

SISU AXLES

Maintenance Manual for following Sisu Axles:

FSDP-14-G

FSMP-14-G

FSFP-14-G

FSFN-14-G

FSND-12-G

SSDP-18-G



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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.

1 REPAIR INSTRUCTIONS FOR SISU FSXX - 14 (12) - G FRONT AXLES

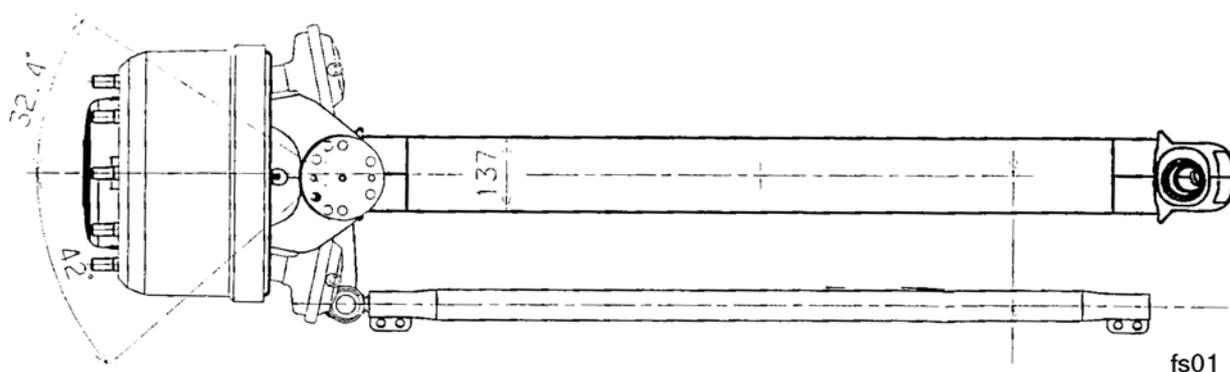
1.1 AXLE DESIGN

FS front axle series consist of four different front axles of which two are live ones and two are non live axles. First of this axle series is FSND - 12 axle, which is non live steering axle for all application where live axle is not necessary. Factory permitted axle mass is 12.000 kg.

The axle beam is made of steel plate and steering knuckle ends are of cast steel and are welded to the axle beam.

The wheel hubs are very similar in design as the hubs are in the live type axles, but there are no drive gear parts inside the hubs.

See general top view of the FSND - 12 axle in illustration below.

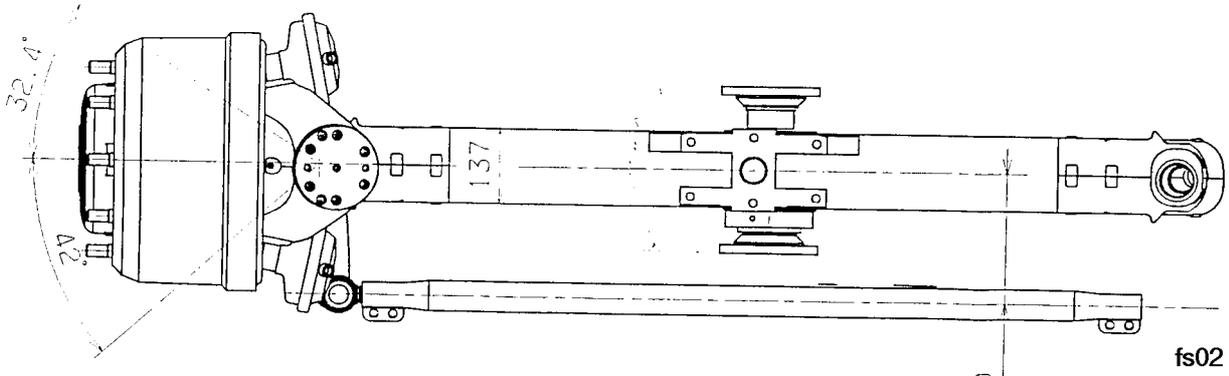


Picture 1 FSND-12

Second of this axle series is FSFN - 14 axle, which is non live steering axle with integrated trough going support axle for applications where there is a live front axle in front of it or in front most rear axle where a good load capacity and steering are needed. Factory permitted axle mass is 14.000 kg. Axle beam design and material are similar as in FSND - 12 axle, but the middle section of the axle beam is stronger due to trough going support axle and higher permitted axle mass.

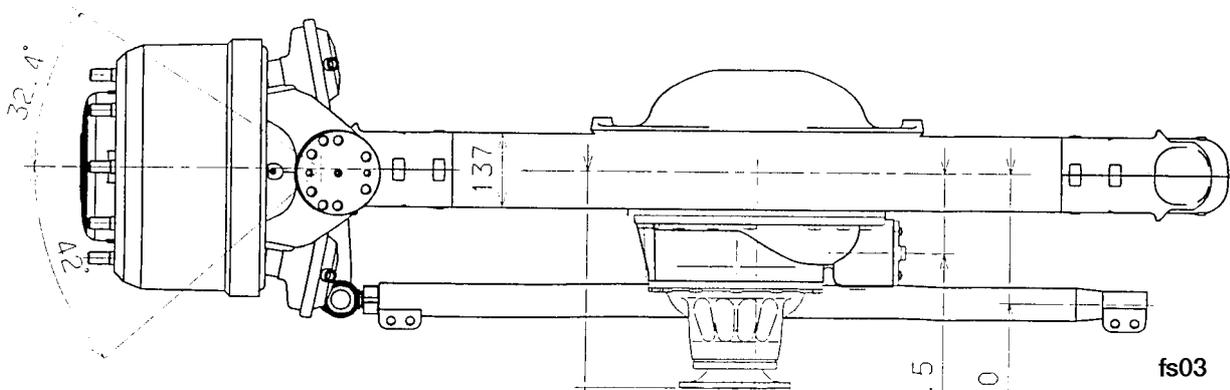
The wheel hubs and steering knuckle ends are similar to ones in FSND - 12 axle.

See general top view of the FSFN - 14 axle in illustration on next page.



Picture 2 FSFN-14

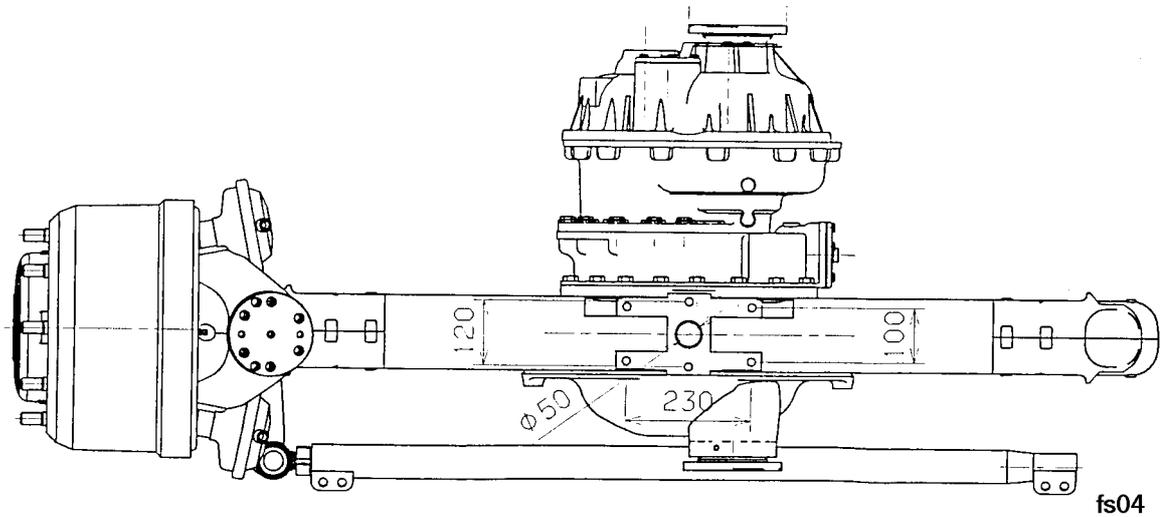
Third of this axle series is FSDP - 14 axle, which is a conventional live steering axle for applications where a live type front axle is needed. Factory permitted axle mass is 14.000 kg. Axle beam design and material are similar as in other FSXX-14 axles, but in the middle there is a bevel gear type drive gear with a lockable differential lock. The wheel hubs are with planetary gears for final reduction. See general top view of the FSDP - 14 axle in illustration below.



Picture 3 FSDP-14

Fourth of this axle series is FSFP - 14 axle, which is a live type steering axle with integrated trough going drive axle and with inter axle and transversal differentials. This axle is used as a front most rear axle together with FRMP tandem drive rear axles and does for a so called Tridem drive. Tridem drive is three live rear axle design, where the front most axle is steering one. Factory permitted axle mass is 14.000 kg. The inter axle differential does divide the power so that 30% is going to FSFP - 14 axle and 70% to the tandem axle. The wheel hubs and the axle beam design are similar to the FSDP - 14 axle.

See general top view of the FSFP - 14 axle in illustration below.



Picture 4 FSFP-14

FSMP - 14 axle is similar to FSFP - 14 axle, but power is divided by ratio 50% /50%

- ☞ *This Manual does not cover the drive gear assembly. These are covered by other manuals and instructions of these manual shall be used when making drive gear repairs.*
- ☞ *note! Drive gears are covered with respective own manuals as follows:*

Axle	Drive gear
FSDP-14G	DP-330
FSMP-14G	MP-330
FSFP-14G	FP-330
SSDP-18G	DP-345H

- ☞ *Change:*

In steering knuckles the king pin and the axle shaft sealing against outside dirt has been changed. In the king pins the seals are now same type Foam-seals as in axle shafts. Shield cups are also installed to protect the seals in king pins and axle shafts, which makes it possible to use high pressure cleaner for cleaning the axles. This change is to improve the protection of the shaft seals.

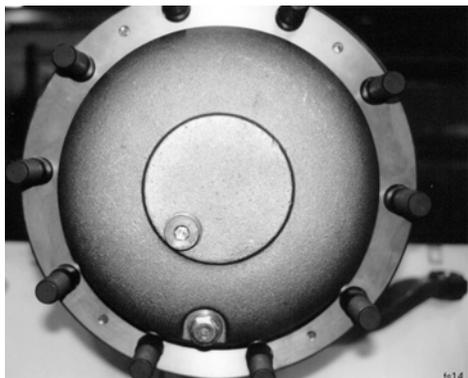
- ☞ *Identify & Date of Change:*

*The axle product codes have been changed also, see the date of change in the list below.
The first axles in production:*

Axle	Date	SerialNo.
FSDP-14-G	April3, 2001	11331
FSMP-14-G	XXXXXX	XXXX
FSFP-14-G	April5, 2001	11336
FSFN-14-G	April4, 2001	11335
FSND-12-G	April26, 2001	11491

1.2 AXLE REPAIR

1.2.1 WHEEL HUBS



Picture 5 . Wheel hub drain plug.

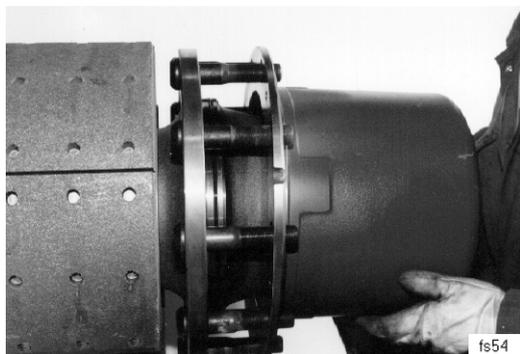
1.2.1.1 Removal

1. Lift axle up and support it on axle stands. Take off the wheel and tire assemblies.
2. Remove brake drum. Utilize pulling screws if necessary.
3. Remove drain plug (lower plug in Picture 5) and drain oil from the wheel hub housing into a suitable container.



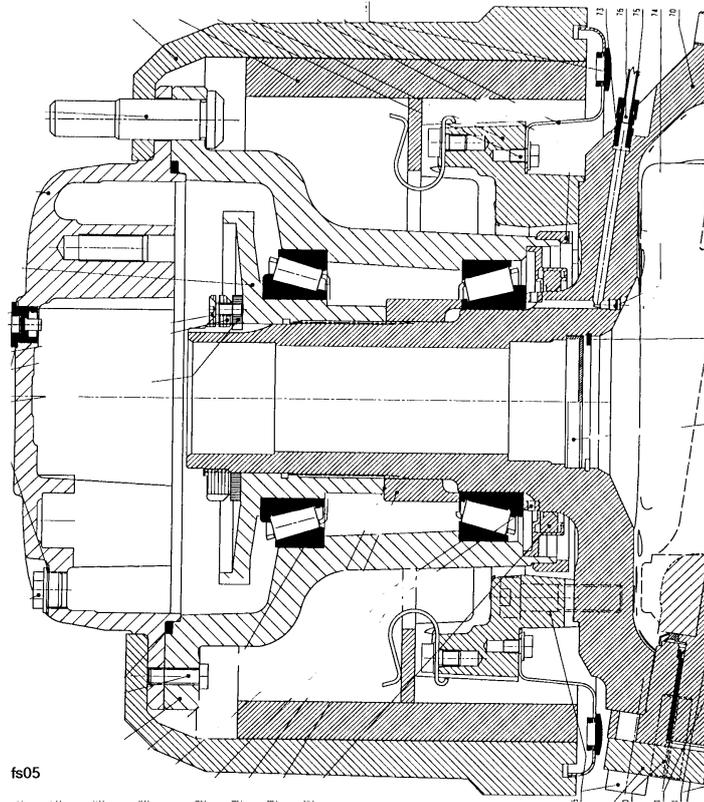
Picture 6 Unscrewing hub housing retaining screws.

4. Unscrew hub housing retaining screws (4 pcs, see Picture 6) and remove hub housing (Picture 7).



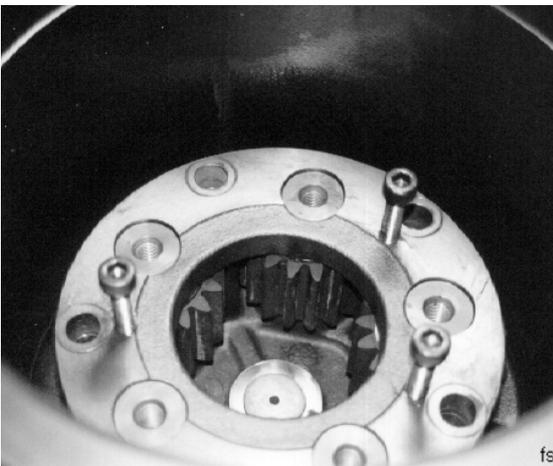
Picture 7 Hub housing removal.

- NOTE. In non live FSND - 12 and FSFN - 14 axles, there are no moving planetary gear parts inside. The ring gear hub (Item 12 in picture 14) is used without the ring gear and wheel hub removal and installation as well bearing adjustment are the same in all axle types. Oil filling of the wheel hub is the same in all axles.



Picture 8 Wheel hub of a non live axle in sectional view

- Remove the planet carrier cover (Item 22 in Picture 14) by unscrewing planet carrier cover retaining screws and by using pulling screws (M10).

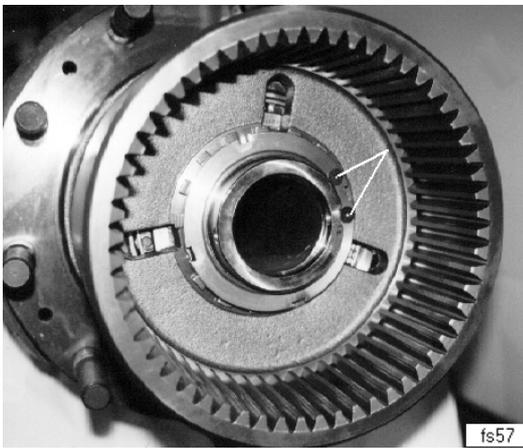


Picture 9 Using planet carrier cover pulling screws.



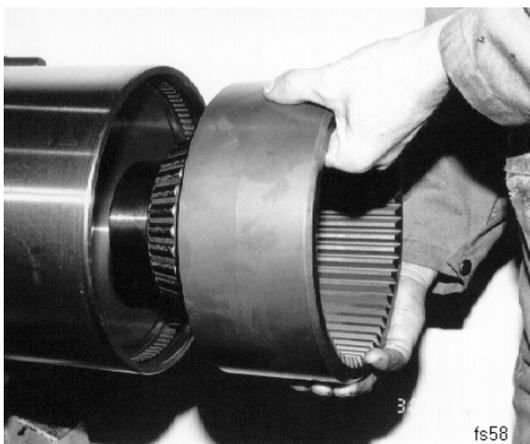
Picture 10 Planet gear shafts removing with a special tool.

6. Pull out the planet gears and take care to contain the bearing needles and spacers which are loose in the planet gears. If necessary pull out the planet gear axle shafts (Picture 10), perform it with a special tool 7 543 049 05.
7. Remove the sun gear circlip (Item 20 in Picture 14) and take the sun gear (Item 19 in Picture 14) off the half shaft. Remove also the circlip below the gear (Item 18 in Picture 14)



Picture 11 Bearing adjustment nut lock screws.

8. Remove the locking screws (Picture 11) from the bearing adjustment nut. Remove the nut with the special tool 7543-050-020. Remove the lock plate (Item 14 in Picture 14).



Picture 12 Removing the ring gear and the ring gear hub.

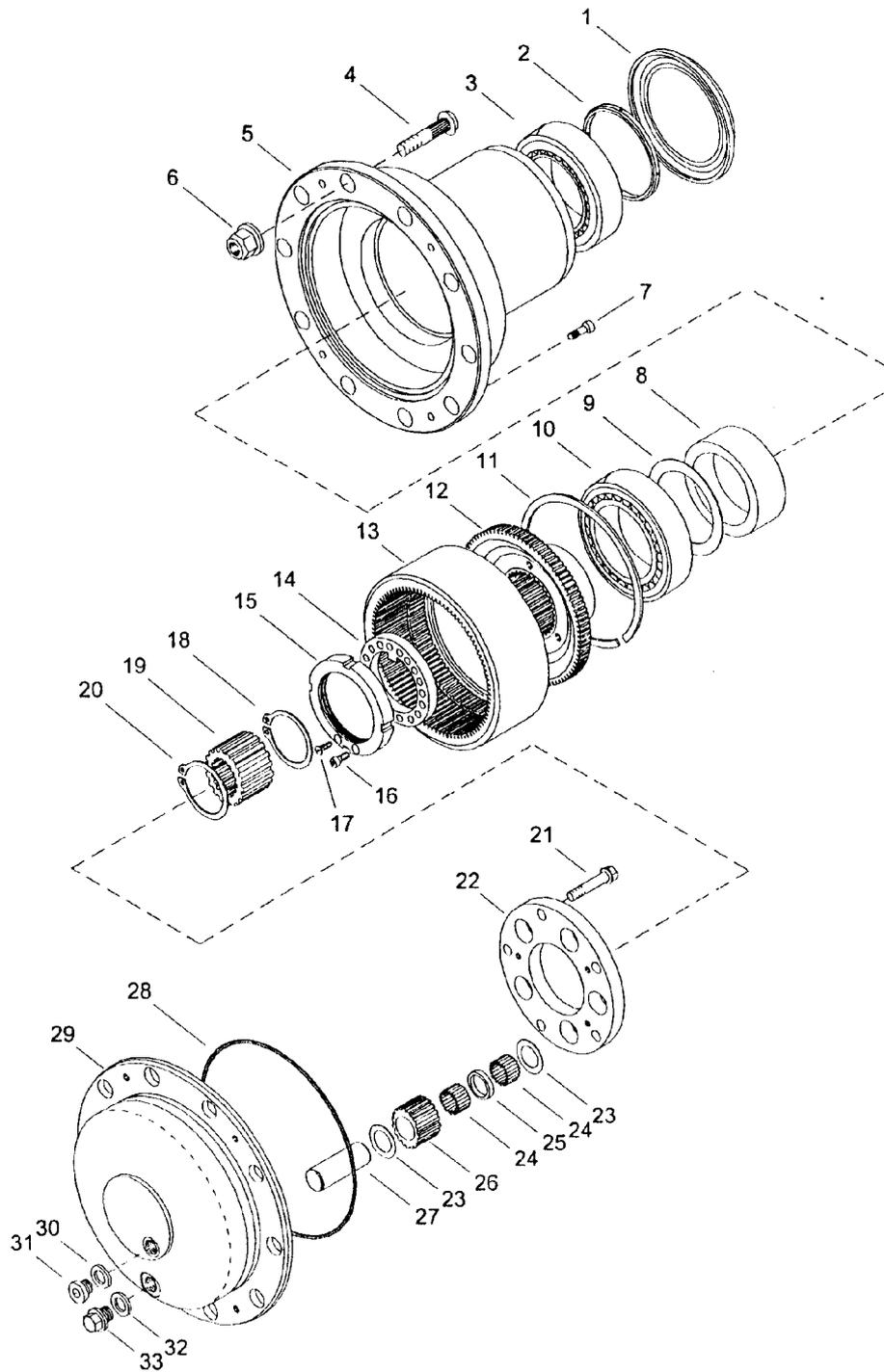
9. Remove the ring gear and the ring gear hub from the axle tube (Picture 12). The outer bearing will follow the ring gear hub. To make removal easier, support the wheel hub.

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. If bearing replacement is required remove the bearing cups from the hub with a soft drift.



Remove the retaining ring. Remove the ring gear from the ring gear hub by tapping lightly with a soft metal hammer.

Picture 13 Retaining ring removal.



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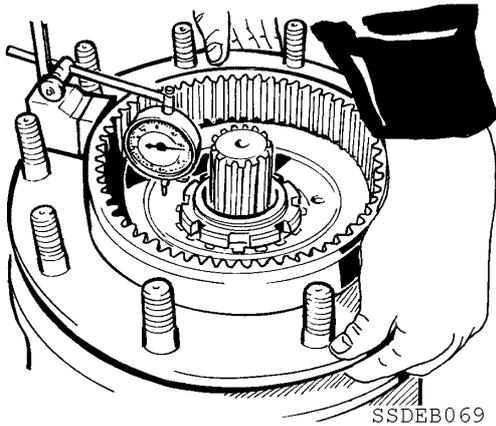
Picture 14 Exploded view of wheel hub assembly.

1.2.2 Assembly:

Inspect the wheel hub carefully before assembly. Always install a new wheel hub seal (Item 1 in picture 14). Replace any bearings which have any defects such as scratches, worn spots or discolouring. 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.

Note! See – section „CHANGE IN WHEEL HUB SEALING“ on page -38

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



Picture 15 Checking of the wheel hub bearing clearance

1.2.2.1 Wheel hub bearing adjustment:

1. Lift the wheel hub onto the steering knuckle. Install the lubricated outer hub bearing.
2. Install the locking plate (Item 14 in Picture 14) and bearing adjusting nut and tighten slightly by wrench No. 7543-050-020. Adjust the wheel hub bearing as follows:
3. Tighten the adjusting nut to 1000 Nm [738 lb-ft] torque while rotating the hub. Then, tighten the nut so that it can be locked in this position with two lock screws (The longer screw shall be inserted into the hole of the nut, which is aligned with a bore in the locking plate 14 in Picture 14).
4. Attach a dial gauge 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 and read the bearing clearance on the dial. The correct clearance is -0,05 ... 0,05 mm. Adjust the clearance, if necessary, by changing the shim plates. Thicker plates increase the clearance.
5. Use Loctite locking liquid and tighten the lock screws to 12 Nm [9 lb-ft] torque with a torque wrench.

Available shims for hub bearing adjustment:

590731-09520	(0.20 mm)
590731-09530	(0.30 mm)
590731-09550	(0.50 mm)
590732-09510	(1.00 mm)

1.2.2.2 Drive shaft spline inspection and installation:

Inspect the drive shaft splines and associated sun gears prior to installation. Pay special attention to the condition of the sun gear teeth (Item 19 in picture 14). If cracks or other defects are found, the sun gear has to be replaced. Install the lower circlip (Item 18 in Picture 14) on the half shaft groove and the sun gear the chamfered side of the teeth outwards. Lock the sun gear in place with the circlip (Item 20 in Picture 14).

If excessive clearance is found between the drive shaft splines and the sun gear, the sun gear and/or the drive shaft complete or the outer end have to be replaced.

1.2.3 Assembly of planet carrier

(See Picture 14):

Inspect all planetary gear components and discard all excessively worn or damaged parts. Insert needle bearings (24) and spacers (25) between the bearings and other spacers (23) outside of the planet gears. Use grease to make assembly easier and to ensure lubrication at startup.



1. Press the planet gear shafts (27) to the hub housing by using a workshop press and a special guiding tool 7 543 049 06 (Picture 16). Use planet carrier cover plate retaining screws to fix the guide tool. Use a special tool 7 543 049 02 (support plate) under the hub housing to prevent the hub housing rolling while pressing the planet gear shafts.
2. Place planetary gears with thrust washers (23) onto the planet gear shafts. Install the planet gears so that the chamfered sides of the teeth point out to the wheel hub to make hub housing installation easier. Install the planet carrier cover (22). Use Loctite locking liquid on threads and tighten the planet carrier cover retaining screws manually or by using a slow speed screw machine to 180 Nm [130 lb-ft] torque.

Picture 16 Installation of the planet gear shafts

- ☞ *Change:* The planet gear shafts have been changed so that there are machined shoulders in their ends and the new planet carrier also has matching shoulders to ensure the locking of the planet gear shafts. This change also increases the space between the planet carrier and the hub nut.
- ☞ *Identify:* This change concerns the hub reductions with the Sisu Compact Hubs (integral hub housing and planetary gear assembly construction) in the following axle types:
FSDP-, FSMP- & FSFP-14 front axles.
Axle part numbers have not been changed.

Changed Parts:

Description	Old Part No.	New Part No.
Planet gear shaft	535-251-1400	535-251-1410
Planet carrier half	535-231-1300	535-231-1310

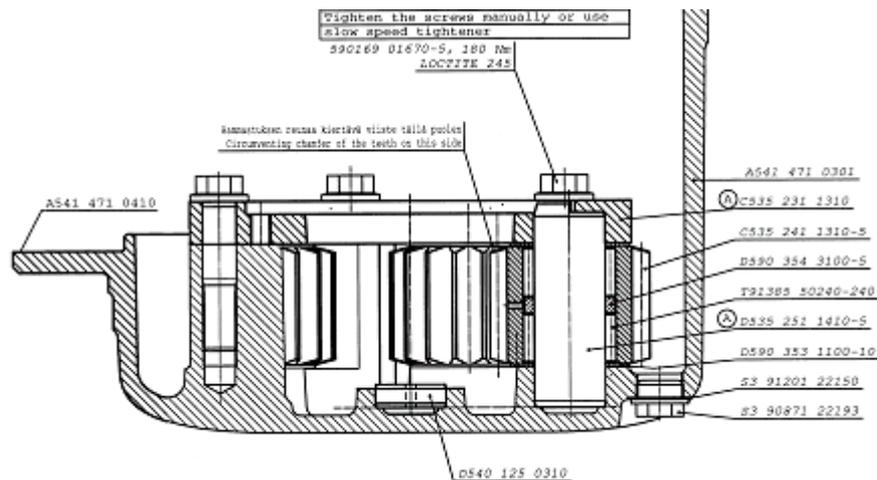
Interchangeability:

The planet gear shafts (5 pcs) and the planet carrier have to be replaced all at the same time.

The changed parts alone of the new design are not interchangeable with the parts of the previous design.

Date of Change: January 25, 2001, serial No. 10374

- ☞ **NOTE!** When installing new type planet gear shafts, part no. 535-251-1410, chamfers must be directed out so, that installation of the planet carrier half, part no. 535-231-1310 is possible. There is a special tool - guide plate, part no. 7543-049-030 available but if not, the planet carrier half can be used as a guide tool when turned up side down.



Picture 17 Planetary design after the change

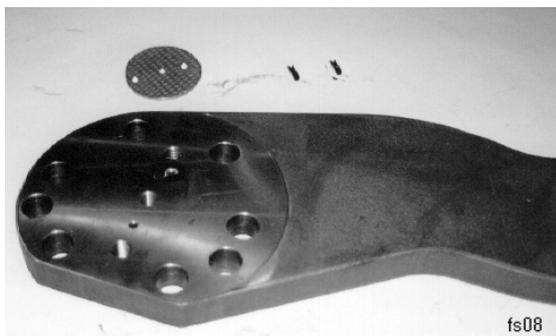
1.2.4 Installation of planetary gear hub

(See Picture 14):

Install the assembled planetary gear hub. Replace always the o-ring (28) before hub installation. Rotate the hub housing back and forth a little so that all the gears engage allowing you to slide the hub housing in to place. Tighten the hub housing retaining screws (7) to 40 Nm [30 lb-ft] torque. Always replace seal rings (30 and 32) when re-installing the plugs.

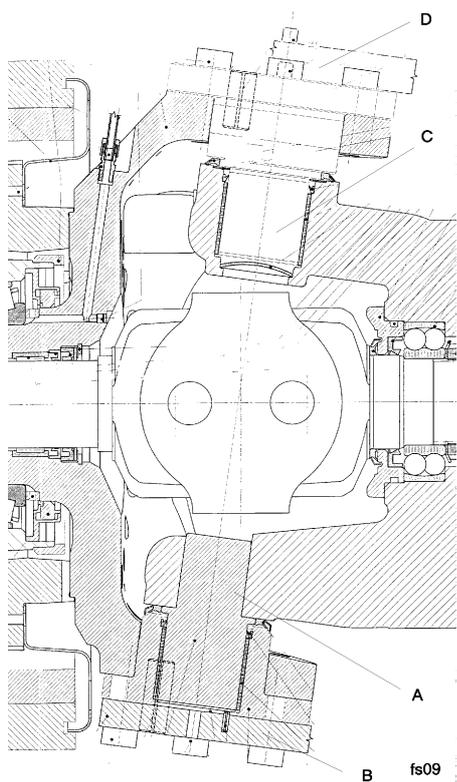
1.3 STEERING KNUCKLES AND DRIVE SHAFTS

1.3.1 Steering knuckle removal



Picture 18 Tie rod arm with thrust bearing removed from the axle

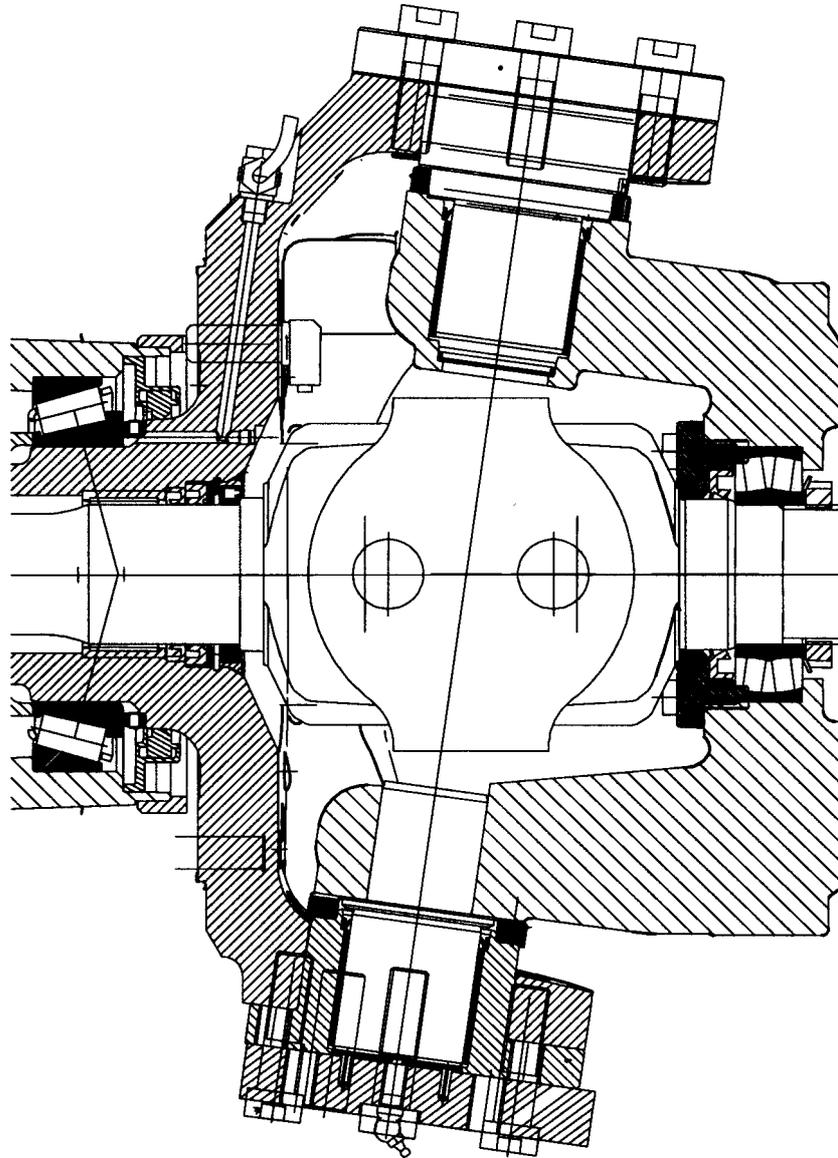
1. Remove the wheels and wheel hubs as described earlier.
2. Remove the brake shoes and return springs according to respective instructions.
3. Remove the brake shield and brake reaction plate also, so that the steering knuckles only are in the axle ends within the king pins.
4. Remove the track rod from both tie rod arms.
5. Remove retaining screws (32 in Picture 21) and pull both tie rod arms (30) off the axle. The king pin thrust washers (28) with their locking pins will follow toe rod arms. Remove the lower king pin bearing assembly (27, 21 and 20) by using the extractor screws in threaded holes in the bearing flange (27).



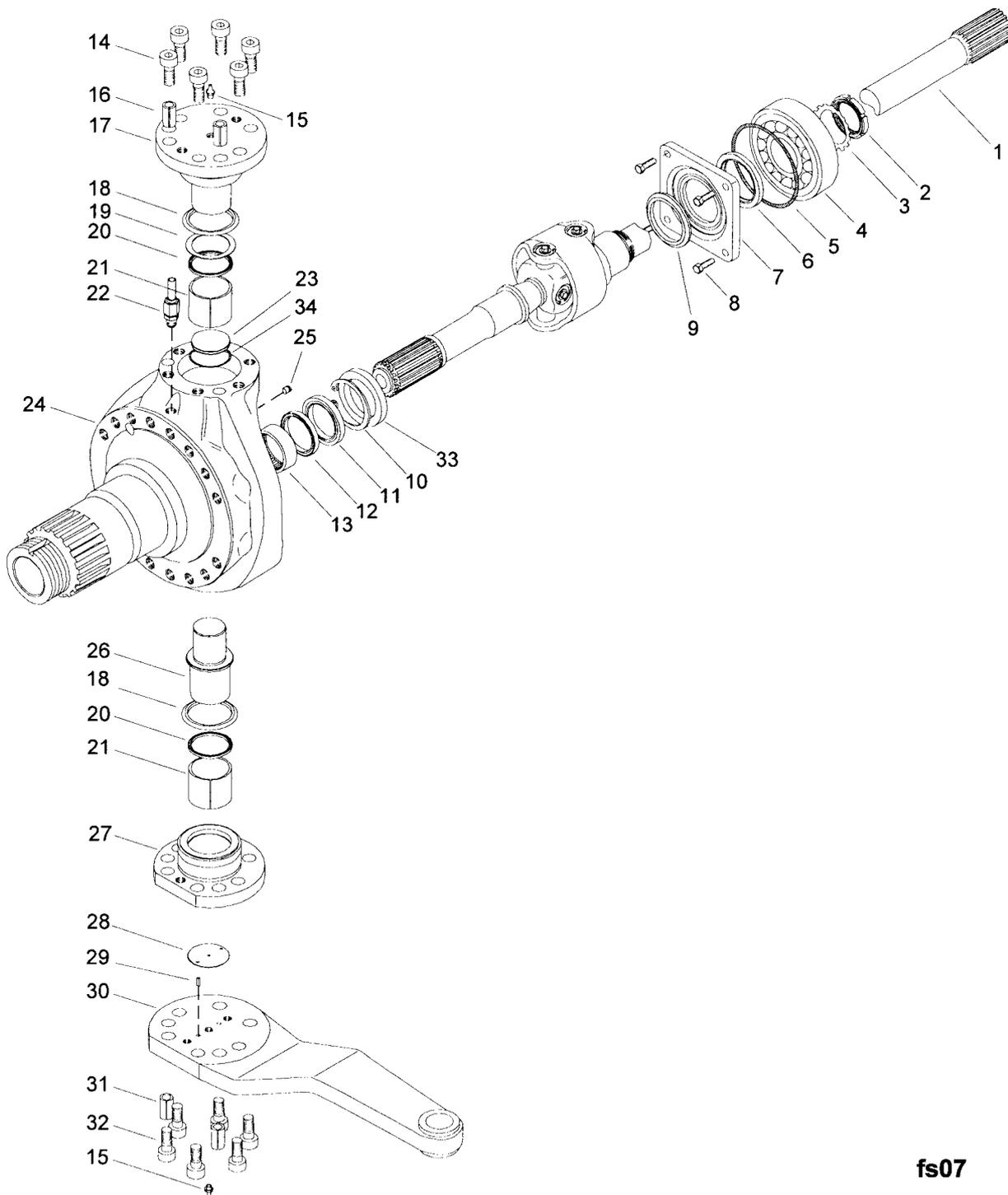
6. Remove upper king pin retaining screws (14) at both sides and remove first the steering arm (D in Picture 19) on the top of left hand king pin flange.
7. Turn two retaining screws in the threaded holes of the king pin flange (17) and extract the king pin (C in Picture 19) off the axle by these screws.

As can be seen in Picture 19, the lower king pin A is force fitted into the axle end and normally the flange (27 in Picture 21) with the bearing bush as well the top side king pins necessary to be removed for the steering knuckle (24 in Picture 20) removal. Before the steering knuckle the wheel hub breathing tube (see also picture 20) must be removed from connector (22) as well ABS brake wheel sensor inside the steering knuckles if fitted.

Picture 19 Steering knuckle pivot (King pins) in sectional view (earlier design)

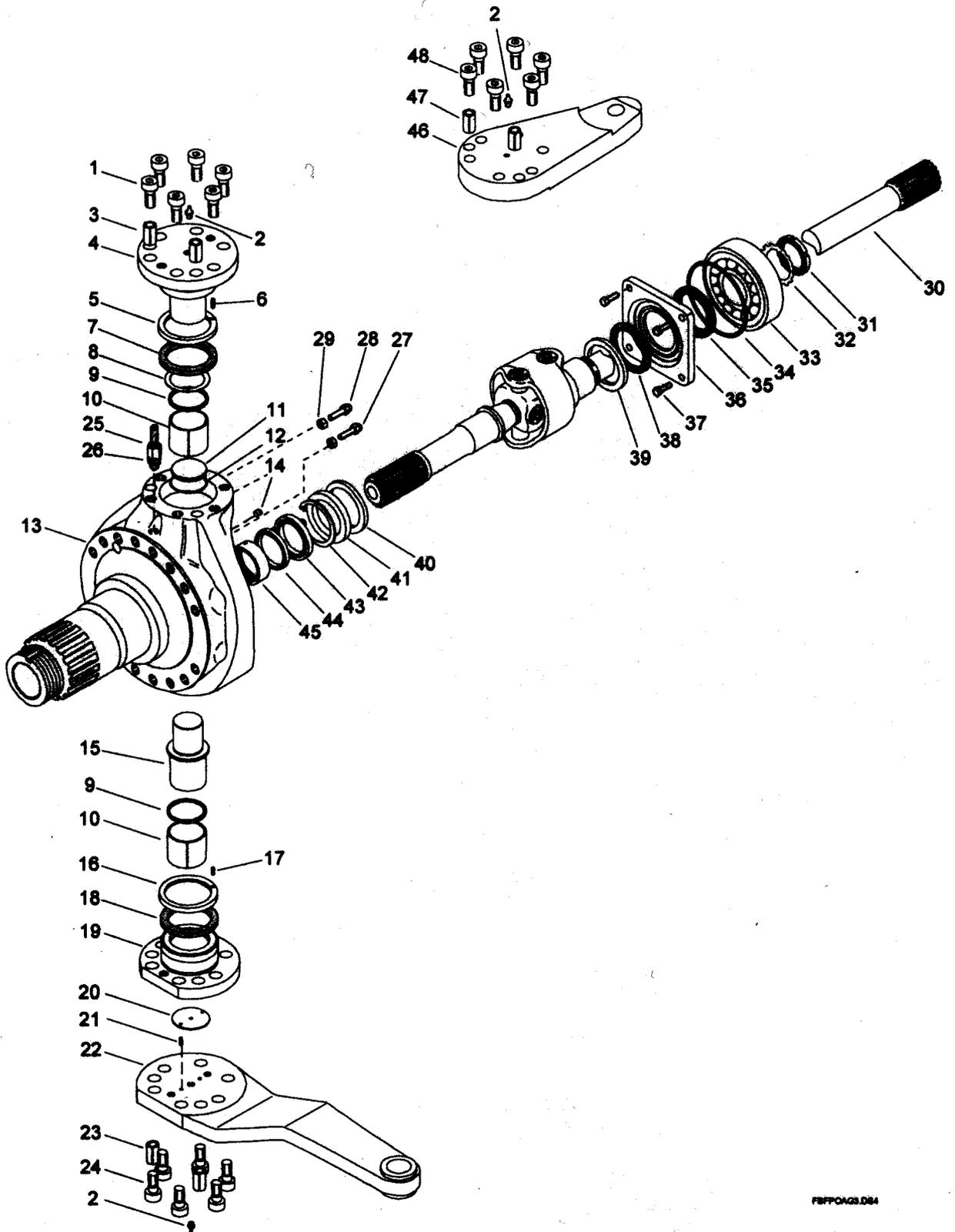


Picture 20 Steering knuckle pivot (King pins) in sectional view (later design)



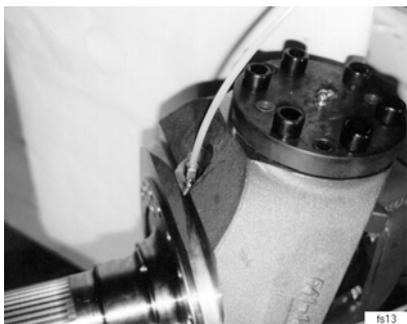
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Picture 21 Steering knuckle in exploded view (earlier design)



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Picture 22 Steering knuckle in exploded view (later design with improved sealing)



Picture 23 Top side king pin ready for removal. Threaded holes are covered with plugs.

When all above mentioned parts has been removed, the steering knuckles can be lifted away. The drive shaft (1 in Picture 21) remains in the axle housing. Steering knuckles have to be pulled carefully out, so that the seals (11 and 12 in Picture 21) do not get damaged.



Picture 24 Steering knuckle ready to be removed.

When the steering knuckles are removed the drive shafts are to be removed and the lower king pins, if there are damages or excessive wear.



Picture 25 Axle housing end with the lower king pin with the gamma seal as well the drive shaft.

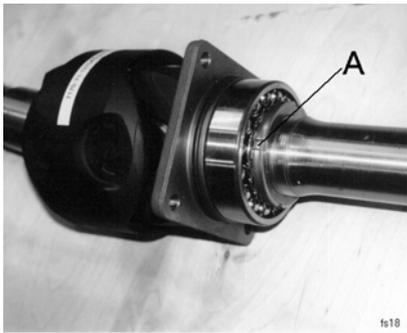
1.3.2 Drive shaft removal

When the steering knuckles are removed, perform removal of the drive shafts as follows:

1. Remove drive shaft flange retaining screws.
2. Pull the drive shaft out from the axle housing.



Picture 26 Drive shaft partially out pulled.

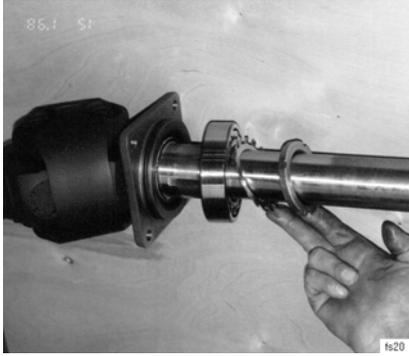


Picture 27 Locking plate tab (A)



Picture 28 Opening of the drive shaft support bearing nut

3. Place the drive shaft on the working bench. Bend the tab (A) of the locking plate so that the nut itself can be opened.



Picture 29 Drive shaft support bearing, locking plate and nut.

4. Remove the nut, locking plate, support bearing and the flange.

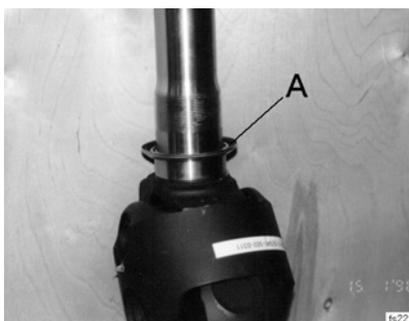
1.3.3 Drive shaft assembly and installation



Picture 30 Drive shaft flange with shaft seal and O-ring. Seal installation tool is at RH side. (earlier design).

1. Inspect all related parts and discard all seals and O-rings.
2. Install new shaft seal into the drive shaft axle flange. Install the Foam seal and its Shield cup of the new design (38 and 39 in Picture 22)

☞ Foam seal shall be oiled prior installation by submerging them into the 80°C hypoid oil for 30 minutes.



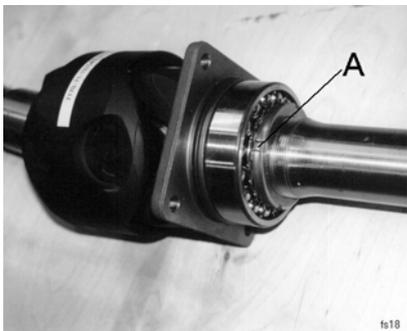
Picture 31 Gamma seal (A) ready for installation (earlier design)

3. Install a new gamma seal (9 in Picture 21) on the drive shaft. Use suitable bushing for installation. Improper installation will damage this seal.

*☞ In later production:
Seal parts, pos. 40 and 41 in Picture 22, shall be installed in the steering knuckle.*



Picture 32 Installation of the drive shaft flange.



Picture 33 Locking of the drive shaft support bearing nut.

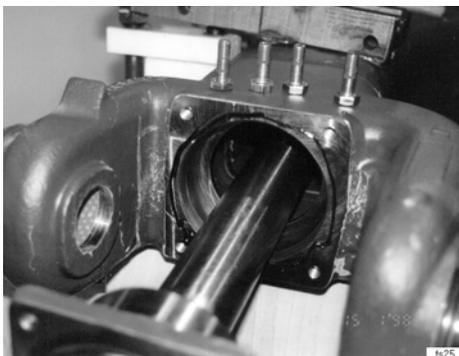
4. Install assembled drive shaft flange onto the shaft. Lubricate the shaft seal before the installation.

5. Install the drive shaft support bearing with locking plate and the nut.
6. Tighten the nut to 110 Nm [81 lb-ft] torque.
7. Lock the nut by bending a lock plate tab into the nut groove.

Now the drive shaft assembly is complete and the drive shaft can be installed.

NOTE. If the lower kin pin or the upper king pin bearing bush have to be replaced, these works must be performed before installation of the drive shaft. See instructions for these works in later chapter in this volume.

1.3.4 Installation of the drive shaft.



Picture 34 Drive shaft being installed.

1. Lift the drive shaft into the axle housing, so that axle splines do enter inside the differential gear.
2. Use Loctite locking liquid and tighten the flange retaining screws to 41 Nm [30 lb-ft] torque with a torque wrench.

1.4 King pin and king pin bearing replacement

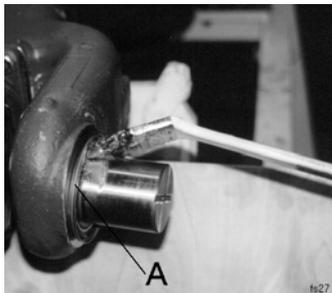
If there are some damages or excessive wear in the king pin surfaces or in the bearing bushes, king pins and/or bearing bushes have to be replaced before installation of the drive shafts and further axle assembly.

1.4.1 King pin replacement

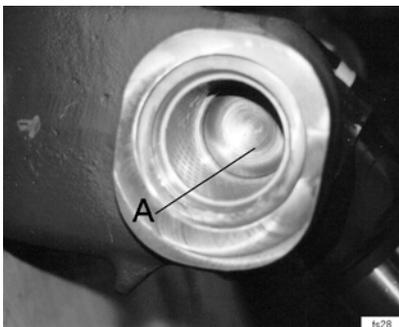
The lower king pin is force fitted into the axle end bore. When replacing this king pin, do follow these instructions:



Picture 35 Installation of the lower king pin.



Picture 36 Gamma seal (A) installed and being lubricated



Picture 37 Cover plug inside the upper axle end bore.

1. Take the plug (23 in Picture 21) off the upper axle end bore.
2. Remove the old king pin off the lower axle end bore by using a large drift and a heavy hammer.
3. Inspect the axle housing bore and assure that there are no damages there. If some damages are found, they must be removed before installation of the new lower king pin by careful grinding with crocus cloth or with a fine cut file.
4. Install a new kin pin with a installation drift and a heavy hammer.

5. When the lower king pin installation is ready, do install the gamma seal (18 in Picture 21) around the king pin shoulder.
6. Install also the covering plug with a new O-ring into the upper axle end bore.

☞ *(In early production there were expander plugs used; these shall be replaced with plug and O-ring (23 and 34 in Picture 21)*

☞ **NOTE!** *In new design there is Foam seal with Shield cup (18 and 16 in Picture 22) instead of earlier Gamma seal.*

Locking against rotation of the Foam seal is done by one rivet into the frame.

Replacement of the upper king pin does not need any special procedures.

☞ **NOTE!** *Locking of the Foam seal at the upper king pin is done by a cylindrical pin.*

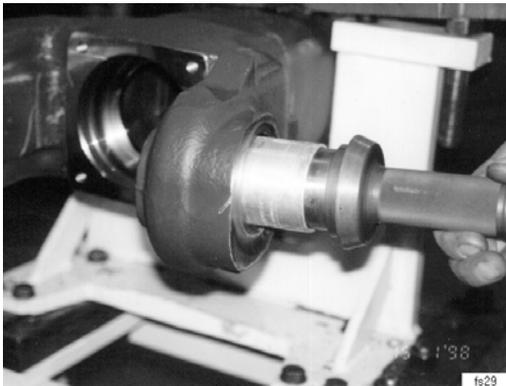
☞ *Foam seal shall be oiled prior installation by submerging them into the 80°C hypoid oil for 30 minutes.*

1.4.2 King pin bearing bush replacement

Removing of the king pin bearing bushes will destroy the bushes and the new ones as well new seals must be available.

Upper king pin bearing bush with seal are installed into the upper axle end bore. Do replace these as follows:

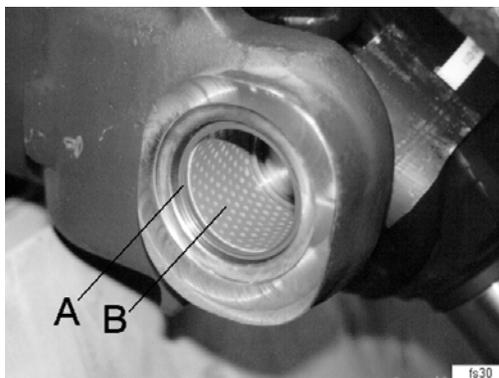
1. Pry the old seal first out by a screw driver.
2. Take the plug (23 in Picture 21) off the upper axle end bore.
3. Use a suitable drift and knock the bushing (21 in Picture 21) out.
4. Inspect the axle housing bore and assure that there are no damages there. If some damages are found, they must be removed before installation of the new bearing bush by careful grinding with crocus cloth or with a fine cut file.



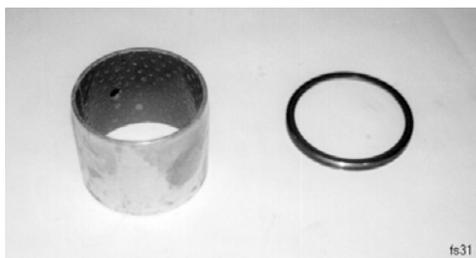
Picture 38 Upper king pin bearing bush being installed

5. Install a new bearing bush into the axle end bore by a suitable installation drift.
6. When the upper king pin bearing bush installation is ready, do install the seal ring (20 in Picture 21) onto top of the bearing bush.
7. Install also the covering plug with a new O-ring into the upper axle end bore.

⚠ (In early production there were expander plugs used; these shall be replaced with plug and O-ring (23 and 34 in Picture 21))



Picture 39 Bearing bush (B) and seal (A) installed



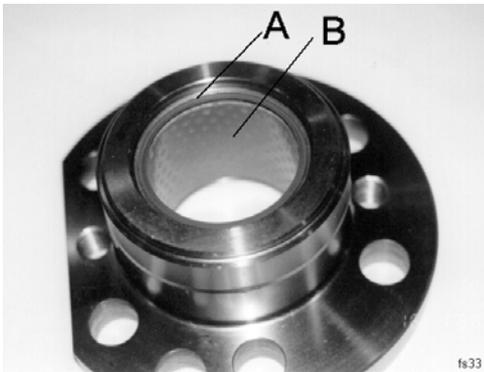
Picture 40 Kin pin bearing bush and respective seal ring

1. Lower king pin bearing bush with respective seal ring is installed inside the flange (27 in Picture 21). Do replace these as follows:
2. Pry the old seal first out by a screw driver.
3. Use a suitable drift and knock the bushing (21 in Picture 21) out.
4. Inspect the flange bore and assure that there are no damages there. If some damages are found, they must be removed before installation of the new bearing bush by careful grinding with crocus cloth or with a fine cut file.



Picture 41 Lower king pin bearing bush being installed into the flange bore.

5. Install a new bearing bush into the flange bore by a suitable installation drift.



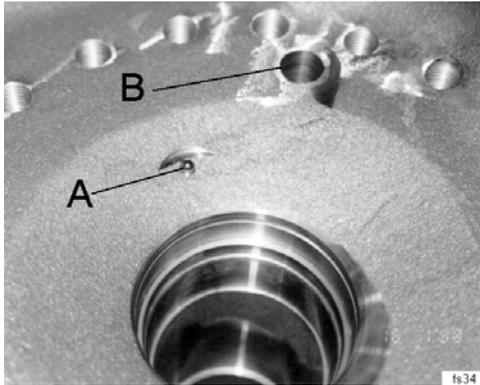
Picture 42 Lower king pin bearing bush (B) and seal ring (A) ready installed into the flange

6. When the lower king pin bearing bush installation is ready, do install the seal ring (20 in Picture 21) onto top of the bearing bush.

1.4.3 Drive shaft support bearing replacement in the steering knuckle

There are supporting needle bearings (13 in Picture 21 inside the steering knuckles and the condition of these shall be inspected always when drive shafts are removed.

If the drive shaft support bearings are damaged or worn out, they and also seal rings (12 and 11 in Picture 21 or 43 and 44 in Picture 22) must be replaced follows:



Picture 43 Drive shaft support bearing removed. Pls. Note closing rivet (A) and bore for ABS sender (B).



Picture 44 Needle bearing ready installed.

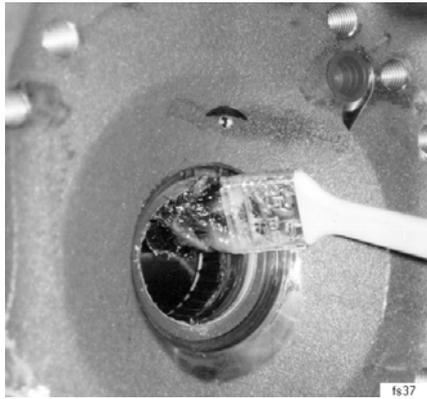


Picture 45 Seal rings being prepared for installation.

1. Remove the circlip (10 in Picture 21 or 42 in Picture 22) and pry old seal rings out and discard them.
2. Remove the bearing by a long drift trough the drive shaft bore of the steering knuckle.

Note. Check that the closing rivet (A) is properly in place. If the rivet is missing, there will be an oil leak from wheel hub trough the bore.

3. Inspect the steering knuckle housing bore and assure that there are no damages there. If some damages are found, they must be removed before installation of the new needle bearing by careful grinding with crocus cloth or with a fine cut file.
 4. Install a new needle bearing (13 in Picture 21 or 45 in Picture 22) by using a suitable installation drift.
 5. Install new seal rings (12 and 11 in Picture 21 or 43 and 44 Picture 22) on the top of the needle bearing. They can be installed simultaneously by a special drift (Picture 45) if available.
- Installation can be done one by one with a simple installation bush.**



Picture 46 Seals and circlip installed. Seals being lubricated.

6. Install the circlip (10 in Picture 21 or 42 in Picture 22) and check that it is properly in the groove.
7. Protect ABS sensor bore with a plastic plug, if ABS sensor is not used.

1.5 Steering knuckle installation

When necessary inspection works are performed, and all related components are found to be in sound condition or are replaced, perform the installation of the steering knuckles as follows:

Note: When installing the steering knuckle (24 in Picture 21) pls. check that the Foam seal (33 in Picture 21) is installed against the drive shaft collar. **Earlier design.**



Picture 47 Upper kin pin prepared for installation

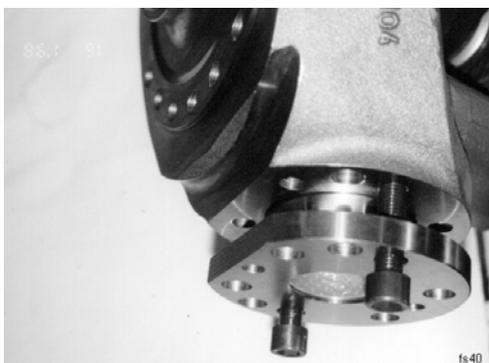
1. Lift the steering knuckle onto the axle end so that the lower king pin does enter into the lower king pin flange bore.
2. Prepare the upper king pin with Gamma seal (18 in Picture 21) and place a shim (19) against king pin shoulder. Use grease to assure shim in place. **(Earlier design)**

Or

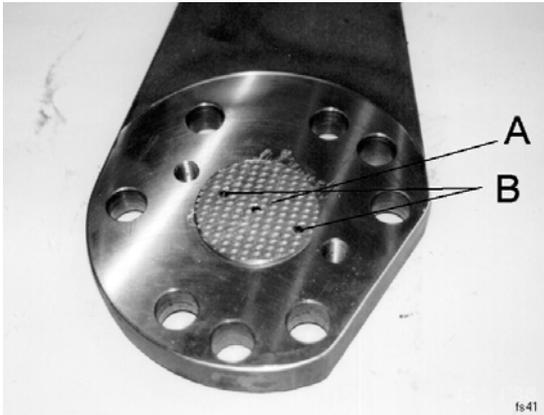
Install Foam seal and Shield cup (41 and 40 in Picture 22) instead Gamma seal **(New design)**

Note: Foam seal shall be oiled prior installation by submerging them into the 80°C hypoid oil for 30 minutes.

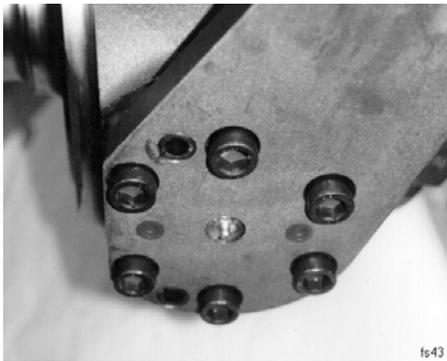
3. Install the upper king pin without seal and adjustment shim(s) (18 and 19 in Picture 21 or 5, 7 and 8 in Picture 22) into the bearing bush and secure it by two screws (14 in Picture 21 or 1 in Picture 22) by moderate torque.
4. Install the lower king pin bearing bush flange and pull it completely home by two retaining screws. Remove the screws and let the bearing bush flange stay in the place.



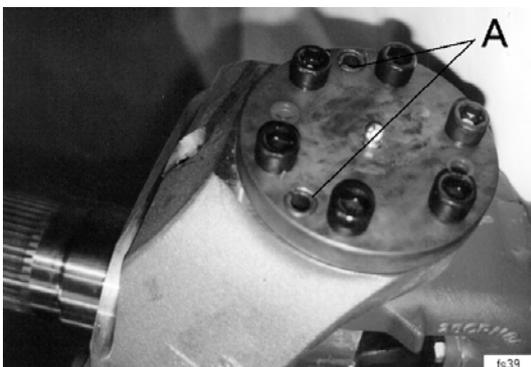
Picture 48 Lower king pin bearing bush flange being installed



Picture 49 Tie rod arm with thrust bearing (A) and location pins (B).



Picture 50 Lower king pin and tie rod arm installed



Picture 51 Upper king pin and guiding dowels installed

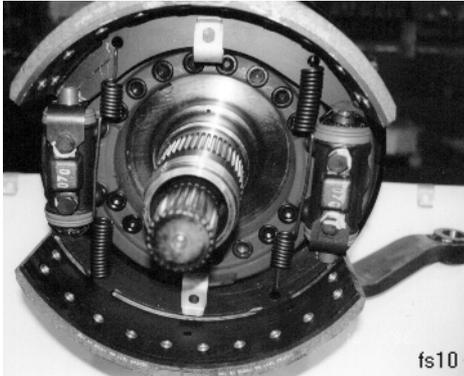
5. Prepare tie rod arms for installation by placing thrust bearings (A) (28 in Picture 21 or 20 in Picture 22) in the arm surface and lock them in the position by hammering in the cylindrical pins (B) (29 in Picture 21 or 21 in Picture 22).

Caution: The pins must be 1 mm below the thrust bearing surface.

6. Install the tie rod arm (30 in Picture 21 or 22 in Picture 22) with thrust bearing.
7. Mount the tie rod arm screws (32 in Picture 21 or 24 in Picture 22) by hand with a wrench.
8. Install the guiding dowels (31 in Picture 21 or 23 in Picture 22) through arm bores and also through bores in the steering knuckle (24 in Picture 21 or 13 in Picture 22).
9. Tighten tie rod arm retaining screws (32 in Picture 21 or 23 in Picture 22) to 320 Nm [235 lb-ft] torque with a torque wrench.
10. Push the steering knuckle with the tie rod arm upwards by a gluing clamp between the axle housing fork and tie rod arm.
11. Measure the steering knuckle axial clearance between the upper king pin (17 in Picture 21 or 4 in Picture 22) collar and the axle housing fork surface (where the shim [19 in Picture 21 or 8 in Picture 22] shall be installed), with a feeler gauge.
12. Disassemble the upper king pin (17 in Picture 21 or 4 in Picture 22).
13. Select the correct shim, so that axial clearance will be within specified - 0,10 ... 0,0 mm.
14. Install the upper king pin with this shim and seal and tighten screws by hand with a wrench.
15. Install guiding dowels (A) through king pin flange and also through holes in the steering knuckle.
16. Tighten king pin retaining screws to 320 Nm [235 lb-ft] torque with a torque wrench.

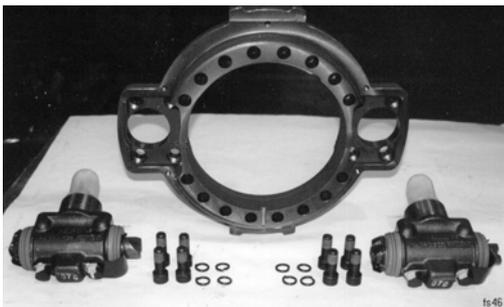
2 PERROT BRAKES

2.1 General



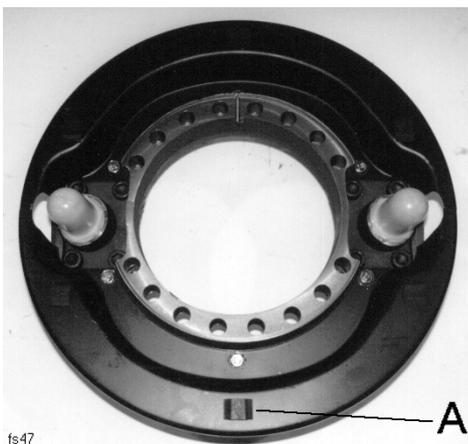
Picture 52 General view of the brake when the brake drum is removed

Brakes are double wedge brakes and consist of a brake bracket, two wedge type expander units with retaining screws, a dust shield, the brake shoes and brake shoe return springs. Brake capacity is nearly identical in both directions of travel.



Picture 53 Brake bracket with two expander units with retaining screws

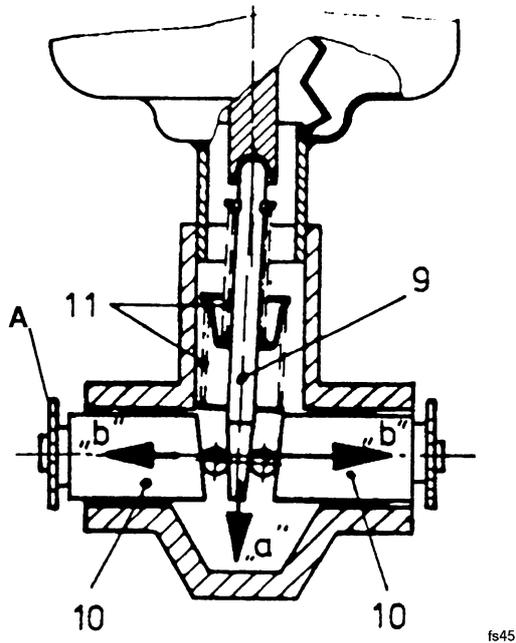
Automatic adjusters (see separate section) are used to compensate for brake lining and drum wear, keeping gap between lining and drum constant.



Picture 54 Brake dust shield installed on the brake bracket; inspection holes (A).

Inspection holes in the dust shield allow for control of lining wear.

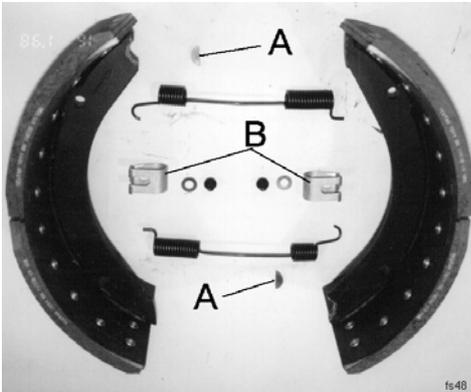
2.2 Brake Function



When brakes are applied brake air cylinder forces the wedge (9) in direction of arrow "a". Roller bearings between wedge and pistons (10) cause pistons with automatic adjusters to move in directions of arrows "b". the pistons force the brake shoes against the brake drum. Springs (11) ensure complete retraction of the brake shoes after every brake application.

Picture 55 Brake function

2.3 Brake lining replacement



Picture 56 Brake shoes with return springs, retaining springs (B) and load bearings (A).

Brake linings have to be replaced when worn to minimum thickness, indicated by the wear edge moulded into the edge of the lining.

1. Remove wheels and the brake drums.

NOTE! If brake drums are excessively worn and drums cannot be removed, use screw driver and back off (anti-clockwise) serrated nut (A) Picture 55 through an opening of the brake backing plate so that clearance between the brake drum and brake shoes increases.

If thickness of brake linings is down to max. wear marks, replace linings. If linings show signs of grease or oil, the cause of the leakage of grease or oil into the brakes must be found and corrected. Replace always such linings.

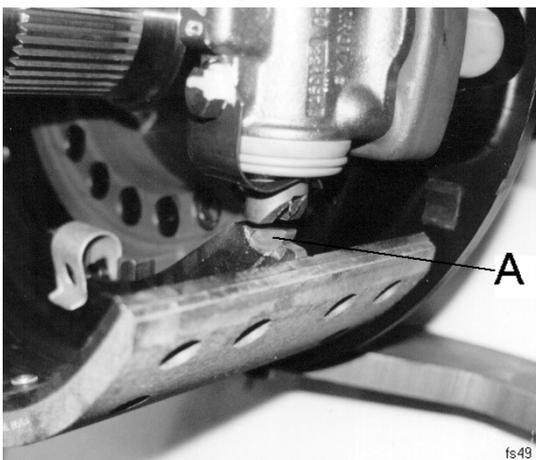
2. Use brake spring pliers for removal of the brake shoe return springs.

3. Use suitable tool for removal of the brake shoe retaining springs.

4. Remove brake shoes.

5. Remove worn brake linings and clean brake shoes carefully.

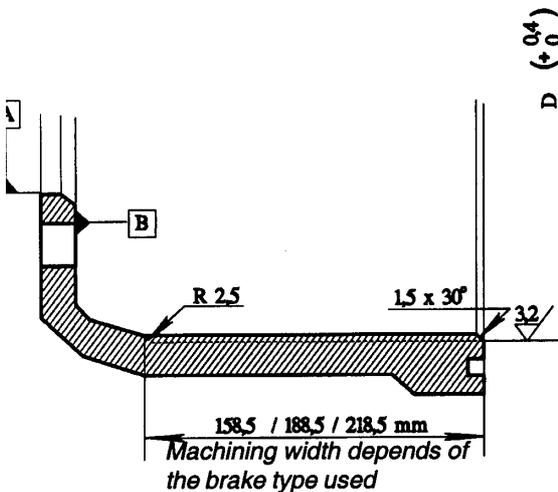
CAUTION! Inspect the load bearing / pivot surfaces of the brake shoe web for excessive wear and check the shoe plate surfaces for corrosion and possible deformation. Replace brake shoes with new ones if damaged.



Picture 57 Brake shoe installation. Check load bearing (A).

Install new brake linings in normal manner by air driven riveting device using proper riveting tools. Install in reverse order.

2.4 Brake drum



Nominal diameter	410 mm
Nominal diameter for oversized linings	414 mm
Largest permitted turning diameter	416 mm
Rejection limit	418 mm

2.4.1 Brake drum machining

Machine the drum as shown in the illustration. Standard size brake linings are used for brake drum diameters of 410-413.5 mm. It should be remembered, however, that brake linings do not “sit” against a re-machined drum and must be carefully “run in” by braking. We recommend a hub lathe for machining the linings to the correct radius when the size is over 412 mm. Oversize linings must be used for drum diameters of 414-416 mm.

With oversize linings, machining the friction blocks is not necessary.

Picture 58 Brake drum machining details

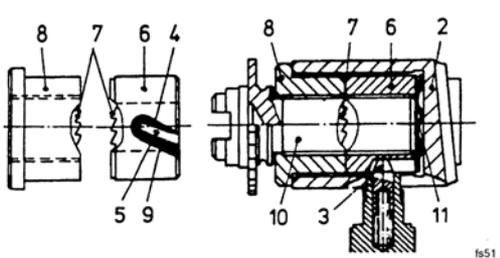
2.5 Brake equipment repair

Detach air pipe connections from brake cylinder and remove it. First unlock cylinder locking nut and turn complete cylinder anti-clockwise and take it off. Take the wedge and the return spring off too.

2.5.1 Inspection of brake parts

1. Examine state of wear of the drums. If scoring, damage to the braking surface, deformation or eccentricity of more than 0,25 mm is found, turning of the respective drum must be carried out.
2. Inspect wedges and replace if wear or scoring is found.
3. Remove retaining screws take off and dismantle automatic adjuster / expander units.
4. Inspect all these parts carefully and replace all damaged or excessively worn ones.

2.5.2 Assembly



Picture 59 Automatic adjuster in detail

Install the adjuster units to brake backing plate. Tighten screws to a torque of 72 Nm. Screw in the adjuster unit completely, then unscrew by one turn to give an initial setting for automatic take-up. Position it so that the grooves allow the shoes to be installed.

1. Replace adjuster dust boots.
2. Install brake shoes
3. With above described tool install springs
4. Install wedges with springs and brake cylinders and secure them in correct position for air pipes by locking nuts.
5. Actuate brakes several times and check function.

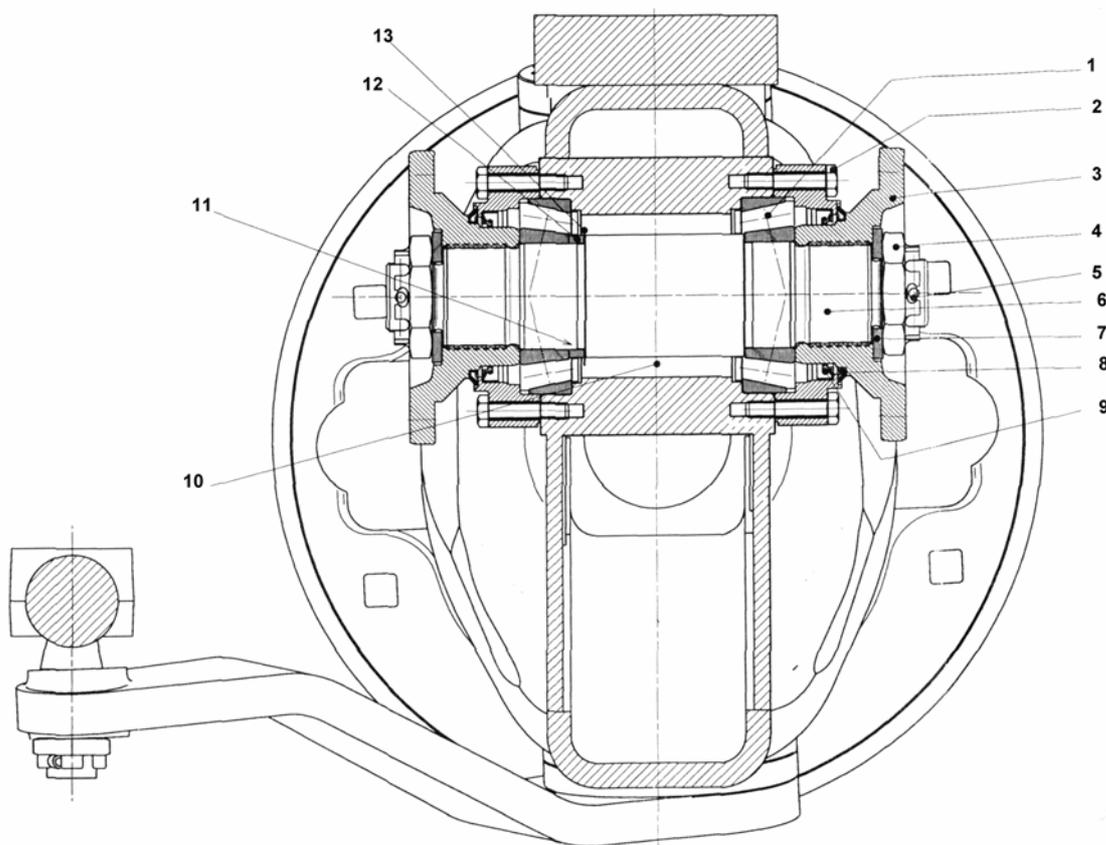
2.6 FSFN axle support bearing

2.6.1 Design

Purpose of this support bearing is to provide necessary support for propeller shaft within twin front axle designs where the front most axle is a live one.

This support bearing is fitted with two tapered roller bearings.

This design is very basic and reliable.



Picture 60 Support bearing in sectional view

2.6.2 Maintenance and repairs

2.6.2.1 Assembly of support bearing

The numbers in the text refer to the Picture 60.

1. Check that all components to be re-used are in perfect condition.
2. Replace both shaft seals (9) in the sealing flanges.
3. Install bearing cups into the axle casing if bearings are to be replaced.
4. Check that the bore surfaces are in good condition prior the installation.
5. Heat tapered bearing cone (1) to 125°C and install it against the shaft (6) collar.
6. Lubricate the bearing (1) and fill 45– 50% of the axle housing cavity with good quality grease. (SKF LGWA2 or equivalent).

☞ *Grease volume is 3.4 ± 0.2 dl*

7. Install the shaft with the bearing into the axle housing bore and insert the shim (13) and spacer (12) onto the shaft and well the opposite side bearing cone (11) also heated to 125°C. The shaft will remain in the axle bore.
8. Spread sealing paste onto the sealing flange sealing surface.
9. Install the sealing flange to the axle housing (opposite to the adjustment side) and tighten the retaining screws (2) to 36 Nm [26 lb-ft] torque.
10. Install the seal ring (8) against the propeller shaft flange (3) collar.
11. Install the flange (3) to shaft splines. Install the washer (7) and nut (4).
12. Tighten the nut (4) by hand.
13. Spread sealing paste onto the other sealing flange sealing surface.
14. Install the sealing flange and the propeller shaft flange to other side as instructed above.
15. Install both propeller shaft flanges as aligned as possible.
16. Tighten both nuts to 100 Nm torque while rotating the shaft.
17. The shaft must rotate all the time. If rotation begins to be heavy, assembly must be dismantled and more shims (13) must be added.
18. When nuts have been tightened to 100 Nm torque, check the bearing clearance by using a dial gauge with magnetic holder
19. The bearing clearance must be 0.03 – 0.07 mm
20. When the clearance is within the limits, tighten both nuts against each other to 500 Nm [370 lb-ft] torque.
21. Lock the nuts with cotter pins (5).

☞ *Tighten the nuts further, if required, so that the cotter pins can be inserted to next possible locking position.*

3 LUBRICATION

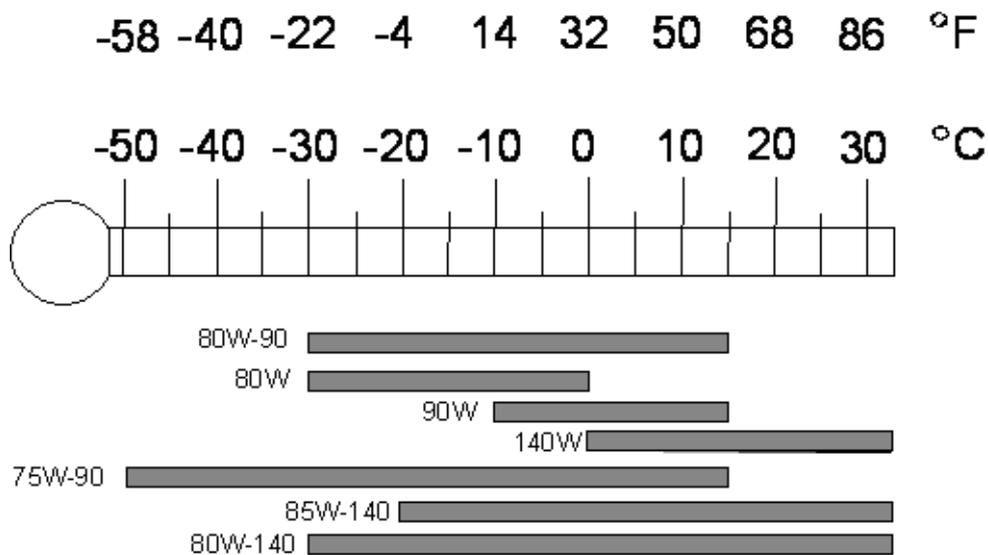
Grease quality for grease lubrication NLGI 2 - Mobil Grease MP or comparable

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:



Picture 61 Oil grades in various ambient operation temperatures

3.2 Oil temperatures in operating conditions

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

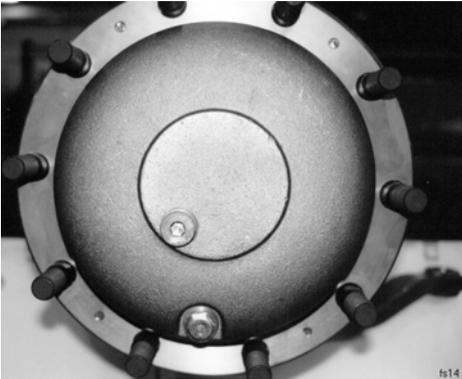
Good thermal stability shall be considered as an oil selection criteria.

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.

3.4 Planetary wheel hub oils



Picture 62 Wheel hub housing oil level plug (upper one).

1. Rotate the wheel hub until the oil drain plug is in most low position.
2. Oil level in the wheel hub housing must be at the level of the check plug opening.
3. Fill approx. 1,4 liter (3 U.S. pints) recommended oil. Check the differential oil level afterwards.
4. Tighten oil level plug and oil drain plug to 50...70 Nm [37...52 lb-ft] torque

3.4.1 Filing volume

Planetary wheel hubs, each	1,4 liters	3 pints
Non driven wheel hubs, each	1,8 litres	3,8 pints

3.4.2 Service and Maintenance recommendations for Automotive Sisu Axles

Maintenance interval 20.000 kms or 6 months

- Check the thickness of the brake linings
- Check the oil level in the differential carrier and the wheel hubs
- Check the overall condition of the axle (possible oil leak etc.)

Maintenance interval 50.000 kms

- Change the oil for the wheel hubs

Maintenance interval 100.000 kms or 12 months

- Perform all above points
- Check/adjust the wheel hub bearings
- Change the oil for the differential carrier

The grease lubrication according to the vehicle's standard schedule.

4 SPECIAL TOOLS

Adjustment wrench for wheel hub bearing	7543-050-020
Puller for planet gear axle shafts	7543-049-05
Guide plate for installation of the planet gear axle shafts	7543-049-06
Support plate under the hub housing when using workshop press	7543-049-02
Guiding tool for planetary axles	7543-049-030

5 TECHNICAL DATA

Axle housing	Fabricated of pressed steel plate
Planetary wheel hub gears	5 planetary gear design, ratio 3.64: 1
Brakes	410 x 210 mm [16 x 8.25 in]
Clearance of wheel hub bearing	-0,05 ... 0,05 mm [-0.002 ... 0.002 in]
Steering knuckle axial bearing clearance	-0,10 .. 0,0 mm [-0.004 ... 0.0 in]

6 TORQUE VALUES

Description	Nm	Lb-ft
Wheel nuts	550 - 650	406 - 480
Wheel hub oil level and drain plugs	50 - 70	37 - 52
Tie Rod End nuts (thread M30x1.5)	350	260
Tie Rod Clamp Bolts & Nuts M14x1.5	160 - 180	118 - 133
Tie Rod Clamp Bolts & Nuts M12x1.5	70 - 90	52 - 66
Other values: See respective instructions		

**SERVICE BULLETIN
6.5.2002/7.11.2002****No. S12001B
Page 1/2****CHANGE IN WHEEL HUB SEALING**

The type of hub sealing has changed mainly in the heavy front and rear truck drive axles. The hub sealing has changed also in the industrial SRDP-30-S and SSDP-18 axles. In the new wheel hub seal the pre-shielding before the actual sealing lip is better than in the older seal type. The outer shell of the new seal is rubber coated compared to the older seal where the outer surface was metal. In addition, the dimensions of the seals have changed, except the inner diameter of the rear axle hub seal. The new dimensions are based on the International System of Units. The diameter dimensions of the rear axle seal are 127/160 mm (earlier 127/159) and respectively in the front axle seal 150/180 mm (earlier 133.4/187.5).

Cause of Change:

To improve sealing life and to prevent seal leaks.

Identify and Changed Parts:

Front Axles: FSDP-14, FSFP-14, FSMP-14, SSDP-18-G and also non-drive FSND-12 & FSFN-14.

Changed Parts in Front Axles:

Description	Old Part No.	New Part No.
Shaft seal	591122-13301	591122-15001
Spacer Ring	540-415-1010	540-415-1300
O-ring Ø133*2.62 mm	--	91101-33026
Wheel Hub (FSXX-12/14 Axles)	541-411-1401	541-411-1410
Wheel Hub (SSDP-18 Axles)	541-411-1402	541-411-1412

Rear Axles: FRDP-11/13/16, FRMP-11/13/16, FRFP-11/13/16 and SRDP-30-S

Changed Parts in rear Axles:

Description	Old Part No.	New Part No.
Shaft seal	91122-12701	591122-12702
Wheel Hub (FRDP/FRMP/FRFP-11/13/16 and SRDP-30-S Axles)	143-441-0410	543-441-0700
Wheel Hub, (FRDP/FRMP/FRFP-11/13/16 Axles with Al-Rims)	543-441-0600	543-441-0710
Wheel Hub (FRDP/FRMP/FRFP-11/13/16 with Compact Hub)	543-411-3510	543-411-3800

**SERVICE BULLETIN
6.5.2002/7.11.2002****No. S12001B
Page 2/2****Interchangeability in Service:**

It is not possible to install parts of the new design individually to an axle of the earlier design.

The new hub sealing is possible to install to the earlier design as follows:

Front Axles: Wheel hub, spacer ring, seal and o-ring to be replaced together.

Rear Axles: Wheel hub and seal to be replaced together.

Date of Change:

Axle type	Serial No.	Date
FRDP/FRMP/FRFP-11/13 axles with compact hub	20322	February 2002
FRDP/FRMP/FRFP-13/16 axles (BTE-hub)	20580	March 2002
FSDP/FSFP/FSMP/FSFN-14, FSND-12, FSFN-14 & SSDP-18-G axles	20287	February 2002
SRDP-30-S axles	22055, 22072, 22073 and all since 22221	September 2002

Installing of the Hub Seals:

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

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

☞ Seal 591122-15001 with tool **7541-040-150**.

Note! No sealing compound is allowed to use in installing.

The new seal type has rubber coated outer surface for sealing the gap between seal and seal housing.

When installing the assembled hub, the axle spindle has to wiped with blend of alcohol and water (1:1) to prevent friction between the spindle and the hub seal.

Oiling is not recommended because there are risk of the seal inner race turning with the hub on the axle spindle.

If installed dry, the internal pre-shielding in the hub seal may damage as result of the axial pressure.