

# **SISU** AXLES

## **SISU MP-330 DRIVE GEAR**

### **Maintenance Manual**

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**TABLE OF CONTENTS****REPAIR INSTRUCTIONS FOR SISU MP-330 DRIVE GEAR  
IN FSMP-14 & FRMP-13/16 AXLES**

	Page
CARRIER UNIT .....	2
Removing the carrier from the axle housing .....	2
Disassembly of the inter-axle differential .....	2
Dismantling the input shaft and parts. ....	4
Inter-axle differential assembly .....	4
DIFFERENTIAL LOCKS (Both inter-axle and axle) .....	5
Disassembly .....	5
Assembly .....	5
Lock Adjustment .....	5
AXLE DIFFERENTIAL .....	7
Disassembly .....	7
Assembly .....	7
PINION ASSEMBLY .....	7
Disassembly .....	7
Assembly .....	7
CARRIER ASSEMBLY .....	10
Installation of the differential assembly .....	10
Assembly and adjustment of gear backlash and contact .....	10
Replacement of the ring and pinion gears .....	11
Installation of the inter-axle differential housing .....	13
Assembly of the drop gear including the inter-axle differential .....	13
Adjustment of gear backlash on inter-axle differential .....	14
Installation of carrier assembly .....	16
Installation of the output shaft .....	16
Adjustment of the inter-axle differential lock indicator light sender .....	16
OIL CHECKS AND OIL CHANGES .....	17
Differential oils .....	17
SPECIAL TOOLS .....	18
TORQUE VALUES .....	18
LUBRICATION .....	18
Oil volumes .....	18
TECHNICAL DATA .....	19
APPENDIX 1. DRIVE RELEASE COUPLING .....	20

**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

Drain carrier oil.

Remove the cotter pin from the propeller shaft flange nut and unscrew the nut a few turns. Use a retaining 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.

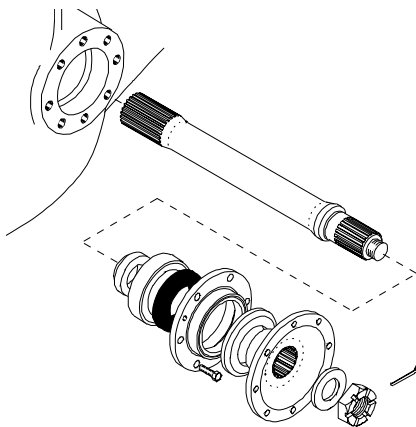
Remove the axle from the vehicle. (The carrier can be removed alone while the axle remains in the vehicle by using a special lift).

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 plug). Remove the carrier with suitable lifting gear and place it on a repair stand with the ring gear down.

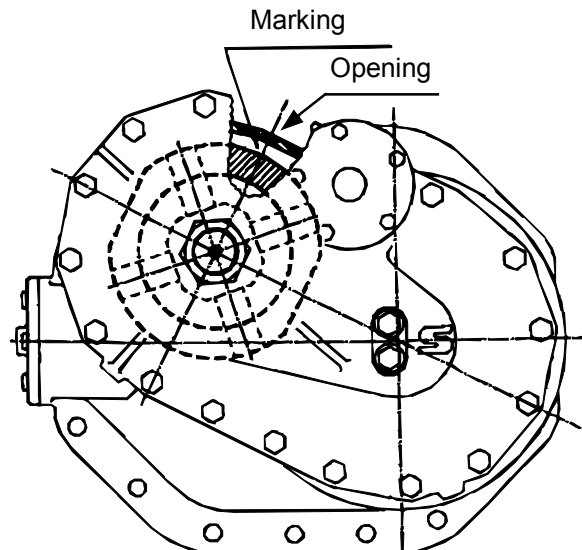
Remove cap screws from output bearing cover on rear of axle housing. Remove the output shaft and its bearing from the rear of the axle housing.



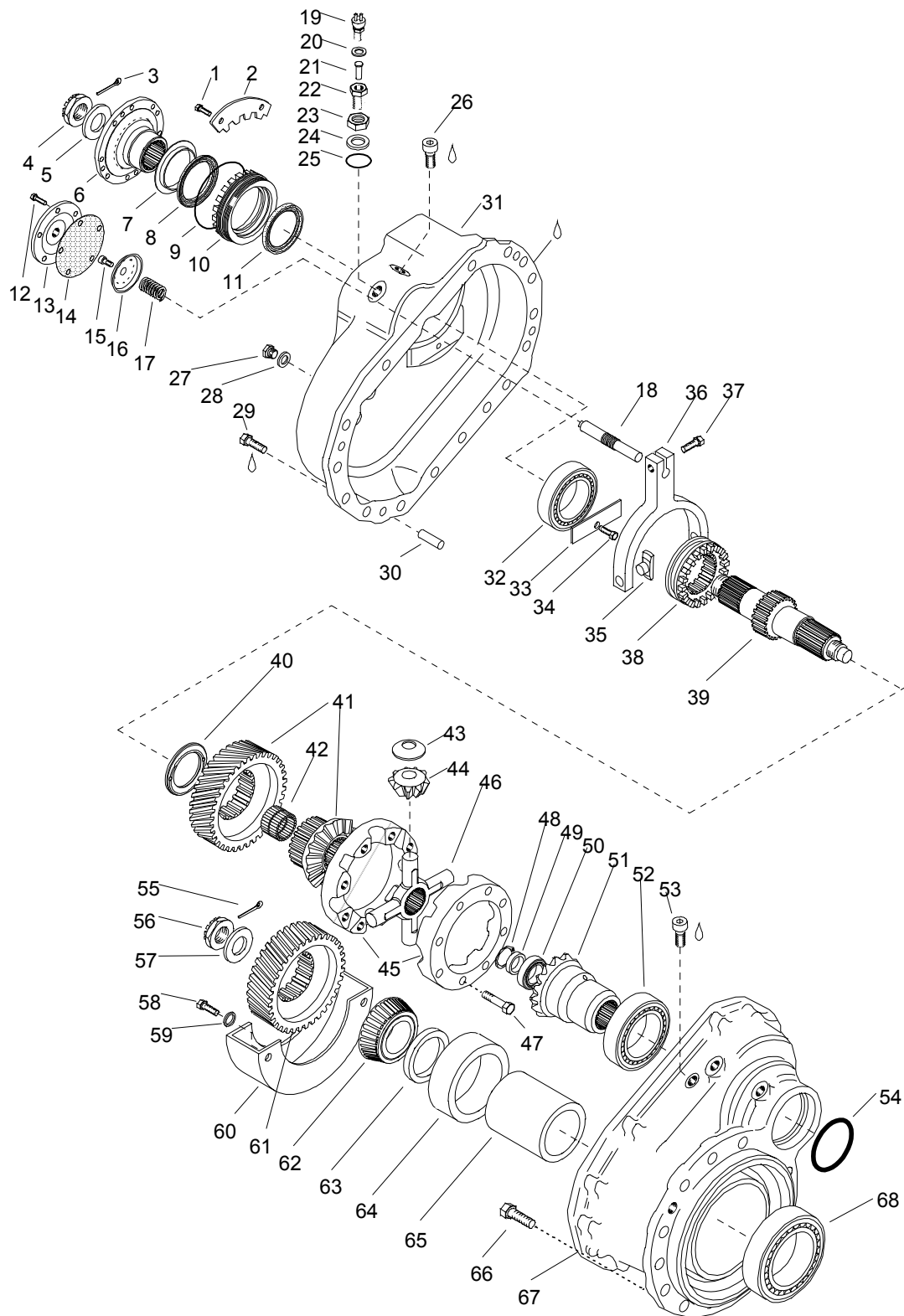
**Picture 1.** Exploded view of output shaft and associated parts.

### Disassembly of the inter-axle differential (See picture 3)

Remove cap screws (29) holding together the two halves of the inter-axle differential housing. Remove the plug (53) on the top of the housing and rotate the propeller shaft flange so one of the two markings on the inter-axle differential case is aligned with the plug opening. This is necessary to allow one of the two milled faces on the differential case to pass the lower spur gear.



**Picture 2.** Differential body positioned correctly to allow removal or installation.



Picture 3. Exploded view of Inter-Axle Differential.

With the inter-axle differential case properly aligned, remove the forward half of the inter-axle differential housing (31). The input shaft (39), the complete inter-axle differential lock, the upper spur gear (41) and the inter-axle differential less the rear side gear (51) are removed with the housing. The inter-axle differential rear side gear stays on the splines of the output shaft or the optional drive release coupling if so equipped.

Remove the side gear from the housing.

Remove three screws (58) and the oil through (60) for the lower spur gear

**Note! The oil through (60) has not been installed after axle serial No. 61919 (August 1996) and it can be left out in reassembling.**

Remove the cotter pin (55) and nut (56) for the lower spur gear.

Remove the cap screws (66) attaching the rear half of the inter-axle differential housing to the carrier case.

The pinion and its bearing are removed with the rear half of the inter-axle differential housing. Note: Carefully save the shims between the two housings. The pinion to ring gear engagement is adjusted by these shims and the old shims will be used at reassembly.

#### **Dismantling the input shaft and parts.**

Remove the switch (19) for the inter-axle differential lock warning light.

Disassemble the inter-axle differential lock following the instructions on Page 5.

Remove the input flange retaining nut (4) and the input flange (6).

Remove the cap screw (34) and the input shaft bearing oil dam (33).

Turn the housing over and remove the input shaft (39) with its other parts from the housing.

Remove cap screws (1) and the bearing adjustment lock plate (2). Remove the adjusting nut (10).

Remove the tapered roller bearing (50) from the input shaft inner and save the shims (49) under the bearing. These shims adjust the differential gear clearance.

Remove the lock ring (48) and lift the inter-axle differential assembly off the splines.



**Picture 4.** Inter-axle differential assembly.

Note the two milled sides of the differential case for removal and installation.

Remove the differential side gear and spur gear (sold as a set only) (41) with the needle bearing (42), thrust washer (40) and inter-axle differential lock gear (38) off the input shaft.

Using a shop press, remove the outer bearing cone from the input shaft.

If bearing as being replaced, remove the bearing cups from the housing with a soft drift.

Mark the inter-axle differential case halves (45) with a center punch and disassemble the case by removing the cap screws (47). Inspect the inter-axle differential parts and replace all worn and defective parts with new ones.

#### **Inter-axle differential assembly**

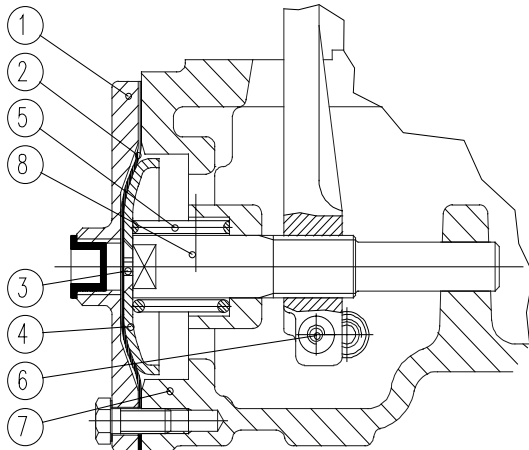
Assemble the inter-axle differential and apply Mobil-Grease MP grease to all moving surfaces. Apply Loctite locking liquid to cap screws (47) and tighten them to 72 Nm [55 lb-ft] torque.

## DIFFERENTIAL LOCKS (BOTH INTER-AXLE AND AXLE)

See picture 5

### Disassembly

Remove the lock cylinder cover cap screws (5 pcs), the cover (1), and the diaphragm (2). Remove the diaphragm support cup screw (3), the cup (4) and the spring (5). Loosen the shift fork lock screw (6) approx. two turns (For access to the screw, remove the plug from the housing.) and remove the fork shaft (8) by turning it counter clockwise with a suitable open end wrench. With the shaft removed, remove the fork and slide shoes.



Picture 5. Differential lock.

### Differential lock parts:

1. Lock cylinder cover
2. Diaphragm
3. Support cup retaining cap screw
4. Support cup
5. Releasing spring
6. Fork lock screw
7. Lock housing (part of main housing)
8. Fork shaft

### 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.

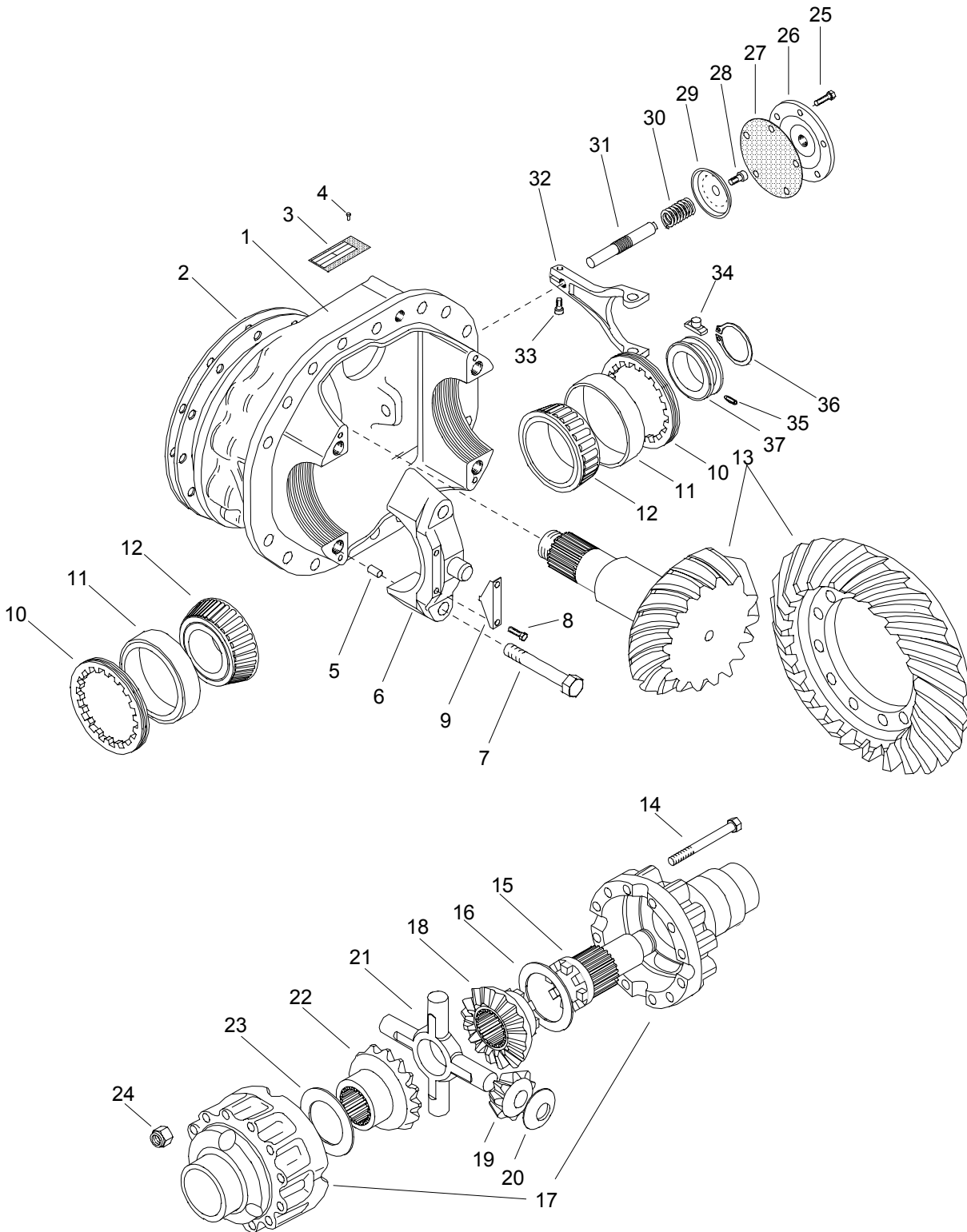
### Lock Adjustment

For adjustment, the following parts must be removed.

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

### Adjusting procedure:

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. *In differential cross locks:*  
When the shaft does not go in further, turn it clockwise 1/4 turn (approx. 0.4 mm [0.015 in]) which is the suitable operational clearance.  
*In inter-axle differential locks:*  
In inter-axle differential lock the adjustment is depending of the axial clearance of the inter-axle differential assembly (the clearance range is 0.8 ... 1.2 mm [0.03 ... 0.05 in], see adjusting instructions on page 15).  
Calculation example for the inter-axle differential lock adjustment value: If the measured inter-axle differential assembly axial clearance is eg. 1.1 mm, then the suitable operational clearance 0.4 mm for the diff lock needs total 1,5 mm movement which can be achieved by turning the lock shaft clockwise one full turn in this case (the pitch of the lock shaft thread 1.5 mm/turn = the measured inter-axle differential axial clearance 1.1 mm + the suitable operational clearance 0.4 mm).
7. Tighten the fork locking screw(6) to 35 Nm [26 lb-ft] torque.
8. Install the cup (4) and retaining screw(3).
9. Push on support cup manually to make sure that the cup rim touches the bottom of the casing.
10. So the adjustment is performed. Remove the cup once more and assemble the lock. Tighten cup retaining screw to 30 Nm [22 lb-ft] torque and the lock cover retaining screws to 21 Nm [15 lb-ft] torque.



**Picture 6.** Exploded view of carrier with ring and pinion gears and axle differential lock.

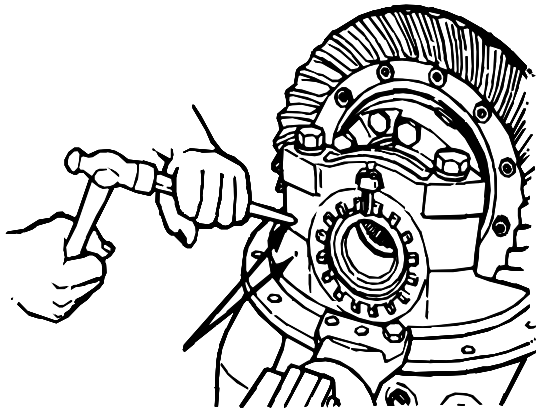


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**AXLE DIFFERENTIAL****Disassembly**

Items in text are for picture 6.

Remove bearing adjustment nut lock plates (9) and unscrew the bearing adjustment nuts (10) 1/2 turn. Make punch marks on the side bearing caps (6) and the adjacent main case to ensure that the caps are reinstalled in the same way they were originally installed.



**Picture 7.** Area to be marked with center punch.

Remove bearing cap cap screws (7) and remove caps. Remove the dowels (5) under the caps if necessary. Lift the ring gear, differential, and side bearing cones (12) from the housing. Be careful not to damage the bearing cups (11) when removing the differential assembly. Mark the differential case halves (17) with a center punch. Mount the assembly in a vise or a repair stand with the ring gear teeth facing upwards. Remove the nuts (24) from the bolts holding the differential case and ring gear together and lift off the upper half of the case. Remove the differential parts from the lower half of case. If the ring and pinion are to be replaced, remove the lower case half from the ring gear.

**Assembly**

Items in text are for picture 6 on Page 6.

Prior to assembly, ensure that all components to be reused are in good condition **without exception**. If bearings are being replaced, press the outer bearing cones (12) onto the differential case halves (17).

Install the ring gear side of the differential case half in the ring gear. Put the differential lock engagement sleeve (15) and side gear (18) with the thrust washer (16) into the case half. Place the differential spider gears (19) with their thrust washers (20) on the spider

(21). Place the spider gear assembly on the side gear in the case half.

Place the other side gear (22) with its thrust washer (23) on the top of the spider gears. Install the upper case half with the punch marks aligned and install cap screws (14) and nuts (24). Use Loctite locking liquid and tighten nuts to 320 Nm [236 lb-ft] torque. Always use new nuts.

**PINION ASSEMBLY****Disassembly**

Item numbers in text are for picture 3 on Page 3

Remove pinion cotter pin (55), nut (56), and washer (57) from pinion and remove the spur gear (61) with a gear puller.

Remove the pinion from the housing (67) with a shop press. The inner bearing cone (68), spacer bushing (65), and the bearing adjusting shims (63) come with the pinion. The outer bearing cone (62) and cup (64) remain in the housing.

**Assembly**

Items in text are for picture 3 on Page 3.

Prior to assembly, ensure that all components to be reused are in good condition **without exception**. Only a bearing in perfect condition may be reused. If a new ring and pinion set is installed, always use a new bearing.

Start assembly by pressing the inner bearing cone (68) onto the pinion. Place old shim(s) (63) and spacer bushing (65) on the pinion.



**Picture 8.** Pinion with inner bearing cone installed.

Note installation of spacer bushing and shims

Press bearing cups (64 and 68) into the housing (67). Place the rear half of the inter-axle differential housing (67) on the pinion.

Using a shop press, install the outer bearing cone (68) on the pinion using a suitable bushing while rotating the housing.

Increase pressing force up to 160 kN [35,000 lbs.]. If bearing bottoms and resists rotation, press the pinion out and replace shims and/or bushing until proper clearance results and repeat previous step.

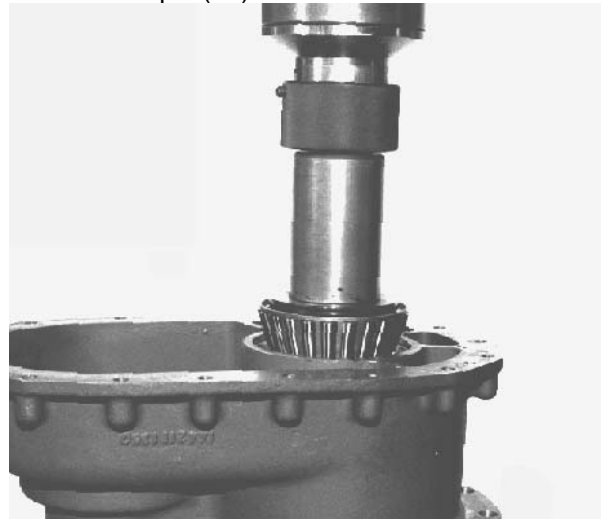
When bearings rotate properly, check the pinion rotating torque as follows:

Wrap a few turns of string around the machined surface of the housing (67) (diam. 255 mm [10 in.]

and pull the string with a spring scale. Correct force needed to rotate the housing is 40 - 65 N [9.2 - 15.0 lb.] for standard pinion (Ø68mm) bearings and 30-40N [6.9 - 9.2 lb.] for heavier pinion (Ø76mm) bearings (later design).

Change the shims as required to reach the correct force.

When the bearing adjustment is correct, install the spur gear (61), washer (57) and nut (56) and tighten the nut to 1,300 Nm [970 lb-ft] torque and secure it with a cotter pin (55).



**Picture 9.** Pinion bearing installation and adjustment.

The final check of the pinion rotating torque shall be performed with a torque wrench.

The rotating torque shall be within 5.3...8.0 Nm [4.0...6.0 lb-ft] for the standard bearing and 4.0...5.3 [3.0...4.0 lb-ft] Nm for the heavier pinion bearing in the later design.

The following shims and spacer rings are available for pinion bearing adjustment:

**Adjusting shims for the earlier pinion bearing (Pinion Ø68 mm):**

Description	Part No.	Thickness	
Shim	099 516 7000	0.1 mm	0.004 in
Shim	099 516 7001	0.3 mm	0.012 in
Shim	099 516 7002	0.5 mm	0.020 in
Shim	099 516 7003	0.25 mm	0.010 in

**Adjusting shims for the later reinforced pinion bearing (Pinion Ø76 mm):**

Description	Part No.	Thickness	
Shim	590731-07510	0.10 mm	0.004 in
Shim	590731-07530	0.30 mm	0.012 in
Shim	590731-07550	0.50 mm	0.020 in

**Spacer rings for the earlier pinion bearing (Pinion Ø68 mm):**

Description	Part No.	Thickness	
Spacer ring	143-261-0700	94.20 mm	3.709 in
Spacer ring	143-261-0701	94.15 mm	3.707 in
Spacer ring	143-261-0702	94.18 mm	3.708 in
Spacer ring	143-261-0703	94.12 mm	3.706 in

**Spacer rings for the later reinforced pinion bearing (Pinion Ø76 mm):**

Description	Part No.	Thickness	
Spacer ring	543-261-1300	89.00 mm	3.504 in
Spacer ring	543-261-1301	89.02 mm	3.505 in
Spacer ring	543-261-1302	89.05 mm	3.506 in
Spacer ring	543-261-1303	89.08 mm	3.507 in

If a shop press is not available for assembly, adjustment can be performed as follows:

Assemble as described but instead of pressing by a shop press, install the spur gear (66), washer (63) and nut (62) 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 spur gear, washer and nut and tighten the nut to 1,300 Nm [970 lb-ft] torque and secure it with a cotter pin (55).

**The following shims are available for ring and pinion engagement adjustment:**

(Between inter-axle differential housing and carrier housing)

Description	Part No.	Thickness	
		millimeters	inches
Shim	144 239 2003	0.1 mm	0.004 in
Shim	144 239 2002	0.2 mm	0.008 in
Shim	144 239 2001	0.5 mm	0.020 in
Shim	144 239 2000	1.0 mm	0.040 in

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**CARRIER ASSEMBLY**

The pinion is already assembled in the housing.

**Installation of the differential assembly**

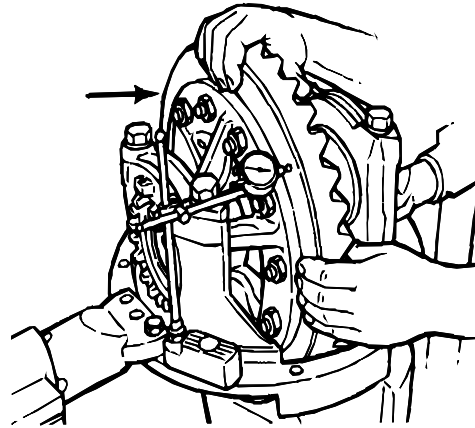
Place the carrier housing so that the so that the inter-axle differential housing mounting face is down. Using suitable lifting gear, place the differential assembly with the ring gear and bearing cups installed in the housing. Install the bearing caps according to the punch marks. Install the bearing cap cap screws with Loctite on them and tighten them finger tight only. Screw in the bearing adjusting nuts until their outer surfaces are flush with the bearing cap surfaces. Tighten the bearing cap cap screws to 480 Nm [254 lb-ft.] torque. Adjust the bearing adjusting nuts until the bearing end play is eliminated.

**Assembly and adjustment of gear backlash and contact**

Turn the carrier housing over so that the inter-axle differential housing mounting face is up.

Place the previously removed pinion engagement shims (2 in picture 6) on the housing surface and install the inter-axle differential housing (67 in picture 3 on page 3) and the installed pinion on the carrier housing with cap screws (66 in picture 3 on page 3). Tighten to 240 Nm [177 lb-ft] torque.

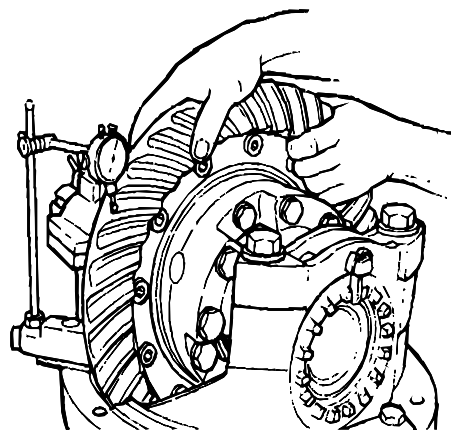
Adjust the position of the ring gear so that the backlash is approximately correct, 0.15 - 0.40 mm [0.006 - 0.016 in].



**Picture 10.** Adjusting the carrier side bearings.

Position a dial indicator with a magnetic base as shown in picture 10 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.

Adjust gear backlash by moving the ring gear in or out by turning both adjusting nuts equally so that bearing preload remains as previously set. Adjust gear backlash to 0.15 - 0.40 mm [0.006 - 0.016 in].



**Picture 11.** Checking gear backlash.

### 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 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, 27/21) indicates that the pinion has 21 teeth and the ring gear 27 equal to a drive ratio of 1.286 : 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.

On ring gears, the pair numbers are marked on the outside diameter.

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

Each pinion is marked with a true installation distance or with a variation value which indicates the correct installation compared to the nominal installation distance.

Variation value = True installation distance - 173 mm.

This variation value will be used in calculating the shims to place between the inter-axle differential housing and the carrier housing.

The variation number (for example +0.1 or -0.1) is marked on either end of the pinion.

To calculate the thickness of the shims:

1. Measure the thickness of the previously used shim(s) with a micrometer.
2. Note the variation number on the new pinion. 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 2003	0.1	0.004
Shim	144 239 2002	0.2	0.008
Shim	144 239 2001	0.5	0.020
Shim	144 239 2000	1.0	0.039

Use these shims singly or in combination as required.

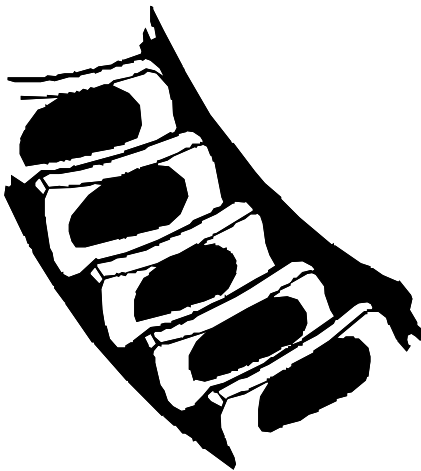
**Note:** Check the tooth contact and correct it as required. Obtaining the correct contact pattern may require the pinion to be moved. This will change gear backlash and adjustment has to be done simultaneously.

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). The following pictures illustrate tooth contact patterns unloaded.

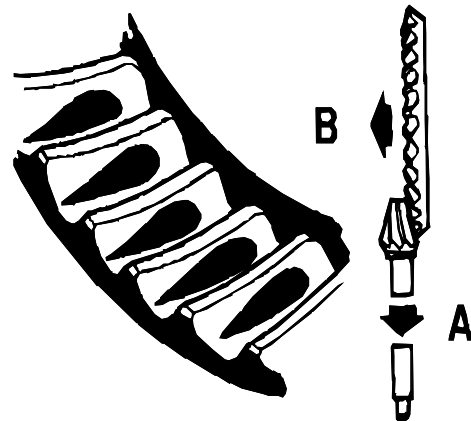
picture 12 indicates that the pinion is set correctly. This gives a quiet drive and long life.



**Picture 12.** Good tooth contact.

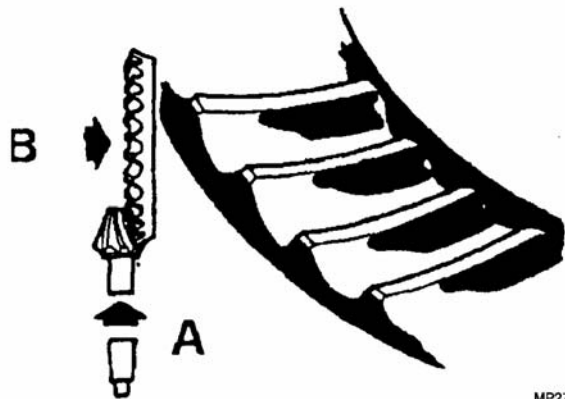
picture 13 indicates that the pinion is set too deeply. This causes a noisy drive and excessive wear or damage to the gears.

To set the correct position of the pinion, add shims under the inter-axle differential 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 13.** Poor tooth contact- too deep.

picture 14 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 inter-axle differential 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)



MP270-08

**Picture 14.** 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 inter-axle differential housing

When the adjustments are completed, remove the inter-axle differential housing and coat both surfaces and shim(s) with Silmate Silicone Rubber RTV 1473 or similar Room Temperature Vulcanizing sealant. Install the lubricated O-Ring (54 in picture 3 on Page 3) in the upper shaft seal housing. Reinstall the inter-axle differential housing. Install the cap screws with Loctite on them and tighten them to 240 Nm [177 lb-ft] torque.

### Assembly of the drop gear including the inter-axle differential

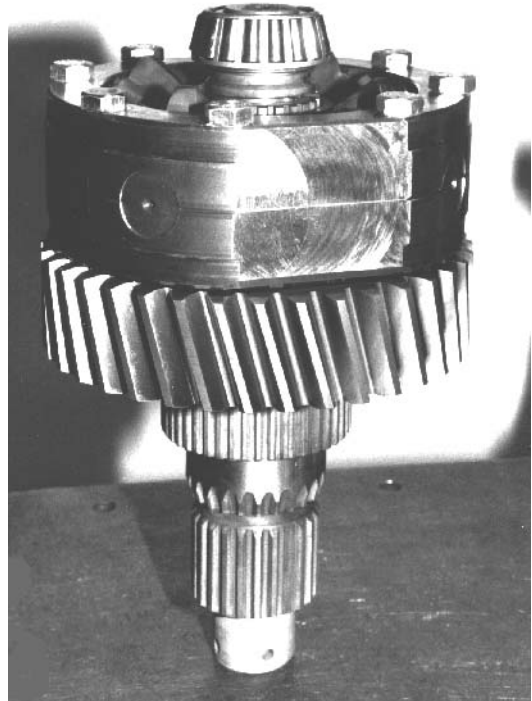
Items in text are in picture 3 on Page 3.

Wash all drop gear components and inspect them carefully. **Discard** all faulty or excessively worn parts. Inspect bearing very carefully. Replace all bearings if their condition is **at all** questionable.

Install the bearing cups (52 and 32) in the housings and the cup of the input shaft inner end bearing inside the side gear (51). Heat the outer bearing cone (32) to a temperature of approx. 120° C [248° F] and install it on the shaft against the shoulder.

Install the inter-axle differential lock sliding gear (38) on the shaft with its teeth facing up. Place the thrust washer (40) with its chamfer up and place the gear set (41) with the bearing (42) so the engagement teeth face down.

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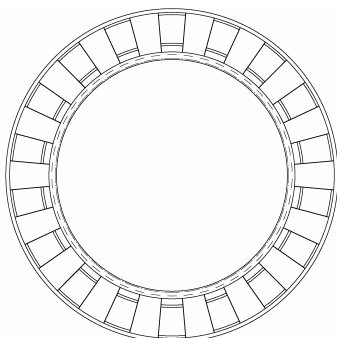
**Picture 15.** Assembly of the input shaft with the gear group set installed.

Place the assembled inter-axle differential case on the shaft splines with the cap screw heads up and install its retaining ring (48).

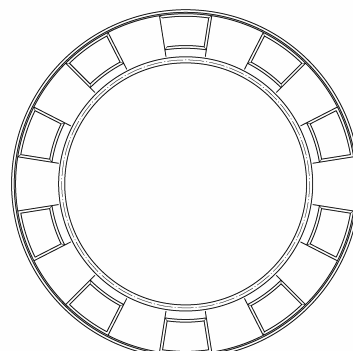
Place old or new adjustment shim (49) for differential gear backlash adjustment on shaft shoulder. Heat the bearing cone and install it on the shaft.

**NOTE!** The inter-axle differential lock gear dog teeth have been changed approx. in the beginning of the year 2005 in the new generation FRMP-13/16-S axles. Please see parts manual for the part numbers and serial numbers if needed.

The sliding ring and the gear assembly with the new toothing are not interchangeable with the corresponding items of the old design. However the new 10 dog teeth sliding ring and gear assembly can be installed to replace the earlier 18 dog teeth sliding gear and gear assembly if they are both changed simultaneously and not mixed.



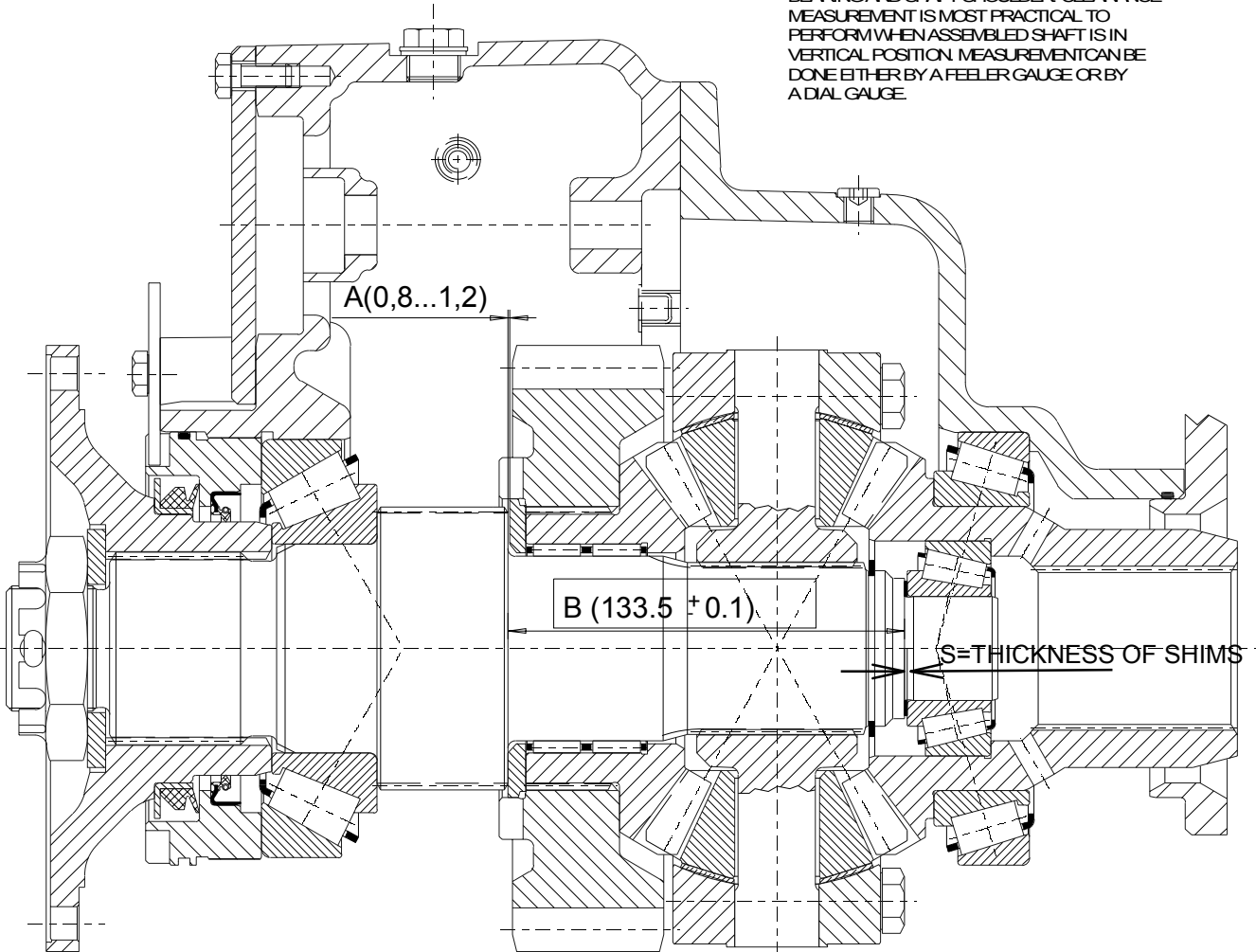
Picture of the earlier dog teeth



Picture of the later dog teeth

**Adjustment of gear backlash on inter-axle differential**

FUNCTIONALLY CORRECT AXIAL CLEARANCE (TOTAL BACKLASH OF DIFF. GEARS) SHALL BE ADJUSTED TO CORRECT VALUE (0.8..1.2mm) BY PLACING SUITABLE SHIMS BETWEEN THE BEARING AND SHAFT SHOULDER. CLEARANCE MEASUREMENT IS MOST PRACTICAL TO PERFORM WHEN ASSEMBLED SHAFT IS IN VERTICAL POSITION. MEASUREMENT CAN BE DONE EITHER BY A FEELER GAUGE OR BY A DIAL GAUGE.

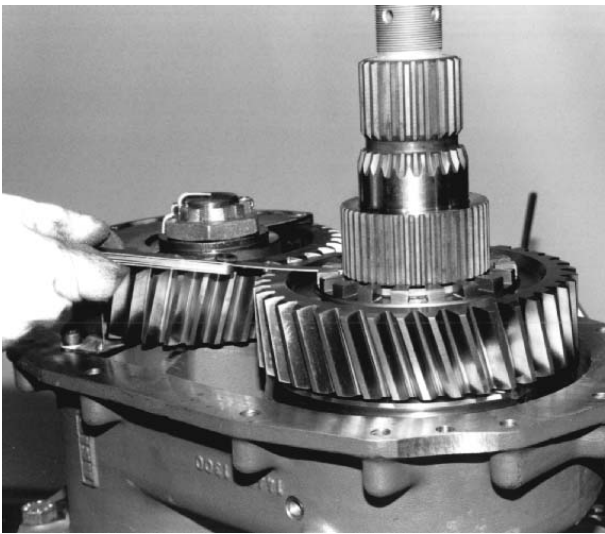


**Picture 16.** Section through input shaft assembly showing clearance measurement point (A).

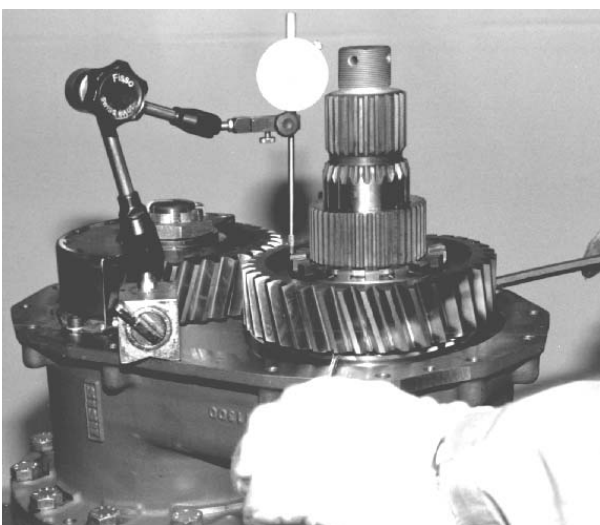


The actual gear backlash of differential gears has to be 0.2 - 0.3 mm [0.008 - 0.012 in]. This corresponds to 0.8 - 1.2 mm [0.031 - 0.047 in] axial clearance. With repairs, this axial clearance has to be verified and adjusted with shims (S in picture 16). Backlash in differential gears can be checked with assembled input shaft either when shaft is in the housing or when shaft is mounted in a vise.

Clearance can be checked with a feeler gauge placed between the dog coupling teeth as shown in picture 17.



**Picture 17.** Clearance check with a feeler gauge when the shaft is in its housing.



**Picture 18.** Clearance check with a dial indicator.

Clearance check with a dial indicator (picture 18) is done with the shaft assembly in a vertical position and measured on the thrust washer (40 in picture 3 on Page 3). Place a dial indicator with a magnetic base so the indicator pin is against the spur gear (41) top surface and zero the dial with some preload. Lift the gear up by means of two pry bars and record the clearance. If the clearance is within the limits of 0.8 - 1.2 mm [0.031 - 0.047 in] continue assembly. If not, remove bearing (50) and replace the shim (49) with an appropriate one and recheck the clearance.

Replace the seal (11) inside the input shaft adjustment nut (10) and fill the inside of the seal with Mobil-Grease MP grease and install a new lubricated O-Ring (9) in outside th groove of the nut.

Tighten adjusting nut (10) by hand against the bearing (32) inside the housing, then back the nut off one complete turn. This is necessary to avoid unnecessary stress on the bearing during assembly.

Install the lower spur gear oil through (60) using cap screws (58) with Loctite locking liquid tightened to 21 Nm (15 lb-ft) torque.

**Note! The oil through (60) has not been installed after axle serial No. 61919 (August 1996) and it can be left out in reassembling.**

Place the differential rearmost side gear (51, without the engagement coupling teeth), and its bearing (52) in the housing.

*(Axles with the optional rear axle drive release coupling: The installation of the inter axles differential rearmost side gear is described in the separate release coupling instructions.)*

Place inter-axle differential housing (31) in a fixture or vise with the mating surface up and install the input shaft assembly in the housing.

Install the input bearing oil retaining plate (33) with the cap screw (34) using Loctite locking liquid. Tighten to 21 Nm (15 Lb-ft) torque.

Install propeller shaft flange (6) on input shaft splines and tighten nut (4) by hand.

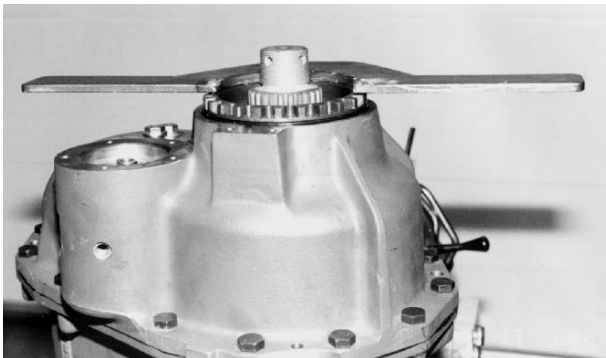
Assemble inter-axle differential lock as instructed on page 5.

Coat both surfaces with Silmate Silicone Rubber RTV 1473 or similar Room Temperature Vulcanizing sealant.

Place front section of the inter-axle differential housing (31) on the rear section (67). Install cap screws (29) with Loctite locking liquid on the threads and tighten to 130 Nm [96 lb-ft] torque.

Remove the propeller shaft flange and adjust the input shaft bearing as follows:

Tighten the adjusting nut (10) with a suitable drift and a hammer or by a special tool 7544-201-010 (not similar than in picture) until there is no clearance in bearing (picture 19). Then tighten or loose the nut still approx.one locking position more and then lock the nut to the nearest locking position with the lock plate. Note that the lock plate (2) can be used in two positions. Apply Loctite locking liquid to lock plate cap screws (1) and tighten to 21 Nm [15 lb-ft] torque.



**Picture 19.** Adjusting the input shaft bearing preload.

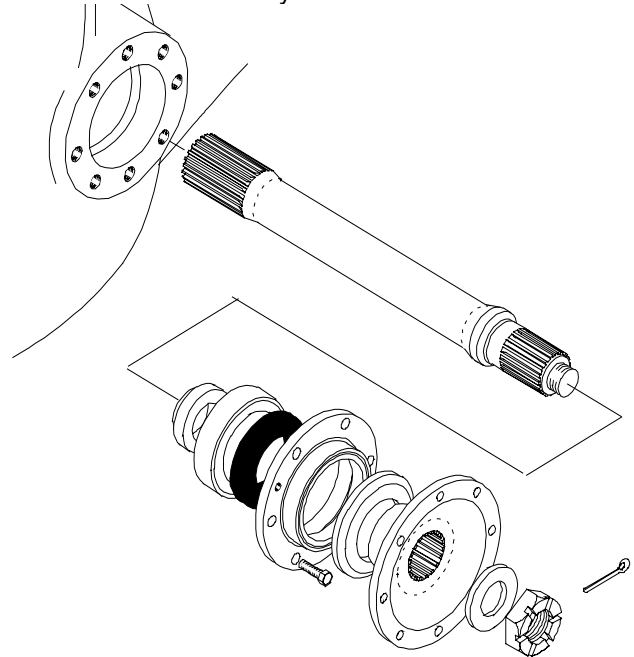
Install a new protection plate (7) and a new V-Seal (8) on the propeller shaft flange (6). Install flange on propeller shaft splines. Place washer (5) on shaft and tighten nut (4) to 600 Nm [442 lb-ft] torque. and install cotter pin (3). If easier, this can be done after the axle is installed in the truck. Adjust the inter-axle differential lock (page 5).

### Installation of 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. Fill carrier housing with oil to level of the appropriate fill plug opening (arrow in picture 21, Page 17).

### INSTALLATION OF THE OUTPUT SHAFT

Assemble the output shaft using new parts as required and fill the inside cavity of the seal with Mobil-Grease MP grease. Tighten flange nut to 600 Nm [442 lb-ft] torque and secure it with a cotter pin. Install the shaft assembly



**Picture 20.** Exploded view of output shaft parts.

### ADJUSTMENT OF THE INTER-AXLE DIFFERENTIAL LOCK INDICATOR LIGHT SENDER

See picture 3, Page 3.

To adjust the inter-axle differential lock indicator light sender:

Engage the inter-axle differential lock either manually or with air pressure and rotate the sender switch (19) clockwise until the switch closes. (this can be checked with a multimeter or the indicator light in the vehicle). Rotate the sender an additional 3/4 to 1 full turn clockwise and lock the sender in this position with its lock nut.

**Note!** In later axles (starting approx. August 2004) the differential lock indicator light senders are installed to the lock actuator cover. This kind of sender needs no adjustment when installing to lock actuator cover.

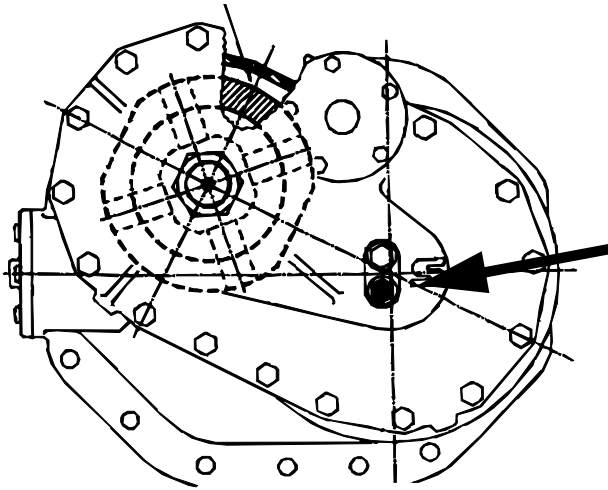
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**OIL CHECKS AND OIL CHANGES****Differential oils**

With the vehicle on level ground, oil level must be to bottom of inspection plug as shown (arrow in picture 21) for most vehicle applications.

On the forward tandem axle for operation on steep grades or with heavy loads at very low speeds, it is advisable to raise the oil level to the upper inspection plug.

In later versions there are only one oil level plug.  
(In production since June 2000)



**Picture 21.** Oil level plug on forward tandem axle.

### SPECIAL TOOLS

Adjustment wrench for differential side bearing	7143-024-010
Adjustment wrench for input shaft bearing	7544-201-010

### TORQUE VALUES

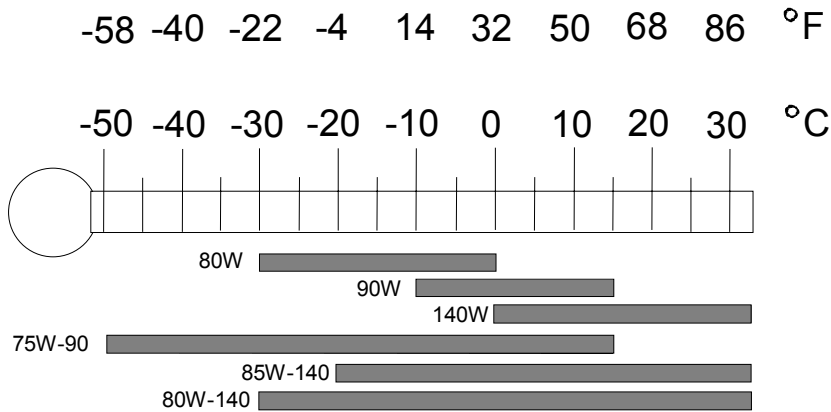
Description	Nm	Lb-ft
Propeller shaft flange nuts	600	442
Pinion nut	1300	960
Differential side bearing cap cap screws	480	354
Differential case halves and ring gear cap screw nuts	320	236
Carrier housing to axle housing cap screws	240	177
Inter-axle differential housing halves cap screws	130	96
Inter-axle differential housing to carrier housing	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
Oil level plug	50-70	37-52

### LUBRICATION

Axle oil quality API GL - 5; use of synthetic oil is permitted too.

Recommendation in very cold operation conditions "full synthetic" SAE 75w-90 and in very hot conditions SAE 140 oil types.

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



### Oil volumes

Filling volumes	Metric	U.S.
Installing angle 4 degrees	26 ltrs	55 pints
(Installing angle 0 degree	24 ltrs	51 pints)

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**TECHNICAL DATA**

Drive gears	Hypoid bevel gear set
Differential locks	Both axle and inter-axle differential locks are standard
Ring and pinion gear backlash	0.15 - 0.40 mm [0.006 - 0.016 in]
Inter-axle differential gear backlash	0.2 - 0.3 mm [0.008 - 0.012 in] (corresponding to 0.8 - 1.2 mm [0.031 - 0.047 in] of axial clearance)
Adjustment measurement of differential locks:	
Inter-axle differential lock	Approx. 0.4 mm [0.016 in] plus the measured value of the inter-axle differential axial play (adjusting range 0.8 ... 1.2 mm [0.031 ... 0.047 inch], total 1.2 ... 1.6 mm [0.031 ... 0.063 inch] (see respective instructions)
Axle differential locks	Approx. 0.4 mm [0.016 in] (see respective instructions)

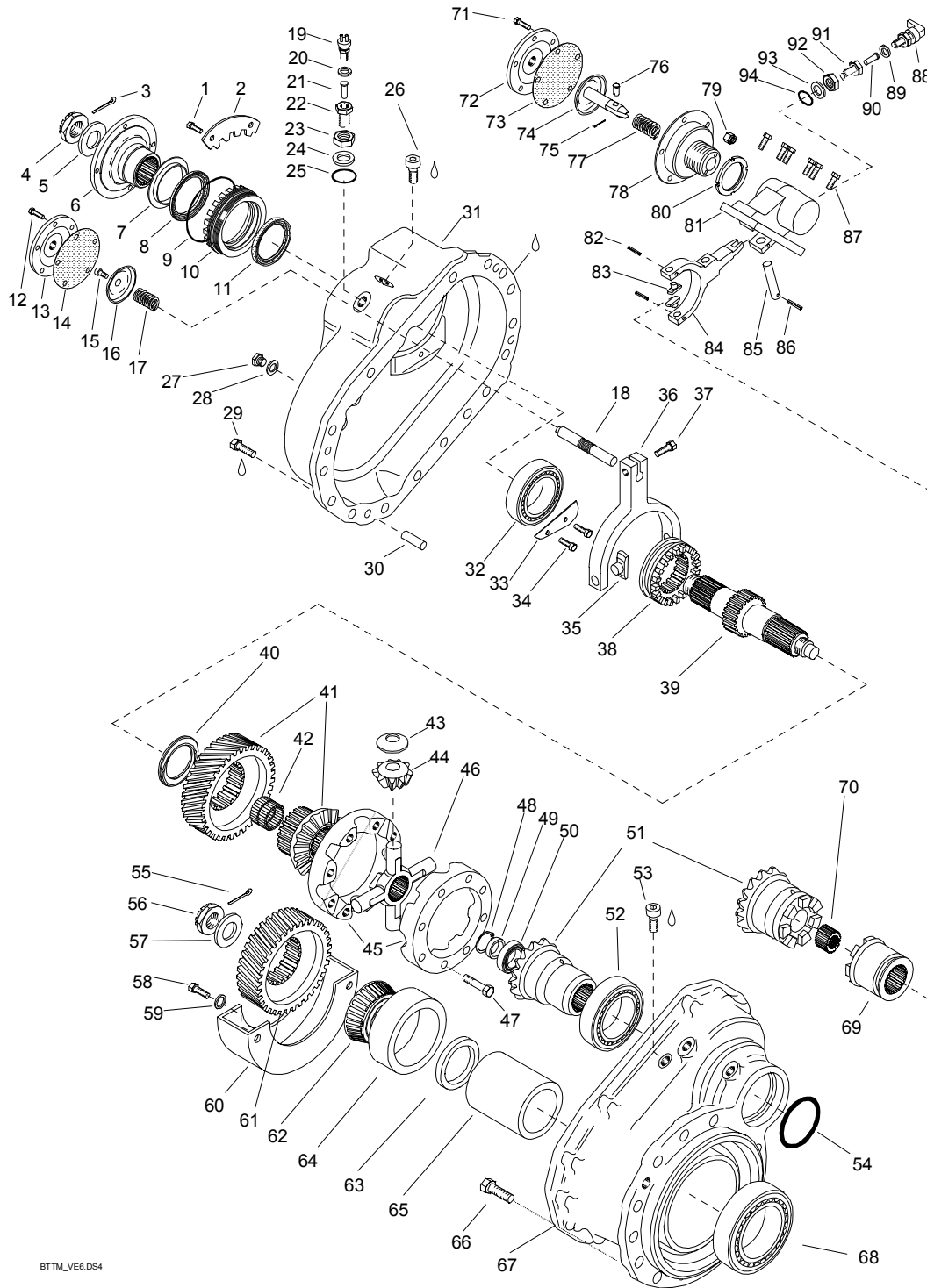
### APPENDIX FOR MAINTENANCE MANUAL FOR DRIVE RELEASE COUPLING

This instruction applies only for FRMP-13/16-S foremost tandem axles equipped with release coupling for the rear axle drive.

#### Installing the rear side gear to axles equipped with release coupling for the rear axle drive:

(See maintenance manual for drive gear MP-330 on page 15.)

Install the needle bearing (70 in picture A) inside the dog toothed side gear (51 in picture A). Install the sliding gear (69 in picture A) first to the housing and on top of it the dog toothed side gear (51 in picture A) with bearing (52).

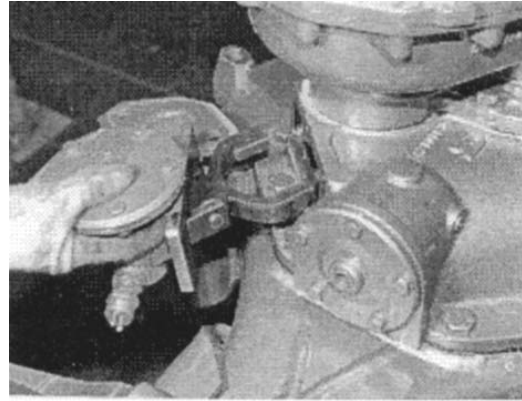


BTM\_VE6.DS4

Picture A Exploded view of the inter-axle differential and drive release coupling in the MP-330 Drive Gear. Release coupling items are 51 (upper) and 69...90.

## Uninstalling the release coupling

Unfasten the fixing screws (6 pcs, item 87 in picture A)  
Pull the release coupling actuator out from the drive gear (picture B).  
Unfasten the actuator cylinder cover five fixing screws, the cover and the diaphragm.  
Unfasten the control fork (84 in picture A) by pressing out the pin (86) from the shaft (85) which can now be pulled out and the fork releases simultaneously.  
The pressure plate/control shaft (74) with its return spring (77) can be removed now.

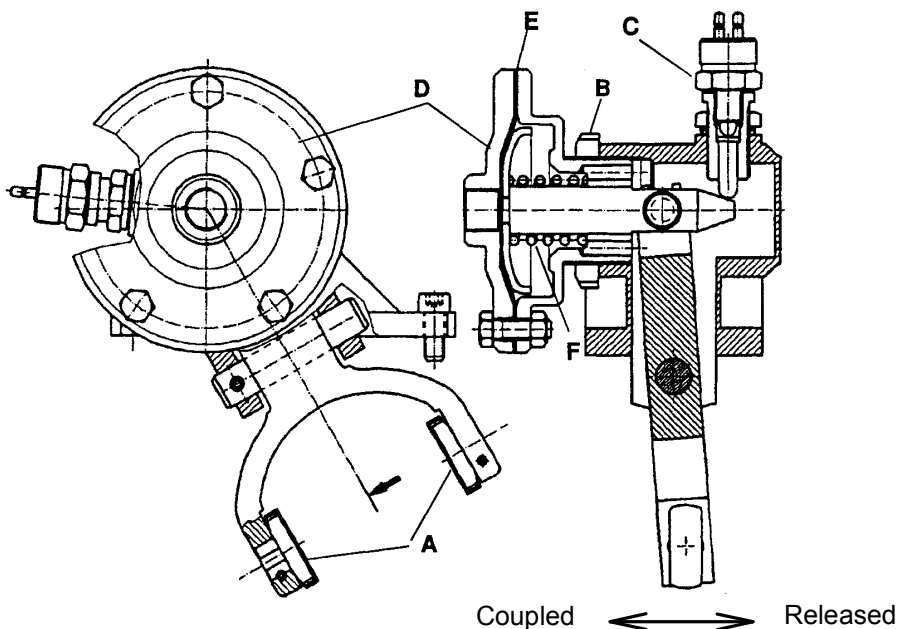


Picture B. Installing release coupling

## INSTALLATION OF REAR AXLE DRIVE RELEASE COUPLING (Optional)

First move the engagement sleeve (69 in picture A) completely in contact with side gear (upper 51)(teeth completely inside each other).

- Remove cylinder cover (D in picture C) and remove the diaphragm (E). Place now approx. 12 mm thick spacer on diaphragm support cup and fix cylinder cover by two screws so, that spring (F) does compress and rim of the support cup in contact with cylinder bottom. Tighten screws only with reasonable power.
- Unscrew the lock nut (B) so that cylinder can be rotated in the base.
- Smear contact surface of coupling unit by Silmate Silicone Rubber RTV 1473 or similar Room Temperature Vulcanizing sealant and install the complete unit (picture B) so that fork slide shoes enter the groove of engagement sleeve. Tighten retaining screws to 35 Nm torque.
- Rotate cylinder clockwise by hand until it stops. Make sure the engagement sleeve is in contact by rotating intermediate shaft at rear side of the axle.
- When sleeve is in the end of engagement stroke and the cylinder rotated by hand so far it go without force, do turn counterclockwise 1/4 of turn and lock cylinder in this position by its lock nut (B).
- Remove the cylinder cover and remove the spacer. Install diaphragm and tighten cylinder cover retaining screws to 21 Nm.



Picture C. Drive release coupling actuator with its linkage.

## Adjustment of the release coupling indicator light sender

Adjustment of the rear axle drive engagement light sender shall performed when assembled as follows:  
Engage drive (there is pressure in the cylinder) and rotate the sender switch (C in picture C) clockwise until the switch do close. (This can checked by a multimeter or by indicator light in the vehicle) Rotate the sender from this position further clockwise by 3/4 - 1 turn and lock the sender switch by its lock nut in this position.

**CHANGE IN THE INPUT AND OUTPUT DRIVE FLANGE SEALING  
IN THE HEAVY THROUGH DRIVE AXLES**

- 1. Change:** In the input and output drive flange sealing the shaft seal with one sealing lip is replaced by a new cassette type seal with multiple sealing lips. Simultaneously the v-ring dust seal and the shield plate (only input) have been removed.
- 2. Cause of Change:** Better technical solution for the input/output flange sealing.
- 3. Applications:** The new cassette seal replaces the older shaft seals in the through drive FRMP-13/16, FSMP-14, FRFP-13/16 and FSFP-14 axles. The differential carrier assemblies are MP-330 and FP-330. MP-330 drive gear is used in through drive rear tandem axle FRMP-13/16 and through drive steer front tandem axle FSMP-14. FP-330 drive gear is used in rear Tridem axle FRFP-13/16 and in drive steer Tridem axle FSFP-14. The Axle product codes and the part numbers of the differential carrier assemblies have changed along with the sealing change.

**4. Changed Items in MP-330 Drive Gear:**

Description	Old Part No.	New Part No.
Shaft Seal (input & output)	91122-08505	591122-08507
Adjusting Nut/Seal Housing (input)	143-226-1200	543-226-1400
V-Ring Seal (input)	090-400-9500	-
Shield Plate(input)	090-711-9010	-
Seal Housing (output)	144-321-0010	544-321-0500
V-Ring Seal (output)	91121-09001	-
Input Flange HS1700/1800	138-918-0400	538-918-1610
Input Flange ISO T180	138-918-0401	538-918-1611
Input Yoke 1710	538-967-0100	538-967-0600
Output Flange HS1700/1800	138-917-2410	538-917-2510
Output Flange ISO T180	538-917-2411	538-917-2511
Output Yoke 1710	538-967-0110	538-967-0610

**. Changed Items in FP-330 Drive Gear:**

Description	Old Part No.	New Part No.
Shaft Seal (input & output)	91122-08505	591122-08507
Adjusting Nut/Seal Housing (input)	143-226-1200	543-226-1400
V-Ring Seal (input)	090-400-9500	-
Shield Plate(input)	090-711-9010	-
Seal Housing (output)	544-321-0200	544-321-0500
V-Ring Seal (output)	91121-09001	-
Seal Housing Bolts (output)	590303-10503	90303-10303
Input Flange HS1700/1800	538-918-0700	538-918-0900
Input Flange ISO T180	538-918-0500	538-918-0511

- 5. Date of Change:** Installing of the new input flange seal has started gradually by axle type from August 2004 (Mainly in the new model year 2005 axles).

**6. Interchangeability:**

The new cassette seal is not interchangeable with the old shaft seal. Retrofit cassette seal kits are available for converting the sealing to the new design. Please see Spare Parts Bulletin SP14003.



### 7. Installing the Cassette Seal:

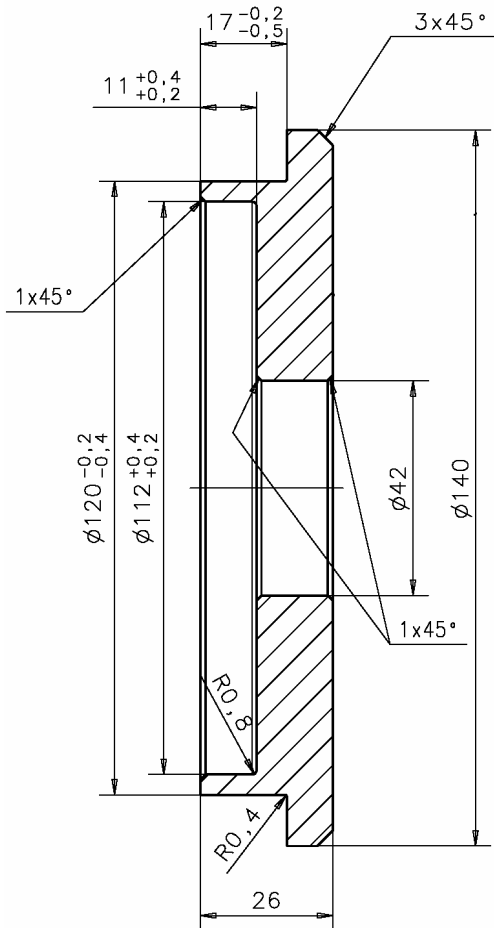
Use installing tool 7544-301-050 when pressing the cassette seal into the adjusting nut/seal housing for input flange sealing and tool 7544-301-060 when pressing the cassette seal into the seal housing for the output flange sealing. The pressing should be done evenly with care by using a shop press.

These installing tools can be also made locally according to the drawings in pictures 1. & 2.

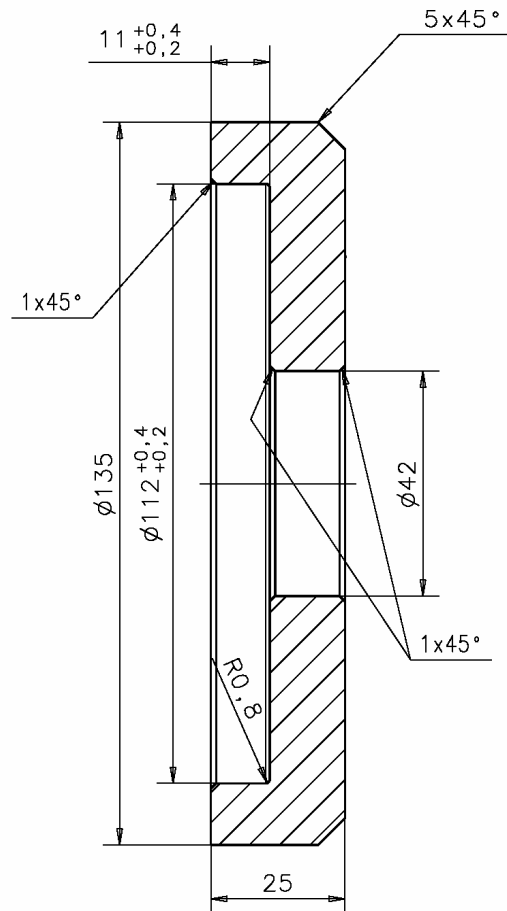
When installing the input drive flange (2 in picture 3.) the sealing surface has to be wiped with **Fretax AF 281** assembly gel to prevent friction between the input flange and the seal during installation.

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

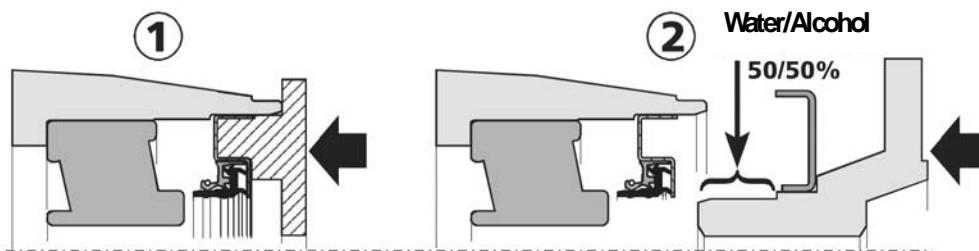
**Note! If installed dry the seal may damage.**



Picture 1. Press tool 7544-301-050 for input seal installation



Picture 2. Press tool 7544-301-060 for output seal installation



Picture 3. Principle pictures of common cassette seal installation.