

SISU AXLES

SISU DP-330 DRIVE GEAR

Maintenance Manual

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TABLE OF CONTENTS

REPAIR INSTRUCTIONS FOR SISU FXDP DRIVE GEAR

	Page
CARRIER UNIT.....	2
Removing the carrier unit from the axle body.....	2
DIFFERENTIAL LOCK.....	3
Disassembly.....	3
Assembly.....	4
Lock Adjustment.....	4
DIFFERENTIAL.....	4
Disassembly.....	4
Assembly.....	6
PINION UNIT.....	6
Disassembly.....	6
Assembly.....	6
Pinion unit installation.....	7
CARRIER ASSEMBLY.....	7
Installation of the differential assembly.....	7
Assembly and adjustment of gear backlash and contact.....	8
Replacement of the ring and pinion gears.....	8
Installation of the carrier assembly.....	10
OIL CHECKS AND OIL CHANGES.....	10
Differential oils.....	10
SPECIAL TOOLS.....	11
TORQUE VALUES.....	11
LUBRICATION.....	11
Oil volumes.....	11
TECHNICAL DATA.....	12

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.

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CARRIER UNIT**Removing the carrier unit from the axle body**

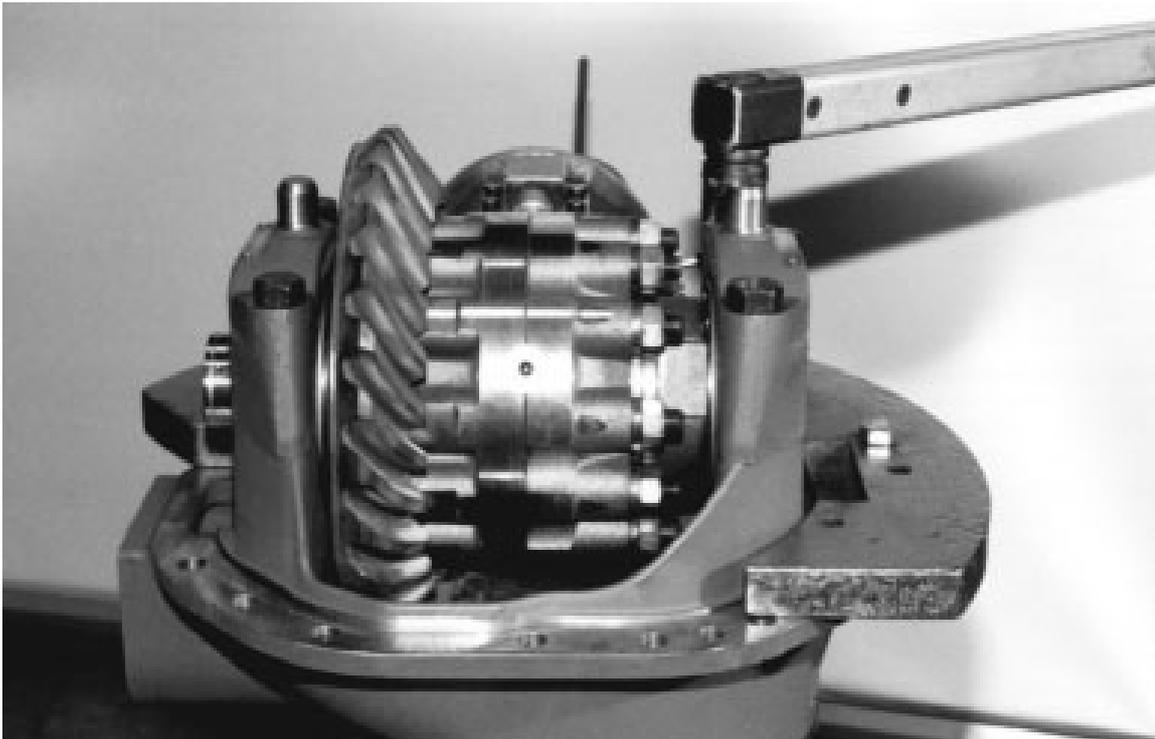
Drain carrier oil.

Remove the cotter pin from the propeller shaft flange nut and unscrew the nut a few turns. Use a pry bar to keep the flange stationary while unscrewing the nut. It is best to do this while the axle is in the vehicle or in a repairs stand if one is available.

Remove the axle from the vehicle. (The carrier can be removed alone while the axle remains in the vehicle by using a special lift). Place the axle assembly on a repair stand so the pinion flange is facing upward.

Removing the carrier from the axle housing:

Remove the carrier housing cap screws and screw two of them into the threaded holes in the carrier housing to act as extractors. (These holes are protected by plastic plugs). Remove the carrier with suitable lifting gear and place it on a repair stand with the ring gear up..



Picture 1. Carrier mounted on repair stand.

DIFFERENTIAL LOCK

Disassembly

Remove the lock cylinder cover retaining screws (5 pcs). Remove the cover and the diaphragm.



Picture 2. . Lock cylinder cover removed and diaphragm is loose.

Remove the diaphragm support cup cap screw and the cup and spring.



Picture 3. Support cup and spring ready for removal.

Loosen the fork lock screw approx. 2 turns (for access, remove the plug from the casing) and remove the fork shaft by turning it counter-clockwise with a suitable open end wrench.



Picture 4. Allen wrench in fork lock screw access hole.

Loosen the sliding ring lock screw and remove the snap ring. Remove the fork, sliding ring and shoes.



Picture 5. Fork shaft removal.



Picture 6. Sliding ring lock screw loosened (arrow).



Picture 7. Removing sliding ring snap ring.

Assembly

Inspect all lock components to ensure that they are in good condition and not excessively worn. Replace all damaged parts. Assemble by following the above steps in reverse order.

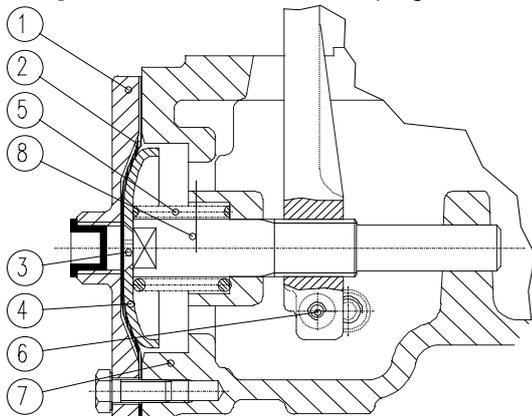
Lock Adjustment

For adjustment, the following parts must be removed.

1. Cover
2. Diaphragm
3. Screw
4. Cup
5. Spring

Lock Adjustment:

1. Engage the dog clutch of the differential lock by pushing the fork shaft in all the way.
2. Place the cup (4) on the fork shaft without the retaining screw.
3. Adjust the fork shaft by turning it in the fork so that the cup touches both the end of the shaft and the bottom of the casing simultaneously.
4. Check by rotating the pinion or input shaft and pushing the fork shaft at the same time to see if the shaft will go in further.
5. If the shaft and the fork went in further, repeat step 3.
6. When the shaft does not go in further, turn it clockwise 1/4 turn
7. Tighten the fork locking screw (6).
8. Install the cup (4) and retaining screw(3). Push on support cup manually to make sure that the cup rim touches the bottom of the casing
9. Install the cup cap screw and tighten to 30 Nm[22 lb-ft]. Use sealant on the hole plug threads.



Picture 8. Differential lock cylinder.

DIFFERENTIAL

Disassembly

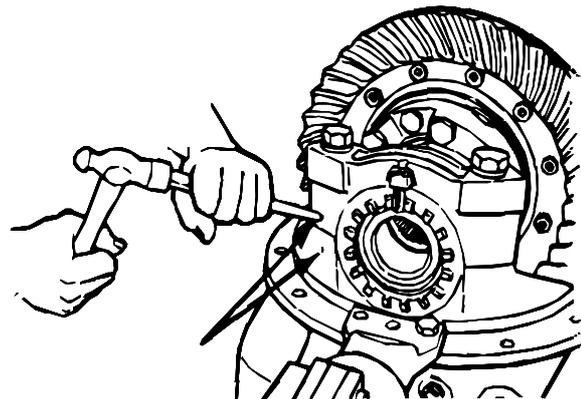
If the ring and pinion are in good condition and will be reused, check and note the gear backlash before disassembly.

NOTE: If the bearings are damaged, this measurement cannot be used at reassembly.

NOTE: Remove the differential lock before removing the ring gear and differential assembly.

Mark carrier bearing caps and the adjacent case with a center punch to identify their positions. Remove bearing cap cap screws, bearing caps, and the bearing caps.

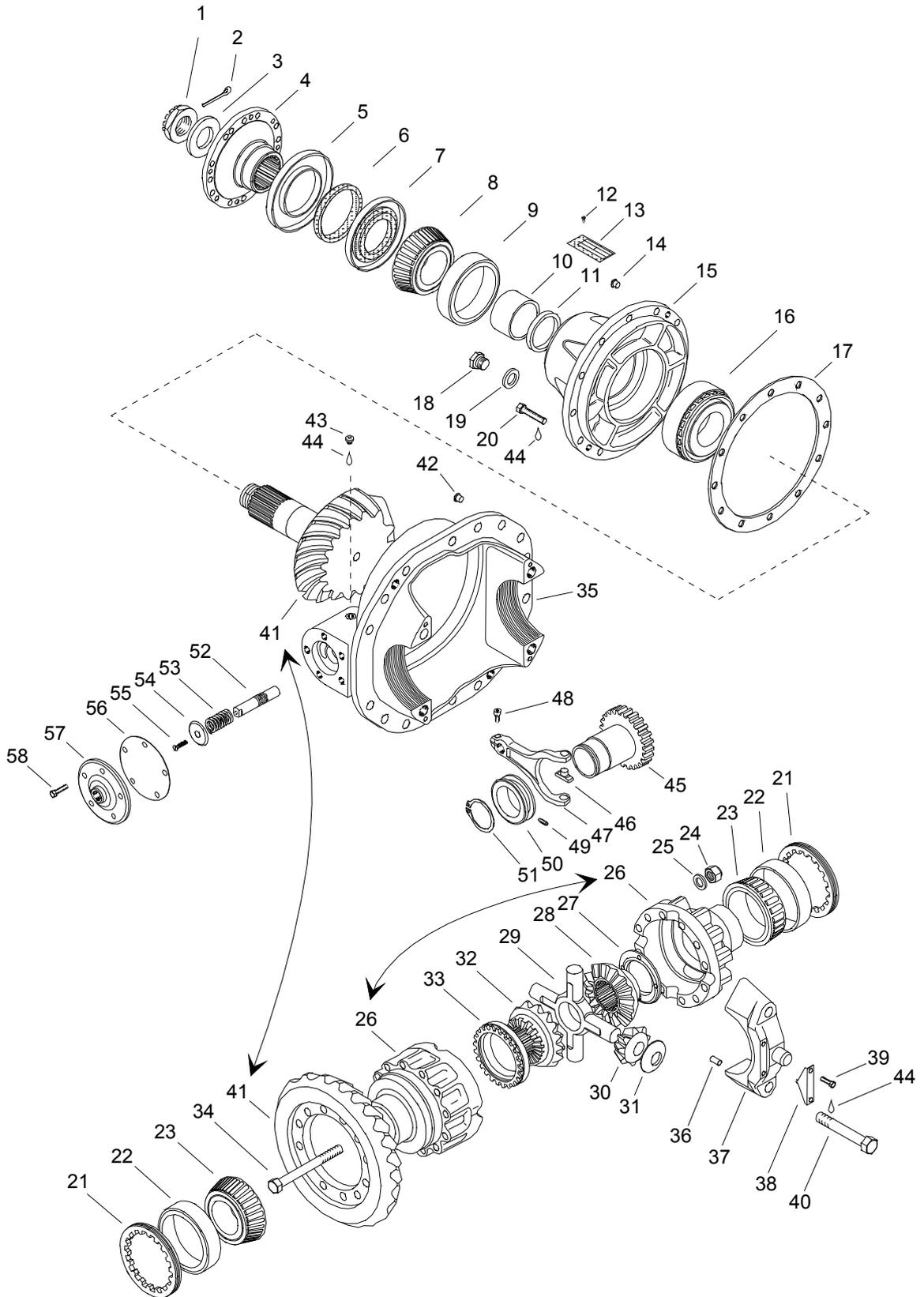
Remove complete ring gear and differential assembly and place in a vise or repair fixture.



Picture 9. Area to be marked with center punch.

Center punch adjacent surfaces on case halves. Remove the differential case nuts and the upper case half. If the ring and pinion are to be replaced, remove the lower case half and differential gears.

Remove the differential lock engagement gear (45) and its guide ring (33) from the differential case. (picture 10)



Picture 10. Exploded view of carrier assembly.

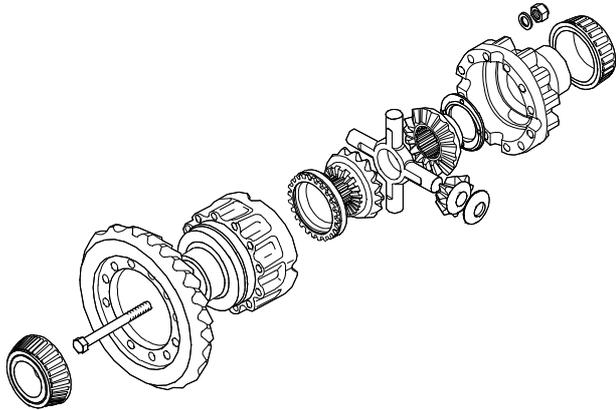
Assembly

(See picture 10)

Inspect all parts carefully to ensure that all parts to be reused are in good condition. Press the bearing cones into the case halves if they are to be replaced. Install the ring gear side of the case half on the ring gear. Place the differential side gear (32) with the guide ring (33) in the case half. Install the differential lock engagement gear. Place the spider gears and thrust washers on the spider and then on the side gear in the case half.

Place the other side gear and its thrust washer on top of the spider gears.

Install the upper case half with punch marks lined up and insert cap screws and washers. Tighten nuts to 320 Nm [236 lb-ft] torque. **Always use new nuts.**



Picture 11. Exploded view of differential (with differential lock)

PINION UNIT

Disassembly

Remove cap screws holding the pinion housing to the differential housing and, with the extractor screws (M12) screwed in the threaded holes, separate the two housings.

Lift the pinion unit off the differential housing. Save shim (Item 17 in picture 10) for use at reassembly.

Remove the pinion flange nut. Hold the flange with a suitable bar to prevent its turning.

Push the pinion out of the housing with a shop press.

The bearing cone (16), spacer (10), and shims (11), will come out with the pinion. The complete outer bearing (8 & 9), seal (7), and cup of the inner bearing (16) will stay in the housing. Put the shims aside to use at reassembly if the gears are to be reused. Remove the seal, the outer bearing and the bearing cups if required, from the housing.

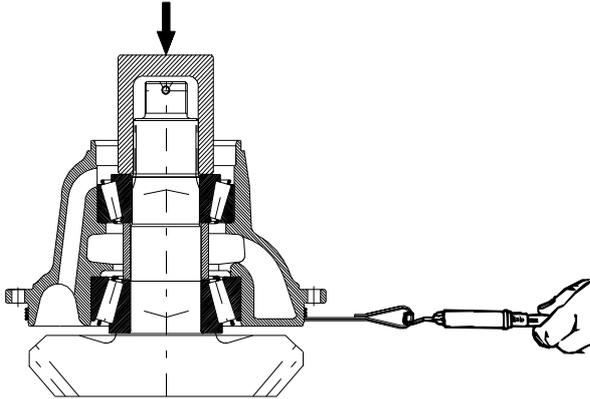
Assembly

Inspect all parts carefully to ensure that all that are to be reused are in good condition. Only bearings in perfect condition may be reused. If ring and pinion are to be replaced, new bearings must be used as well.

Press the bearing cone onto the pinion. Install the spacer bushing and the old shim(s) on top of the bearing on the pinion. Press the outer bearing cup into the housing

Lift the housing onto the pinion and place the outer bearing cone on the pinion. Use a suitable sleeve to press the outer bearing cone into place while rotating the housing by hand. Increase the force to 160 kN (35,000 lbs.). If the bearing binds, press pinion out and replace the shim(s) and/or the spacer with others to increase clearance and repeat the process.

With bearings fully seated and without the seal in place, check the pinion rotation force while maintaining 160 kN (35,000 lbs.) pressure as follows: Wrap a few turns of string around the pinion housing just below the flange and pull the string with a spring scale. The correct value is 55 - 80 N [12.5 - 18 lb]. Replace shims if required until correct rotating torque value is reached.



Picture 12. Checking the pinion bearing rolling torque with a spring scale.

Following spacer bushings and shims are available:

Description	Part No.	Thickness	
		mm	inch
Spacer	099 557 1026	53.7	2.114
Spacer	099 557 1027	53.72	2.115
Spacer	099 557 1028	53.74	2.116
Spacer	099 557 1029	53.76	2.1165
Spacer	099 557 1030	53.78	2.117
Shim	099 517 1000	0.30	0.012
Shim	099 517 1001	0.40	0.016
Shim	099 517 1002	0.50	0.020

Fill the bearing cavity with grease and install the seal. Install the pinion companion flange with its seal protection ring and V-Seal. Screw the pinion nut hand tight.

If a shop press is not available for assembly, adjustment can be performed as follows: Assemble as described but instead of pressing, install the companion flange, washer and nut and tighten the nut to 1,300 Nm [970 lb-ft] torque. Measure and adjust the bearing rotating torque as previously described. When the rotating force is correct, install the companion flange, washer and nut and tighten the nut to 1,300 Nm [970 lb-ft] torque and secure it with a cotter pin

Pinion unit installation

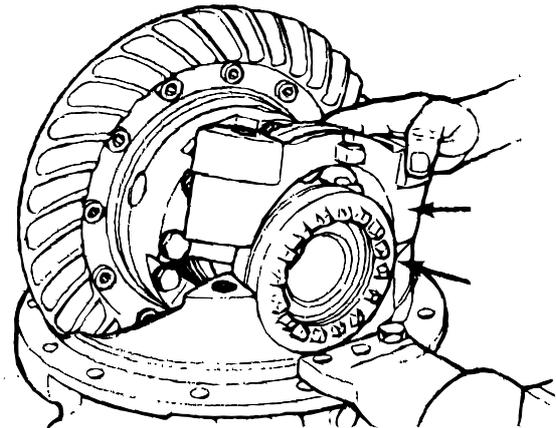
Place previously used adjustment shim(s) (17 in picture 10) on carrier housing and place the pinion housing on the carrier. Coat mating surfaces with Silmate Silicone Rubber RTV 1473 or similar Room Temperature Vulcanizing sealant. Install cap screws and tighten to 150 Nm [110 lb-ft] torque.

CARRIER ASSEMBLY

Installation of the differential assembly

With the carrier housing pinion face down, place the differential and ring gear and its bearing cups in place.

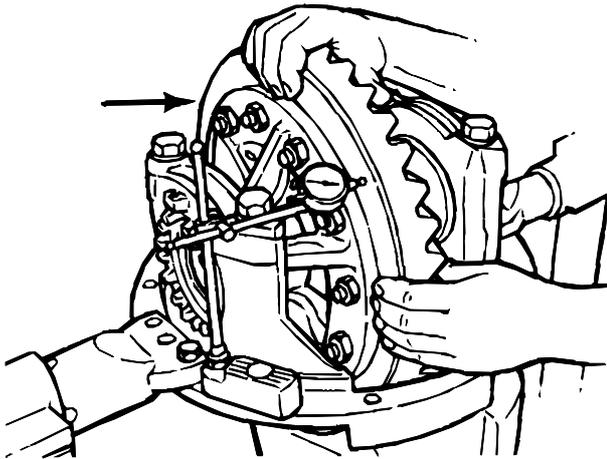
Install the bearing caps according to the punch marks made at disassembly. With Loctite locking liquid on the threads, tighten the cap screws finger tight. Install the bearing adjustment and position the ring gear as close to its correct position as possible.



Picture 13. Installing the bearing caps.

Assembly and adjustment of gear backlash and contact

Tighten the cap screws to 480 Nm [354 lb-ft] torque. Position a dial indicator with a magnetic base as shown in picture 14 and tighten the bearing adjusting nuts until end play is eliminated. Tighten the ring gear tooth side adjusting nut 1 to 1.5 slots further with wrench No. 7143-024-010.



Picture 14. Adjusting the carrier side bearings.

Replacement of the ring and pinion gears

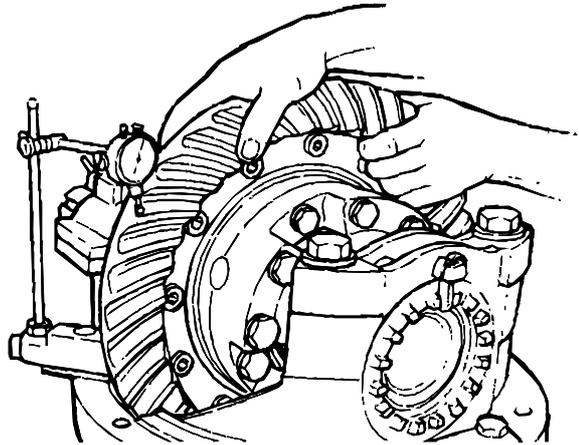
The ring and pinion gears are marked with Information so that when a new ring and pinion gear assembly is to be installed, the correct relationship of the pinion to the ring gear can be determined. The information includes:

1. Part number
2. Number of teeth
3. Ring and pinion set part number
4. Variation value which is needed for correct positioning of the pinion.

The part number and tooth combination numbers are die cut on the outer surface of all pinions. On ring gears, these numbers are marked on the outside diameters. The tooth combination number (for example, 30/12) indicates that the pinion has 12 teeth and the ring gear 30 equal to a drive ratio of 2.50 : 1.

All ring and pinion assemblies are supplied in matched sets and both parts have the same pair number. On pinions, the pair number is die cut in the inner end of the pinion.

Measure gear backlash by dial indicator and adjust it by turning both adjusting nuts equally so that the bearing preload remains as previously set. Adjust gear backlash to 0.15 - 0.40 mm [0.006 - 0.016 in]



Picture 15. Adjusting the gear backlash

NOTE: All dimensions in this section are metric [mm] only.

Never use a ring and pinion together which do not have the same pair numbers.

Each ring gear is marked with a variation value which indicates the nominal installation distance.

The variation number (for example +0.1 or -0.1) is marked on the outside diameter of the ring gear.

To calculate the thickness of the shims used under the bearing cup::

1. Measure the thickness of the previously used shim(s) with a micrometer.
2. Note the variation number on the ring gear. If this number has a plus value (+), subtract it from the measurement calculations, below. If this number has a minus value, (-), add it to the measurement calculations, below.

Take note of this measurement.

CALCULATION EXAMPLES

Example 1

- Thickness of original shim(s) 0.75 mm
- Variation value on pinion = +0.05 -0.05
- Measurement obtained 0.70 mm
- Variation No. on new pinion +0.10 +0.10
- New thickness of shim(s) to be used 0.80 mm

Example 2

- Thickness of original shim(s) 0.65 mm
- Variation value on pinion = -0.05 +0.05
- Measurement obtained 0.70 mm
- Variation No. on new pinion +0.15 +0.15
- New thickness of shim(s) to be used 0.85 mm

Example 3

- Thickness of original shim(s) 0.70 mm
- Variation value on pinion = +0.05 -0.05
- Measurement obtained 0.65 mm
- Variation No. on new pinion -0.05 -0.05
- New thickness of shim(s) to be used 0.60 mm

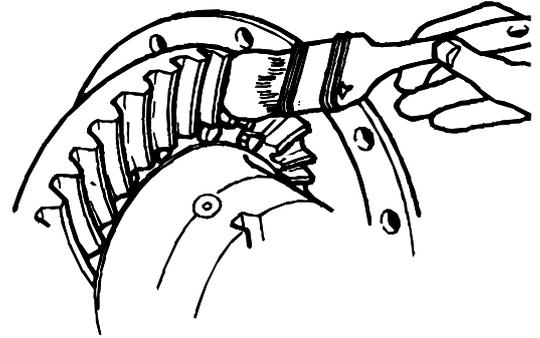
Available shims for setting the location of the pinion:

Description	Part No.	Thickness	
		mm	inch
Shim	144 239 1403	0.10	0.004
Shim	144 239 1401	0.20	0.008
Shim	144 239 1400	0.50	0.020
Shim	144 239 1404	1.00	0.039

Use these shims singly or in combination as required.

Note: Check the tooth contact and correct it as required. To obtain the correct contact pattern may require the pinion to be moved. This will change gear backlash and adjustment has to be done simultaneously.

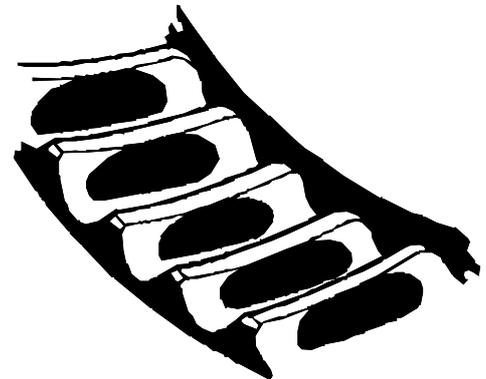
Correct tooth contact is most important and gear backlash has to be set within 0.15 - 0.40 mm [0.006 - 0.016 in] with a new ring and pinion assembly. With an old assembly, the tooth contact and the gear backlash have to be set as they were prior to disassembly. Check tooth contact by using lead oxide paint (red lead).



Picture 16. Apply a thin coat of suitable contact paint.

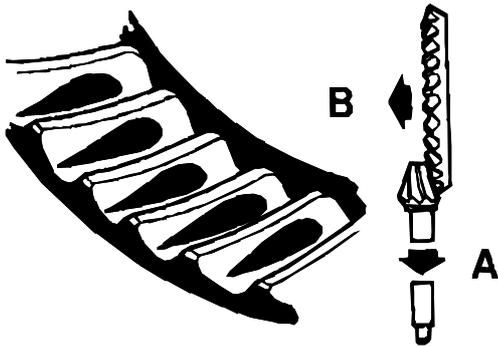
The following pictures illustrate tooth contact patterns unloaded.

picture 17 indicates that the pinion is set correctly. This gives a quiet drive and long life.



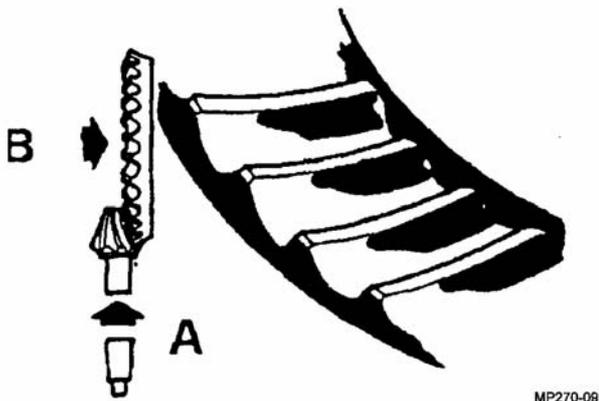
Picture 17. Good tooth contact.

picture 18 indicates that the pinion is set too deep. This causes a noisy drive and excessive wear or damage of the gears. To set the correct position of the pinion, add shims under pinion housing and move the pinion out (in the direction of arrow A in picture) and the ring gear in (in the direction of arrow B in picture). The correct backlash is 0.15 - 0.40 mm [0.006 - 0.016 in].



Picture 18. Poor tooth contact - Too deep

picture 19 indicates that the pinion is set too far out. This causes a noisy drive and excessive wear or damage to the gears. To set the correct position of the pinion, remove shims under the pinion housing and move the pinion in (in the direction of arrow A in picture) and the ring gear out (in the direction of arrow B in picture)



Picture 19. Poor tooth contact - Too shallow

When the differential side bearings are finally adjusted, lock the adjustment nut with their respective lock plates and tighten their retaining cap screws to 21 Nm [15 lb-ft] torque. When the cap screws are tightened, drive the lock plate tabs into the groove of the nut with a hammer.

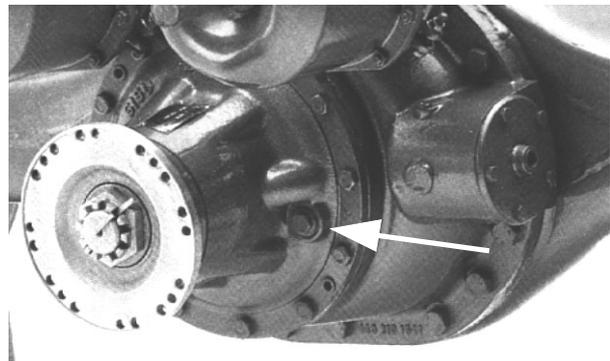
Installation of the carrier assembly

Coat mating surfaces of carrier assembly and axle housing with Silmate Silicone Rubber RTV 1473 or similar Room Temperature Vulcanizing sealant. Install the carrier assembly on the axle using suitable lifting gear. With Loctite locking liquid on threads, install the cap screws and tighten evenly to 240 Nm [177 lb-ft] torque. Install the axle shafts and wheel hubs.

OIL CHECKS AND OIL CHANGES

Differential oils

Fill carrier housing with oil to level of the appropriate fill plug opening (Arrow in picture 20).



Picture 20. Carrier oil level and filling plug.

SPECIAL TOOLS

Adjustment wrench for differential side bearing

7143-024-010

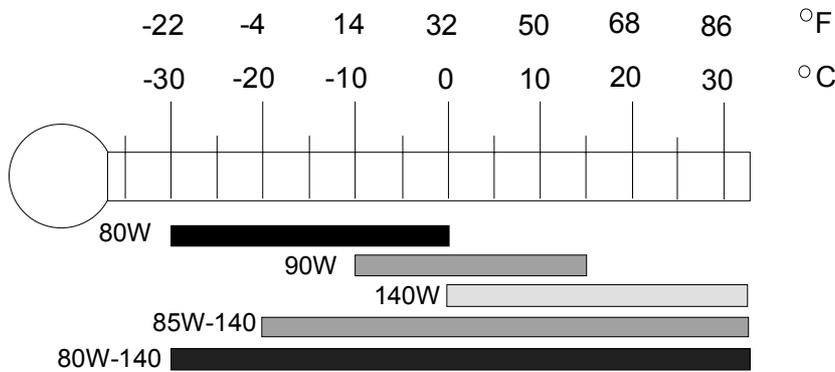
TORQUE VALUES

Description	Nm	Lb-ft
Propeller shaft flange nut	1300	960
Differential side bearing cap cap screws	480	354
Differential case halves and ring gear cap screw nuts	320	236
Carrier housing to axle housing cap screws	240	177
Differential lock cylinder cover screws	21	15
Differential lock cylinder diaphragm to cup cap screw	30	22
Differential side bearing adjustment lock plate cap screws	21	15

LUBRICATION

Axle oil quality API GL - 5

Viscosity according to prevailing ambient temperature as shown on the accompanying table



Oil volumes

Filling volumes -

Pinion in horizontal position

Metric

U.S.

Axle differential

18 ltrs

38 pints

TECHNICAL DATA

Maximum allowed output torque 33,000 Nm [24,300 lb-ft]

Available ratios 1.12 to 2.90 : 1

Differential lock Standard

Ring and pinion gear backlash 0.15 - 0.40 mm [0.006 - 0.016 in]

Adjustment measurement of differential locks:

Axle differential locks Approx. 0.4 mm [0.016 in] (see respective instructions)

Input Flange Cassette Seal

In the later models the input drive flange sealing the shaft seal with one sealing lip is replaced by a new cassette type seal with multiple sealing lips, P/N. 591122-08508.

Simultaneously the v-ring seal (P/N 090-400-9500) between the shaft seal shield plate and the shaft seal has been removed.

The new cassette seal is totally interchangeable with the old shaft seal (P/N 91122-08504). When replacing the old shaft seal with the new one, the v-ring seal should be removed because it has no functional purpose in the new construction

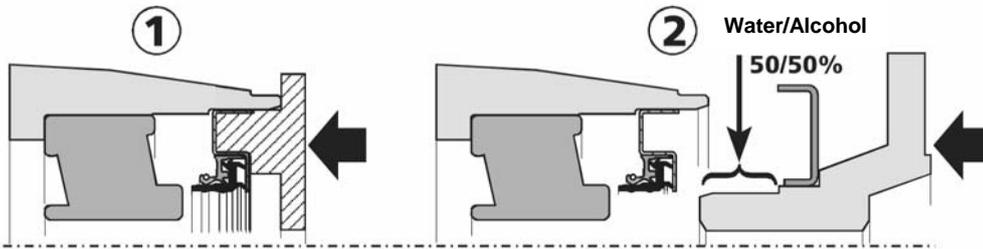
Installing the Cassette Seal:

Use installing tool 7543-204-020 when pressing the cassette seal in it's place (1 in picture 1.). Tool can be also made according to the drawing in picture 2. (Dimensions are in mm.)

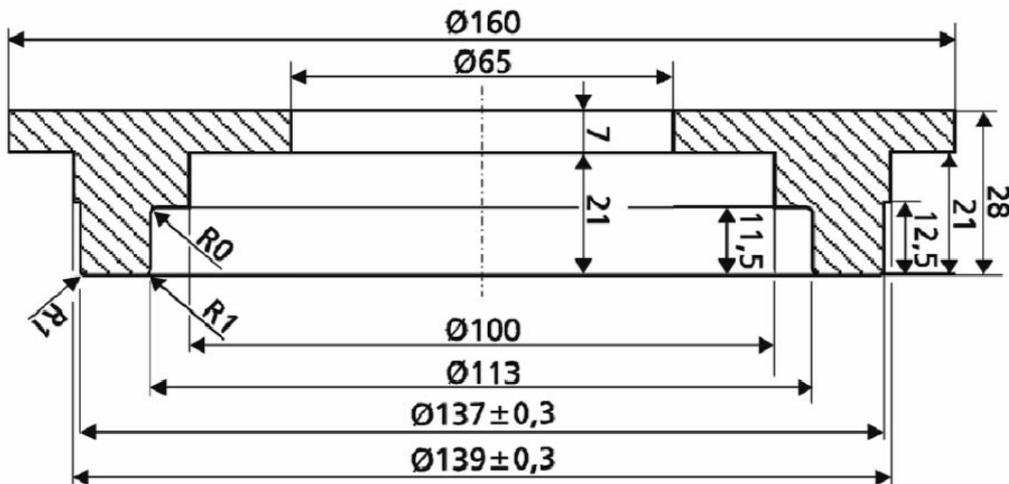
When installing the input drive flange (2 in picture 1.) the sealing surface has to be wiped with **Fretax AF 281** assembly gel to prevent friction between the input flange and the seal during installation.

Alternatively Klüberplus S 06-100 assembly gel or blend of alcohol and water (1:1) can be used in installing.

Note! If installed dry the seal may damage.



Picture 1.



Picture 2. Cassette Seal Installing Tool 7543-204-020