thead>
<tr>
<th>To Contact Tractech Inc.</th>
<th>Telephone:</th>
<th>(586) 759-3850 U.S.A.</th>
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<tr>
<td>FAX:</td>
<td>(586) 759-1645 U.S.A.</td>
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<tr>
<td>Web Site:</td>
<td><a href="http://www.tractech.com">www.tractech.com</a></td>
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<tr>
<td>Office Hours:</td>
<td>7:30 - 4:30 (FT) Mon. - Fri.</td>
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**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.

**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.
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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 bussses 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.
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.

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.
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.

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.
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
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.
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.

Stage 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.
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 finger tight 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.

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](image)

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](image)

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](image)

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 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.

<table>
<thead>
<tr>
<th>Model Series</th>
<th>Part No.</th>
<th>Operating Height</th>
<th>Load (lbs. Minimum)</th>
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<tbody>
<tr>
<td>137S</td>
<td>69978</td>
<td>.45&quot;</td>
<td>40</td>
</tr>
<tr>
<td>162S</td>
<td>69427</td>
<td>.54&quot;</td>
<td>45</td>
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<tr>
<td>187S</td>
<td>68264</td>
<td>.61&quot;</td>
<td>46</td>
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<tr>
<td>187S</td>
<td>69076</td>
<td>.61&quot;</td>
<td>72</td>
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<tr>
<td>187S</td>
<td>72008</td>
<td>.61&quot;</td>
<td>72</td>
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<tr>
<td>187S</td>
<td>72016</td>
<td>.61&quot;</td>
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<td>225S</td>
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<td>225S</td>
<td>69640</td>
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<td>250S</td>
<td>67085</td>
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<td>275S</td>
<td>67115</td>
<td>.86&quot;</td>
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<td>306S</td>
<td>66842</td>
<td>.90&quot;</td>
<td>104</td>
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<td>350S</td>
<td>67204</td>
<td>1.04&quot;</td>
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<tr>
<td>400S</td>
<td>65461</td>
<td>1.41&quot;</td>
<td>144</td>
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<td>450S</td>
<td>64718</td>
<td>1.30&quot;</td>
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<tr>
<td>550S</td>
<td>65423</td>
<td>1.43&quot;</td>
<td>198</td>
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<tr>
<td>600S</td>
<td>68707</td>
<td>1.56&quot;</td>
<td>297</td>
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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.

<table>
<thead>
<tr>
<th>PROBLEM</th>
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<tr>
<td>Hub studs shearing; rear tire scuffing; axle shaft breakage</td>
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<td>Steering difficulty; vehicle pulls on straight forward driving or tends to go straight when making turns</td>
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<td>No differential action; binding in turns</td>
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<td>Excessive driveline noise*</td>
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<td>Excessive tire wear</td>
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<td>Continuous &quot;clicking&quot; sound in straight forward driving</td>
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<td>Excessive backlash in vehicle drivetrain; engine lug or vehicle surge during turns</td>
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<tr>
<td>Tendency to side-slip or “fishtail” on icy roads</td>
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<tr>
<td>Sluggish reengagement of NoSPIN differential clutch assemblies</td>
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<td>Difficulty in turning vehicle from standing start</td>
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<tr>
<td>Erratic operation of NoSPIN differential; premature wear or failure of NoSPIN differential components</td>
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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.


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.


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.
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

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 deferential 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.

**DETOUR 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 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.W.V. - 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.).

**HEXAGONAL** - "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** - Journal allowing a twisting 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.
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.

**LIMITATION OF REMEDIES**

**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.
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.