

SISU AXLES

MAINTENANCE MANUAL SISU FR564 Hub Reduction



Sisu Axles, Inc.
Autotehtaan tie 1
P.O. Box 189
FIN-13101 Hämeenlinna
Finland
Phone int + 358 204 55 2999
Fax int + 358 204 55 2900

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NOTE! This Manual is intended for use by experienced mechanics using safe procedures in properly equipped shops. Safety precautions should always be followed such as wearing safety glasses, using adequate lifting aids, and using tools and equipment in good condition. Sisu Axles, Inc., its agents, associates or representatives are not responsible for damage or injury occurring while working on their components.

SISU FR564 hub reduction

1 General

In this manual, there are repair instructions for the FR564 hub reductions, which are used in Sisu FRDP-13/16, FRMP-13/16 and FRFP-13/16 automotive axles.

The wheel hub incorporates a planetary type hub reduction with 5 planet gears.

Hub repair can be performed in the vehicle or when the axle removed and taken to the workshop.



Note!

NOTE! Repair instructions for the drive gear and for the brakes are in separate manuals.



Picture 1 General view of FR564 Hub reduction (cooled version)

2 Wheel hub repairs

2.1 Planetary Gear Assembly Removal

1. Remove level plug and drain plug (2 and 3 in Picture 2) and drain oil from the planetary gears into a suitable container.



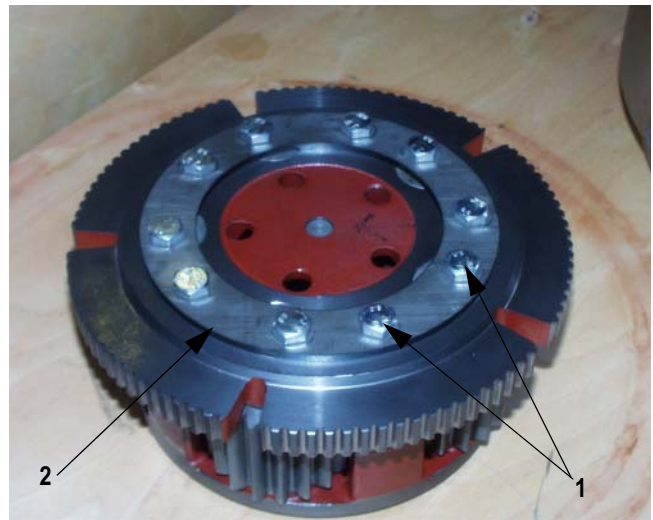
Picture 2 Wheel hub plugs

2. Unscrew hub cover retaining screws (1 in Picture 2) and remove cover.



Picture 3 Wheel hub cover removed

3. Remove locking ring with a suitable screw driver at the end of the ring (arrow 1 in Picture 3). The planetary can now be pulled out.



Picture 4 Planetary gear removed

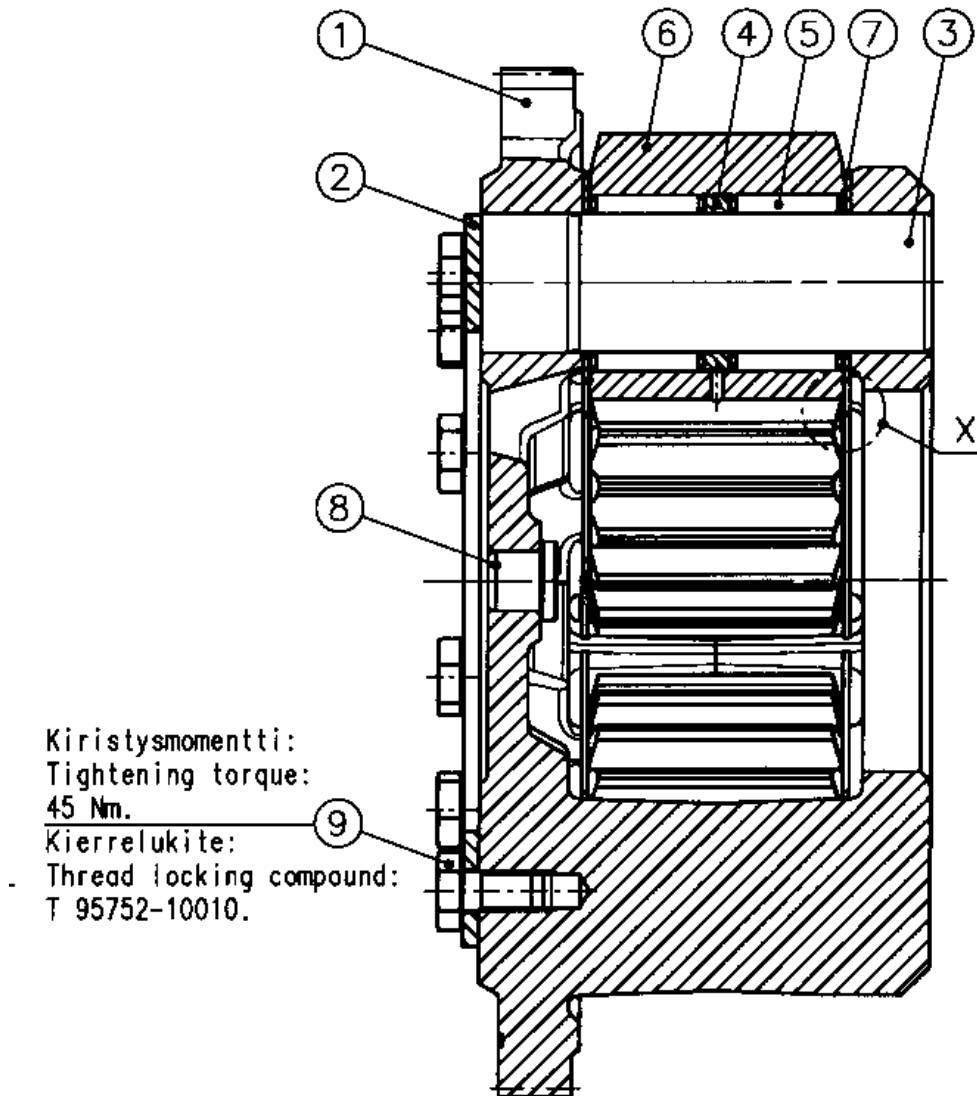
4. Remove screws (1 in Picture 4) which lock planet wheel shafts and locking ring (2 in Picture 4) together with planetary carrier.
5. Take the planetary gear to a workshop press and place the supports under the toothed flange and drive the planet wheel shafts from inside off the carrier.



Note!

With the planet gear shafts removed, take care to contain the bearing needles and spacers which are loose in the planetary gears. Do not lose the axle shaft thrust bearing.

6. Knock also the trust plug, (8 in Picture 5) off the housing.



Picture 5 Planetary gear in sectional view

- | | |
|-----------------------|------------------|
| 1. Planetary carrier | 6. Planet wheel |
| 2. Locking plate | 7. Trust washer |
| 3. Planet wheel shaft | 8. Trust plug |
| 4. Spacer ring | 9. Hexagon screw |
| 5. Bearing needle | |

Inspect all planetary gear parts and discard all defective ones.
Wash all parts to be re-used

2.2 Planetary gear dismantling and assembling

2.2.1 Dismantling

1. Remove screws (1 in Picture 4) which lock planet wheel shafts and locking ring (2 in Picture 4) together with planetary carrier.
2. Take the planetary gear to a workshop press and place the supports under the toothed flange and drive the planet wheel shafts from inside off the carrier.

**Note!**

With the planet gear shafts removed, take care to contain the bearing needles and spacers which are loose in the planetary gears. Do not lose the axle shaft thrust bearing.

3. Knock also the trust plug, (8 in Picture 5) off the housing.

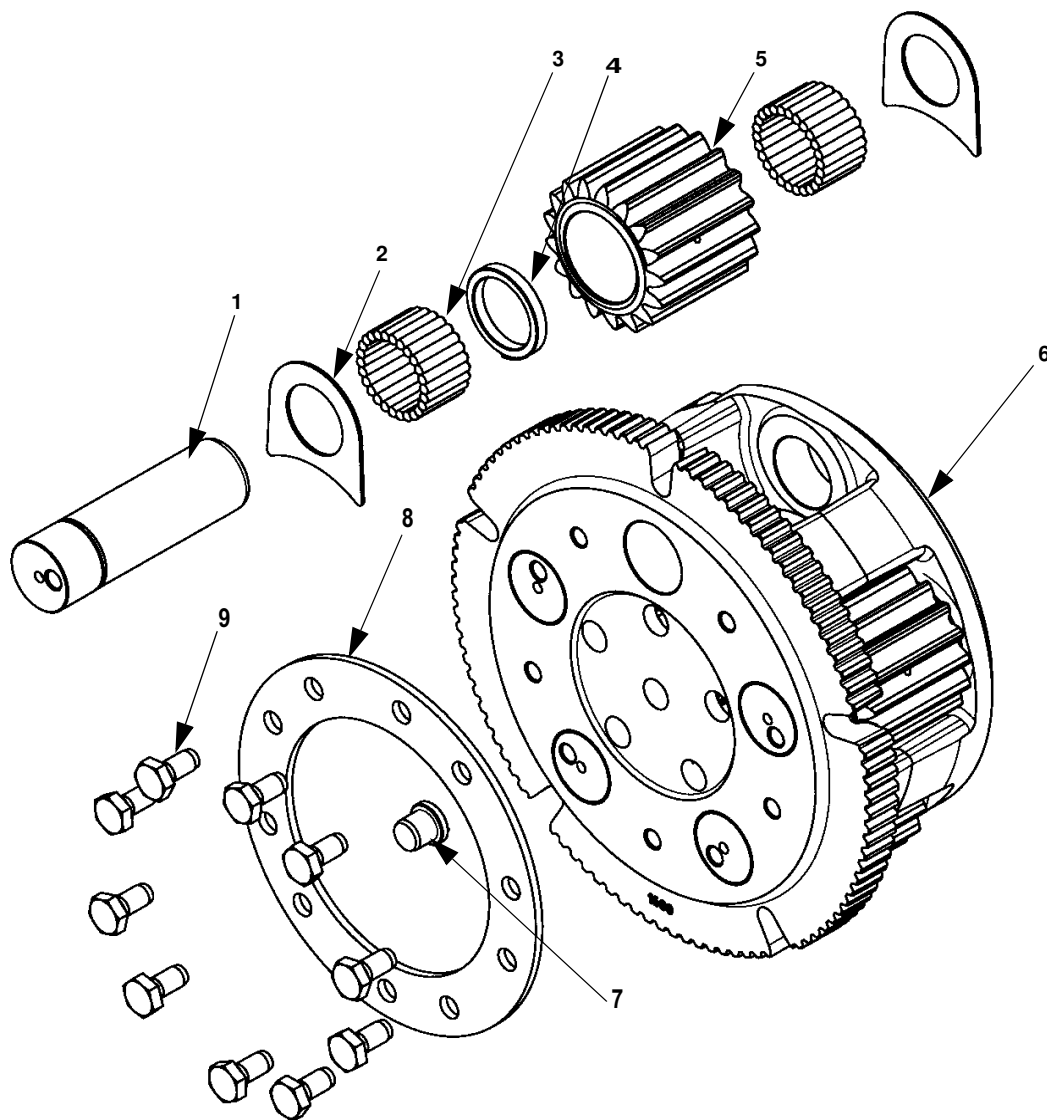
2.2.2 Assembly

1. Attach the planetary carrier to a workshop vise at toothed flange
2. Install bearing needles and spacers inside the planet wheels. Use grease in this operation.

**Note!**

Install bearing needles and spacers very carefully and count the number of them, to be sure that all of them will be installed. 46 needles inside each wheel in two rows.

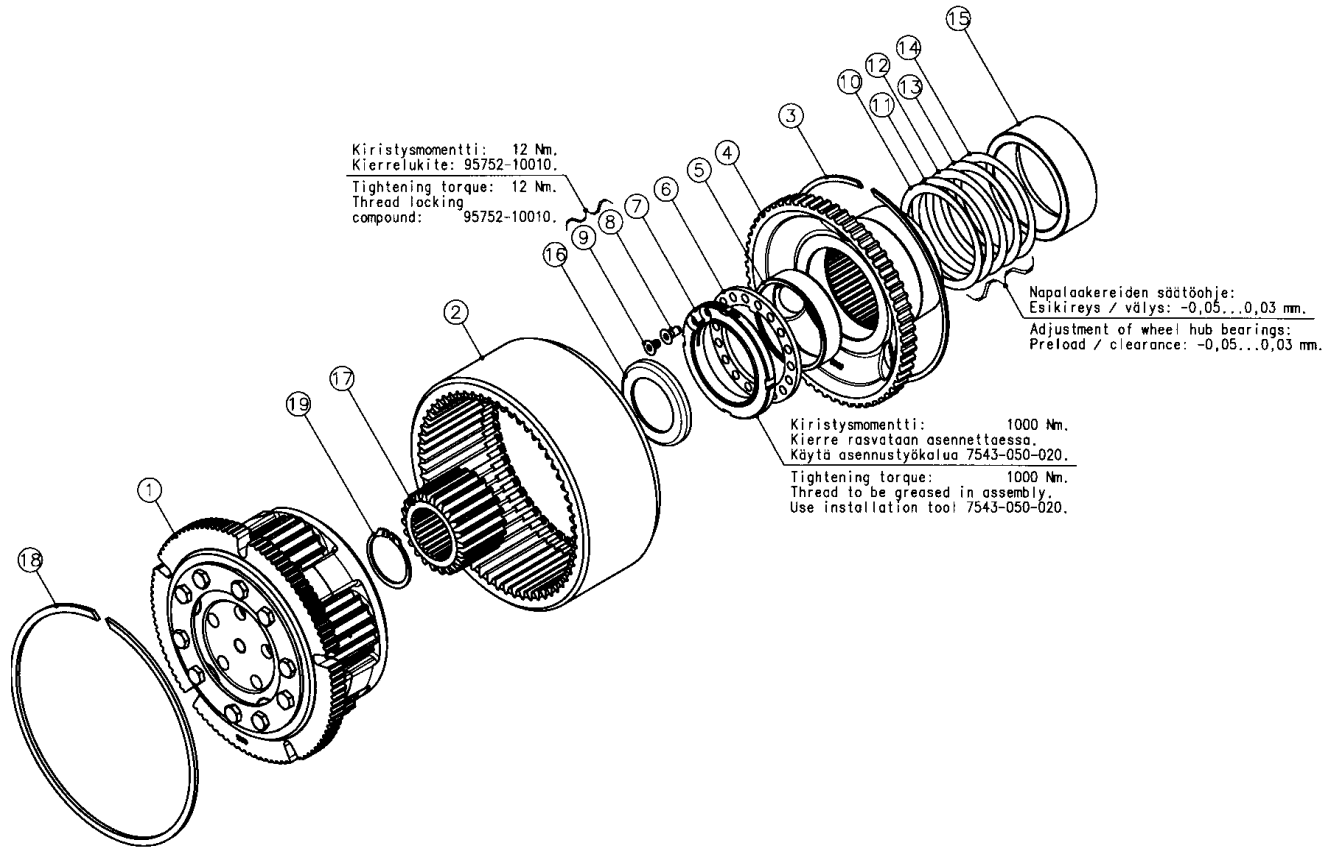
3. Install prepared planet wheel with trust washers and push planet wheel shafts manually as long they slide easily. Note location of the locking screw hole.
4. Install the locking plate, 8 in Picture 6 and attach it on the planet shaft ends with screws, 9 in Picture 6 (5 pcs.). Tighten the screws moderately only.
5. Use locking compound, 95752-10010 in the threads.
6. Take the planetary carrier to a workshop press and use suitable ring on the locking plate inner or outer perimeter and drive the planet shafts to the carrier frame level.
7. Install other screws (5 pcs), which attach the locking plate to the carrier frame.
8. Use locking compound, 95752-10010 in the threads.
9. Tighten all screws to 45 Nm torque.



Picture 6 Planetary gear in exploded view

- | | |
|-----------------------|----------------------|
| 1. Planet wheel shaft | 6. Planetary carrier |
| 2. Thrust washer | 7. Thrust bearing |
| 3. Bearing needles | 8. Lock plate |
| 4. Spacer | 9. Screws (10 pcs.) |
| 5. Planet wheel | |

2.3 Wheel hub dismantling

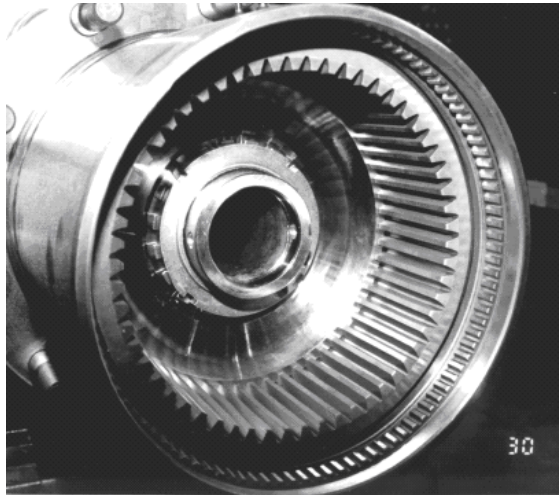


Picture 7 Complete hub reduction with wheel hub in exploded view

- | | |
|----------------------------|--------------------|
| 1. Planetary gear assembly | 11. Shim |
| 2. Ring gear | 12. Shim |
| 3. Locking ring | 13. Shim |
| 4. Ring gear hub | 14. Shim |
| 5. Spacer ring | 15. Spacer bush |
| 6. Locking plate | 16. Protection cup |
| 7. Locking nut | 17. Sun gear |
| 8. Allen head screw | 18. Circlip |
| 9. Allen head screw | 19. Locking ring |
| 10. Shim | |

2.3.1 Wheel hub removal

1. Pull the axle shaft with sun gear out of the axle housing.
Remove the protection cup, 16 in Picture 7 under the sun gear on the axle threads.



Picture 8 Wheel hub planetary assy and axle shaft removed.

2. Remove the screws, 8 and 9 in Picture 7 from the locking nut 7.
3. Remove locking nut with tool 7543-050-020 and take care of locking plate 6.



Note!

The spacer ring, 5 in Picture 7 is installed inside the ring gear hub, 4 with light press fit and it will remain inside the hub.

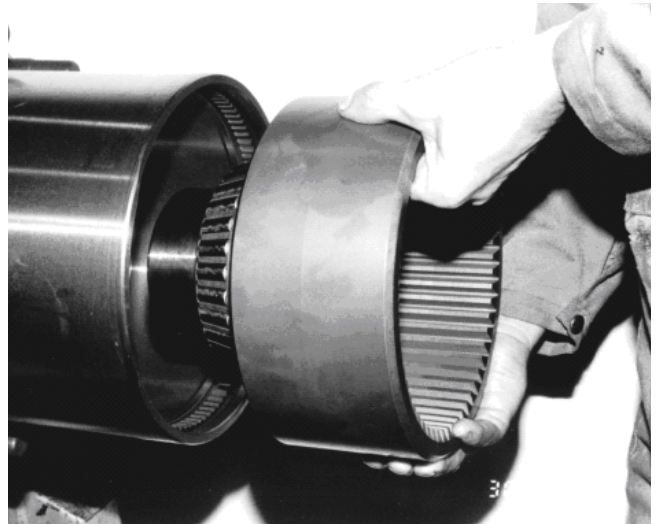
Normally spacer ring do not need replacement, but if it must be replaced it can be removed by knocking with a drift and installed by same way.

4. Lift the ring gear 2 with hub, 4 in Picture 7 off the wheel hub. Outer wheel hub bearing will follow with it.
5. If necessary, remove the locking ring, 3 in Picture 7 and remove the ring gear from the ring gear hub 4.



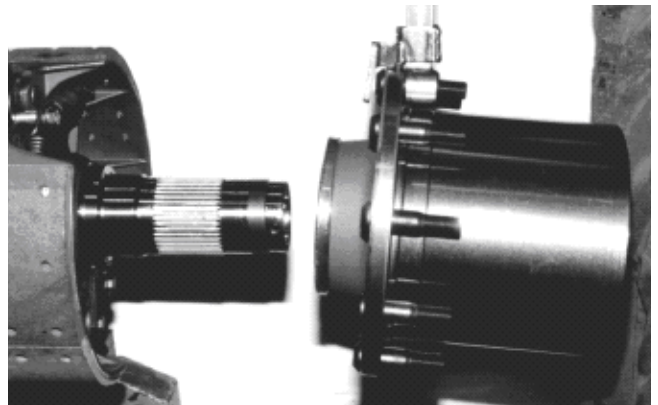
Note!

To make removal easier, support the wheel hub.



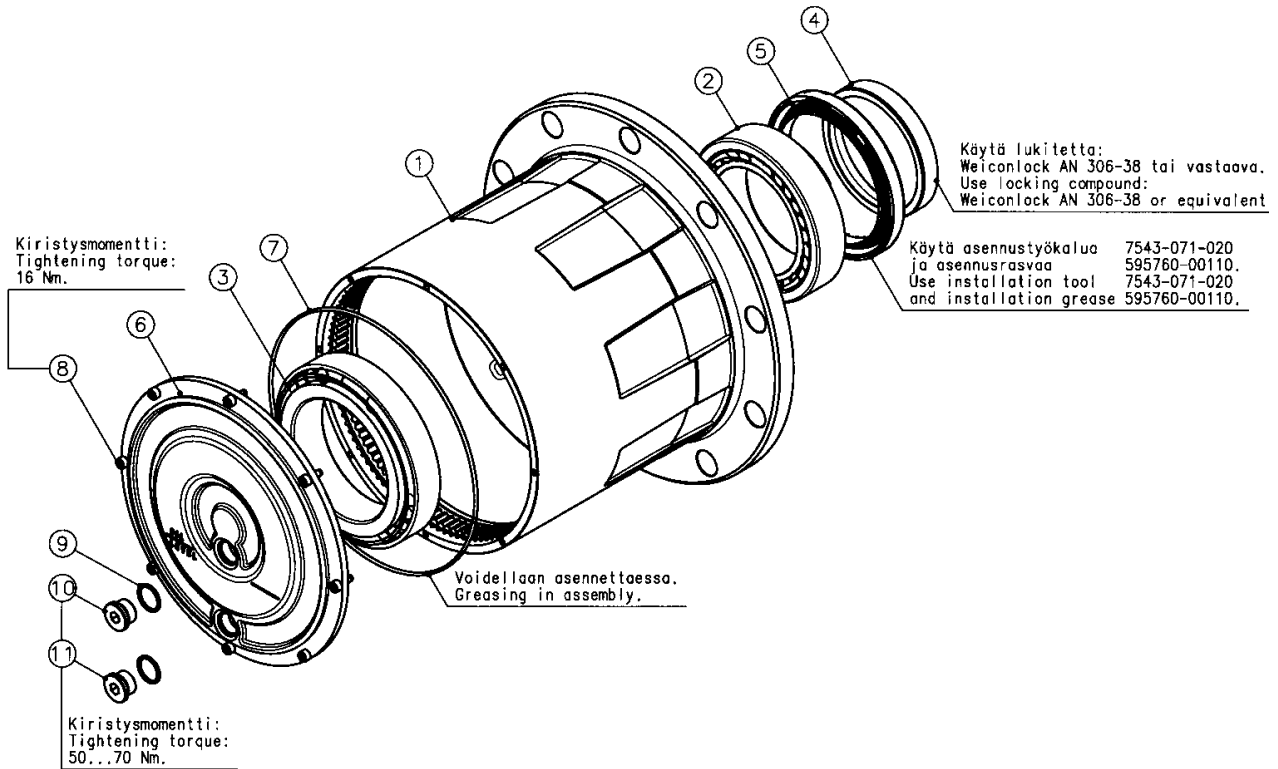
Picture 9 Removing the ring gear with its hub.

After removing the planetary ring gear and its hub, you can remove the wheel hub. The inner wheel bearing and the hub seal can now be removed.



Picture 10 Wheel hub removal, brake drum is already removed

2.3.2 Wheel hub disassembly



Picture 11 Wheel hub in exploded view

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Hub casing 2. Tapered roller bearing 3. Tapered roller bearing 4. Spacer ring 5. Cassette type seal | <ol style="list-style-type: none"> 6. Cover 7. O-ring 8. Allen head screw 9. Sealing ring 10. Level plug 11. Drain plug |
|--|---|

1. Remove the hub seal and the inner wheel bearing. Remove the bearing cups from the hub with a soft drift if bearing replacement is required.
2. Remove spacer ring, 4 in Picture 11, if it need replacement.



Note!

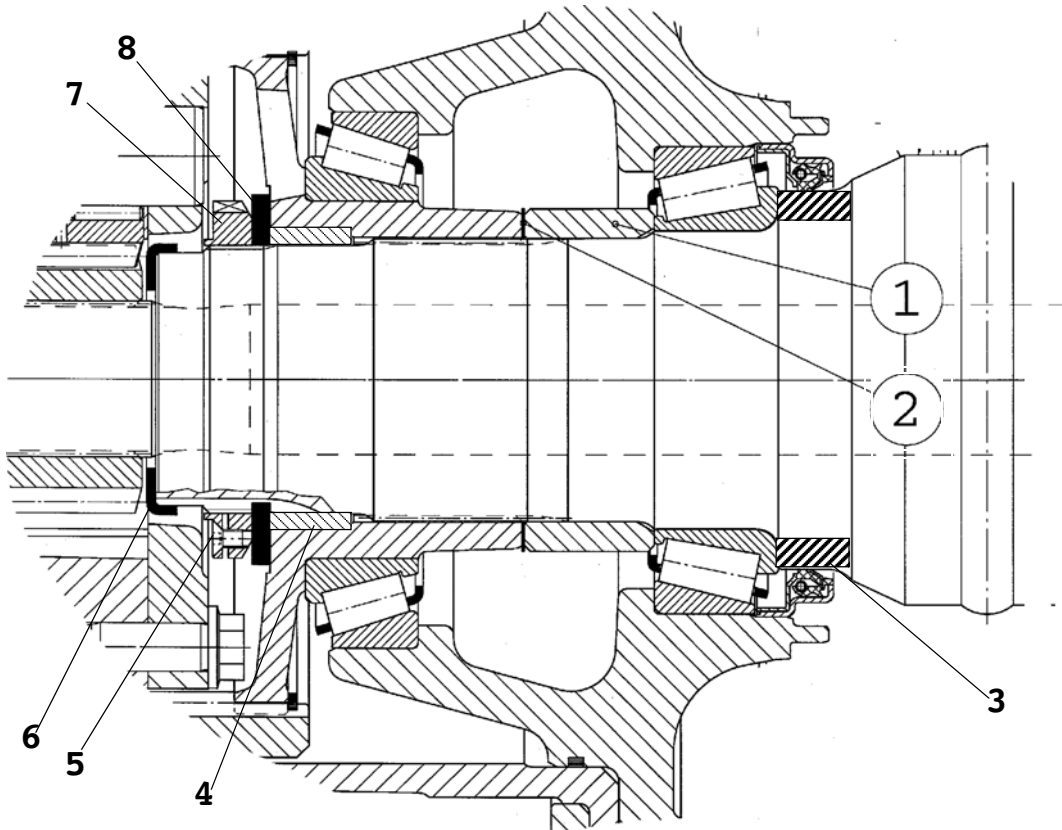
Spacer ring is installed onto axle tube with strong locking compound. Heat the spacer rapidly, that locking compound melts and spacer ring can be taken off.

3. Inspect all wheel components carefully and clean all parts to reused.

2.4 Wheel hub assembly

Inspect the wheel hub carefully before assembly. Always install a new wheel hub seal. Replace any bearings, which have any defects such as scratches, worn spots or discoloring. Ensure that bearing cups are tight in their seats. If cups are loose in the hub, the hub must be replaced. Inspect the planetary ring gear and its mounting in the hub. If any defects are found in the ring gear, it must be replaced.

1. Using a shop press, install the bearing cups in the wheel hub.
2. Lubricate the seal and the bearing with grease. Install the inner bearing cone and the wheel hub seal in the wheel hub.



Picture 12 Wheel hub in sectional view (typical)

- | | |
|------------------|-------------------|
| 1. Spacer ring | 6. Protection cup |
| 2. Shims | 7. Locking screw |
| 3. Spacer ring | 8. Locking ring |
| 4. Spacer | |
| 5. Locking screw | |

2.4.1 Installing of the wheel hub seal

**Note!**

Following installing tools should be used when driving the new seal into it's place

- Seal 591122-12702 with tool 7543-071-020.

No sealing compound is allowed to use in installing.

This seal type has rubber coated outer and inner perimeter surfaces for sealing.

Use Klüberplus S 06-100 assembly gel 595760-00110 for lubrication of seal outer and inner perimeters when installing.

1. Install seal 5 in Picture 11 carefully in workshop press with special tool.

2.4.2 Wheel hub installation

1. Install the spacer ring, 4 in Picture 11, onto axle tube if it was removed. Use Weiconlock AN 306-38 or equivalent locking compound between the ring and axle tube.



Note!

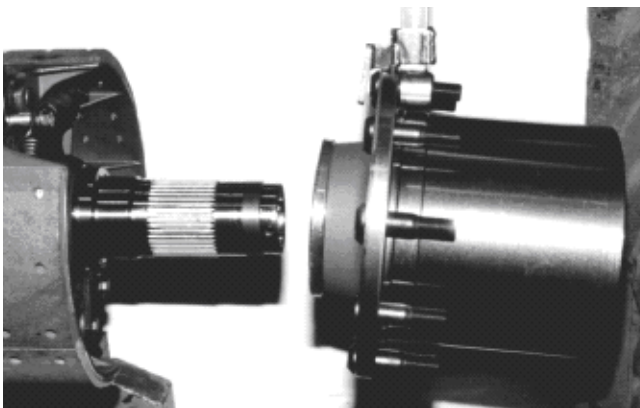
Heat the spacer ring max. up to 80°C temperature prior installation.

2. Lubricate the inside perimeter of the cassette type seal, if not done before.
3. Lift the wheel hub with installed inner bearing and cassette seal onto the axle tube.



Note!

Push the wheel hub carefully home. Pay special attention to alignment. If the cassette seal does not go properly onto spacer ring, there is potential risk of seal damage.



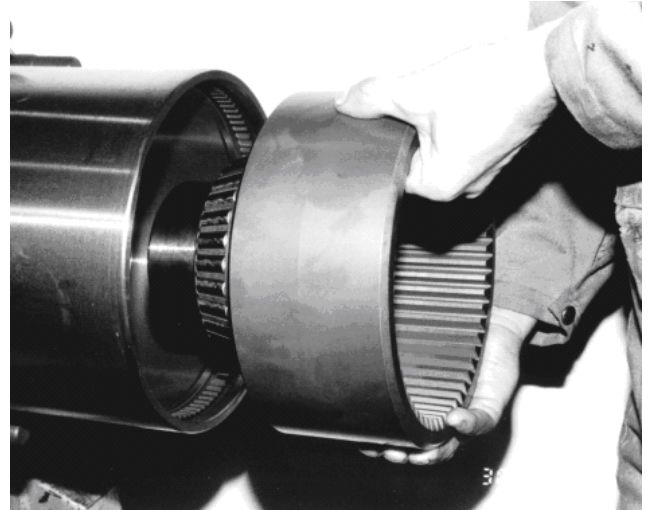
Picture 13 Wheel hub installation

4. Install the ring gear hub with installed ring gear and outer hub bearing cone.



Note!

Install the spacer ring, 4 in Picture 12, prior wheel hub installation, if the spacer has been removed earlier.



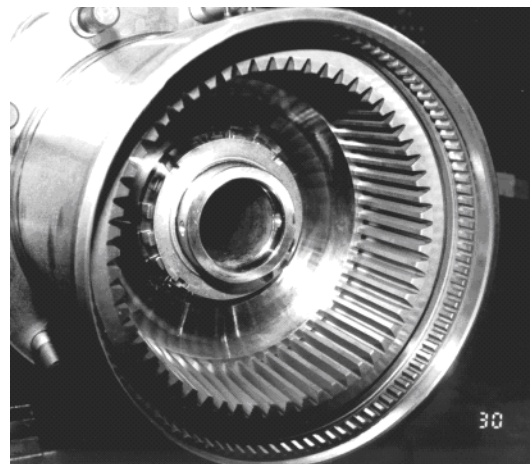
Picture 14 Ring gear hub installation

5. Install locking plate 8 and locking nut 7 in Picture 12 and tighten the locking nut slightly by wrench No. 7543-050-020.



Note!

Lubricate locking nut threads before installation.



Picture 15 Ring gear installed

6. Perform wheel hub bearing adjustment according instructions.

2.4.3 Wheel hub bearing adjustment

Adjust the wheel hub bearing as follows:

1. Tighten the adjusting nut, 7 in Picture 12 with tool No. 7543-050-020 to 250 Nm [185 lb.-ft.] torque while rotating the hub.
2. Check the bearing clearance/preload with a dial indicator. Attach the dial indicator by its magnetic holder to the hub and place the tip of the gauge against the ring gear hub. Move the hub in the direction of the axle while turning it back and forth and read the clearance on the dial.
3. If the clearance is over 0.05 mm, [0.002 inches] remove the wheel bearing locking nut and remove the ring gear hub with the outer hub bearing inner race. Remove the shims to reduce the thickness of the shims so that the correct installing preload/clearance from -0.05 to +0.03 mm [-0.002 to 0.001 inches] can be achieved.
5. Tighten the wheel hub bearing locking nut to 1000 Nm [738 lb.-ft.] torque while rotating the hub.
6. Check the wheel hub rolling torque. It must be 8 ± 2 Nm [4.4 - 7.4 lb.] when measured by a torque wrench in the middle of the wheel hub cover (a special fixture is required). If the rolling torque is not correct, add or remove shims as required.
7. Then loosen the nut only so that the longer one of the locking screws can be installed in one of the two thread holes (M8) so that the tip of the longer locking screw, 8 or 9 in Picture 7 goes to the either hole in the locking plate 6.



Note!

If the hub rotation stops while torquing the nut, remove the wheel bearing adjusting nut and remove the ring gear hub with the outer hub bearing inner race and insert some additional shim(s).

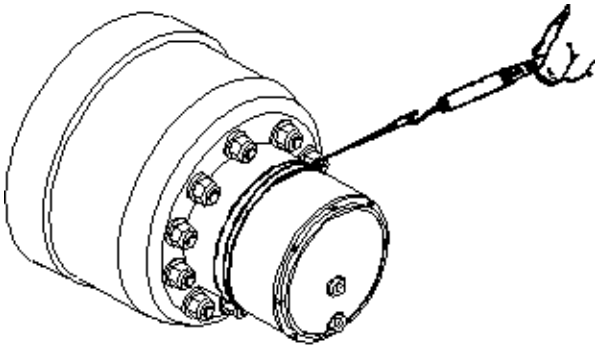


Note!

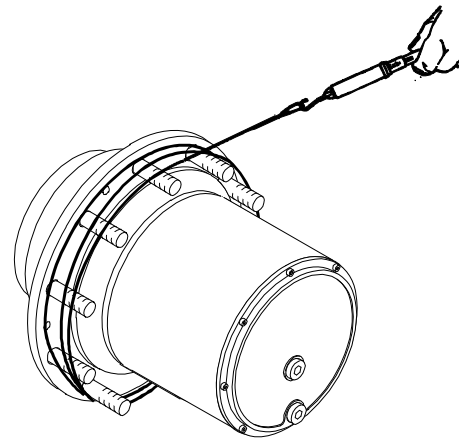
Use locking compound 95752-10010 in locking screw threads.

4. Repeat this until the wheel hub rotates freely.

The rolling torque measurement can be done also by a spring scale and a piece of the string around the wheel hub circumference (43 - 71 N [9.7 - 16.0 lb.], in Picture 16) or from the wheel bolt circumference (34 - 56 N [7.6 - 12.6 lb.], in Picture 17).



Picture 16 Measuring of rolling torque with spring scale on wheel hub circumference



Picture 17 Measuring of rolling torque with spring scale on wheel bolt circumference

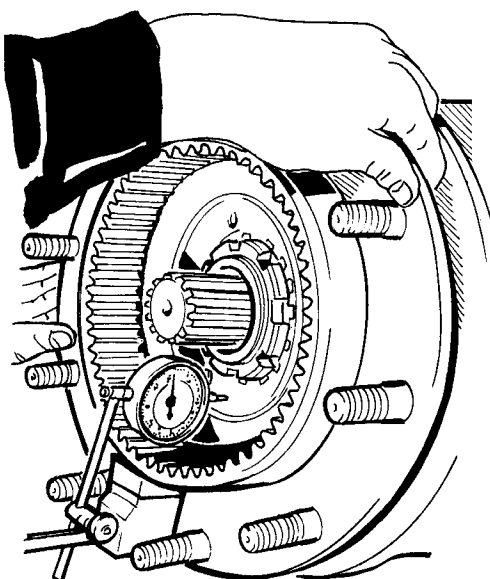


Note!

This measurement shall be done with rotating hub.

2.4.4 Wheel hub bearing clearance check in the vehicle

1. Jack the wheel to be checked up and place a support stand under the axle.
2. Drain the hub reduction oil into a suitable container.
3. Remove hub reduction cover and pull the planetary carrier out.
4. Check the bearing clearance/preload with a dial indicator. Attach the dial indicator by its magnetic holder to the hub and place the tip of the gauge against the ring gear hub. Move the hub in the direction of the axle while turning it back and forth and read the clearance on the dial.
5. If the clearance is over 0.05 mm, [0.002 inches] remove the wheel bearing adjusting nut and remove the ring gear hub with the outer hub bearing inner race. Remove the adjusting shims to reduce the thickness of the shims so that the correct installing preload/clearance from -0.05 to +0.03 mm [-0.002 to 0.001 inches] can be achieved.
6. Install the planetary carrier.



Picture 18 Wheel hub bearing clearance check (typical)



Note!

Rotate the planetary back and forth while pushing the planetary in, so that gear teeth mesh into each other.

7. Replace O-ring, 3 and install the cover, 6 with screws 8 in Picture 11 and tighten screws to 16 Nm torque.
8. Fill recommended oil into the hub reduction trough level plug, 1 in Picture 19 opening up to rim level.
9. Tighten both plugs to 50 - 70 Nm torque.
10. Install the wheel, lower it to ground and remove the axle stand. Check the wheel hub bearing clearances in all other wheels.

2.5 Planetary Gear Assembly installation

1. Install the protection cup, 16 in Picture 7 onto axle tube end over the threads.
2. Install the axle shaft complete with sun gear, 17 in Picture 7 inside the axle tube.
3. Lift pre-assembled planetary gear, 1 in Picture 7 into wheel hub cavity.



Note!

Rotate the planetary back and forth while pushing the planetary in, so that gear teeth mesh into each other.



Note!

Install the hub cover so, that the drain plug hole will be aligned with one cavity in the planetary carrier.

4. Replace O-ring, 3 and install the cover, 6 with screws 8 in Picture 11 and tighten screws to 16 Nm torque.
5. Fill recommended oil into the hub reduction trough level plug, 1 in Picture 19 opening up to rim level.
6. Tighten both plugs to 50 - 70 Nm torque.



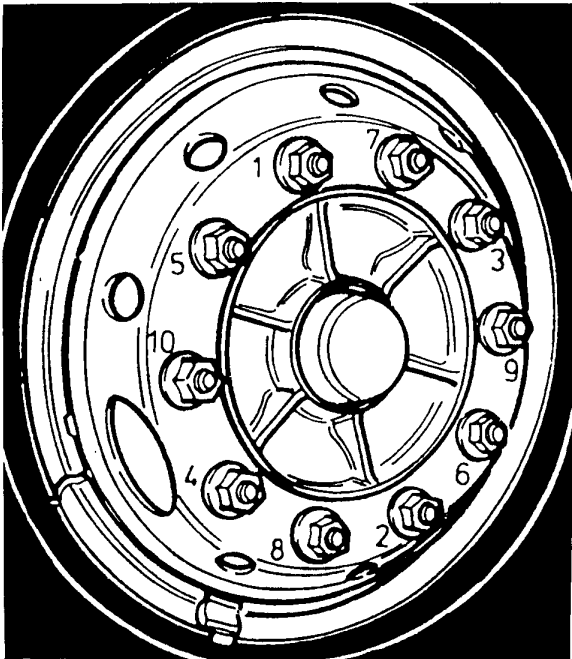
Note!

Replace always plug sealing rings, 9 in Picture 11.



Picture 19 Hub reduction oil plugs

2.6 Attaching the wheel



BRAKE07

Picture 20 Wheel nut tightening sequence

Check that the wheel nuts and bolts are clean and undamaged. Lubricate the bolt threads with a little oil. The tightening torque of the nuts is 550.. 650Nm. Check the tightness of the nuts again at the latest after one day's driving.

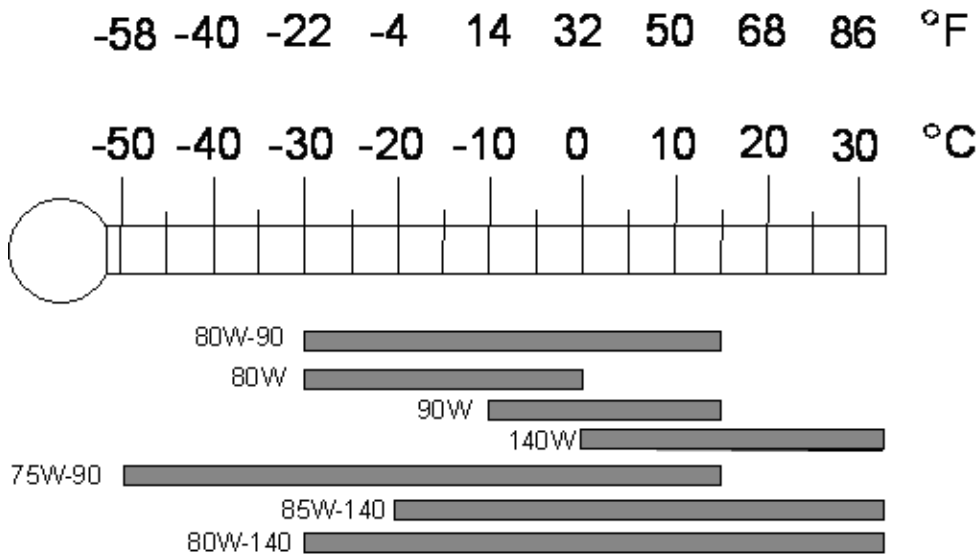
3 Lubrication

3.1 Oil Recommendation

Lubricants used shall be extreme pressure gear oils that meet the requirements of API (American Petroleum Institute) gear oil classification GL-5.

The use of synthetic oil is preferred in extreme low and high ambient temperatures. The used oil type shall be in low temperature conditions "full synthetic" SAE 75w-90 and in very hot conditions SAE 140 offering good viscosity index values.

Viscosity according to prevailing ambient temperature shall be as follows:



3.2 Oil temperatures in operating conditions

Oil suppliers define allowed operating temperatures for their various oil types, which shall not be exceeded.

Good thermal stability shall be considered as an oil selection criteria.

Typical axle temperature values measured in operating conditions can reach 80-100°C, in extreme conditions 120°C. Temperatures continuously over 100°C require normally an adequate oil cooling system to be applied.

3.3 Oil change intervals

Oil change intervals shall be monitored in extreme conditions by oil analysis. In case of high metal content or decreased lubrication properties oil change intervals shall be reduced. Warranty will not cover damages caused by poor lubrication in case of using reduced oil quality.

4 Technical data

Wheel Hub

Oil volume approx. std., hub	1,5	l
Oil volume approx. cooled hub	2,5	l
Wheel hub bearing clearance	0,0...0,05	mm
Wheel hub bearing clearance wear limit	0,1	mm

Tightening torques

Wheel hub nut	1000	Nm
Wheel hub nut locking screws	12	Nm (locking compound)
Planet wheel shaft locking plate screws	45	Nm (locking compound)
Wheel hub cover screws	16	Nm
Wheel nut	550 ... 650	Nm
Oil plugs	50 ... 70	Nm

Locking compounds

Screws	95752-10010	Loctite 243 or similar
Spacer ring on axle tube	Weiconloc AN 306-38	or equivalent

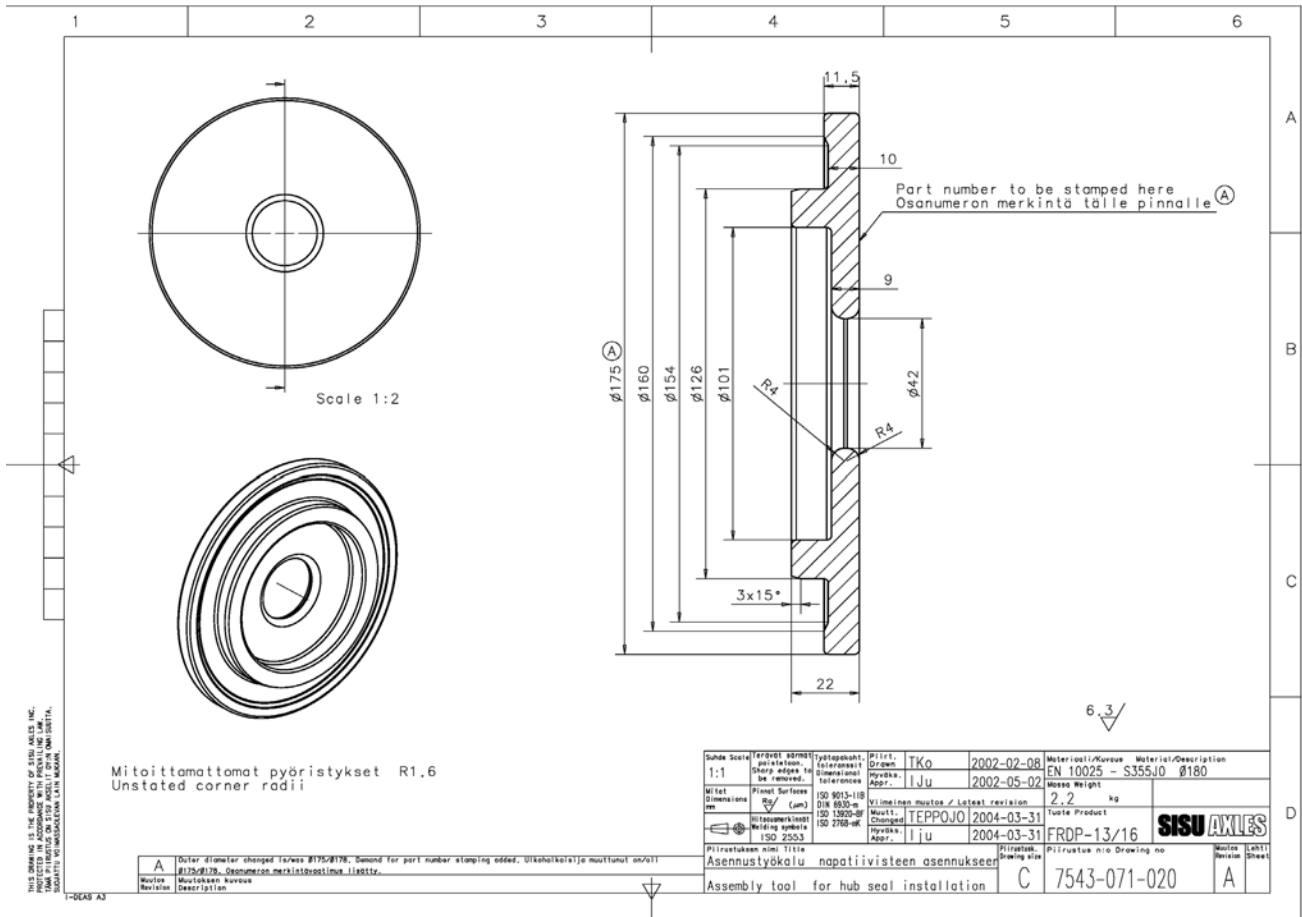
Seal installation lubricant

595760-00110 Klüberplus S 06-100

5 Special tools

Wheel hub wrench	7543-050-020
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5.1 Locally manufactured tools



Picture 21 Installation tool (7543-071-020) for hub seal 591122-12702

