PROPELLER SHAFT & DIFFERENTIAL CARRIER

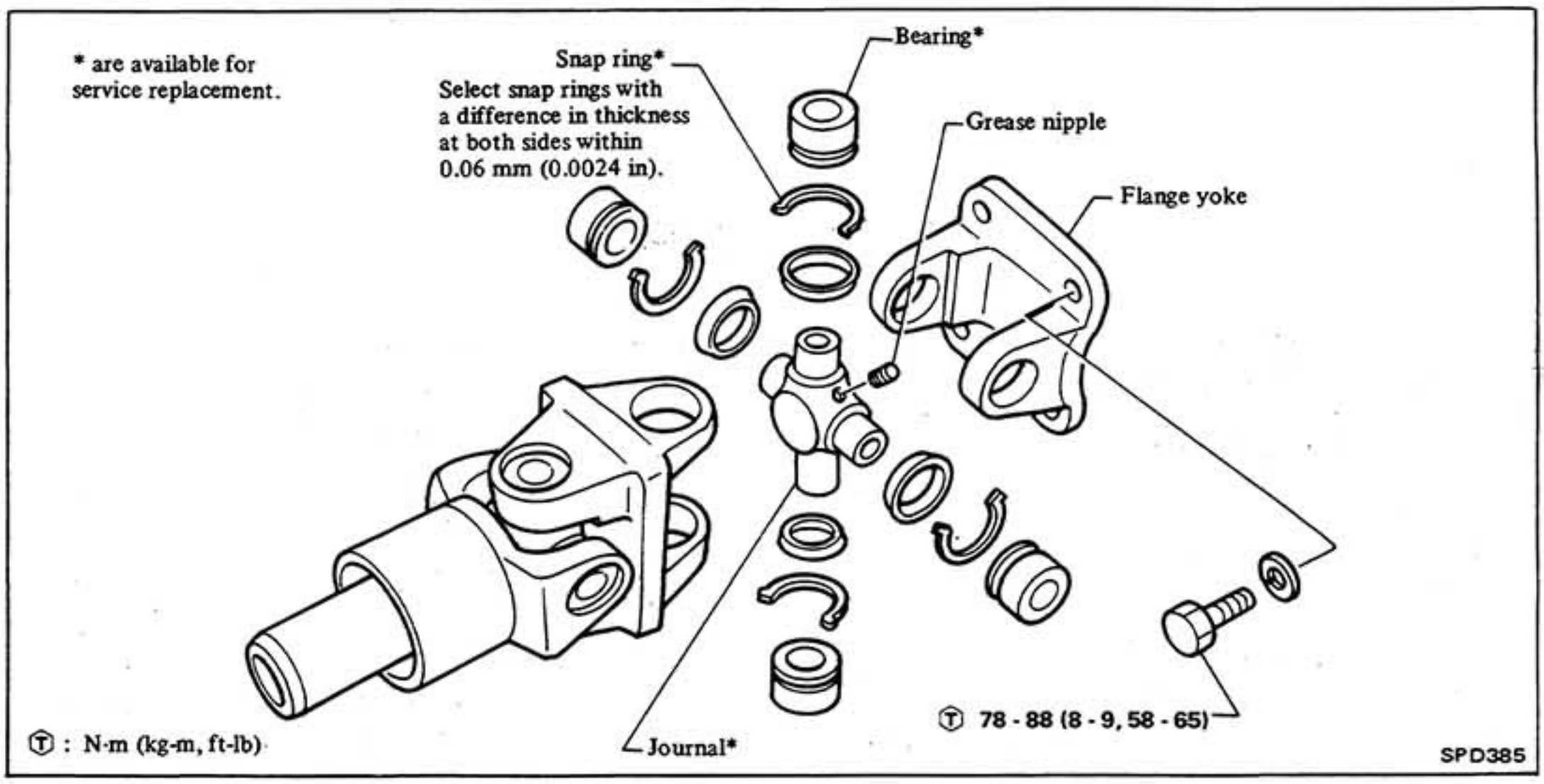
CONTENTS

PD

PROPELLER SHAFT —Model : 2S80B, 2F80B, 2F80B-D—

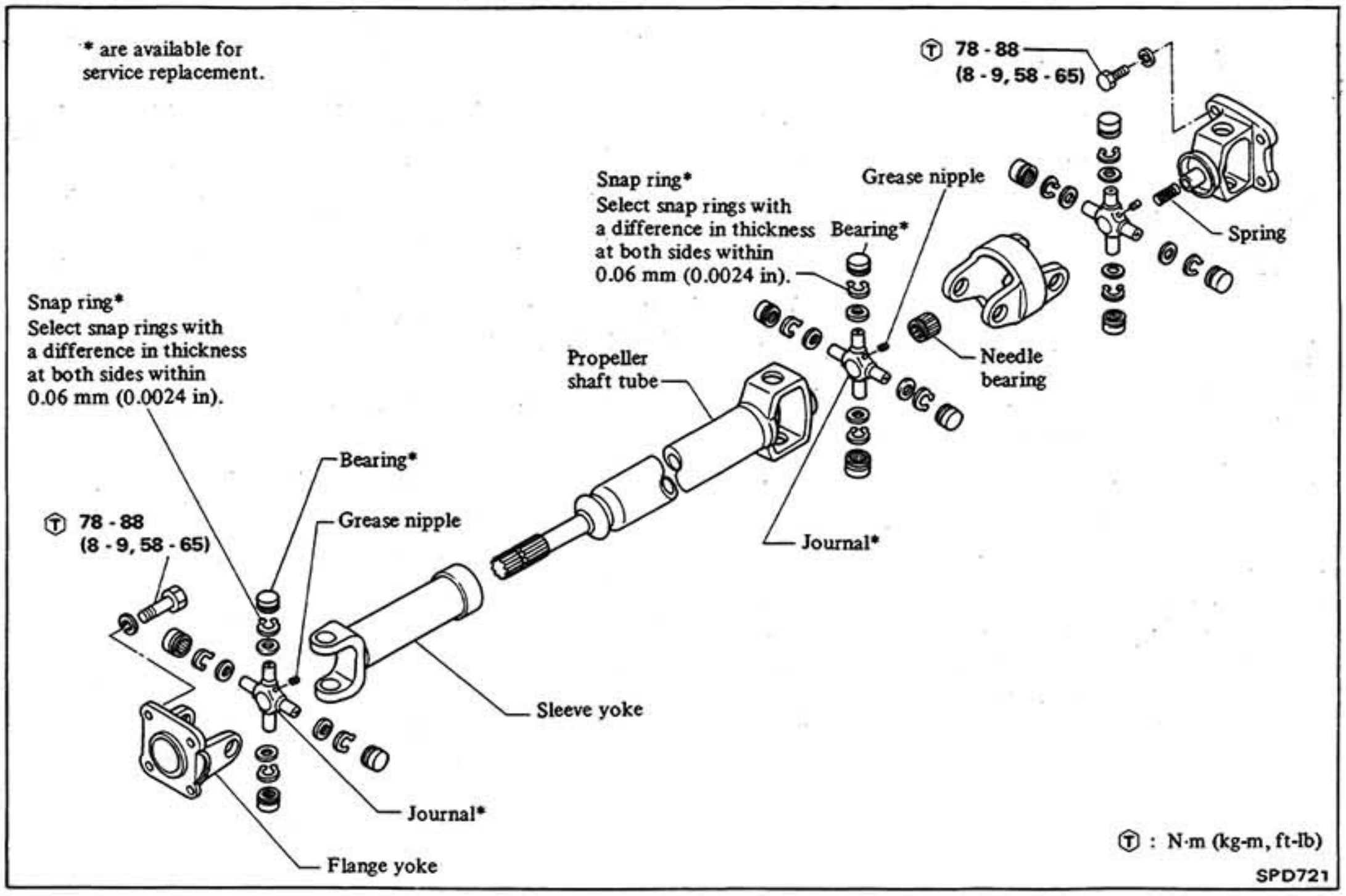
Primary propeller shaft

– Model 2S80B –



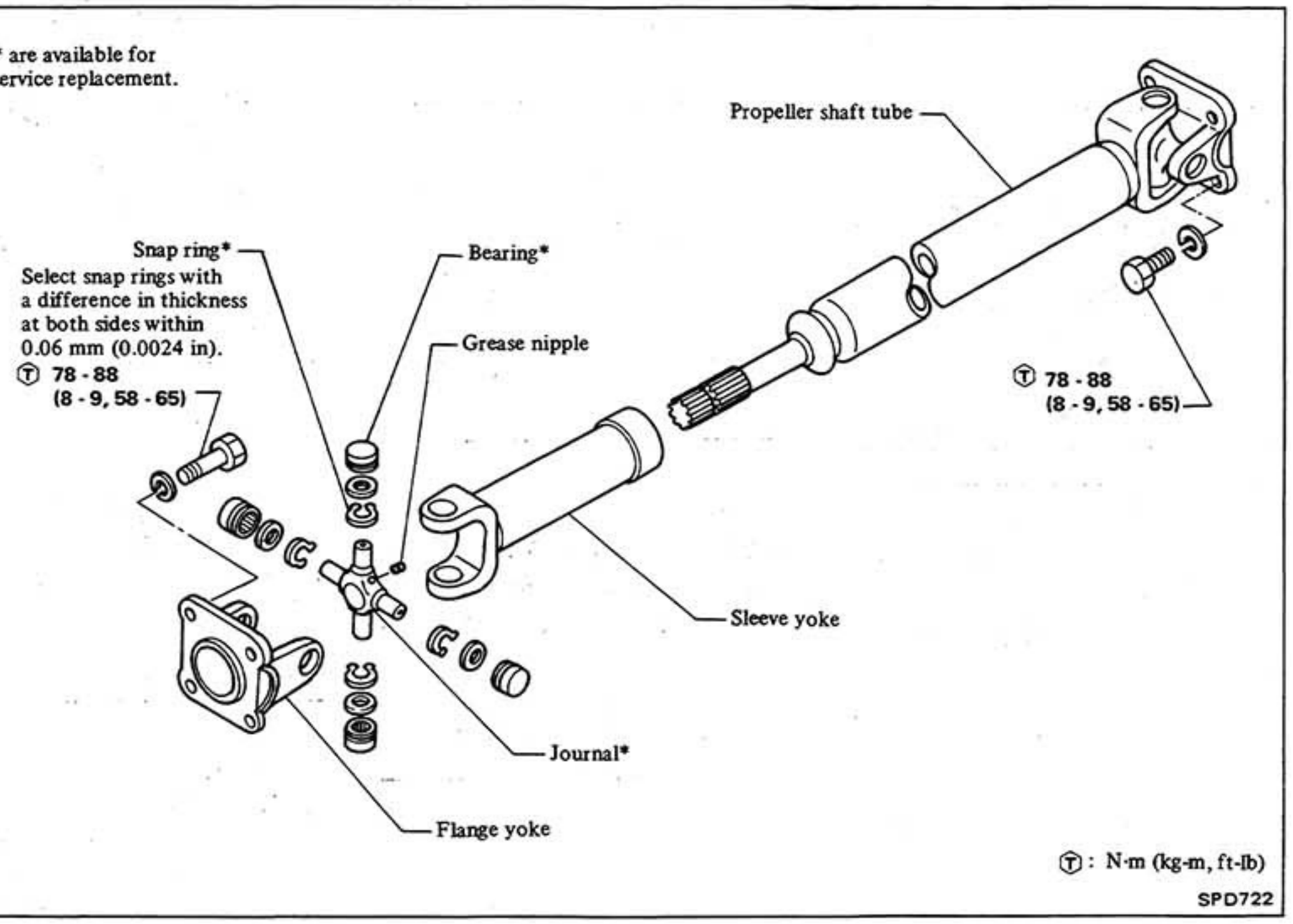
Front propeller shaft

– Model 2F80B-D –



Front and rear propeller shaft

– Model 2F80B –



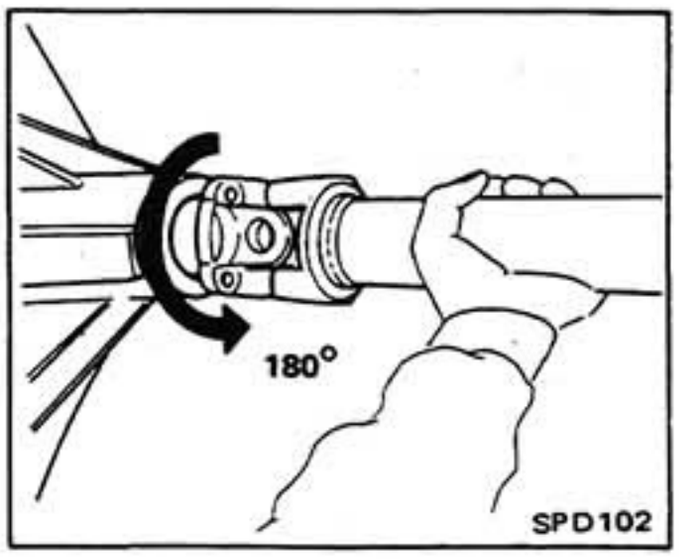
GENERAL INSPECTION

- Inspect propeller shaft tube surface for dents or cracks.
  If damaged, replace propeller shaft assembly.
- If journal is damaged or worn, replace journal.

PROPELLER SHAFT VIBRATION

To check and correct an unbalanced propeller shaft, proceed as follows:

1. Remove undercoating and other foreign material which could upset shaft balance, and check shaft vibration by road test.
2. If shaft vibration is noted during road test, disconnect propeller shaft at differential carrier companion flange, rotate companion flange **180 degrees** and reconnect propeller shaft.



3. Again check shaft vibration. If vibration still persists, replace propeller shaft assembly.

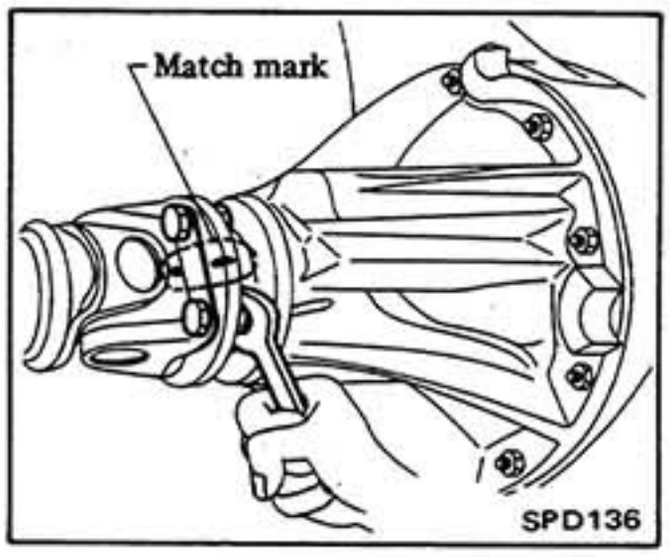
REMOVAL AND INSTALLATION

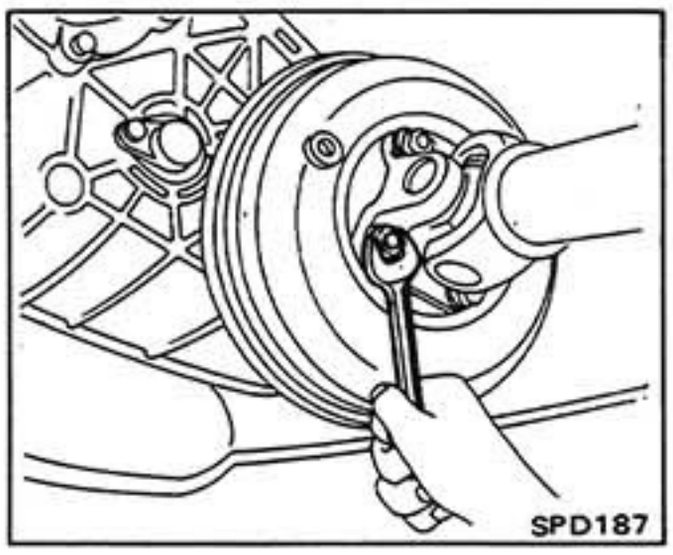
PRIMARY PROPELLER SHAFT

1. Separate propeller shaft from transfer assembly.
2. Remove transfer assembly.
   • **Refer to Section TF (T100L).**
3. Draw out primary propeller shaft from transmission.
4. Installation is in reverse order of removal.

FRONT AND REAR PROPELLER SHAFT

1. **Put match marks** on flanges and separate propeller shaft from transfer and differential carrier.

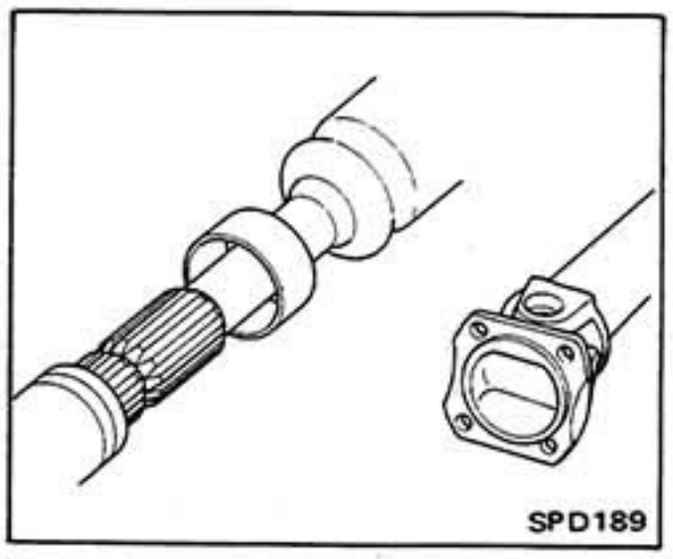




2. To install, reverse the foregoing procedure using reference marks in removal.

FLANGE YOKE AND SLEEVE YOKE

Check flange yoke and sleeve yoke for damage or wear. Replace if necessary.

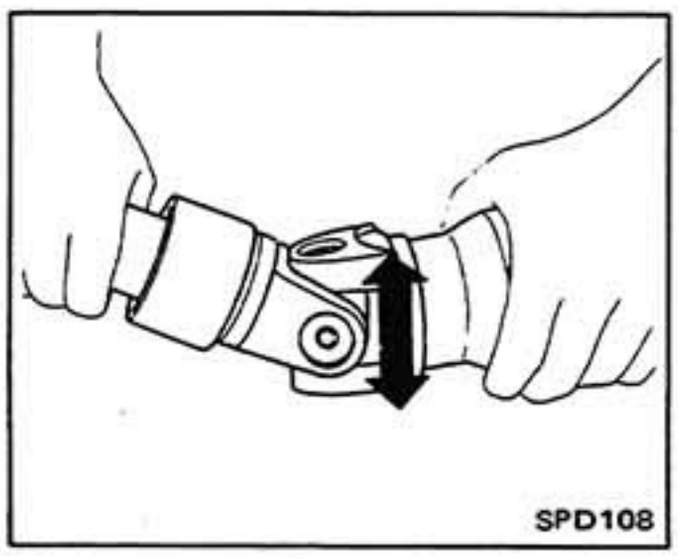


JOURNAL AXIAL PLAY

Inspect journal for axial play.

If play exceeds specifications, repair journal.

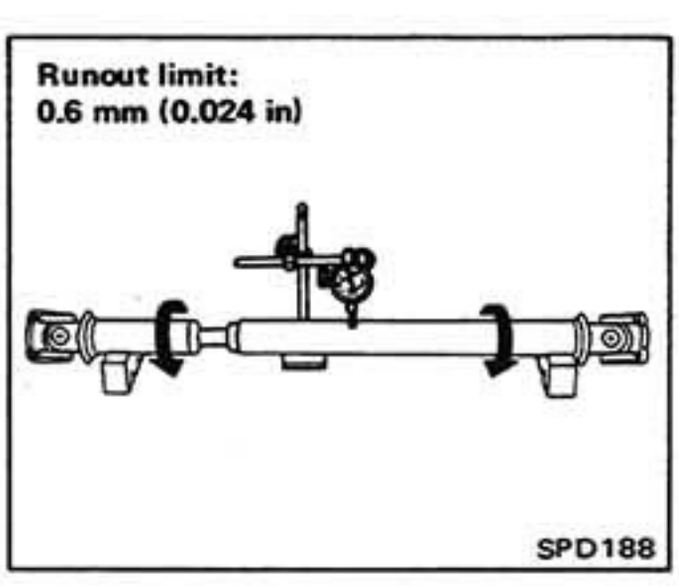
Axial play:
Less than 0.02 mm (0.0008 in)



INSPECTION

PROPELLER SHAFT RUNOUT

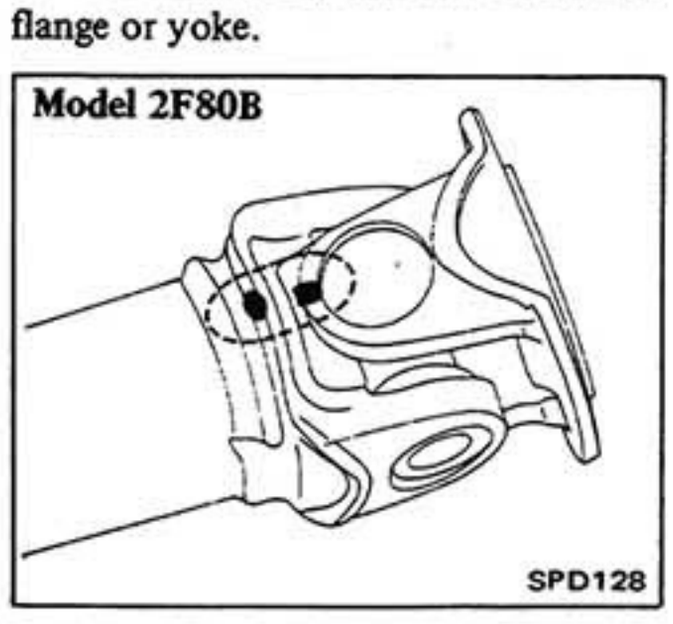
Inspect propeller shaft runout. If runout exceeds specifications, replace propeller shaft assembly.

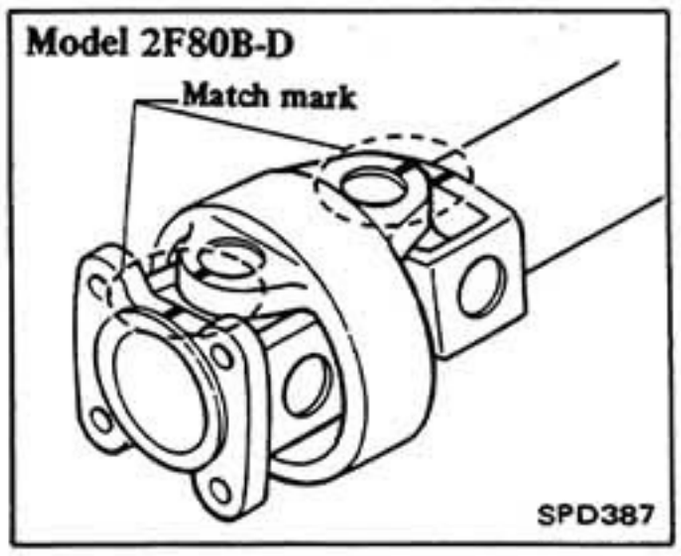


REPAIR

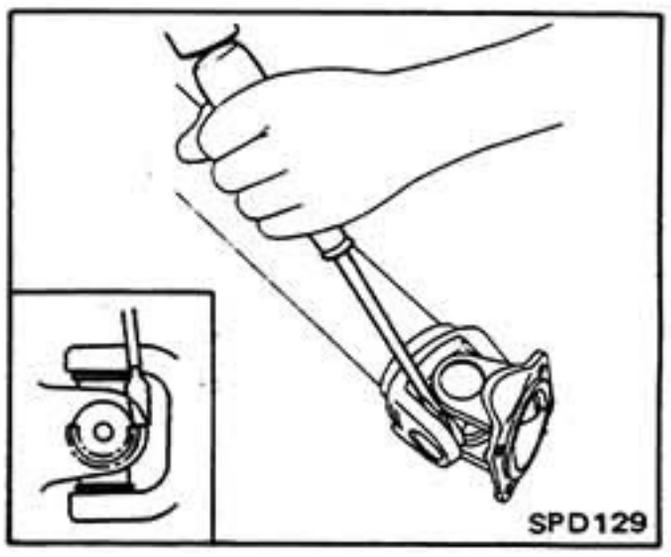
DISASSEMBLY

1. Put match marks on shaft and flange or yoke.

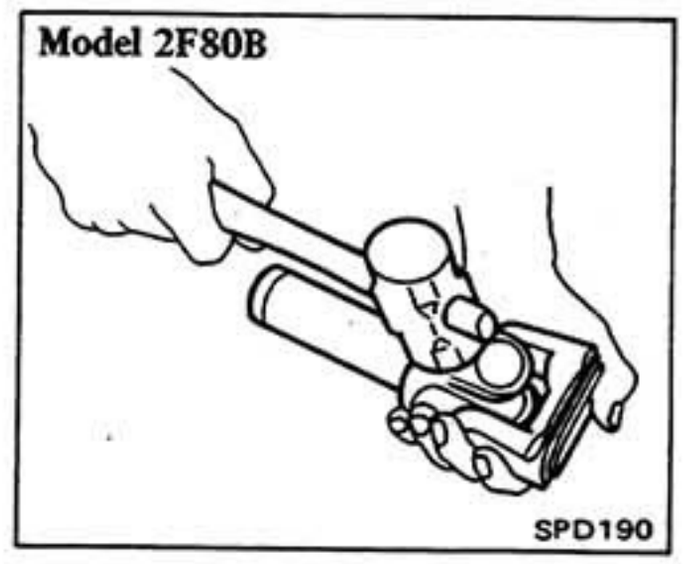




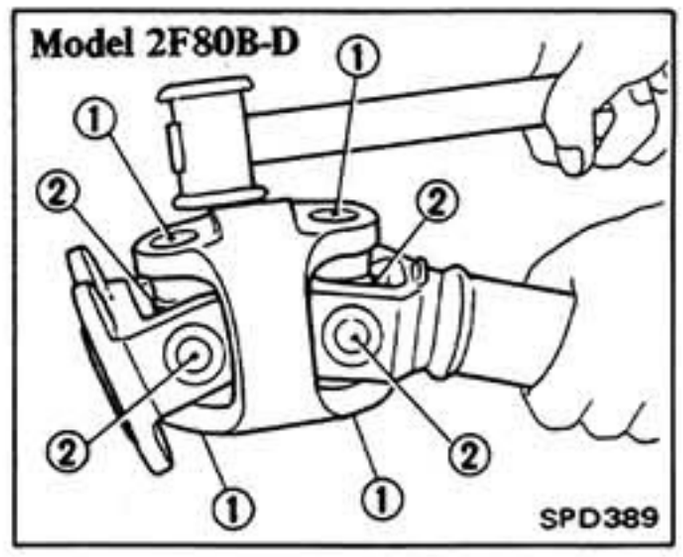
2. Remove snap ring.



3. Remove pushed out spider bearing by lightly tapping yoke with a hammer, taking care not to damage journal and yoke hole.

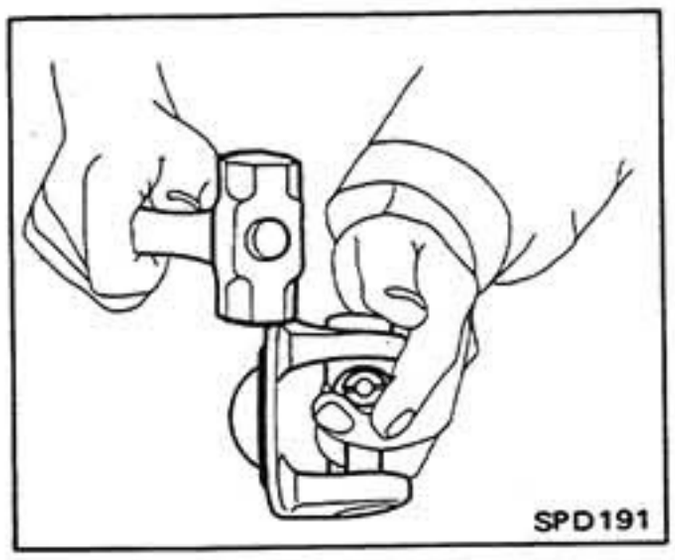


Remove spider bearing in the order of ① and ② as in Figure below.



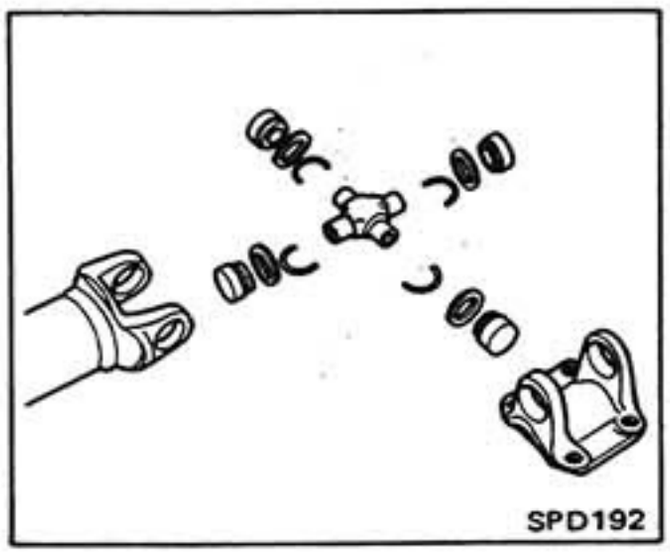
4. Remove bearing at opposite side in above operation.

Put marks on disassembled parts so that they can be reinstalled in their original positions from which they were removed.


SPD191

INSPECTION

Inspect disassembled parts, and repair or replace any faulty part.

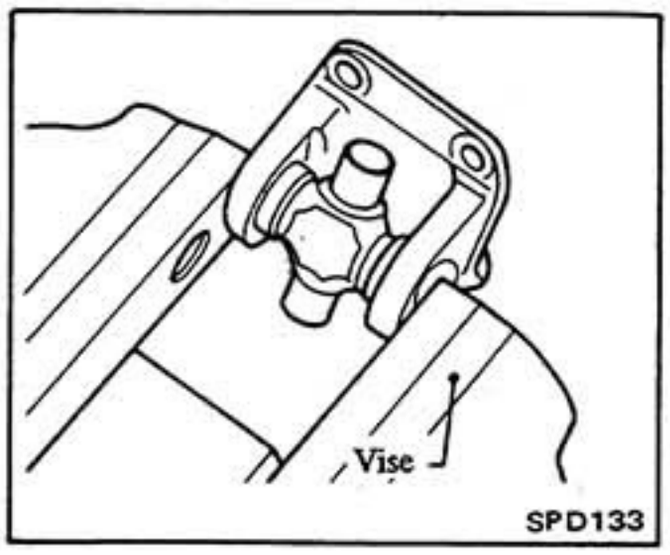

SPD192

ASSEMBLY

To assemble, reverse the foregoing procedure using reference marks in disassembly.

1. Assemble spider bearing. Apply grease to the bearing inner surface and needle bearings.

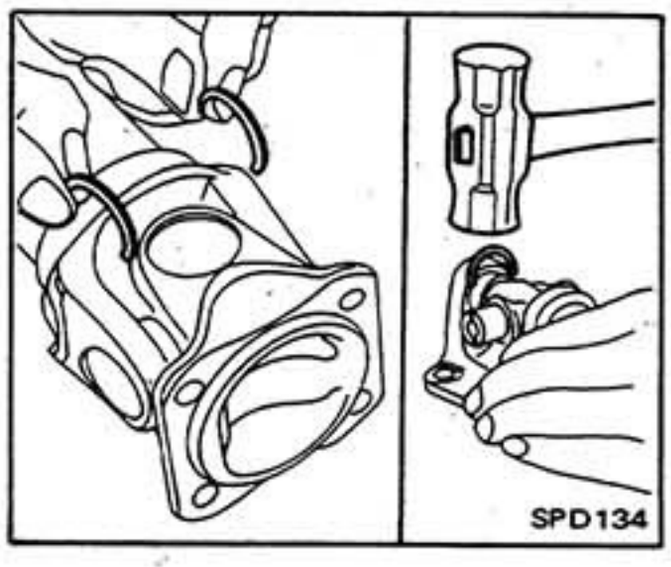
When assembling, be careful that needle bearing does not fall down.



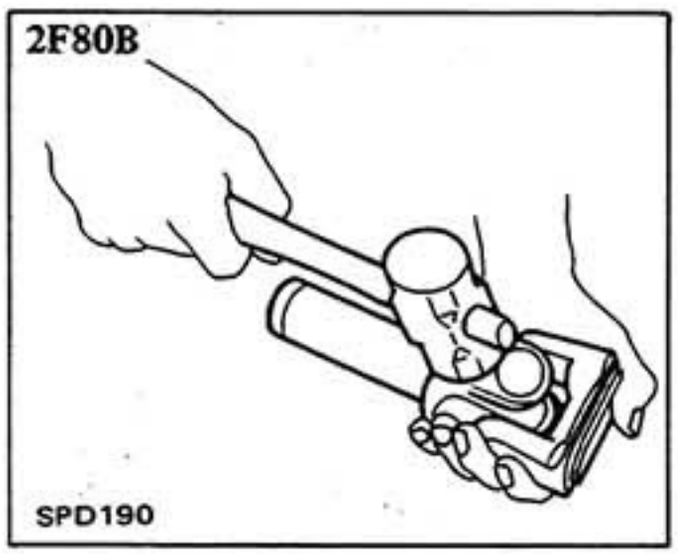
SPD133

2. Select snap ring that will provide specified play in axial direction of journal, and install them **(Refer to S.D.S.).**

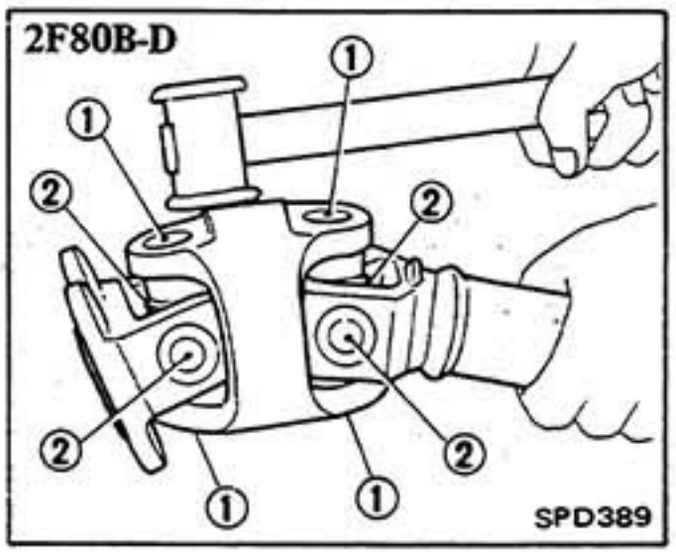
Select snap rings with a difference in thickness at both sides within 0.06 mm (0.0024 in).


SPD134

3. Adjust thrust clearance between bearing and snap ring to zero by tapping yoke.

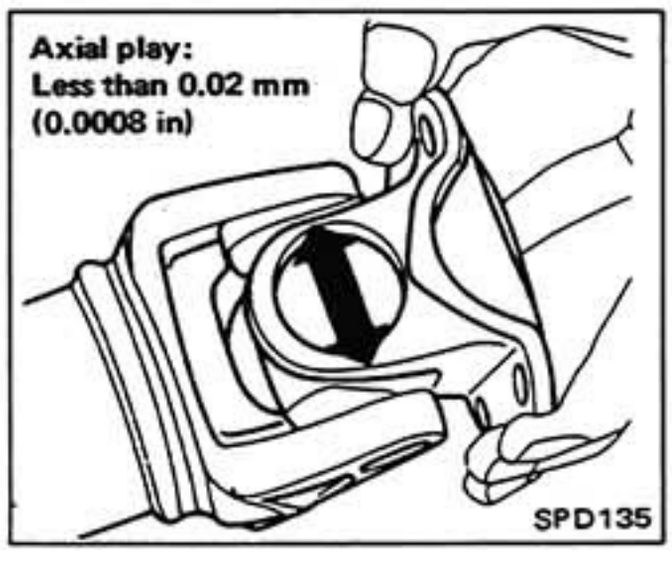


SPD190



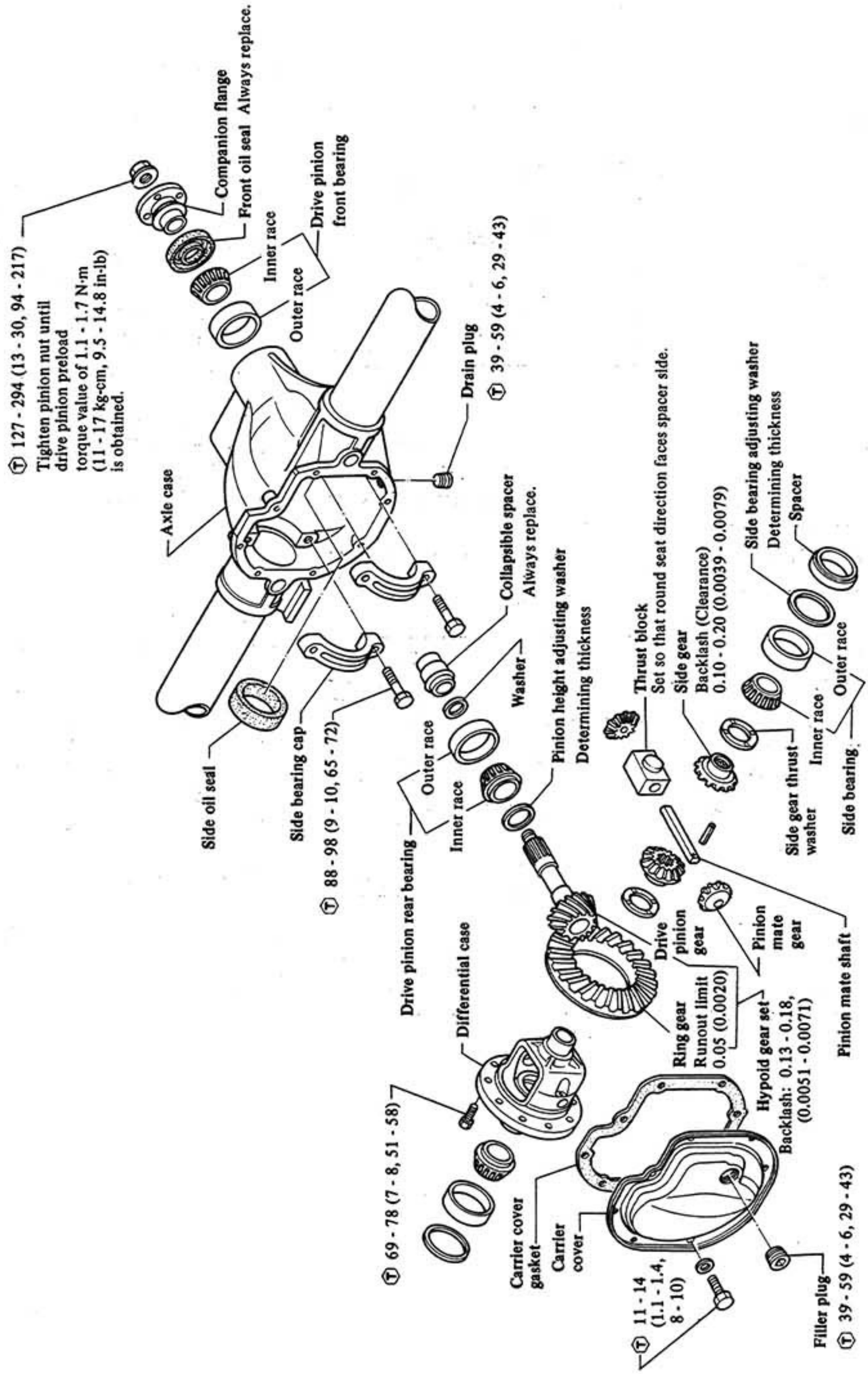
SPD389

4. Check to see that journal moves smoothly and check for axial play.



SPD135

DIFFERENTIAL CARRIER (Final drive) —Model : C200—

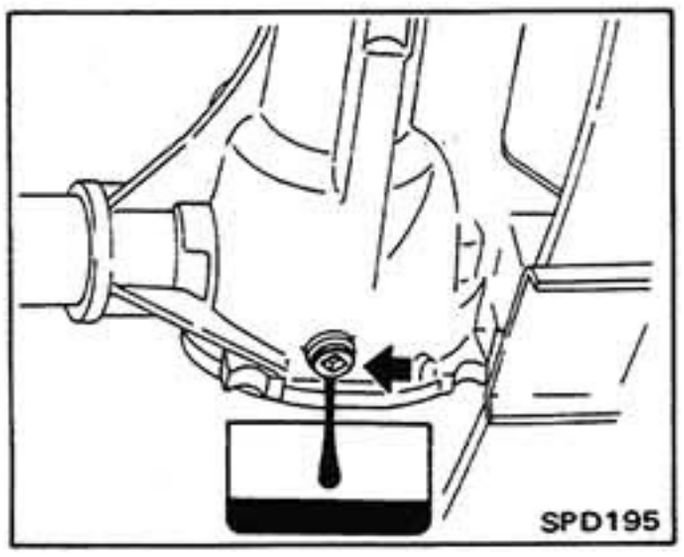


SPD194

PREPARATION FOR DISASSEMBLY

REMOVAL

1. Remove front or rear axle assembly. **Refer to Front Axle (Section FA) or Rear Axle (Section RA) for removal.**
2. Remove drain plug and drain gear oil.



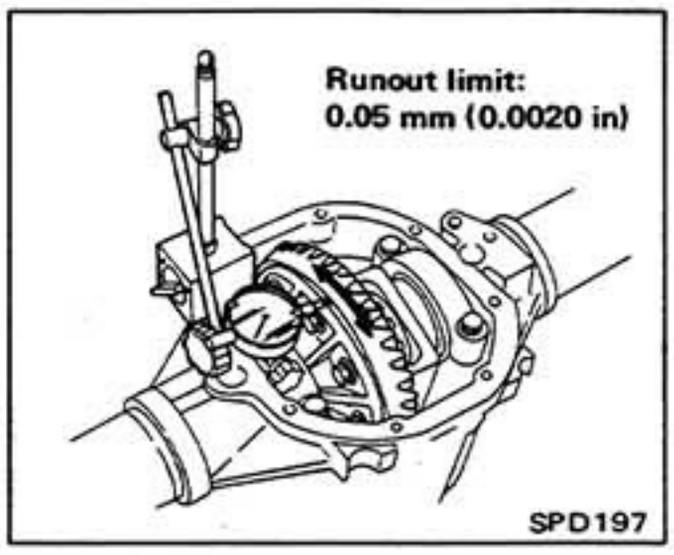
3. Remove front or rear axle shafts. **Refer to Front Axle (Section FA) or Rear Axle (Section RA) for removal.**

PRE-DISASSEMBLY INSPECTION

1. Check backlash of ring gear with a dial indicator at several points. If it is not within specification, **refer to Side Bearing Adjustment.**

2. Check runout of ring gear with a dial indicator. If it is over specification, hypoid gear set or differential case should be replaced.

When backlash varies excessively in different places, the variance may have resulted from foreign matter caught between ring gear and differential case.



3. Check tooth contact. **Refer to Tooth Contact.**
4. Check backlash of side gear. Using a thickness gauge, measure clearance between side gear and differential case.

If it is not within specification, adjust it by selecting side gear thrust washer **(Refer to S.D.S.).**

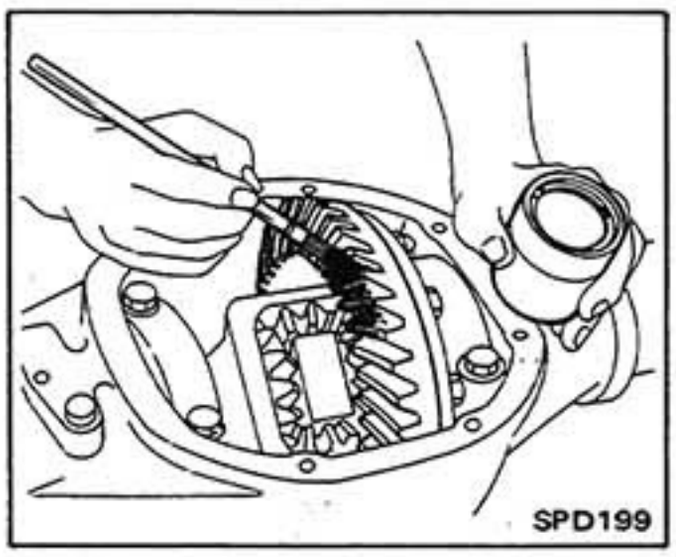
TOOTH CONTACT

Gear tooth contact pattern check is necessary to verify correct relationship between ring gear and drive pinion.

Hypoid gear set which are not positioned properly may be noisy, or have short life or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

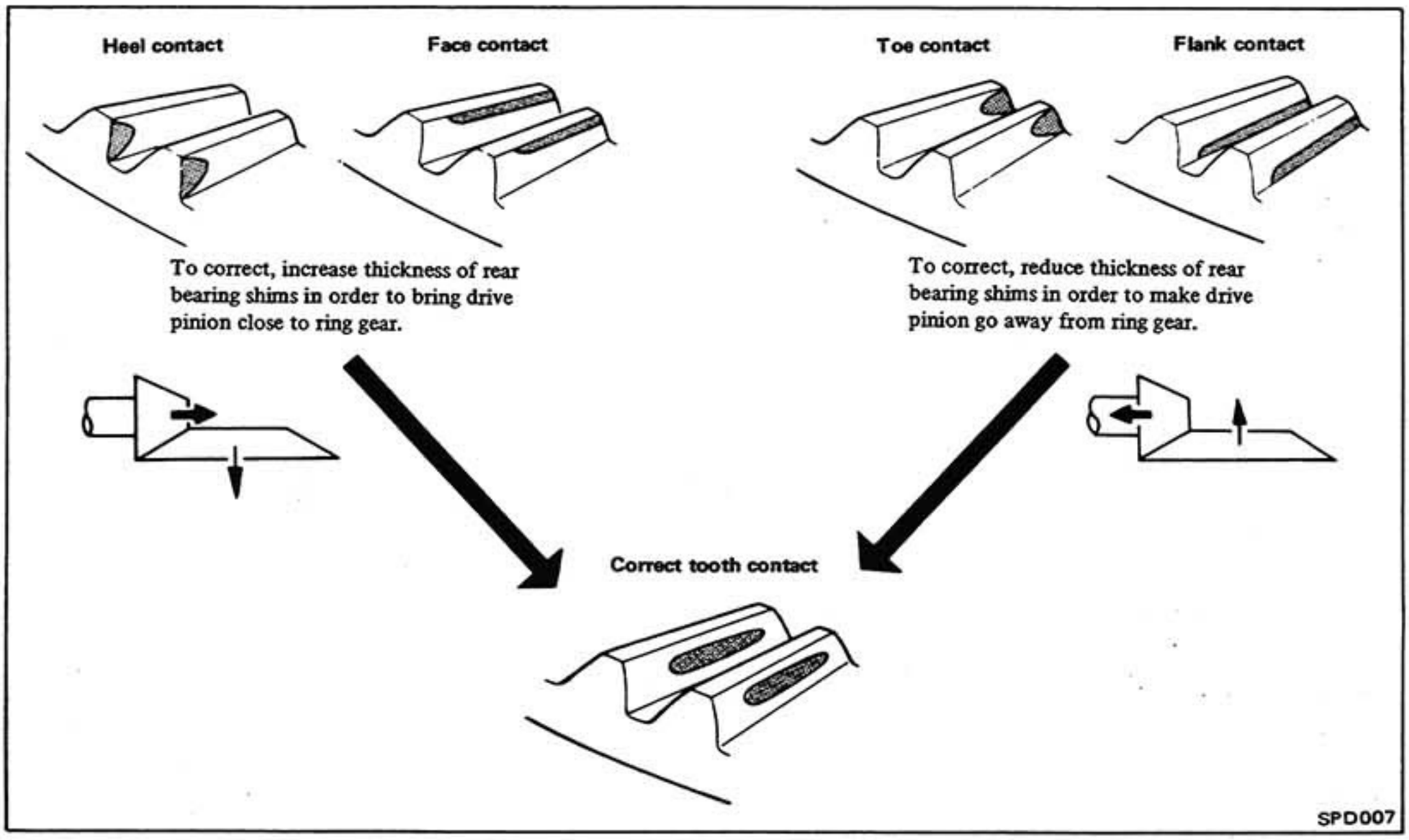
Check

1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear **drive side.**



3. Hold companion flange steady by hand and rotate the ring gear in both directions.

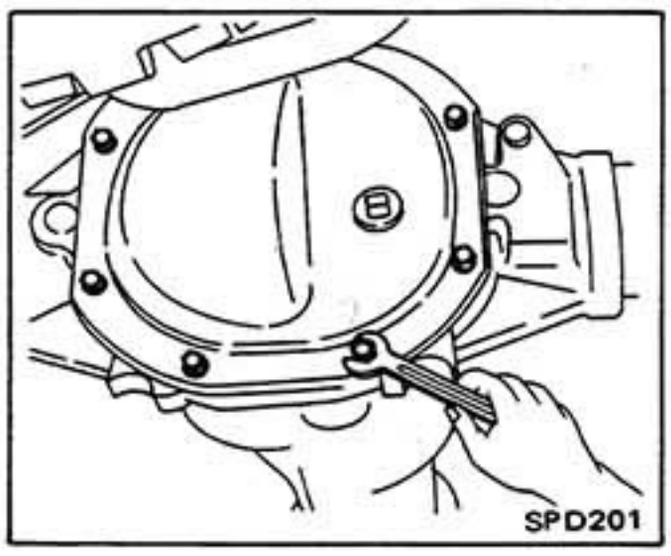
Adjustment



DISASSEMBLY

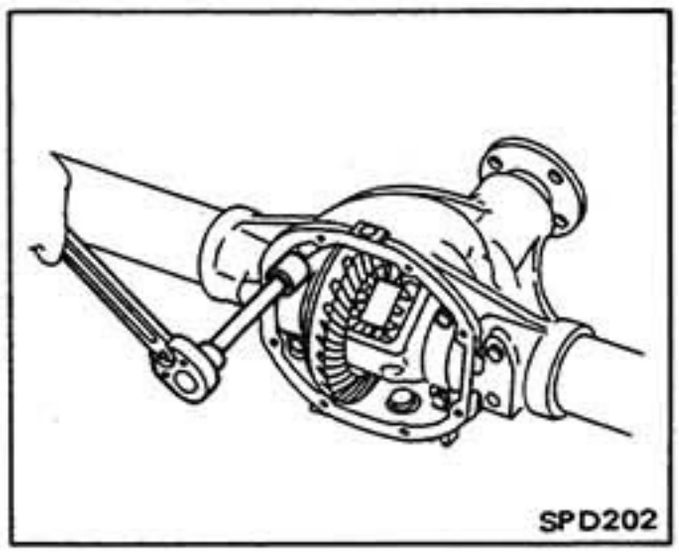
DIFFERENTIAL CARRIER

1. Remove rear cover and rear cover gasket.



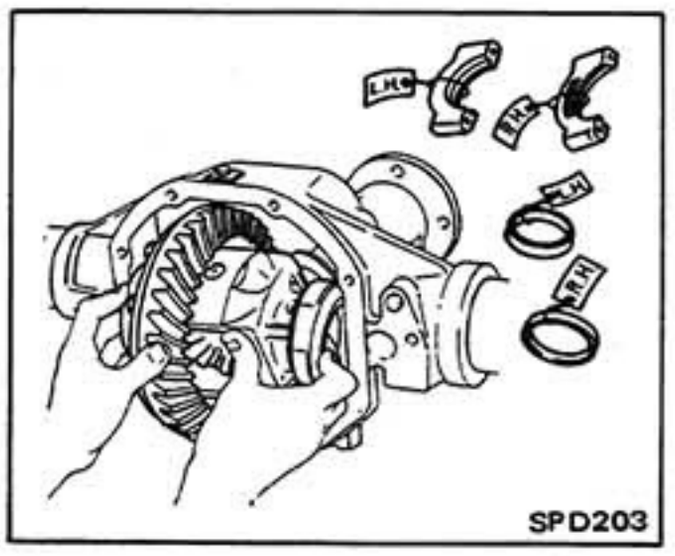
2. Remove side bearing caps.

Bearing caps are line-board during manufacture and should be put back in their original places.

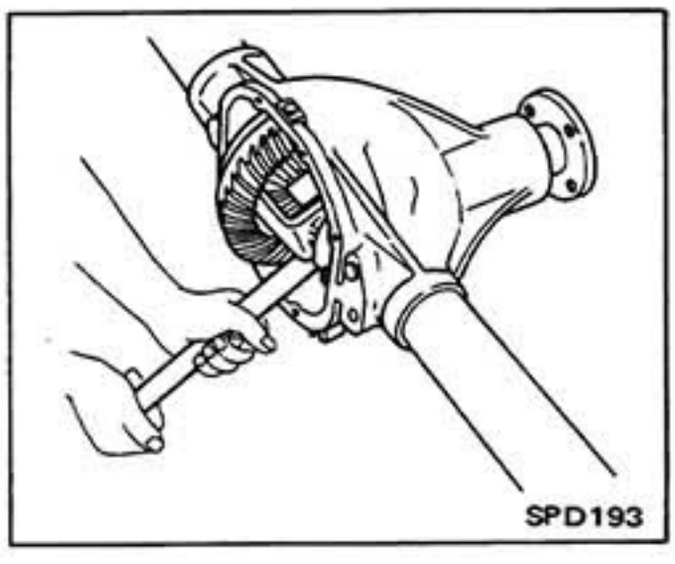


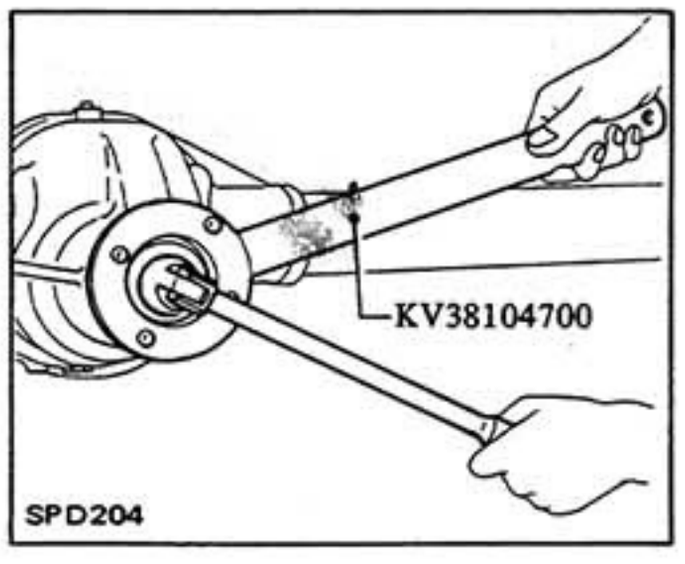
3. Using a pry bar, remove differential case assembly.

Be careful to keep the side bearing outer races together with inner race – do not mix them up.

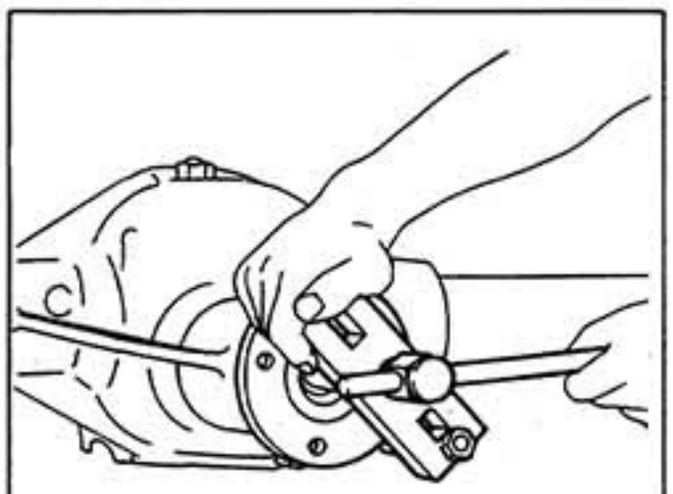


4. Remove drive pinion nut **using Tool.**

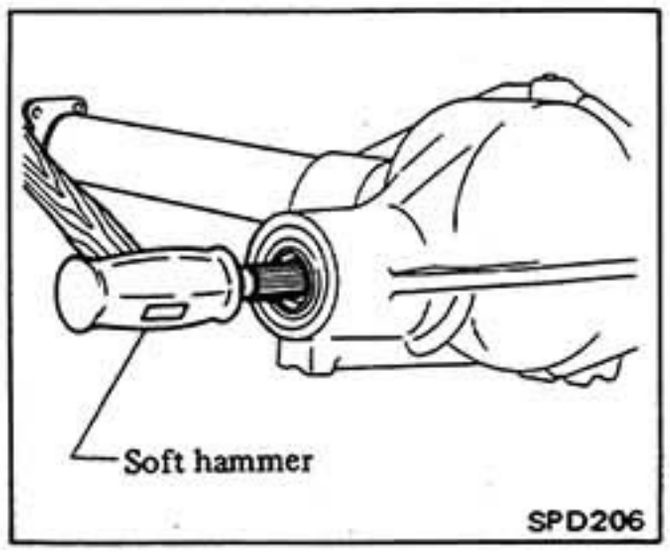




5. Remove companion flange using puller.


SPD205

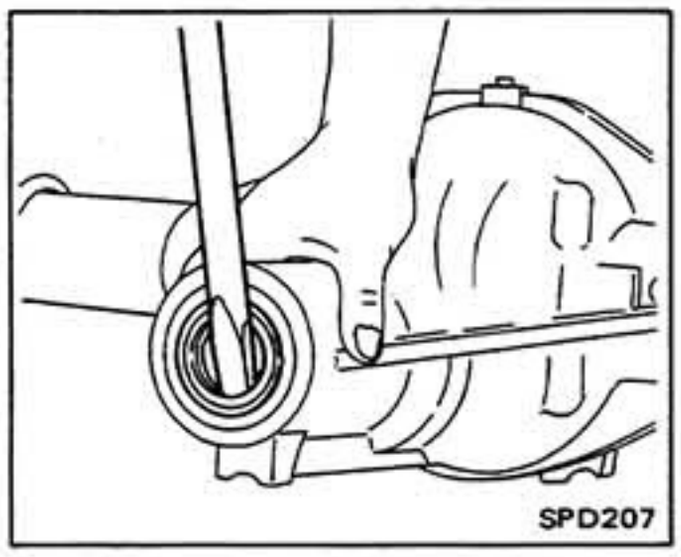
6. Remove drive pinion using soft hammer.



SPD206

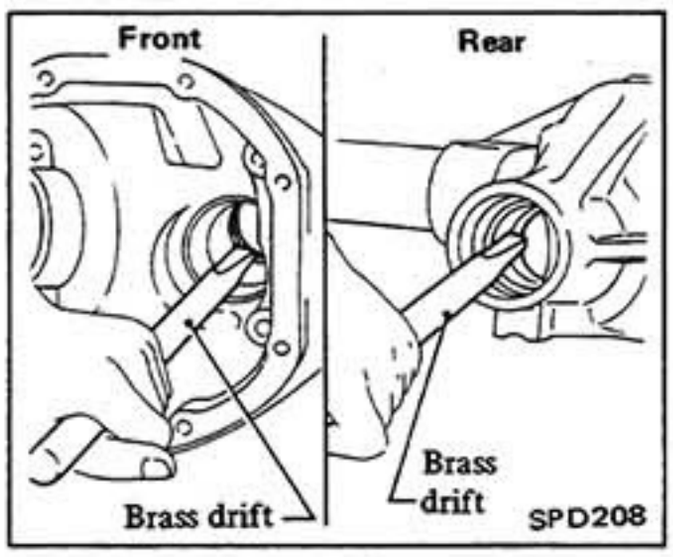
7. Remove oil seal by prying up using a large screwdriver, and remove front pinion bearing inner race.

Do this carefully, so as not to scratch seal bore with screwdriver. Cover end of screwdriver with a rag.


SPD207

Do not reuse oil seal once removed. Always install new one.

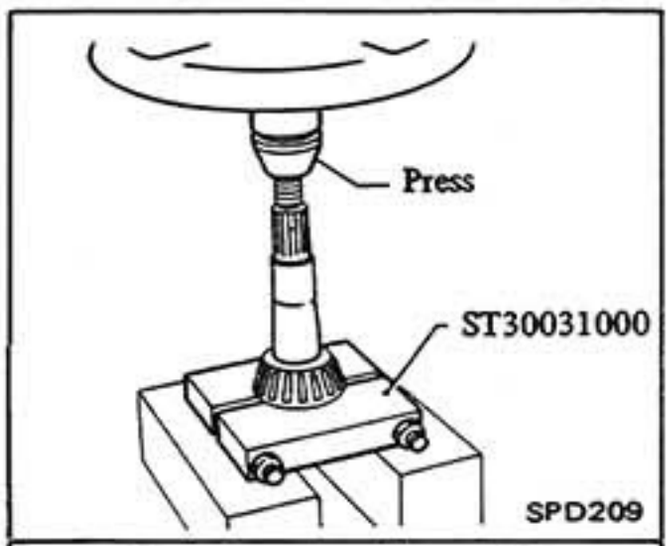
8. Remove pinion bearing outer race using brass drift.



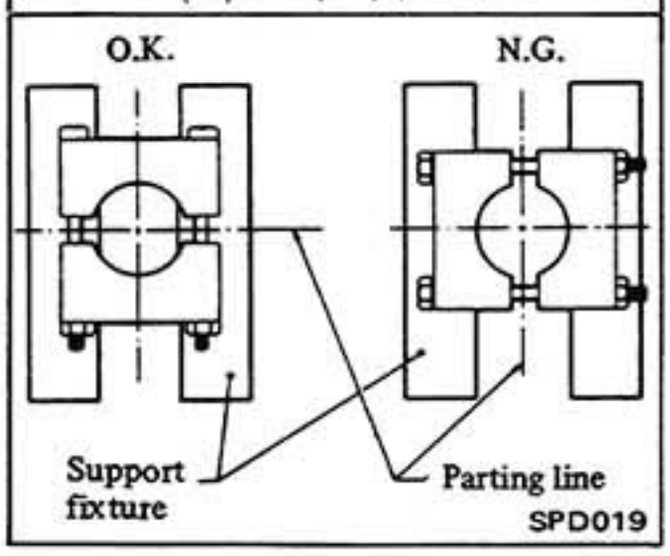
SPD208

9. Remove collapsible spacer and washer from drive pinion.
10. Pull out rear bearing inner race **using Tool.**

Care should be taken when setting Tool in press to make sure that parting line of Tool is a right angle to support fixture of press. This is to prevent bending Tool.

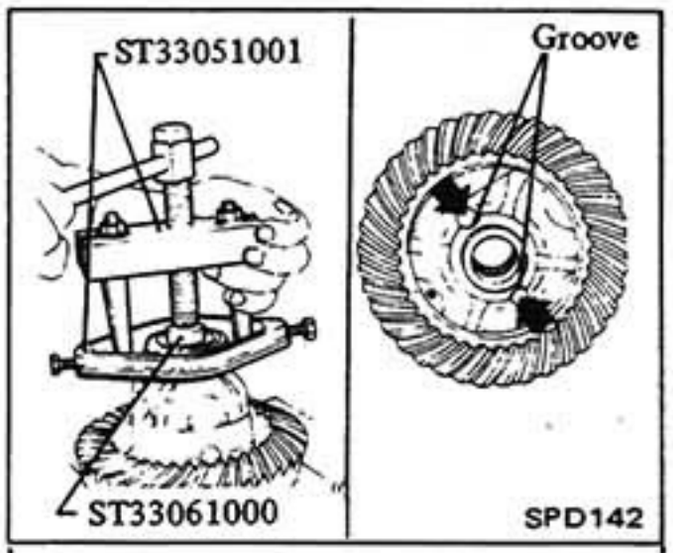


SPD209

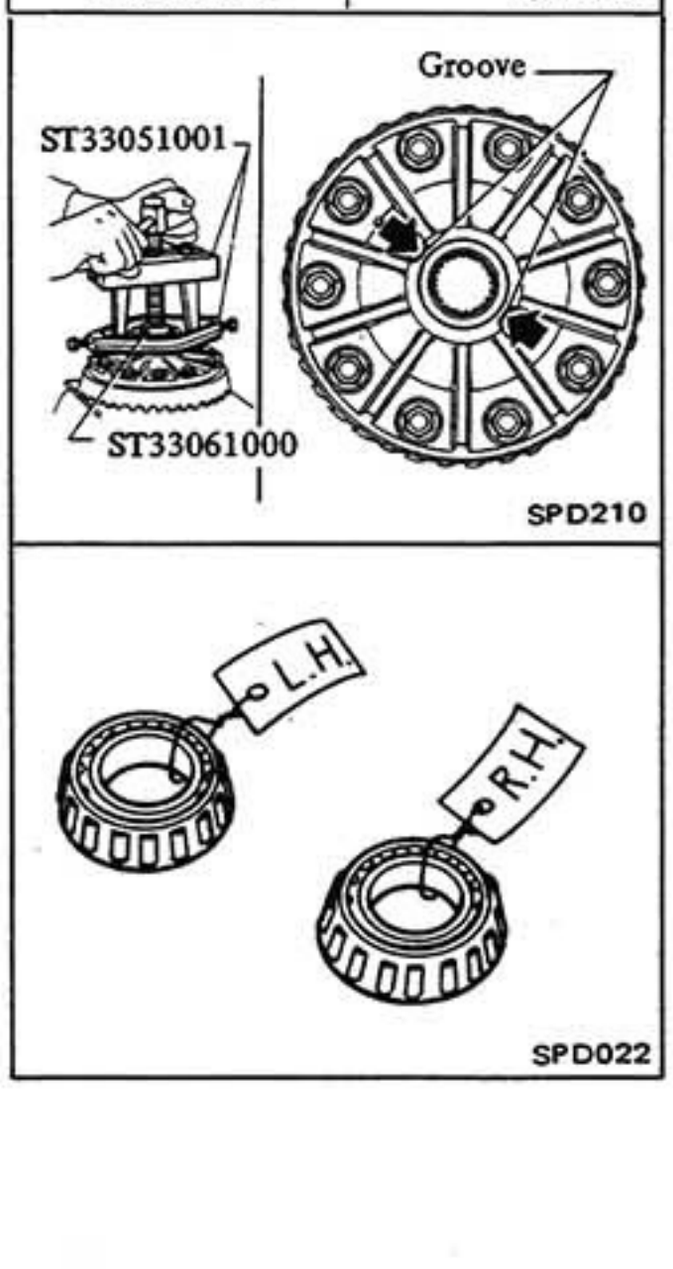


SPD019

To prevent damage to bearing, engage puller paws with groove. Be careful not to confuse left and right hand parts.



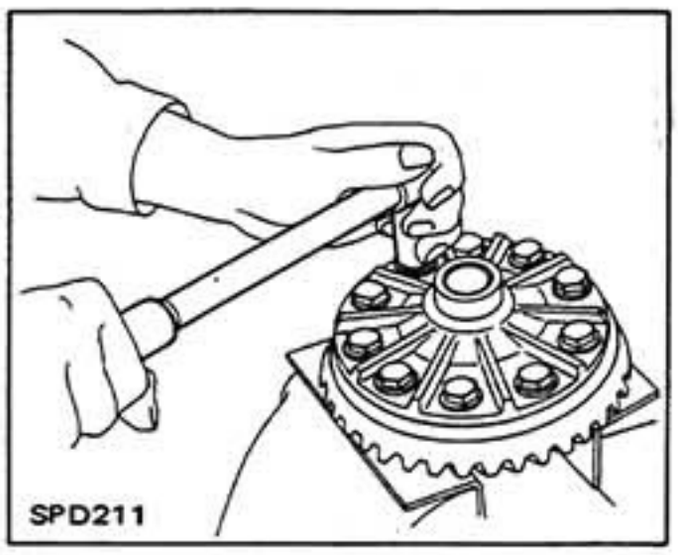
SPD142



SPD210

SPD022

2. Remove ring gear by loosening ring gear bolts **in a criss-cross fashion.**

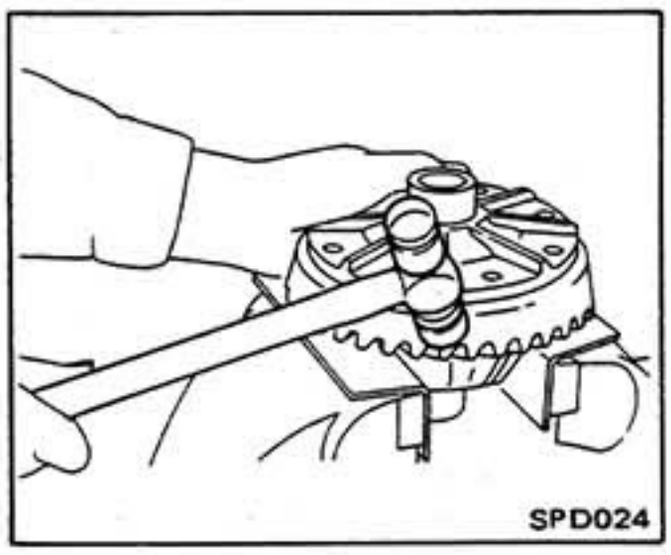

SPD211

DIFFERENTIAL CASE

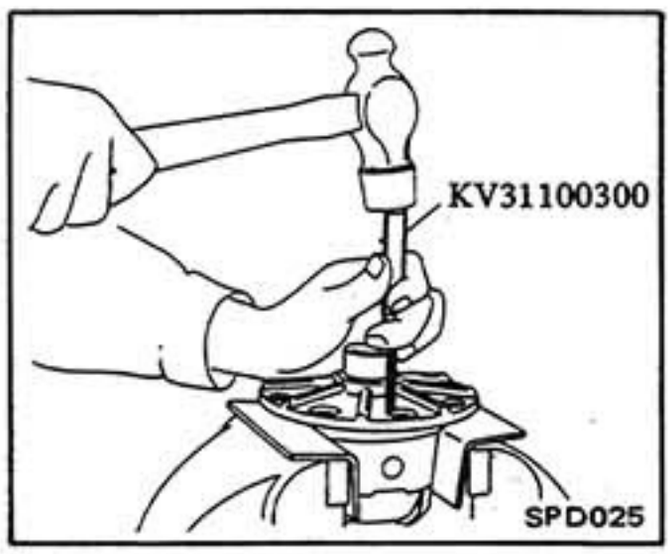
1. Remove side bearing inner race **using Tool.**

3. Tap ring gear off gear case using soft hammer.

Tap evenly all around to keep ring gear from binding.

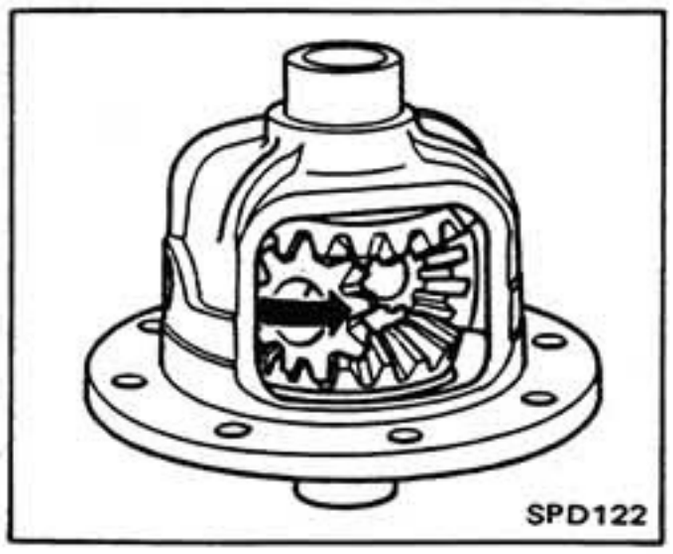

SPD024

4. Drive out pinion mate shaft lock pin **using Tool from ring gear side.**



SPD025

5. Draw out pinion mate shaft, and rotate pinion mate gears out of the case and remove side gears and thrust washers.


SPD122

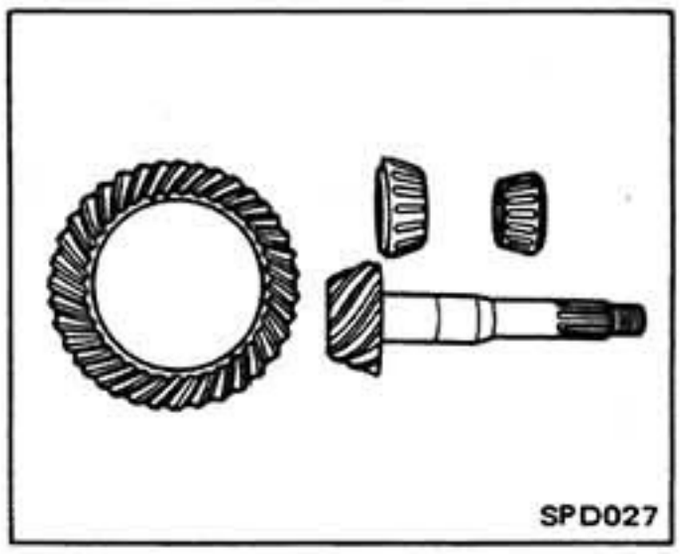
Put marks on gears and thrust washers so that they can be reinstalled in their original positions from which they were removed.

INSPECTION

1. Clean disassembled parts completely.

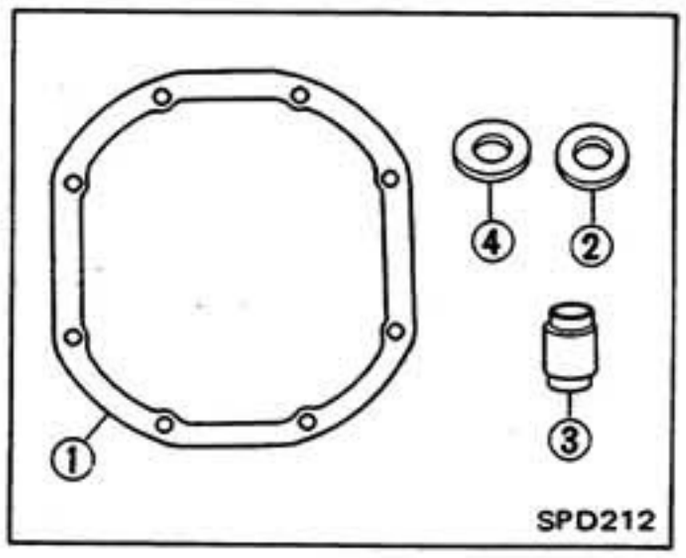
Repair or replace any damaged or faulty parts.

When replacing drive pinion or ring gear, replace with a new hypoid gear set.


SPD027

2. The following parts should be replaced by new ones each time they are removed.

① Gasket
② Front oil seal
③ Collapsible spacer
④ Side oil seal



SPD212

ASSEMBLY

Assembly should be done in the reverse order of disassembly, while marking any necessary inspections and adjustments.

PRECAUTION:

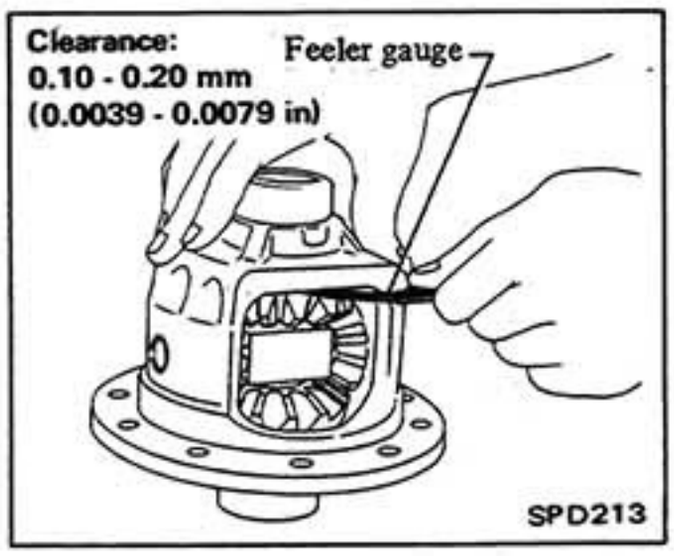
- **a. Arrange washers to install them correctly.**
- **b. Thoroughly clean the surfaces on which spacer, washers, bearings and bearing caps are installed.**
- **c. Apply gear oil when installing bearings.**
- **d. Pack recommended multi-purpose grease into cavity between lips when fitting oil seal.**

DIFFERENTIAL CASE

1. Install pinion mate gears, side gears, thrust washers and thrust block into differential case.

Be sure round seat of thrust block faces spacer.

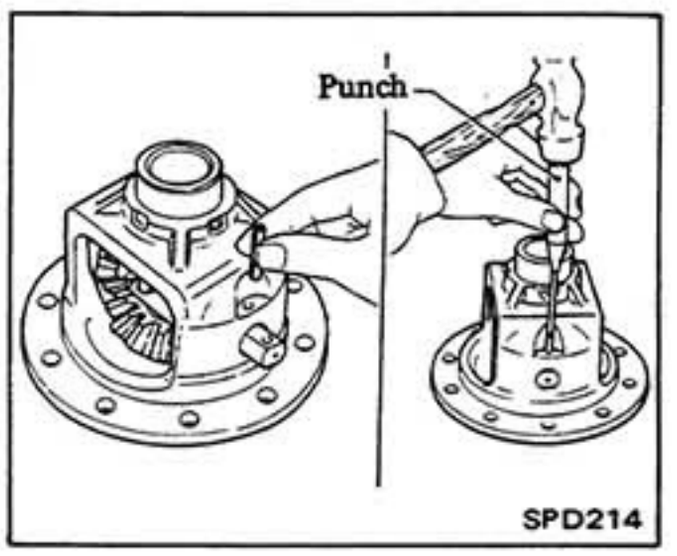
2. Fit pinion mate shaft.
3. Adjust clearance between rear face of side gear and thrust washer by selecting side gear thrust washer **(Refer to S.D.S.).**



SPD213

4. Install pinion mate shaft lock pin using a punch.

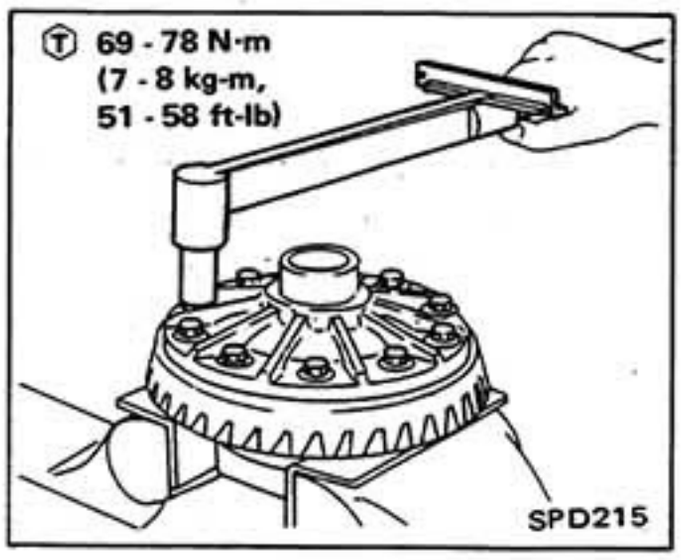
Make sure lock pin is flush with case.



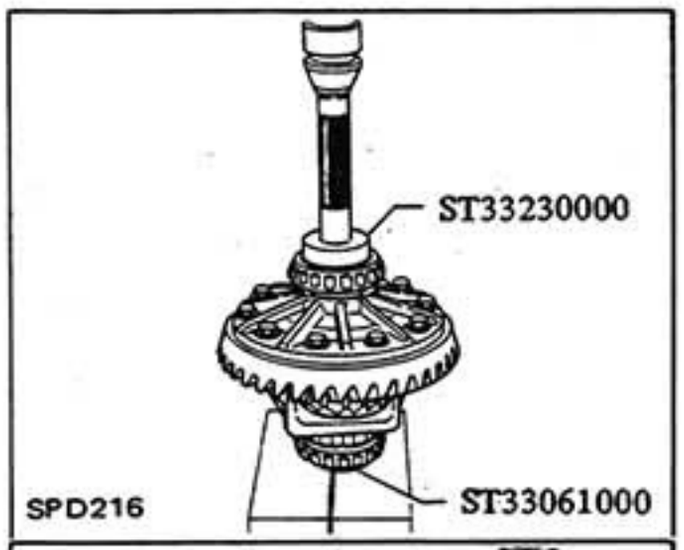
SPD214

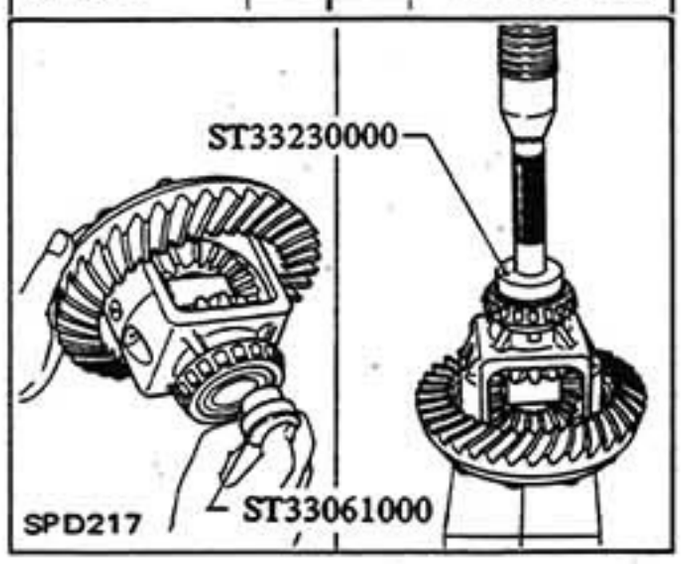
5. Place ring gear on differential case and install bolts.

Tighten bolt in a criss-cross fashion, lightly tapping bolt head with a hammer.



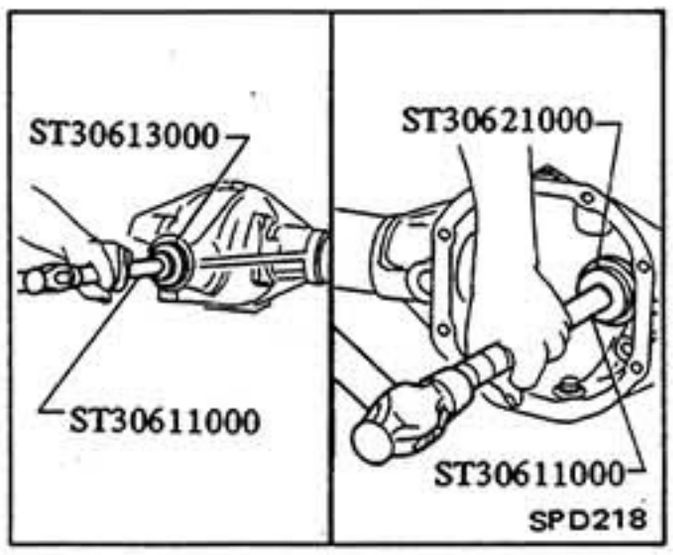
6. Press on the bearings **using Tool.**





DIFFERENTIAL CARRIER

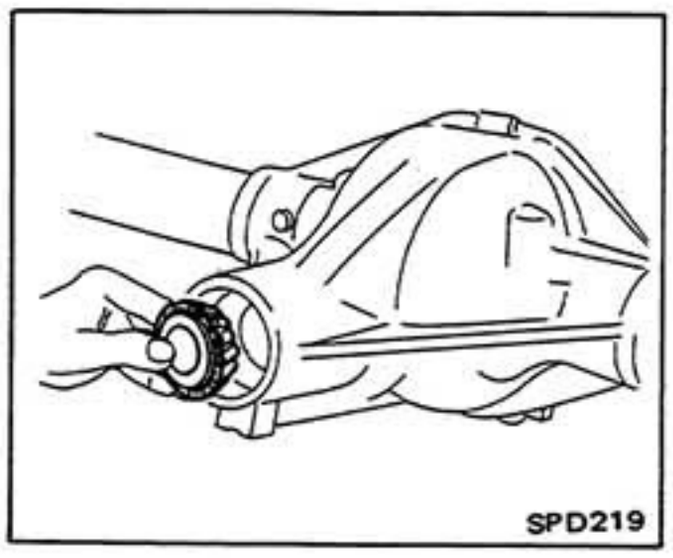
1. Press fit front and rear bearing outer races **using Tools.**



2. Adjust pinion height.

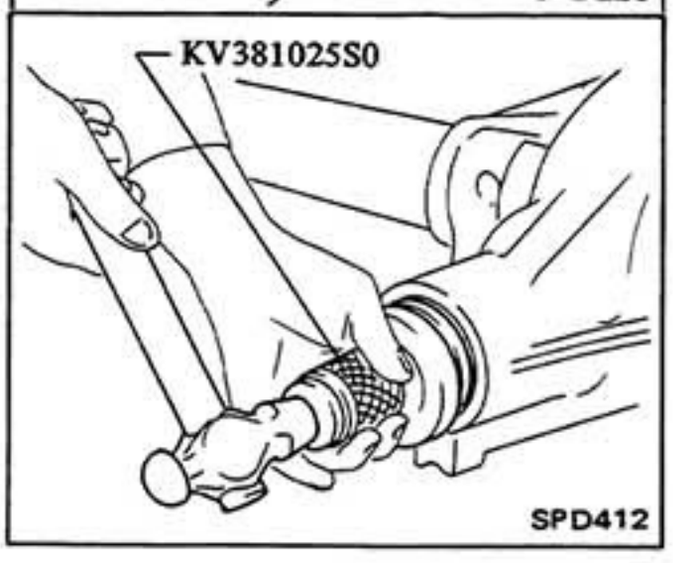
Refer to Pinion Height Adjustment.

3. **Lubricate** front bearing with gear oil and place it in gear carrier.

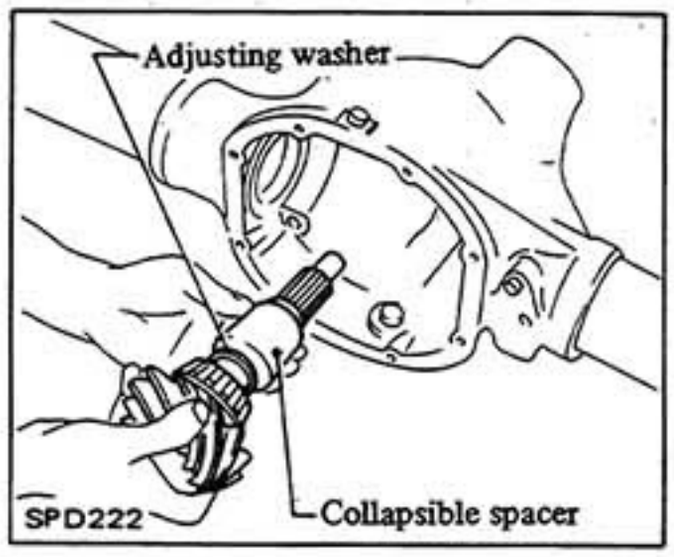


4. **Using Tool,** carefully fit a **new** oil seal into carrier.

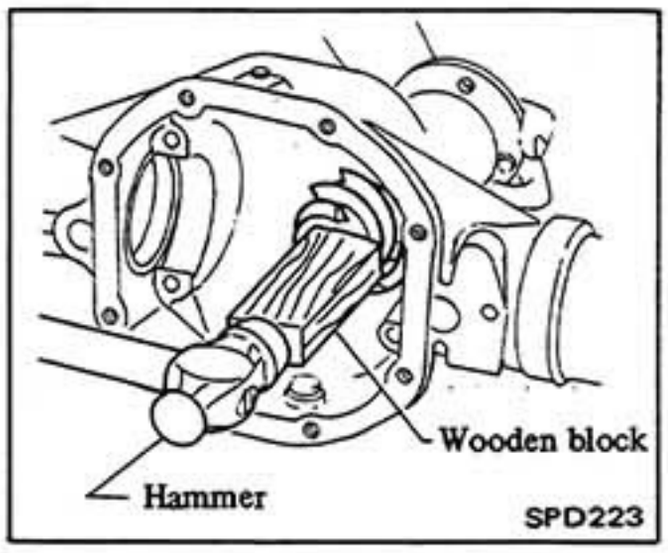
Make sure oil seal is flush with end of carrier and apply multi-purpose grease into cavity between lips.



5. Place a **washer** and a **new** collapsible spacer on drive pinion and **lubricate** rear bearing with gear oil, and insert it in gear carrier.

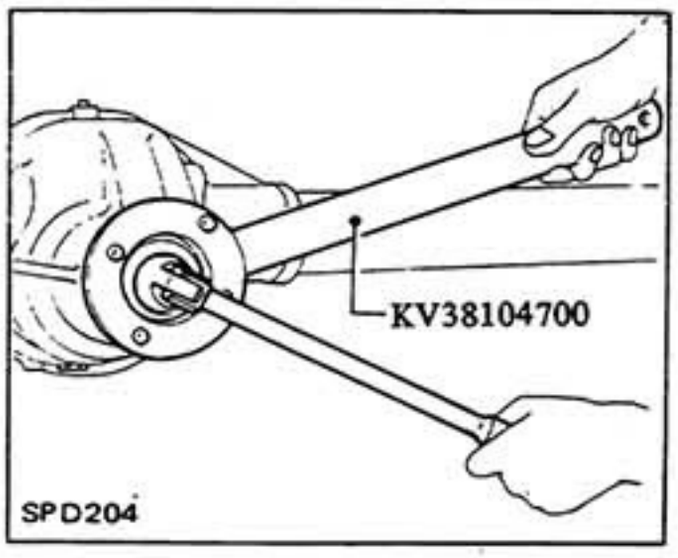


6. Install companion flange and hold it firmly. Insert drive pinion into companion flange by tapping its head with a soft hammer.



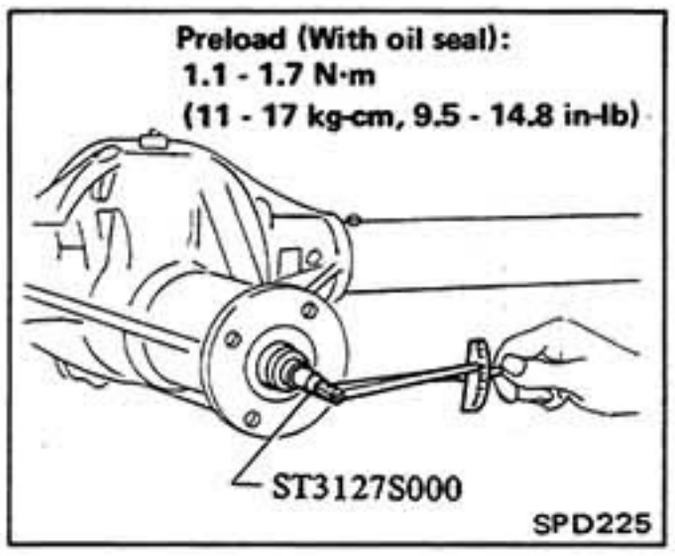
7. Hold companion flange **with Tool** and temporarily tighten pinion nut, until there is no axial play.

Ascertain that threaded portion of drive pinion and pinion nut are free from oil or grease.



8. Tighten pinion nut by degrees to the specified preload while checking the preload **with Tools.**

When checking preload, turn drive pinion in both directions several times to set bearing rollers.



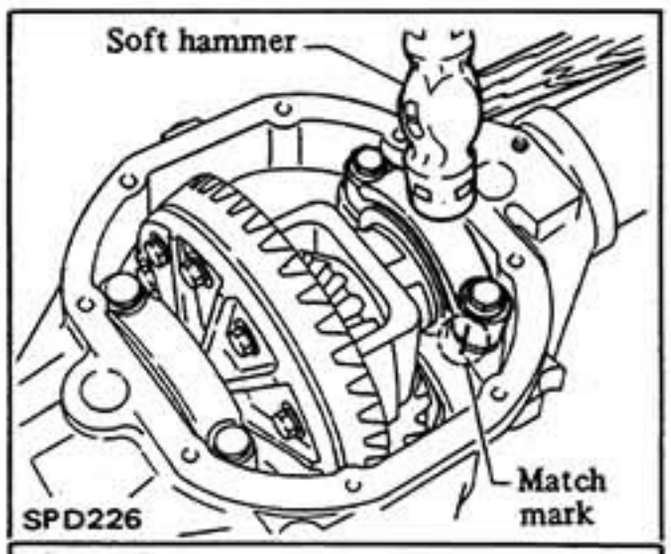
Ⓣ : Drive pinion nut
127 - 294 N·m
(13 - 30 kg-m,
94 - 217 ft-lb)

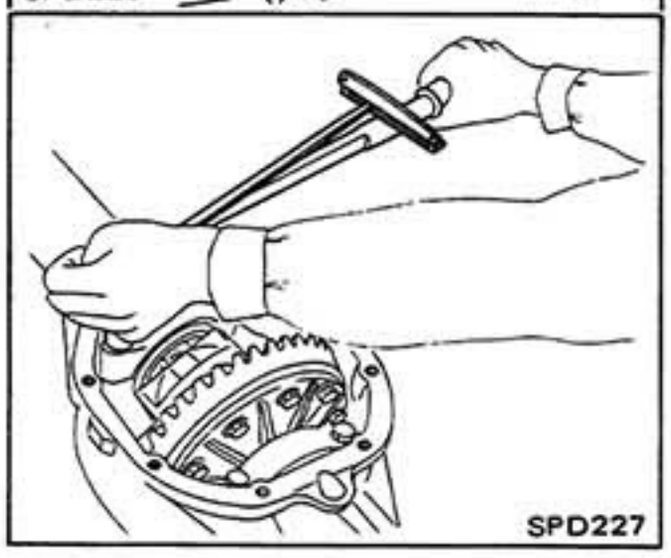
CAUTION:
The preload is achieved by using the permanent set of collapsible spacer. So here, if an over-preload results from excessive turning of the pinion nut, the spacer should be replaced by new one.

9. Install differential case assembly, side bearing outer races and side bearing adjust washer, spacer into differential carrier, and then install side bearing caps.

Tap on the cap with a soft hammer to settle it in the carrier.

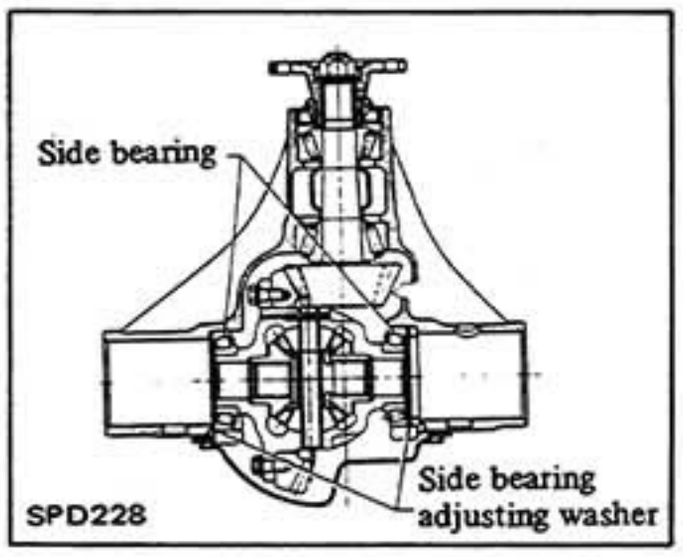
The bearing cap should be installed with the marks put at disassembly aligned.





ADJUSTMENT

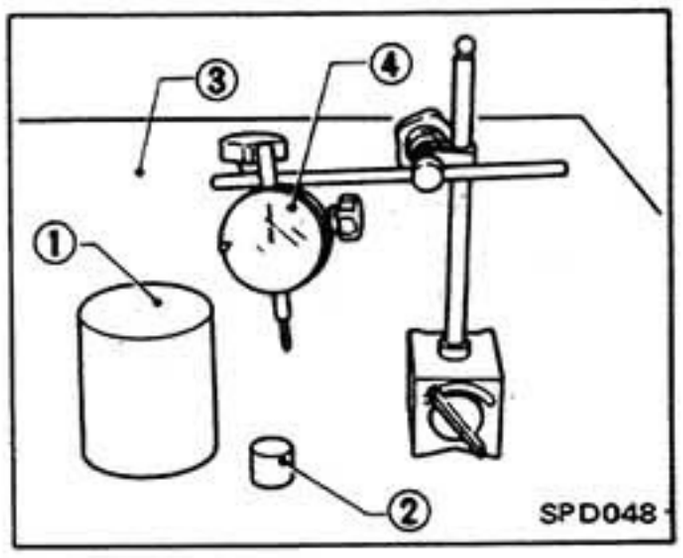
SIDE BEARING ADJUSTMENT



When the differential case, side bearing, or gear carrier is replaced, or when the ring gear backlash or side bearing preload is out of specifications, side bearing adjusting washers of proper thickness should be installed.

– Required Tools –

① Weight Block (ST32501000)
② Master Gauge (KV38102000)
③ Base Plate
④ Dial Indicator

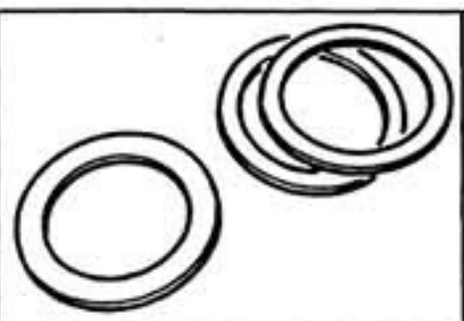
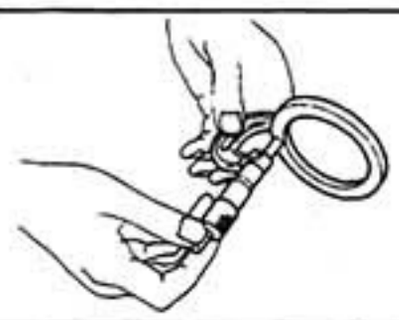
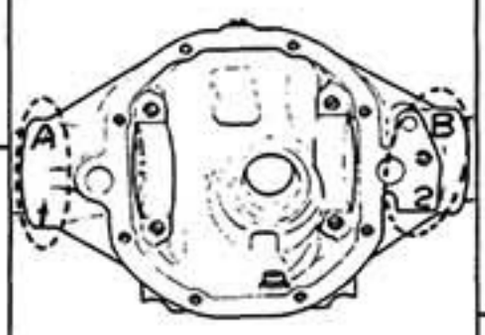
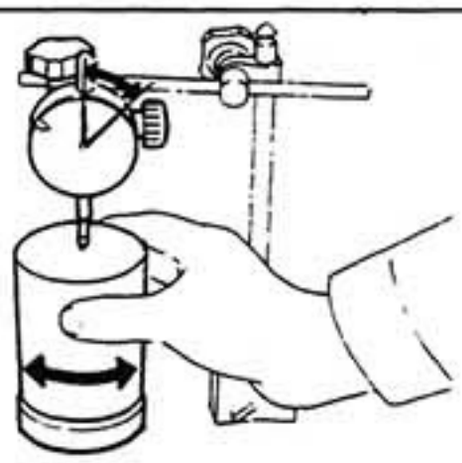
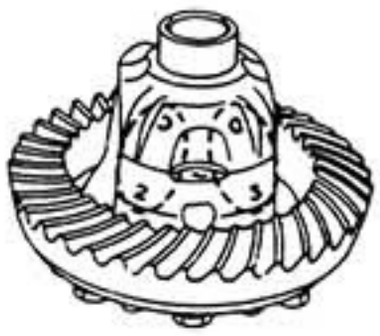


1. Thickness of side bearing adjusting washer can be calculated by following equation.

- **When spacer is located on ring gear side**
  Left side: $T_1 = (A - C + D) \times 0.01 + E - G + 10.03$
  Right side: $T_2 = (B - D) \times 0.01 + F + 2.03$
- **When spacer is located opposite ring gear**
  Left side: $T_1 = (A - C + D) \times 0.01 + E + 2.03$
  Right side: $T_2 = (B - D) \times 0.01 + F - G + 10.03$

CAUTION:
To avoid any confusion while calculating, it is absolutely necessary to stay with metric system.
If you measure anything in inches, the results should be converted into the metric system.

Where:

T_1 = (Left side) T_2 = (Right side)		G =	
A =		E = mm (Left Side Bearing)	
B =		F = mm (Right Side Bearing)	Differences between width of left (E) or right (F) side bearing and standard width.
C =			
D =	Stamped on differential case	A, B, C and D are dimensional variations in a unit of 1/100 mm against each standard value.	

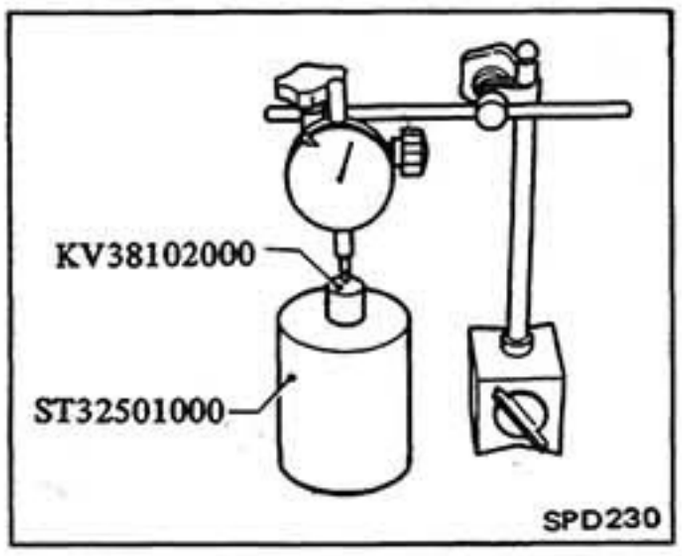
SPD229

2. Measure values **E** and **F**.

(1) Attach a dial indicator to the base plate.

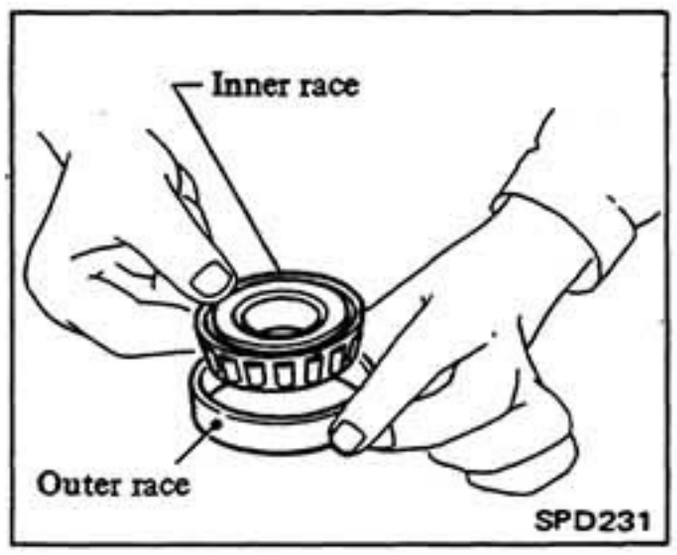
(2) Place a weight block on the base plate, and a master gauge on that block.

Then adjust the dial indicator scale to zero with its tip on the master gauge.



(3) Remove the master gauge and weight block.

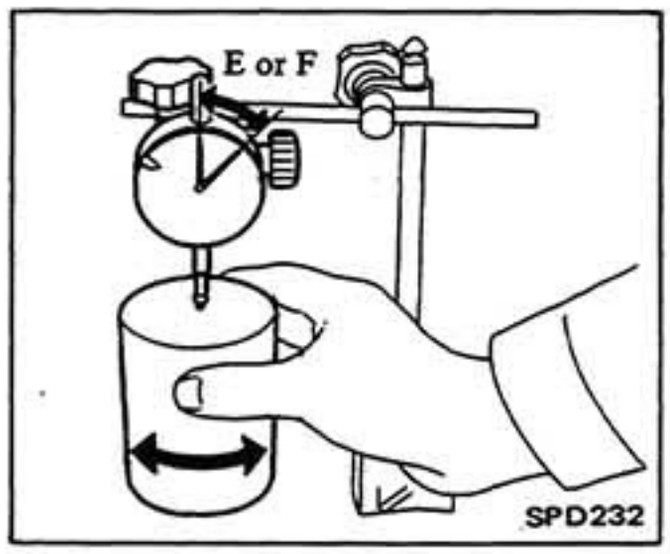
Place the bearing outer race and inner race to be measured on the base plate, and place the weight block on that bearing assembly.



(4) Turn the bearing several times to settle it, and then read the indication of the dial indicator.

The indication should be **E** or **F**.

Left side bearing . . . . . E
Right side bearing . . . . . F



3. Measure thickness **G** of spacer with micrometer.

4. Substitute these values into the equation to calculate the thickness of the side bearing adjusting washer.

If values signifying A, B, C and D are not given, regard them as zero and calculate.

After assembly, check to see that preload and backlash are within specifications. If not, readjust.

Example:

A = 1
B = 2
C = 2
D = 3
G = 8.09
E = 0.15
F = 0.17

- When spacer is located opposite ring gear

Left side:

$T_1 = (A - C + D) \times 0.01 + E + 2.03$
$= (1 - 2 + 3) \times 0.01 + 0.15 + 2.03$

(1) A 1
–C ..... –2
–1
+D ..... +3
2

(2) 2
× 0.01
0.02

(3) 0.02
+E ..... +0.15
0.17

(4) 0.17
+2.03
2.20

$T_1 = 2.20$

Right side:

$T_2 = (B - D) \times 0.01 + F - G + 10.03$
$= (2 - 3) \times 0.01 + 0.17 - 8.09 + 10.03$

(1) B 2
–D ..... –3
–1

(2) –1
× 0.01
–0.01

(3) –0.01
+F ..... +0.17
0.16

(4) 0.16
– G ..... –8.09
–7.93

(5) 10.03
–7.93
2.10

$\therefore T_2 = 2.10$

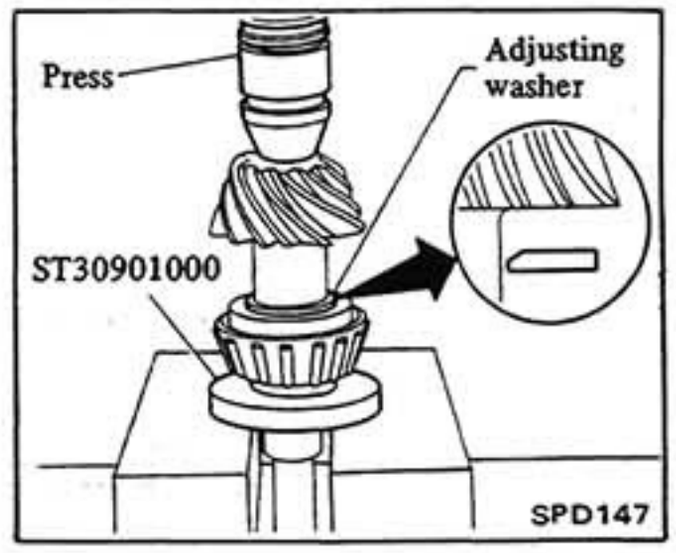
5. Select the proper washer **(Refer to S.D.S.).**

If you cannot find a washer with the desired thickness, use a washer with the thickness closest to the calculated value.

PINION HEIGHT ADJUSTMENT

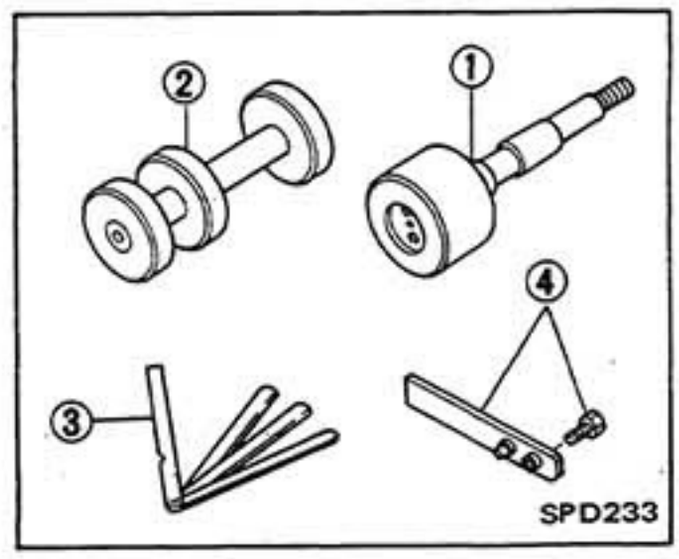
When replacing the hypoid gear set, drive pinion bearing or gear carrier, be sure to adjust the pinion height.

Adjustment of the pinion height can be made by adjusting the washer to be installed between the rear bearing inner race and the drive pinion head.



– Required Tools –

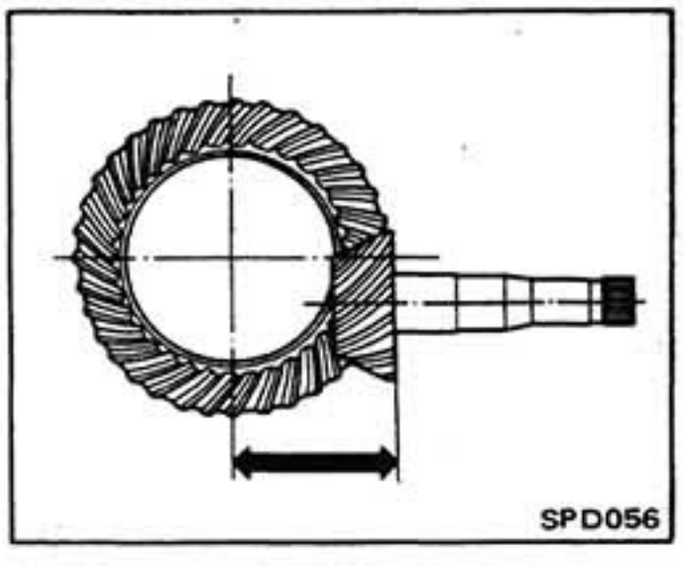
① Dummy Shaft (KV38103910)
② Height Gauge (KV38100120)
③ Feeler Gauge
④ Stopper (KV38100140)

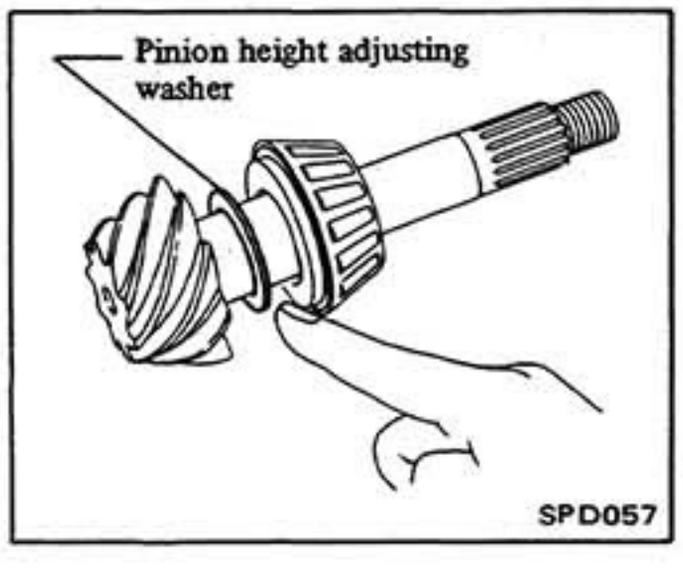


1. Thickness of washer can be calculated by following equation.

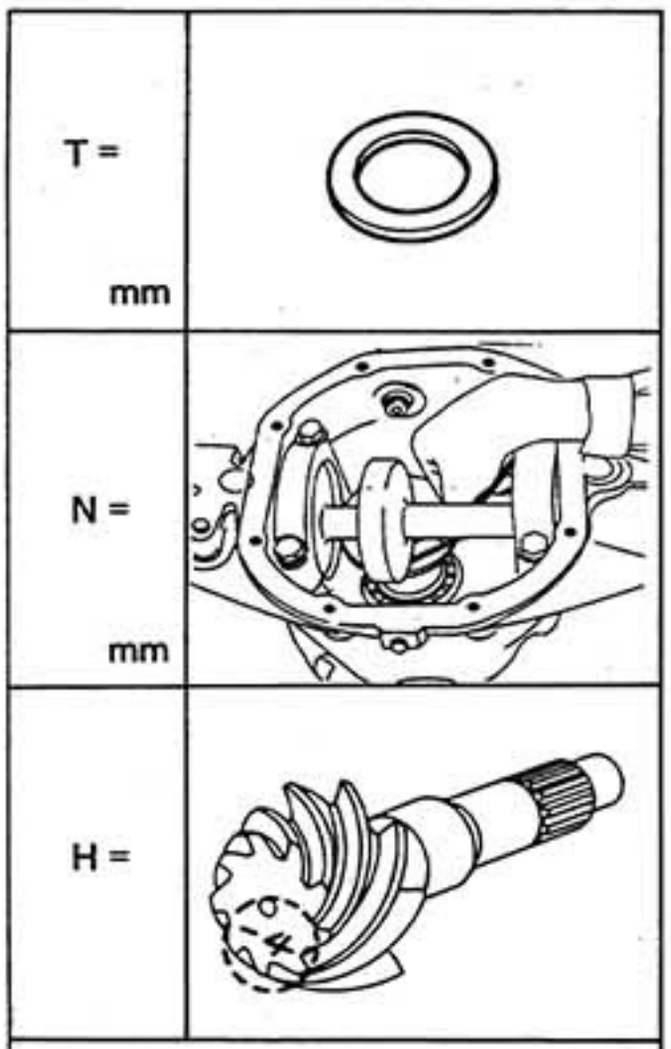
$T = N - (H \times 0.01) + 3.00$

CAUTION:
To avoid any confusion while calculating, it is necessary to stay with the metric system. If you measure anything in inches, the result should be converted to the metric system.





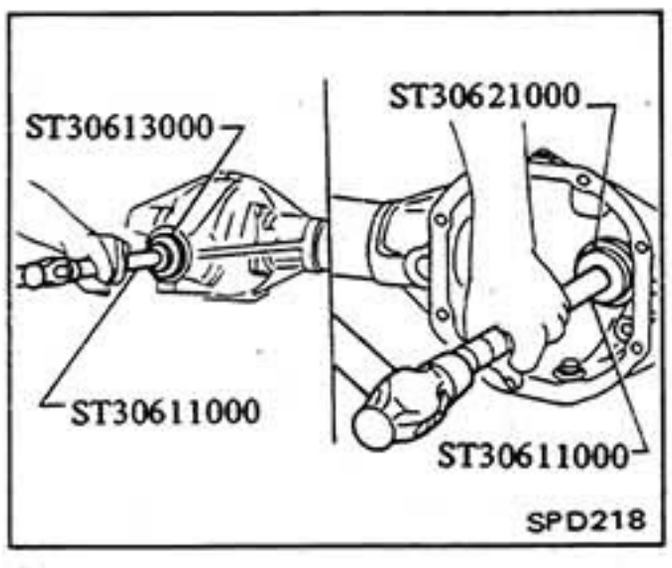
Where:



H are dimensional variations in a unit of 1/100 mm against each standard value.

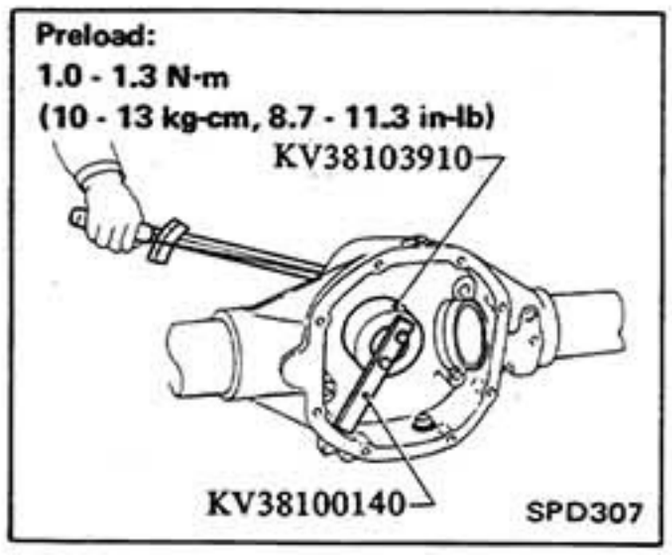
SPD234

2. Press fit front and rear bearing outer races **using Tools.**



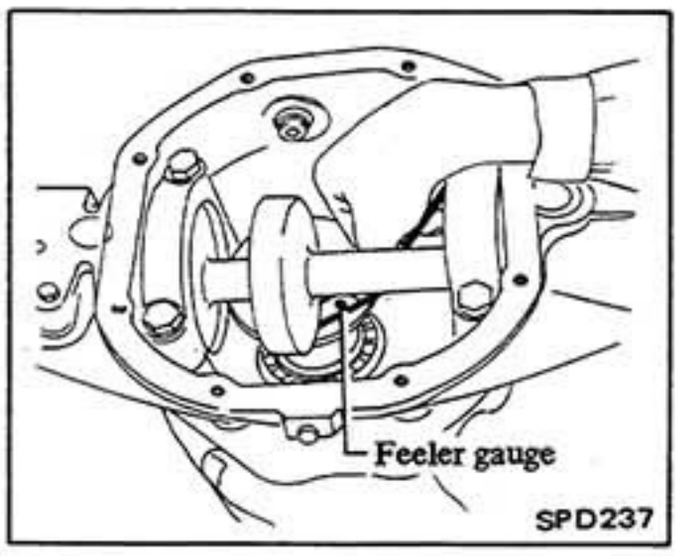
3. Fit rear bearing inner race on dummy shaft and install them on carrier.
4. Install front bearing and companion flange, and tighten drive pinion nut so that drive pinion bearing preload is within the specified value.

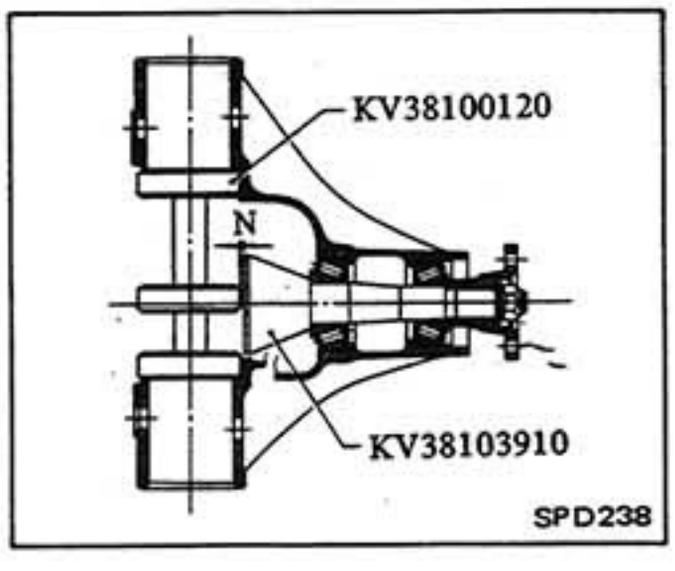
Do not overtighten as there is no collapsible spacer. Tighten gradually.



5. Install height gauge on carrier.

Using a feeler gauge, measure the clearance between the height gauge tip and the dummy shaft face.





6. Substitute these values into the equation to calculate the thickness of the washer.

If values signifying H are not given, regard them as zero and calculate.

After assembly, check to see that tooth contact is correct. If not, readjust.

N = 0.23
H = 1

T = N – (H × 0.01) + 3.00
= 0.23 – (1 × 0.01) + 3.00

(1)	H	1
		× 0.01
		0.01
(2)	N	0.23
		– 0.01
		0.22
(3)		0.22
		+ 3.00
		3.22

∴ T = 3.22

7. Select the proper washer **(Refer to S.D.S.).**

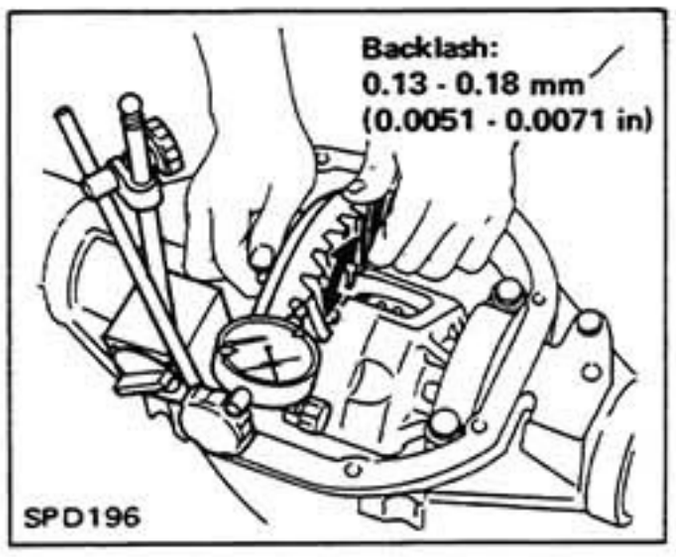
If you cannot find the desired thickness of washer, use washer so that thickness is the closest to the calculated value.

Example:

Calculated value . . . . T = 3.22 mm
Used washer . . . . . T = 3.21 mm

FINAL VERIFICATION

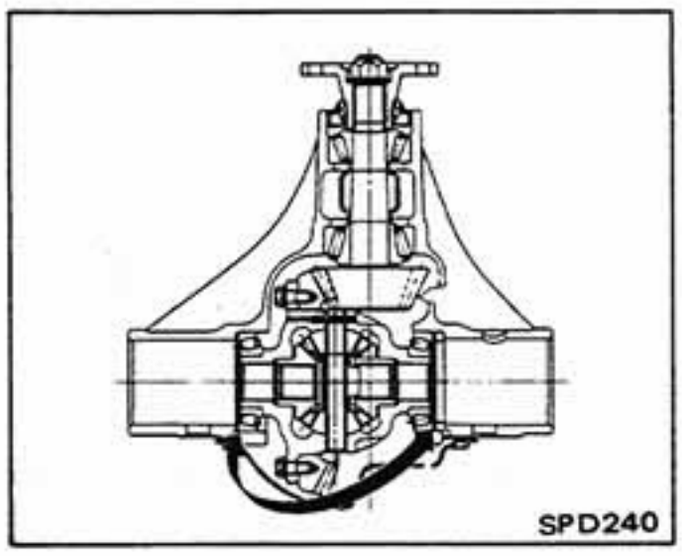
1. Check backlash of ring gear with a dial indicator.



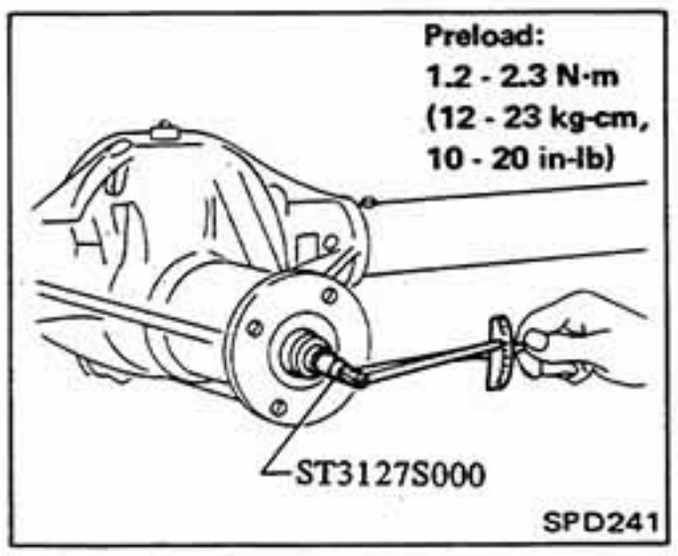
If backlash is too small, decrease thickness of left side bearing adjusting washer and increase thickness of right side bearing adjusting washer by the same amount.

If backlash if too great, reverse the above procedure.

Never add or remove from the total amount of side bearing adjusting washer or bearing preload will be changed.


SPD240

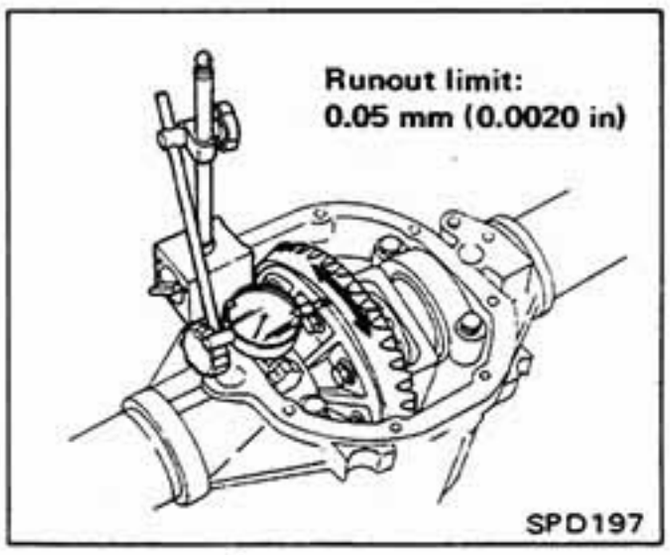
2. Check total preload.



SPD241

If preload is too great, replace side bearing adjusting washers with thinner ones of the same thickness on each side. If preload is too small, replace side bearing adjusting washers with thicker ones of the same thickness on each side. If done incorrectly, ring gear backlash will change.

3. Check runout of ring gear with a dial indicator.



SPD197

If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.

If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

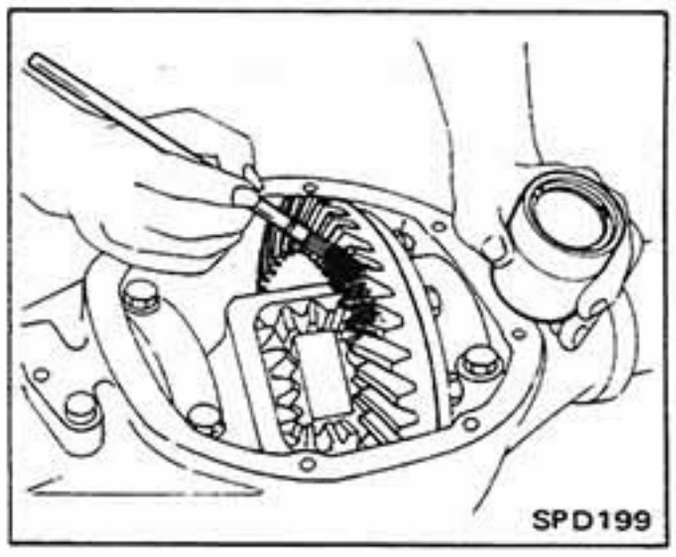
4. Finally, check for tooth contact pattern.

Refer to Tooth Contact.

Usually the pattern will be correct if you have calculated the washers correctly and the backlash is correct.

However, in extremely rare cases you will have to use trial-and-error processes until you get a good tooth contact pattern.

The tooth pattern is the best indication of how well a differential has been set up.

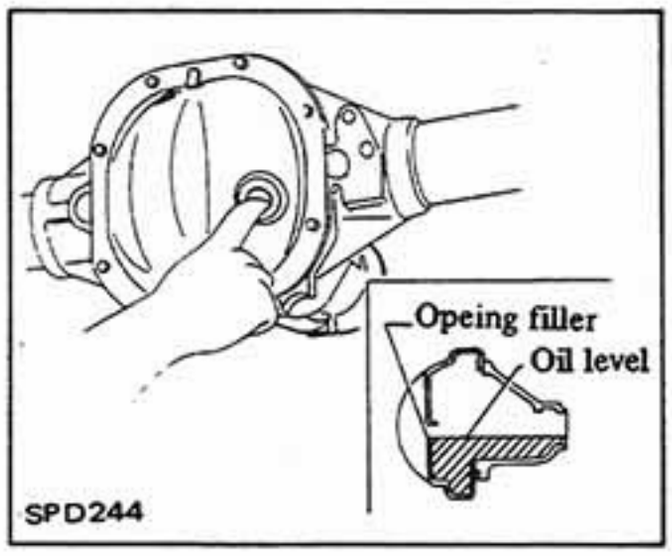

SPD199

5. Install the differential carrier in the vehicle **(Refer to Section FA or RA for installation).**

Gasket should be replaced by new one each time the differential carrier is removed.

Then fill with gear oil.

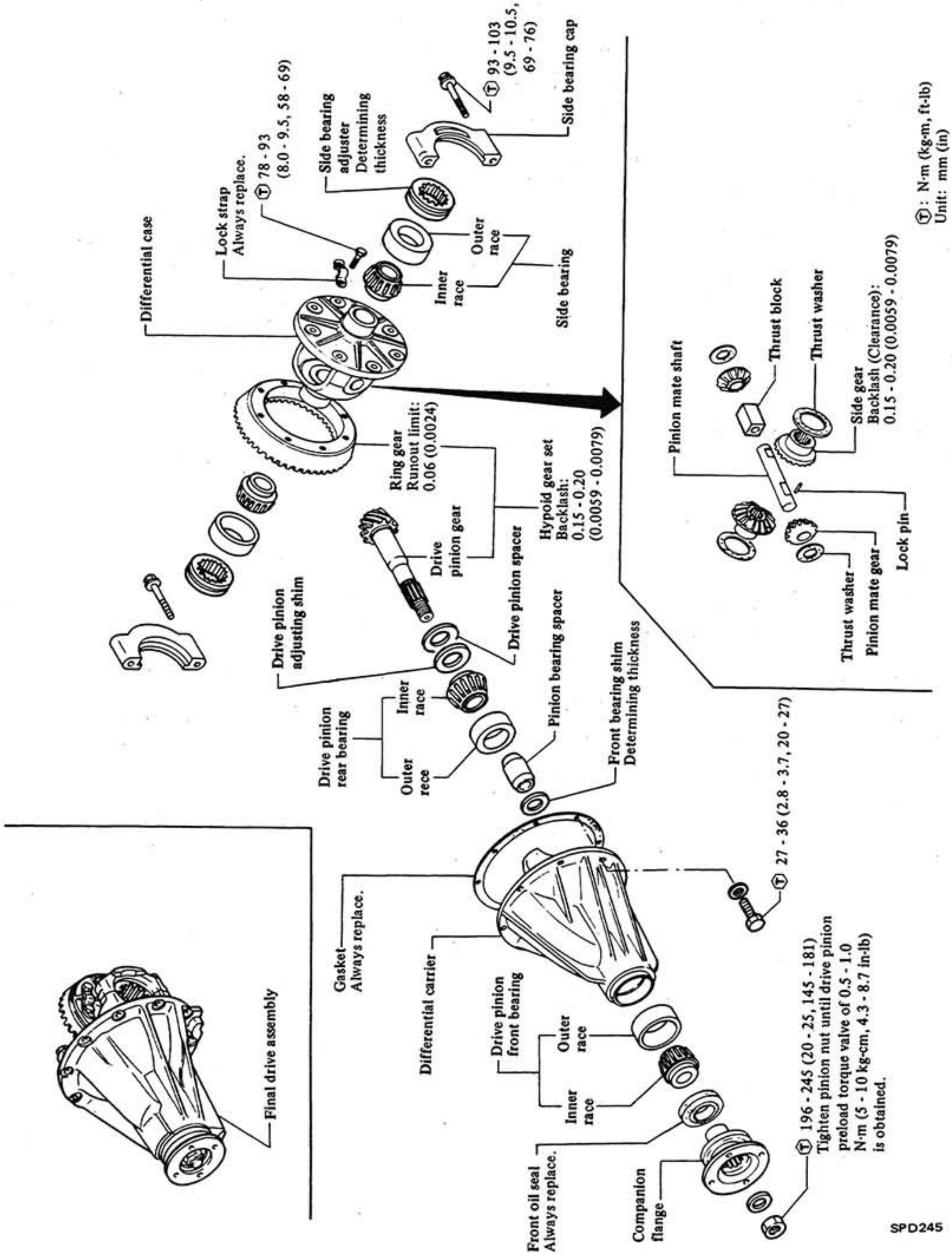
With limited slip differentials, use Gear Oil Hypoid L.S.D. (Service part number: KL430-14002-03).



SPD244

Ⓣ : Drain and filler plugs
39 - 59 N·m
(4 - 6 kg-m,
29 - 43 ft-lb)
Gear oil capacity:
1.5 liters
(2-5/8 Imp pt) for front
1.3 liters
(2-1/4 Imp pt) for rear

DIFFERENTIAL CARRIER (Final drive) —Model : H233B—

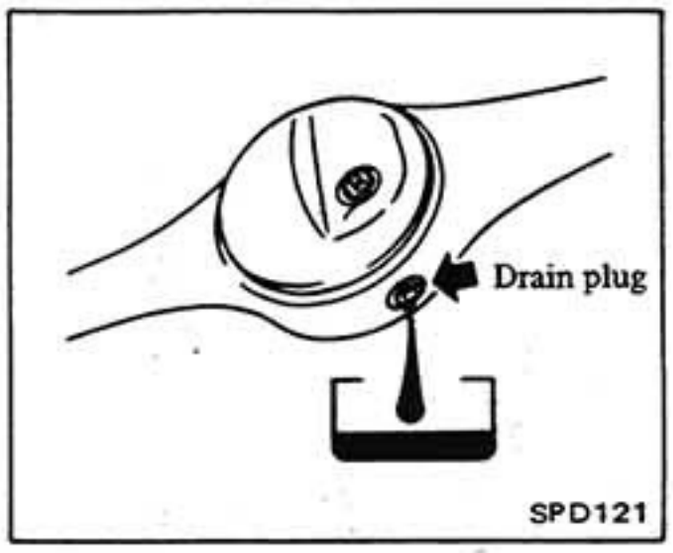


SPD245

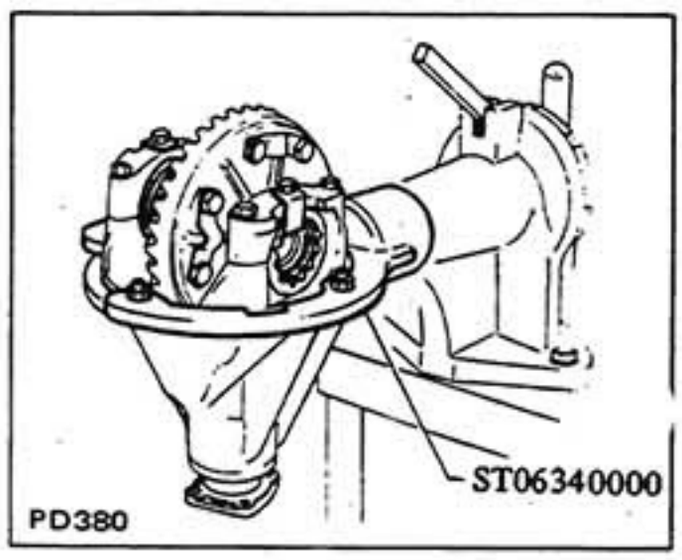
PREPARATION FOR DISASSEMBLY

REMOVAL

1. Jack up rear of vehicle and **support it by placing safety stands under rear axle case, referring to section GI.**
2. Remove drain plug and drain gear oil.

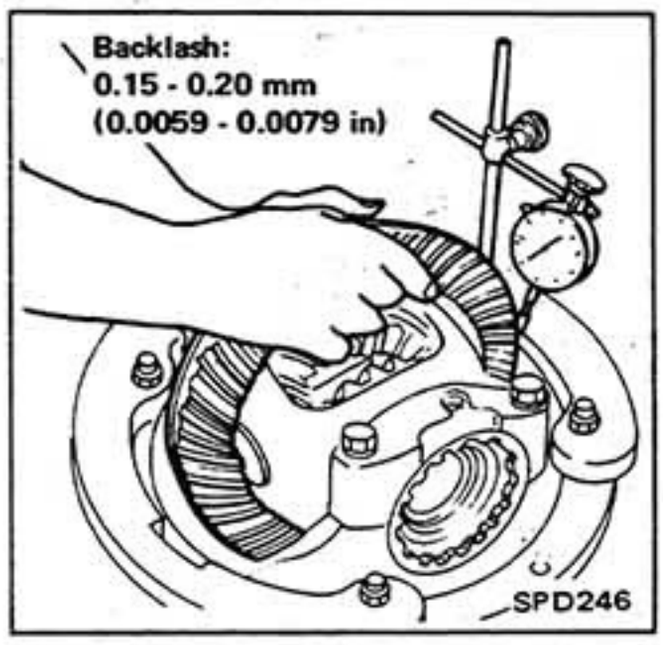


3. Separate propeller shaft and differential carrier.
4. Remove rear axle shaft. **Refer to Section RA for removal.**
5. Loosen off nuts securing differential carrier to rear axle case, and take out differential carrier.
6. Mount differential carrier on **Tool.**



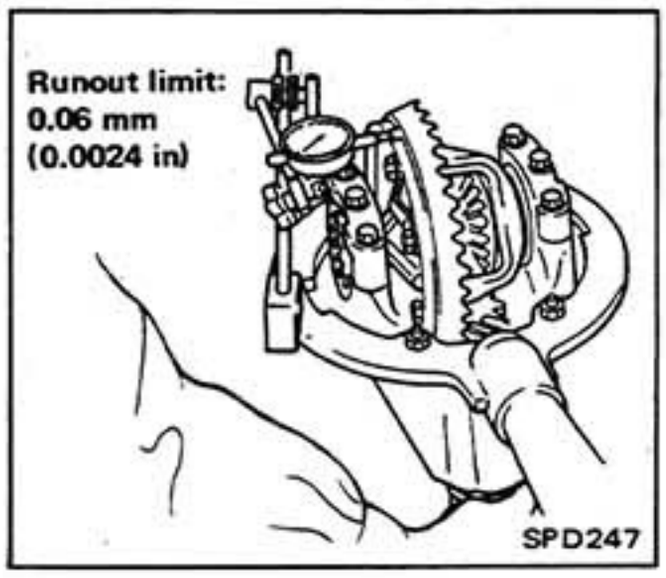
PRE-DISASSEMBLY INSPECTION

1. Check backlash of ring gear with a dial indicator at several points. If it is not within specification, adjust it referring to **Side Bearing Adjustment.**



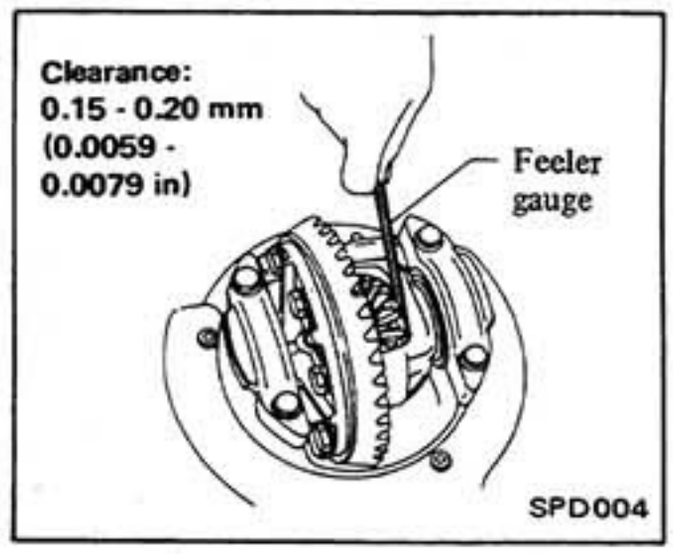
2. Check runout of ring gear with a dial indicator. If it is over specification, hypoid gear set or differential case should be replaced.

When backlash varies excessively in different places, the variance may have resulted from foreign matter caught between ring gear and differential case.



3. Check tooth contact. **Refer to Tooth Contact.**
4. Check backlash of side gear. Using a thickness gauge, measure clearance between side gear and differential case.

If it is not within specification, adjust it by selecting side gear thrust washer **(Refer to S.D.S.).**



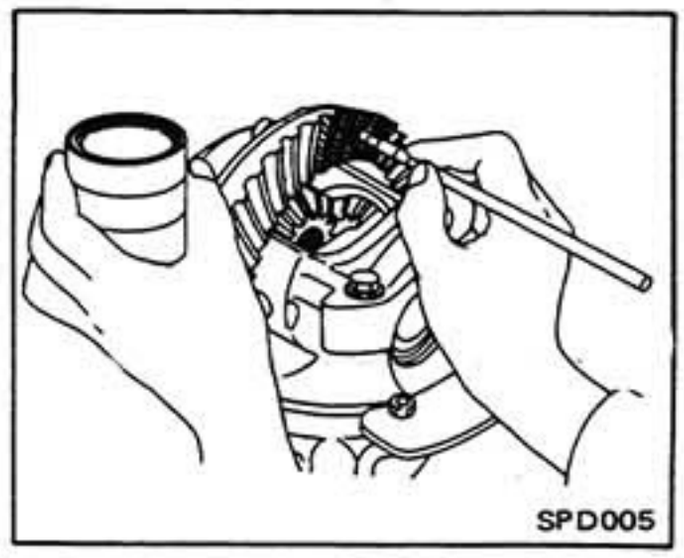
TOOTH CONTACT

Gear tooth contact pattern check is necessary to verify correct relationship between ring gear and drive pinion.

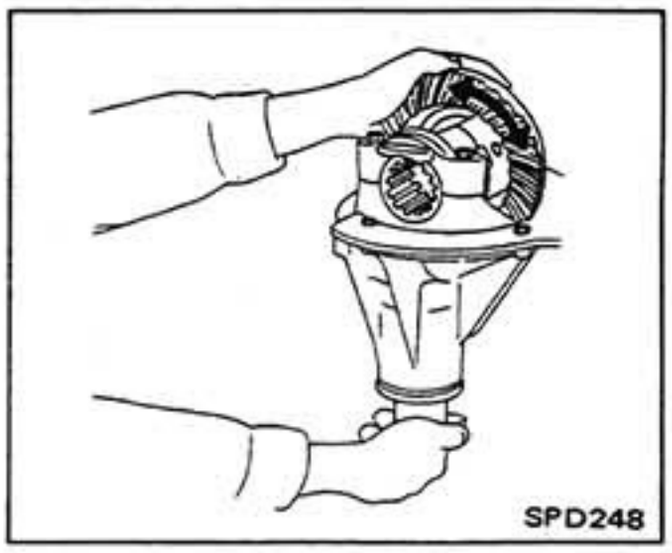
Hypoid gear set which are not positioned properly may be noisy, or have short life or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

Check

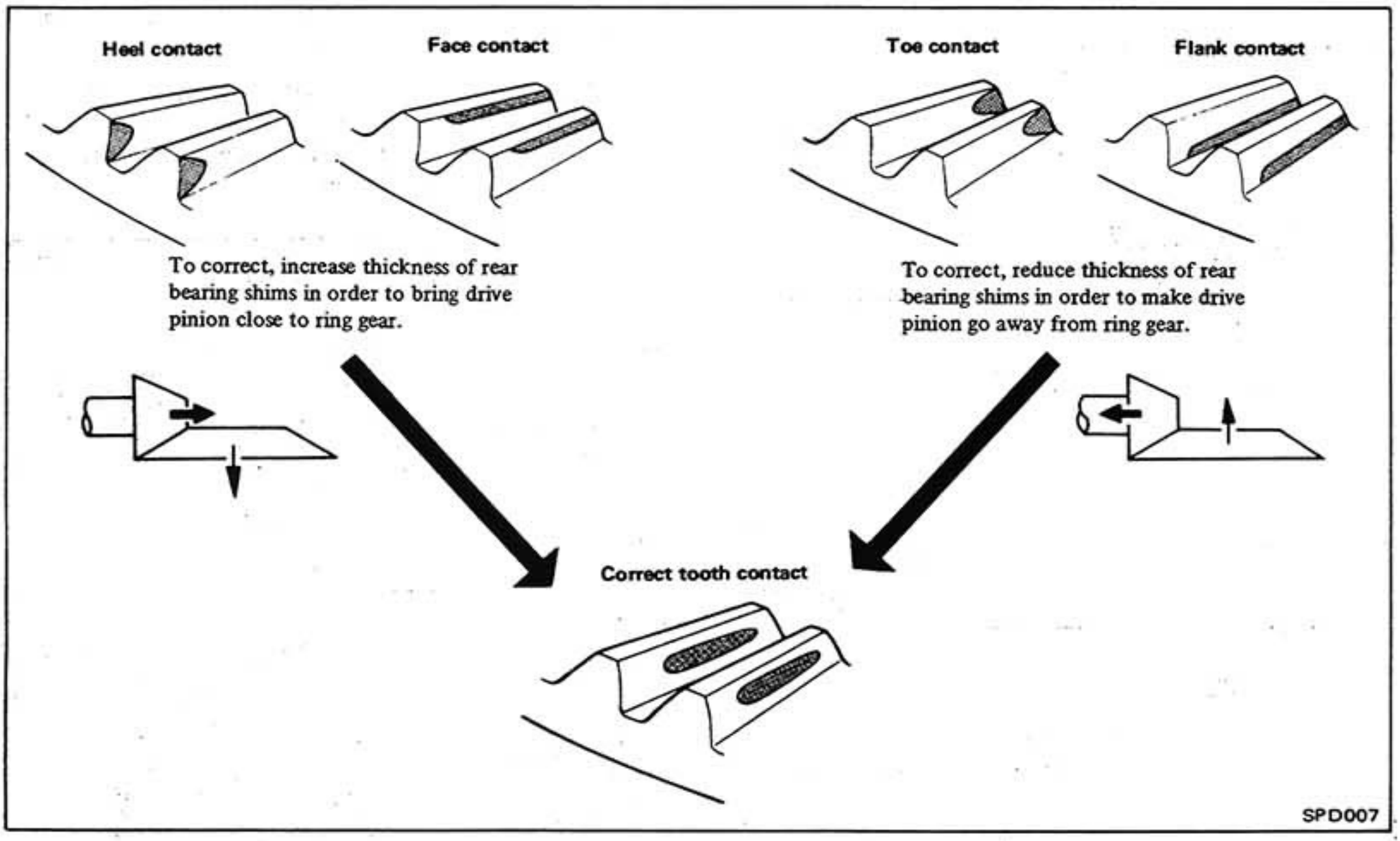
1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear **drive side.**



3. Hold companion flange steady by hand and rotate the ring gear in both directions.



Adjustment

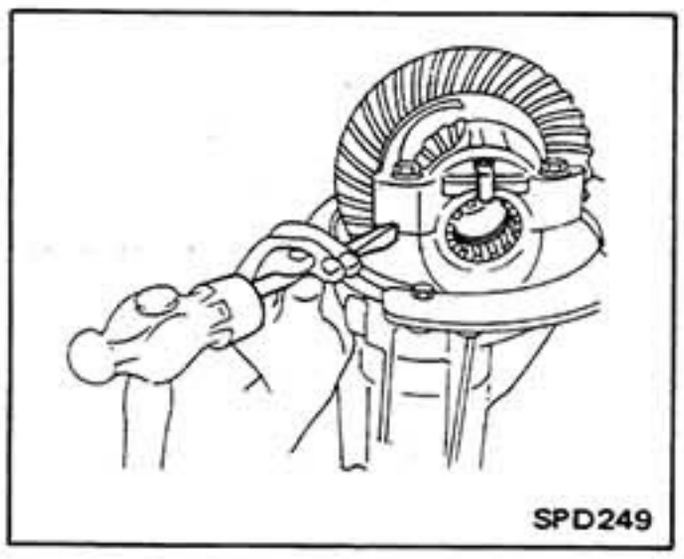


DISASSEMBLY

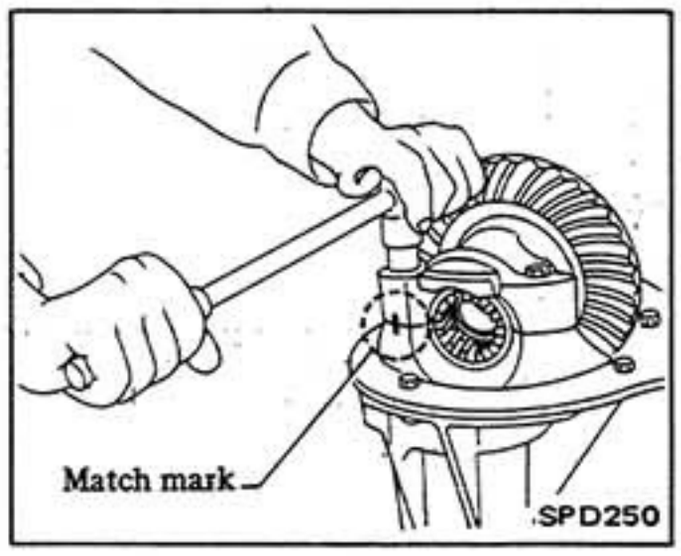
DIFFERENTIAL CARRIER

1. **Put match marks** on one side of side bearing cap with paint or punch to ensure that it is replaced in proper position during reassembly.

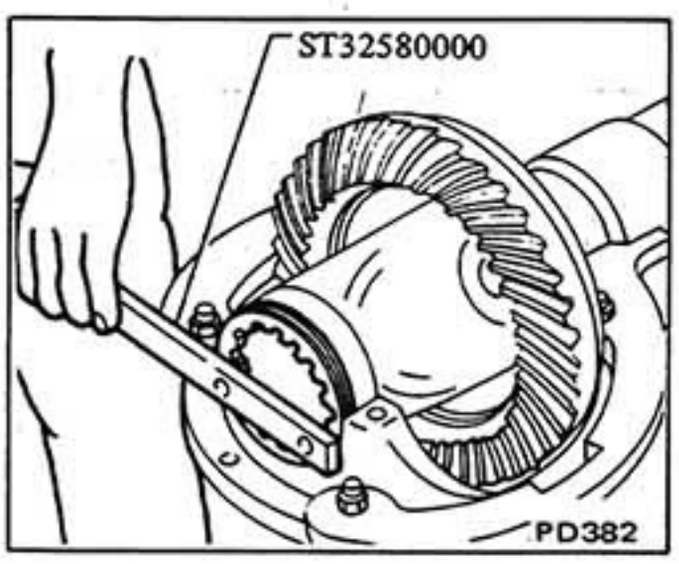
Bearing caps are line-board during manufacture and should be put back in their original places.



2. Remove side lock fingers and side bearing caps.

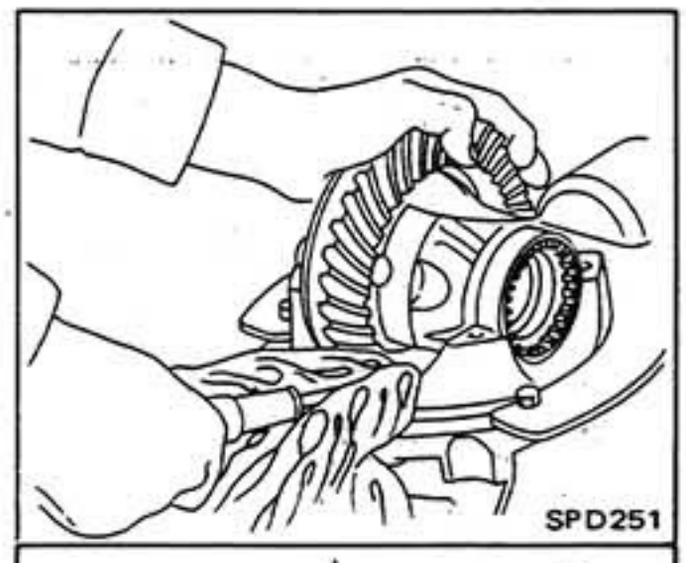


3. **Using Tool,** remove side bearing adjuster.

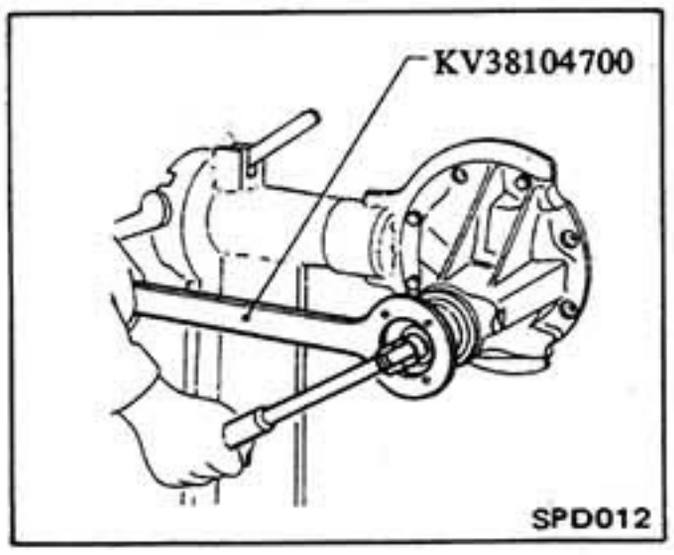


4. Using a pry bar, remove differential case assembly.

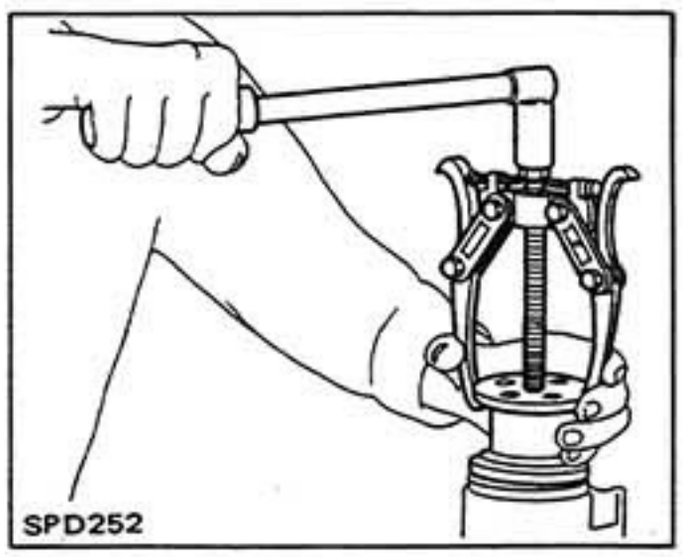
Be careful to keep the side bearing outer races together with inner race – do not mix them up.



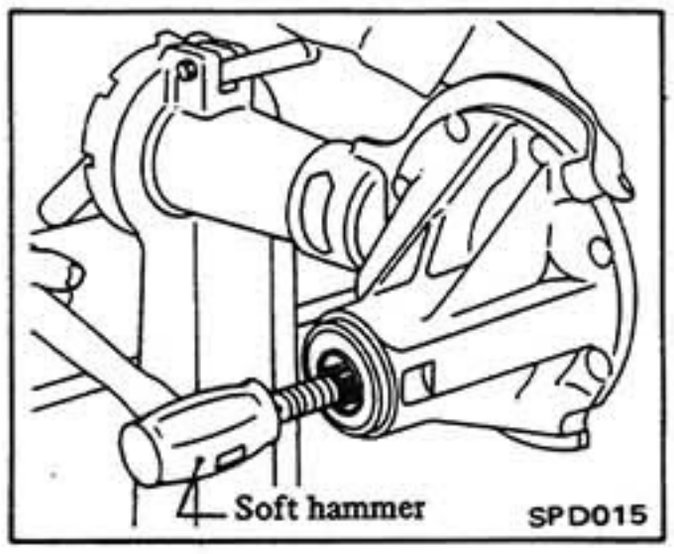
5. Remove drive pinion nut **using Tool.**



6. Remove companion flange with puller.



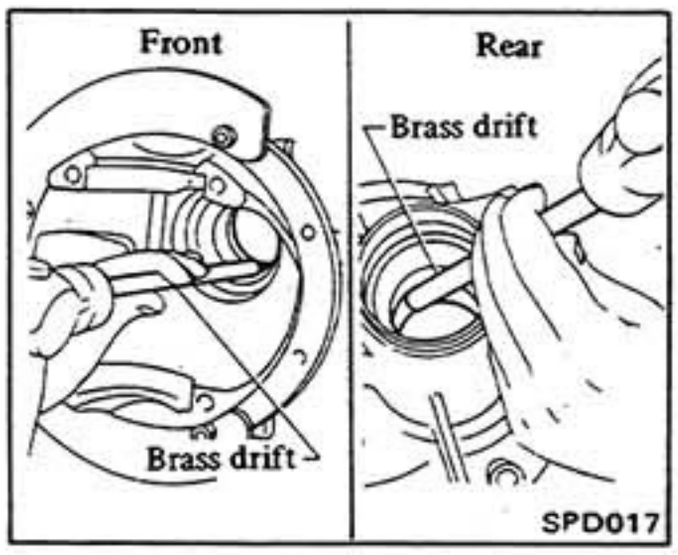
7. Remove drive pinion with soft hammer.



8. Remove oil seal by prying up with a large screwdriver, and remove front pinion bearing inner race.

Do this carefully, so as not to scratch seal bore with screwdriver. Cover end of screwdriver with a rag.

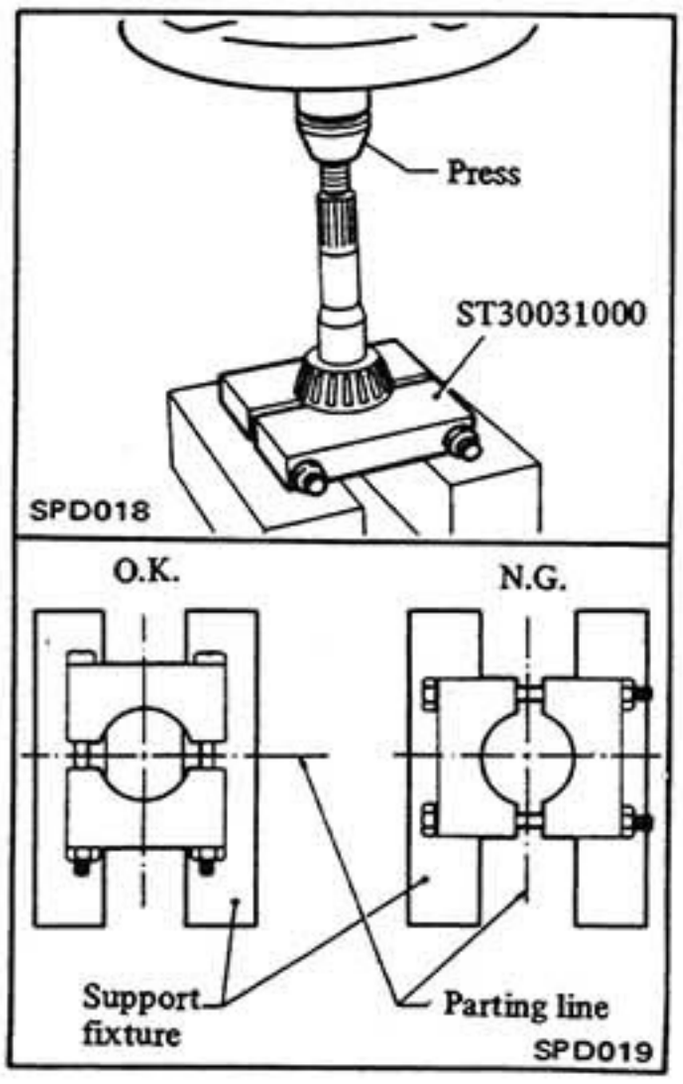
9. Remove pinion bearing outer race using a brass drift.



10. Remove collapsible spacer and washer from drive pinion.

11. Pull out rear bearing inner race **using Tool.**

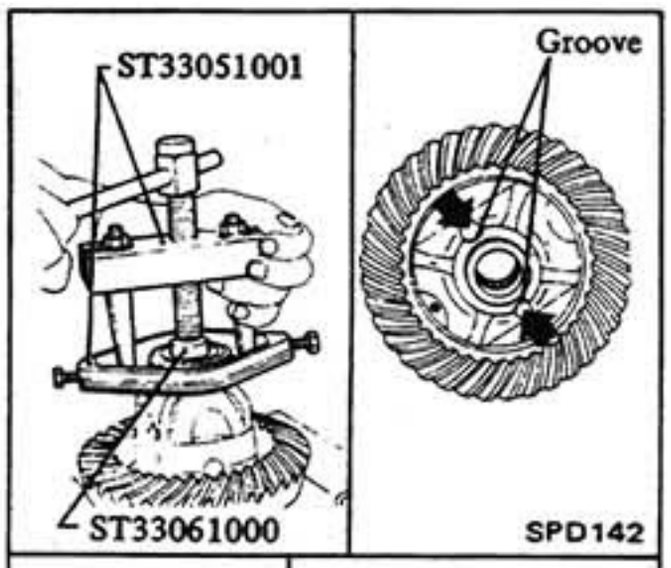
Care should be taken when setting Tool in press to make sure that parting line of Tool is a right angle to support fixture of press. This is to prevent bending Tool.

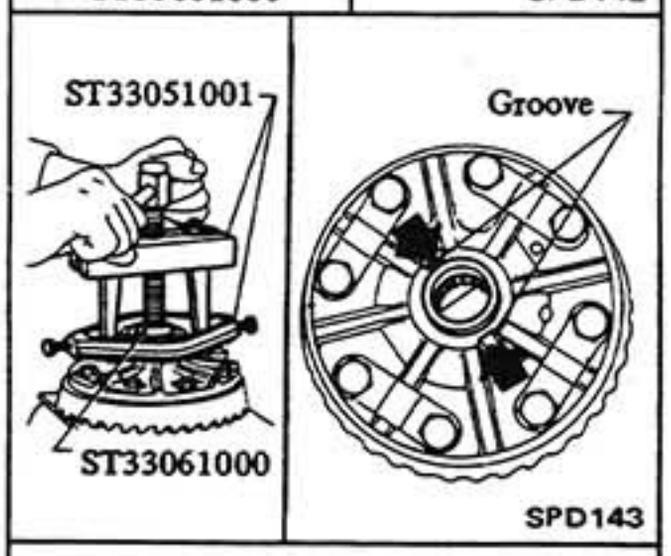


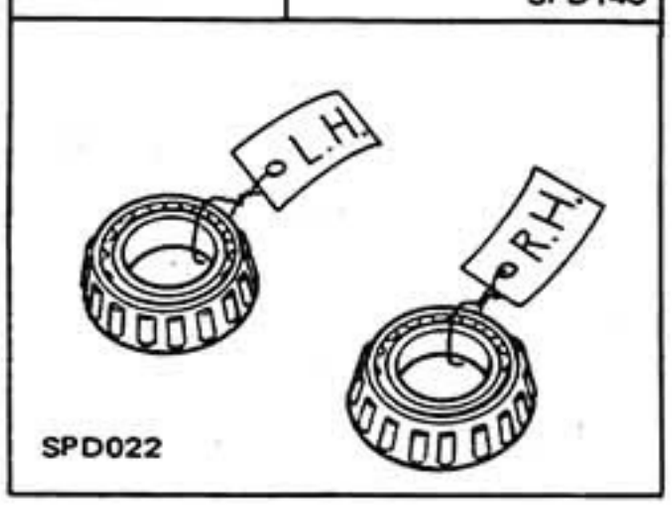
DIFFERENTIAL CASE

1. Remove side bearing inner race **using Tool.**

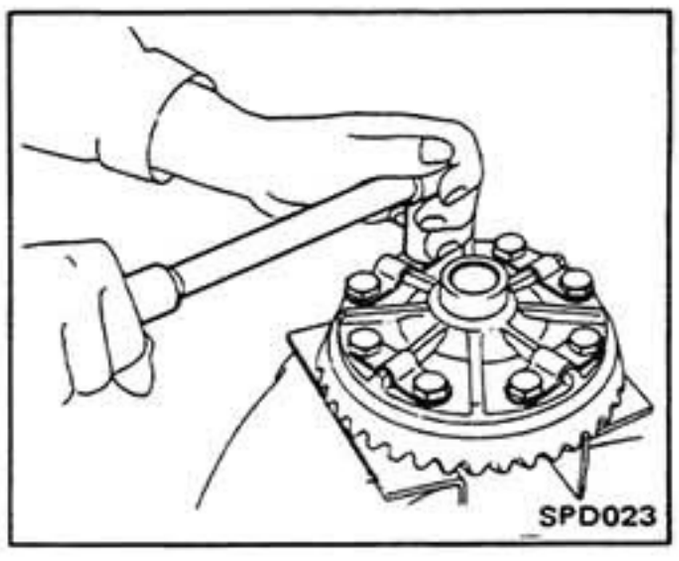
To prevent damage to bearing, engage puller paws with groove. Be careful not to confuse left and right hand parts.





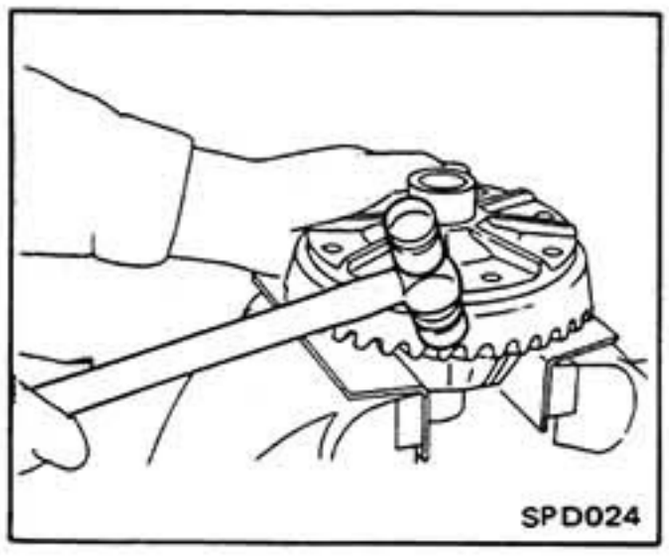


2. Remove ring gear by spreading out lock straps and loosening ring gear bolts in a criss-cross fashion.

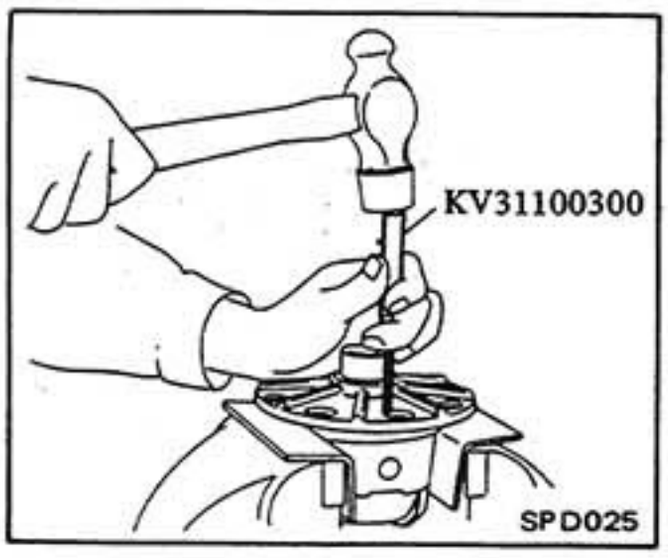


3. Tap ring gear off gear case using a soft hammer.

Tap evenly all around to keep ring gear from binding.

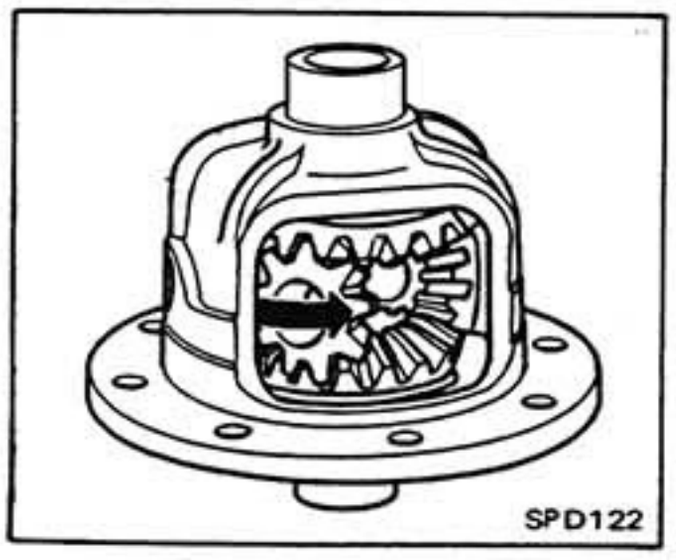

SPD024

4. Drive out pinion mate shaft lock pin, **using Tool from ring gear side.**



SPD025

5. Draw out pinion mate shaft, and rotate pinion mate gears out of the case and remove side gears and thrust washers.


SPD122

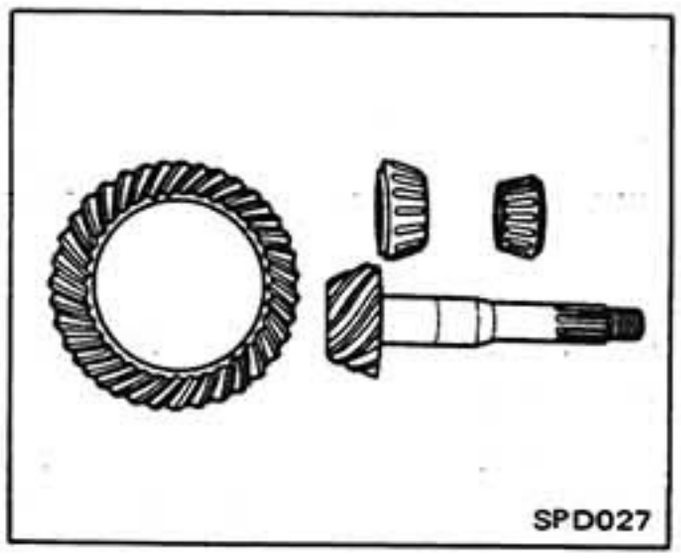
Put marks on gears and thrust washers so that they can be reinstalled in their original positions from which they were removed.

INSPECTION

1. Clean disassembled parts completely.

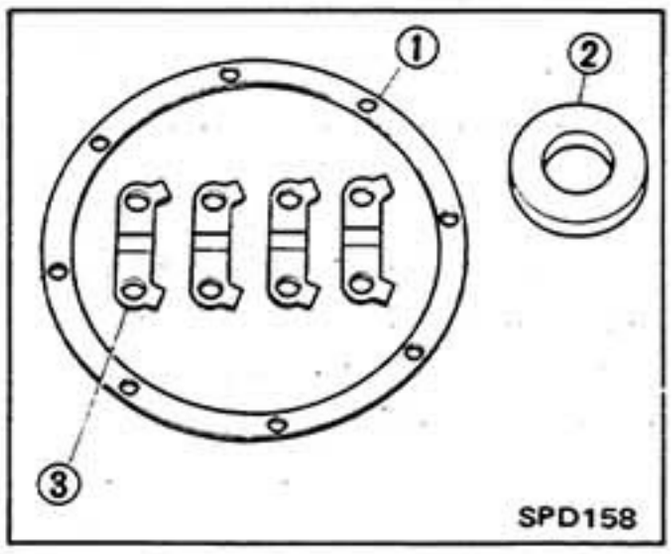
Repair or replace any damaged or faulty parts.

When replacing drive pinion or ring gear, replace with a new hypoid gear set.


SPD027

2. The following parts should be replaced by new ones each time they are removed.

① Gasket
② Front oil seal
③ Lock strap



SPD158

ASSEMBLY

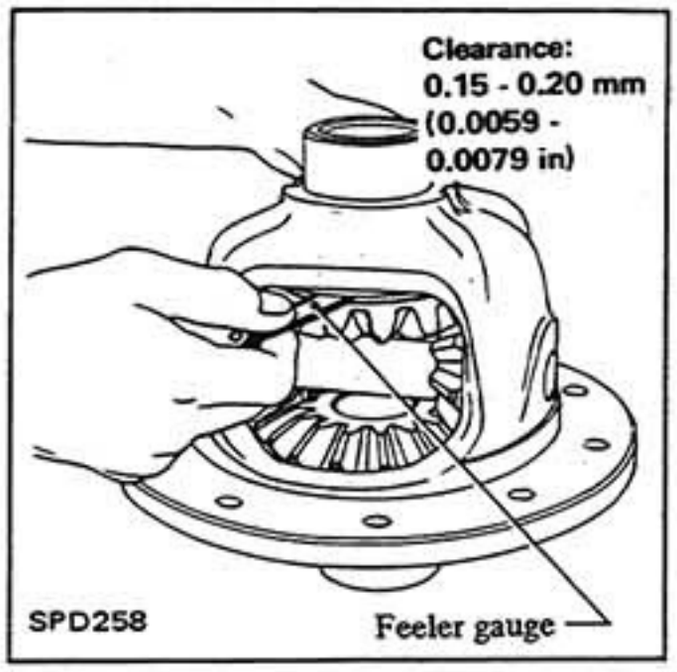
Assembly should be done in the reverse order of disassembly, while making any necessary inspections and adjustments.

PRECAUTION:

a. Arrange shims and washers to install them correctly.
b. Thoroughly clean the surfaces on which shims, washers bearings and bearing caps are installed.
c. Apply gear oil when installing bearings.
d. Pack recommended multi-purpose grease into cavity between lips when fitting oil seal.

DIFFERENTIAL CASE

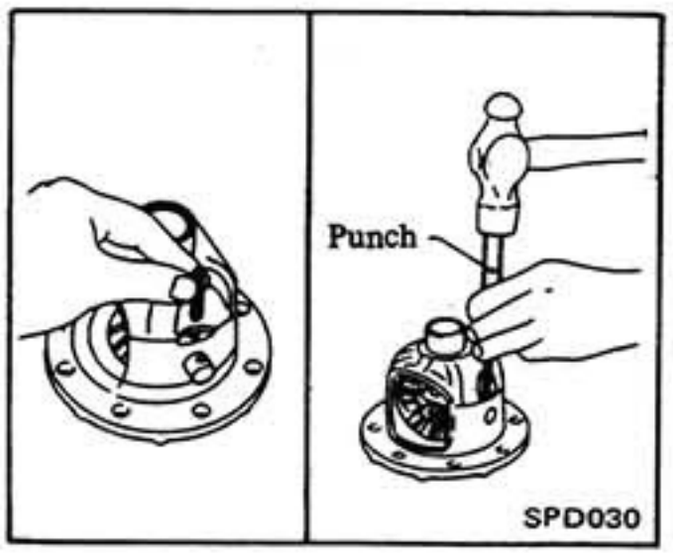
1. Install pinion mate gears, side gears, thrust washers and thrust block into differential case.
2. Fit pinion mate shaft.
3. Adjust clearance between rear face of side gear and thrust washer by selecting side gear thrust washer **(Refer to S.D.S.).**



SPD258

4. Install pinion mate shaft lock pin using a punch.

Make sure lock pin is flush with case.

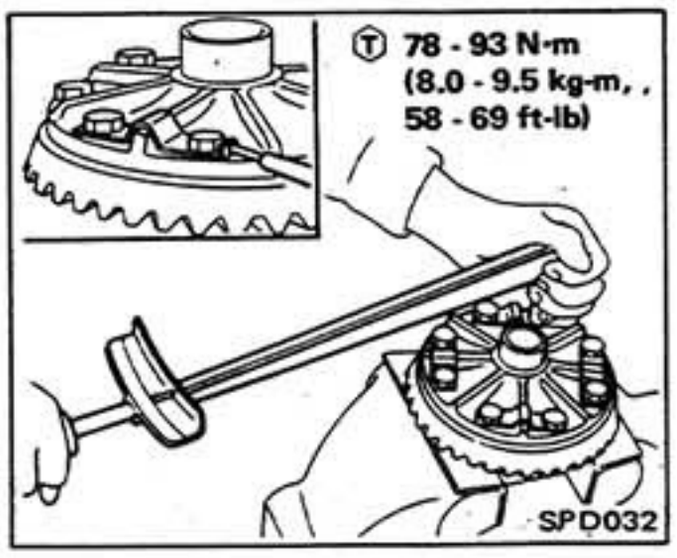


SPD030

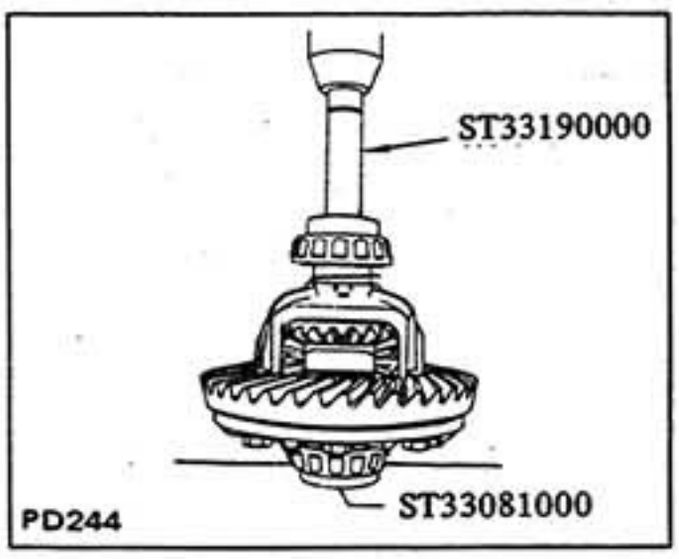
5. Place ring gear on differential case and install **new lock straps** and bolts.

Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

Then bend up lock straps to lock the bolts in place.

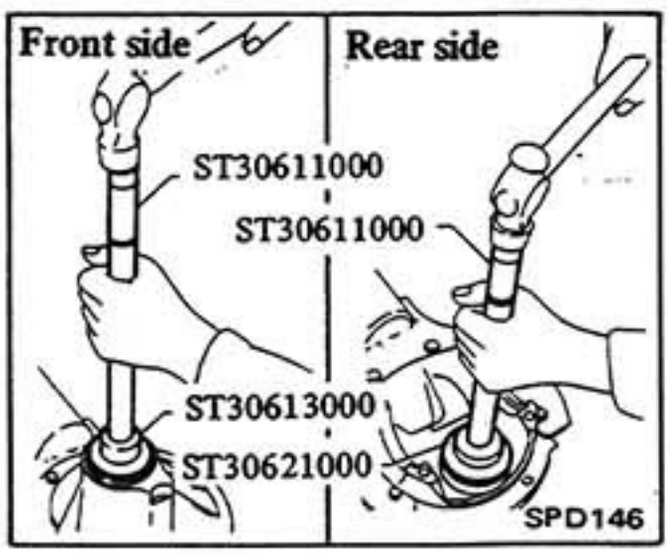


6. Press fit side bearing inner race into differential case, **using Tool.**



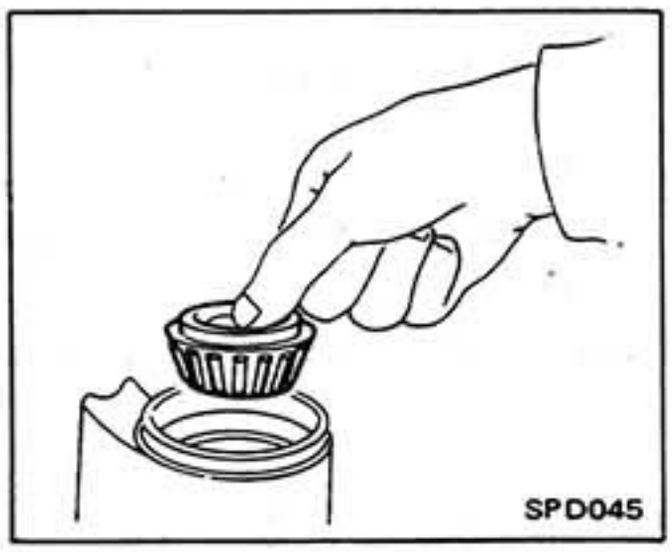
DIFFERENTIAL CARRIER

1. Press fit front and rear bearing outer races **using Tools.**



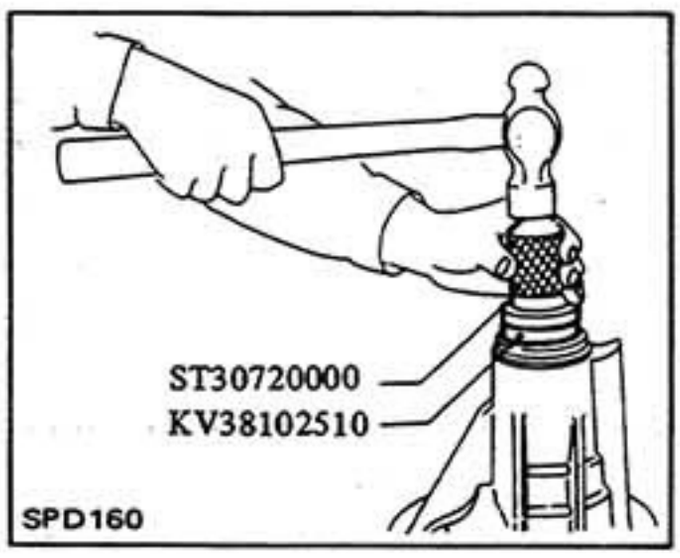
2. Adjust pinion height.
Refer to Pinion Height Adjustment.

3. **Lubricate** front bearing with gear oil and place it in gear carrier.

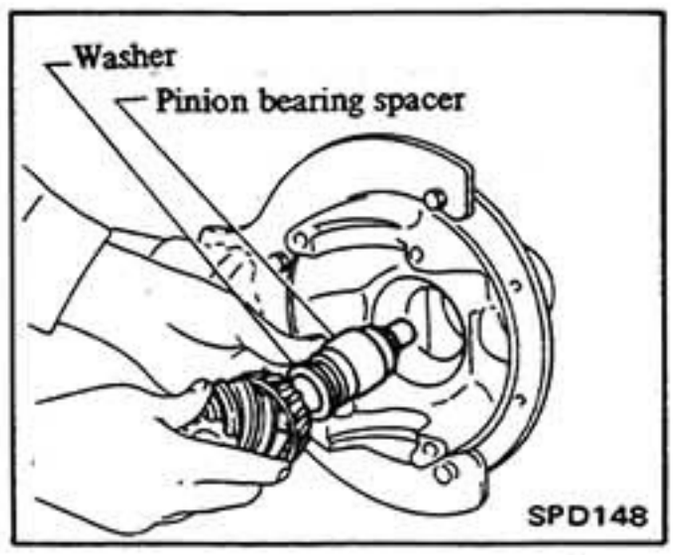


4. **Using Tool,** carefully fit a **new** oil seal into carrier.

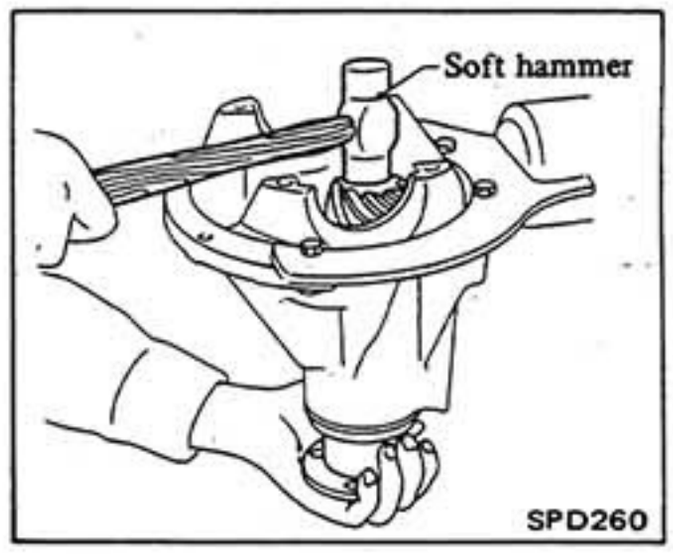
Make sure oil seal is flush with end of carrier and apply multi-purpose grease into cavity between lips.



5. Place a washer and a pinion bearing spacer on drive pinion and **lubricate** rear bearing with gear oil, and insert it in gear carrier.

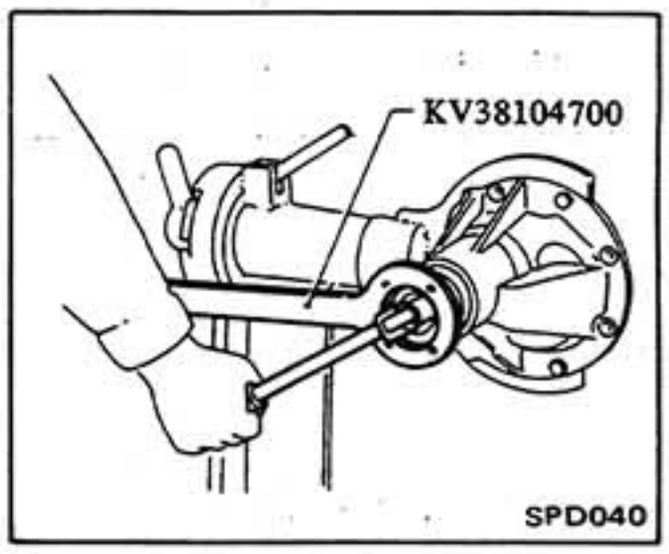


6. Install companion flange and hold it firmly. Insert drive pinion into companion flange by tapping its head with a soft hammer.



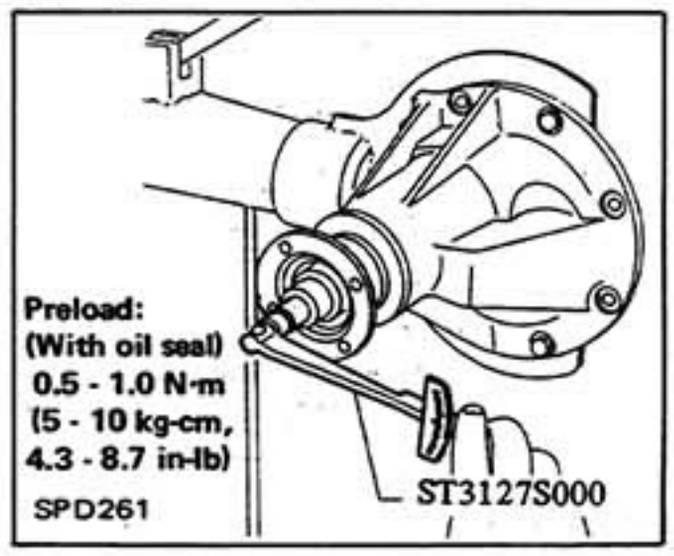
7. Hold companion flange with Tool and temporarily tighten pinion nut, until there is no axial play.

Ascertain that threaded nut is free from oil or grease.



8. Tighten pinion nut by degrees to the specified preload while checking the preload **with Tools.**

When checking preload, turn drive pinion in both directions several times to set bearing rollers.

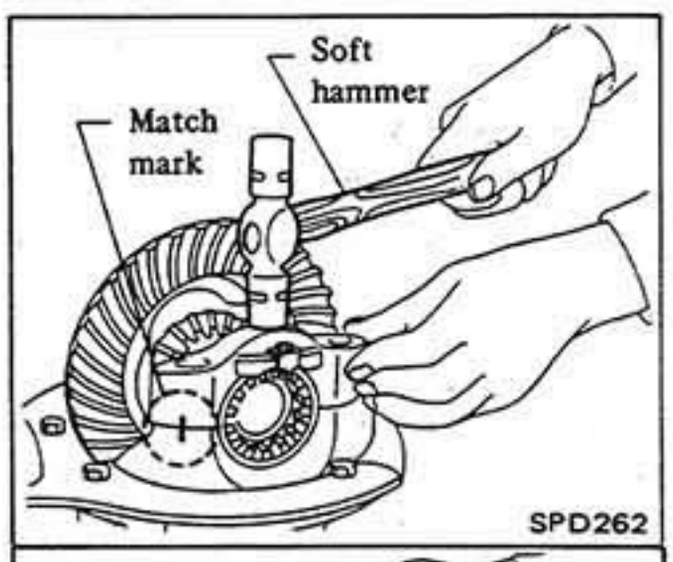


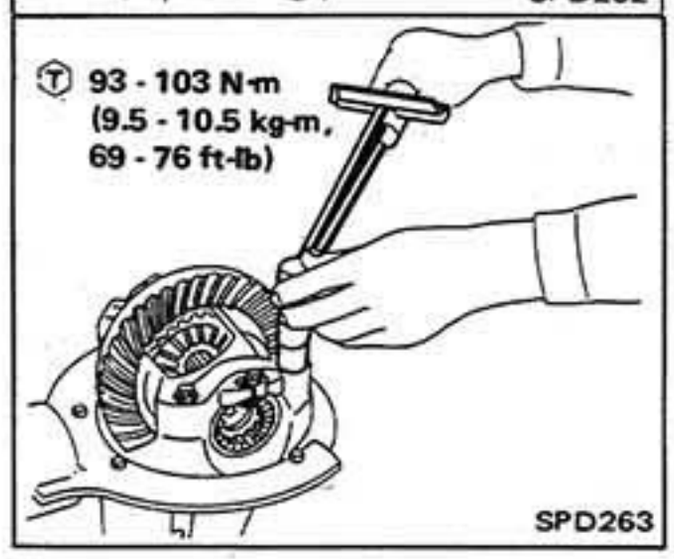
T : **Drive pinion nut**
196 - 245 N·m
(20 - 25 kg-m,
145 - 181 ft-lb)

9. Install differential case assembly and side bearing outer races into differential carrier, and install side bearing cap and side bearing adjusters. **Refer to Side Bearing Adjustment.**

Tap on the cap with a soft hammer to settle it in the carrier.

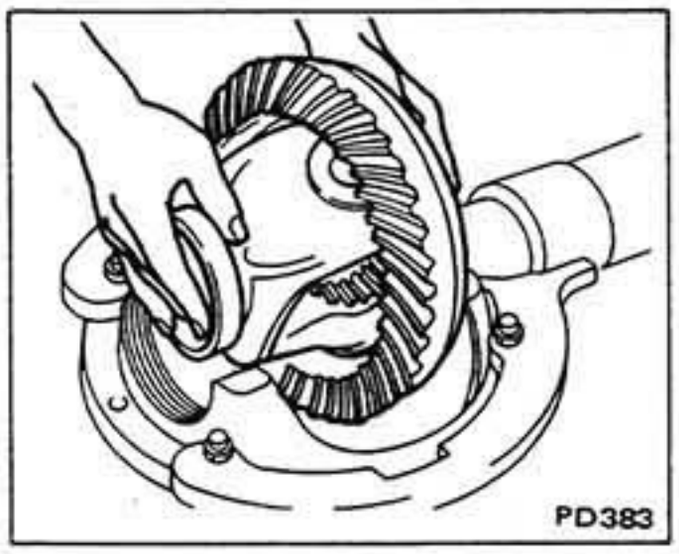
The bearing cap should be installed with the marks put at disassembly aligned.



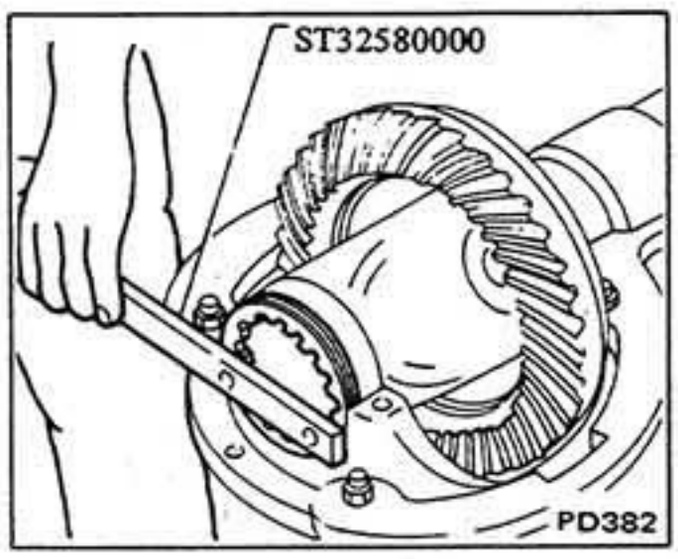


1. Install differential case to gear carrier together with side bearing outer races.

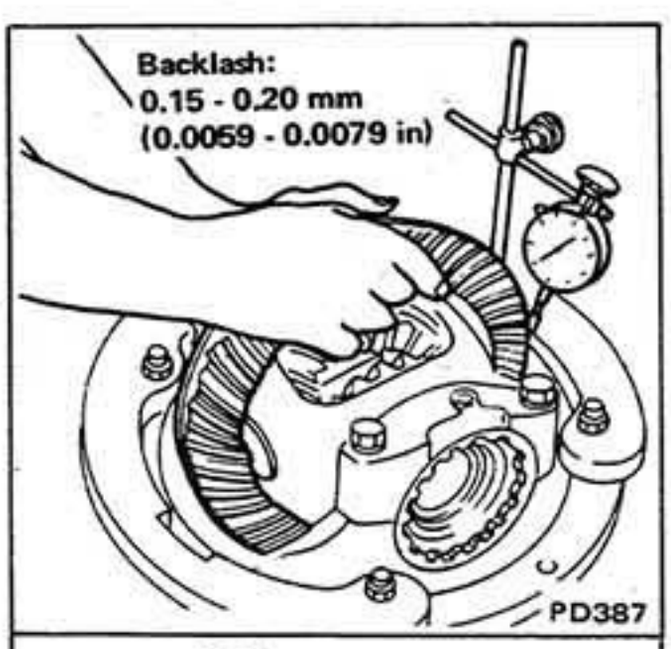
Care should be taken not to confuse the right and left sides of side bearing outer races.

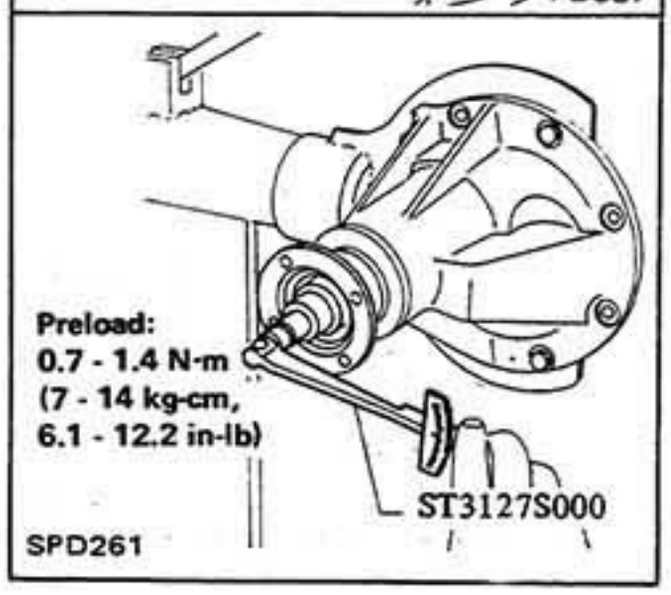


2. Position side bearing adjusters on gear carrier with threads properly engaged; screw in adjusters lightly at this stage of assembly.



4. Tighten both right and left side bearing adjusters alternately and measure ring gear backlash and total preload at the same time. Adjust right and left side bearing adjusters by tightening them alternately so that proper ring gear backlash and total preload can be obtained.

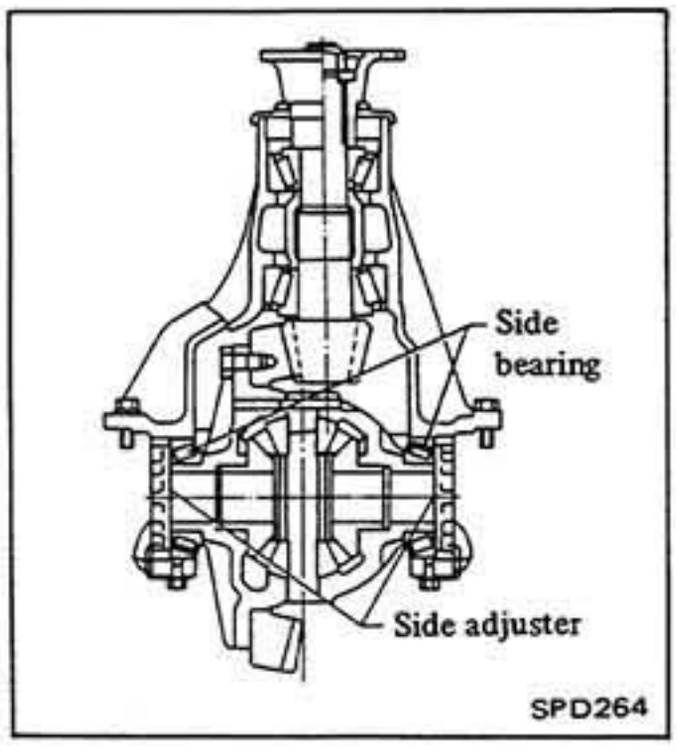




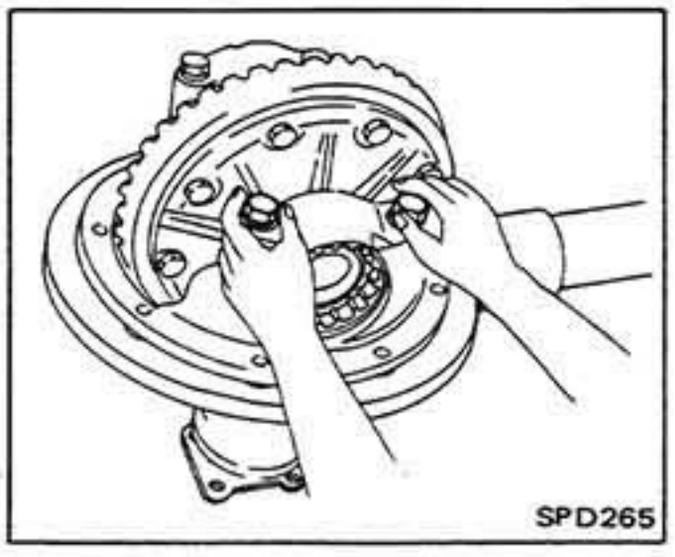
Prior to measuring preload, lightly tap around housing to locate bearings correctly.

ADJUSTMENT

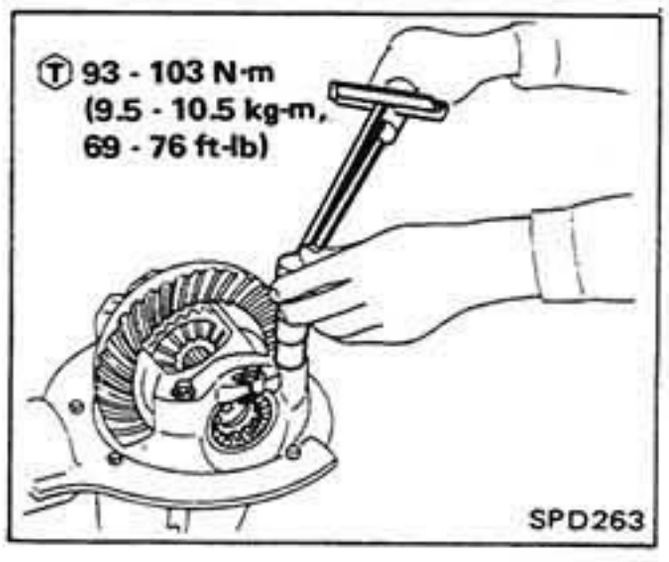
SIDE BEARING ADJUSTMENT



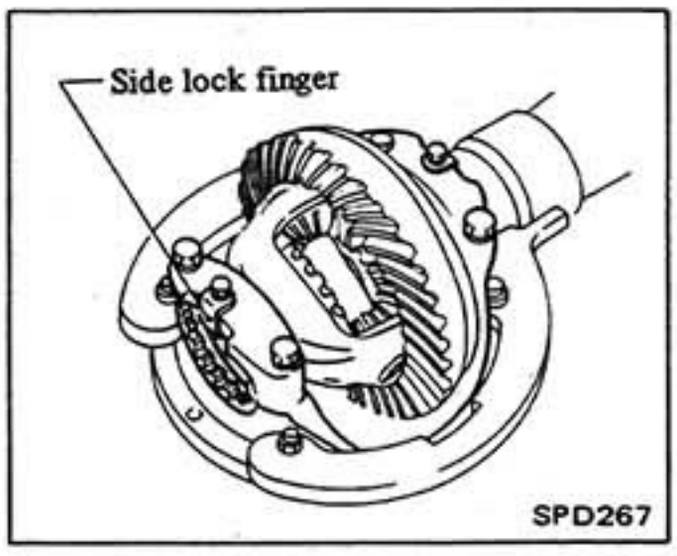
3. Align the marks on side bearing cap with these on gear carrier, and install side bearing cap on carrier. Screw in side bearing cap bolt, **but do not tighten at this point to allow further tightening of side bearing adjusters.**



5. Tighten side bearing cap bolts.



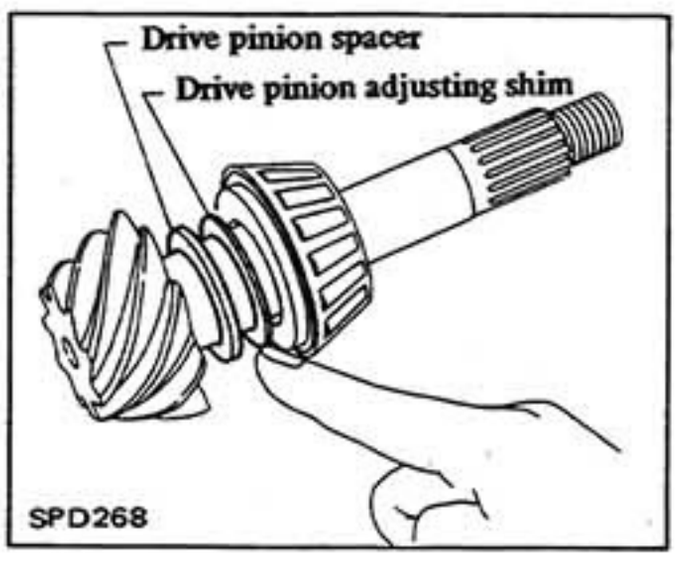
6. Install side lock finger in place and bend down its locking tab against the groove in side bearing adjuster to prevent rotation during operation.



PINION HEIGHT ADJUSTMENT

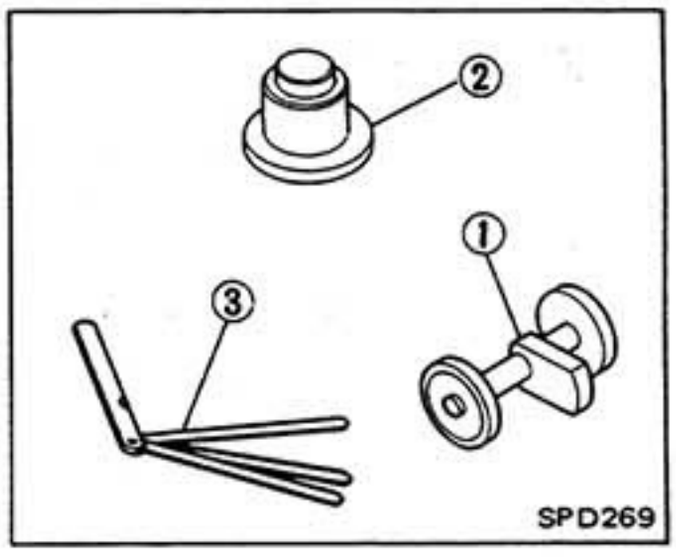
When replacing the hypoid gear set, drive pinion bearing or gear carrier, be sure to adjust the pinion height.

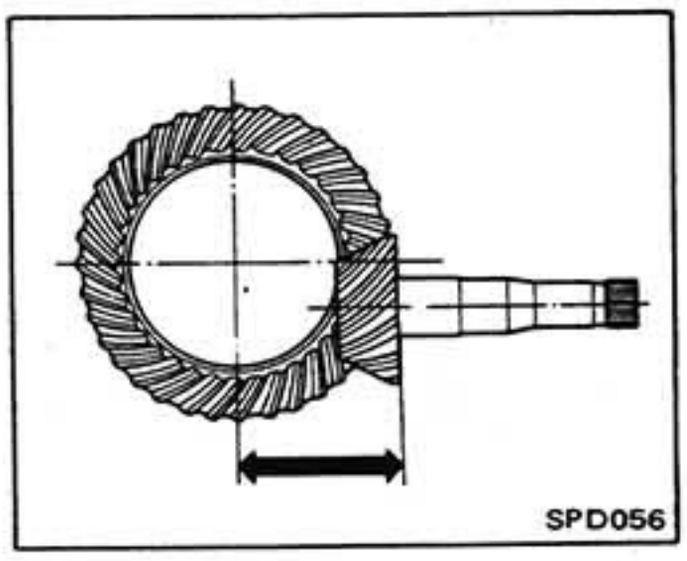
Adjustment of the pinion height can be made by adjusting shim and spacer to be installed between the rear bearing inner race and the drive pinion head.

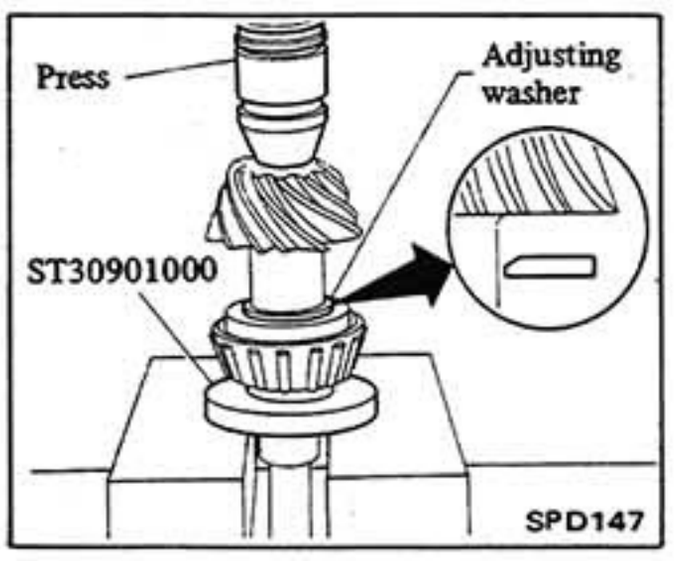


– Required Tools –

① Height Gauge (ST31251000)
② Dummy Shaft (ST31181001)
③ Feeler Gauge





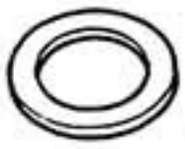
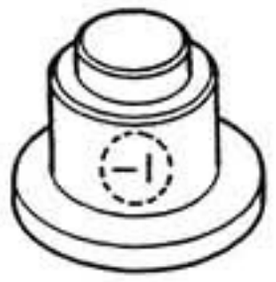
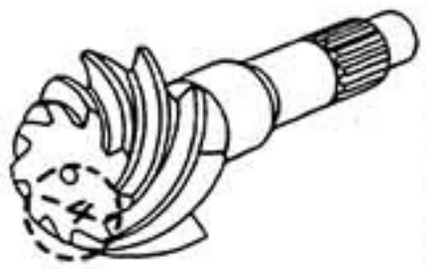


1. Thickness of washer can be calculated by following equation.

$$T = N - [(H - D' - S) \times 0.01] + 0.55$$

CAUTION:
To avoid any confusion while calculating, it is necessary to stay with the metric system. If you measure anything in inches, the result should be converted to the metric system.

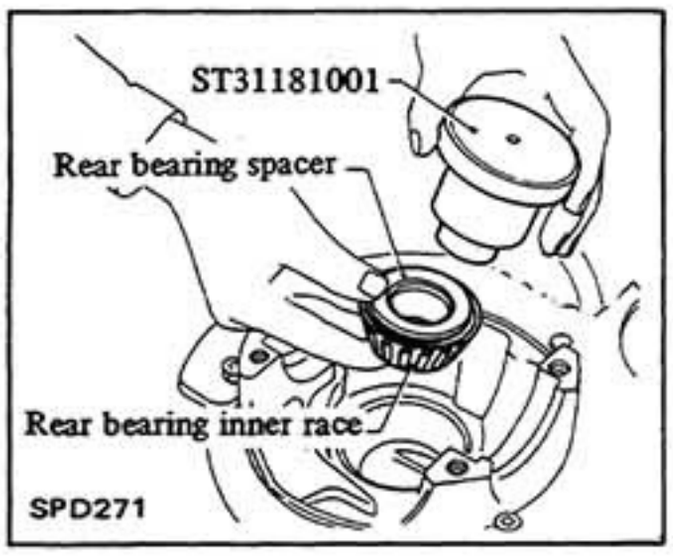
Where:

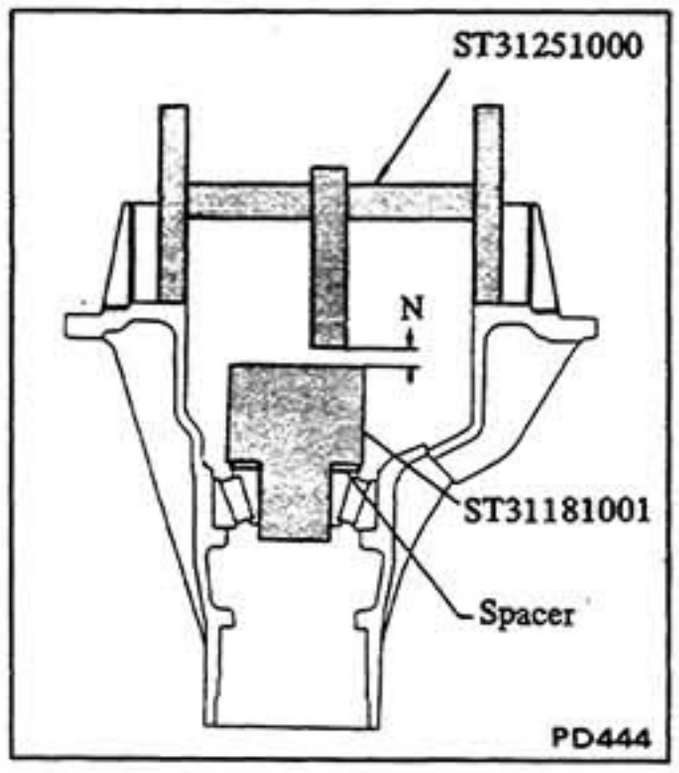
T = mm		D′ =	
N = mm		S =	
H =			

H, D' and S are dimensional variations in a unit of 1/100 mm against each standard value.

SPD270

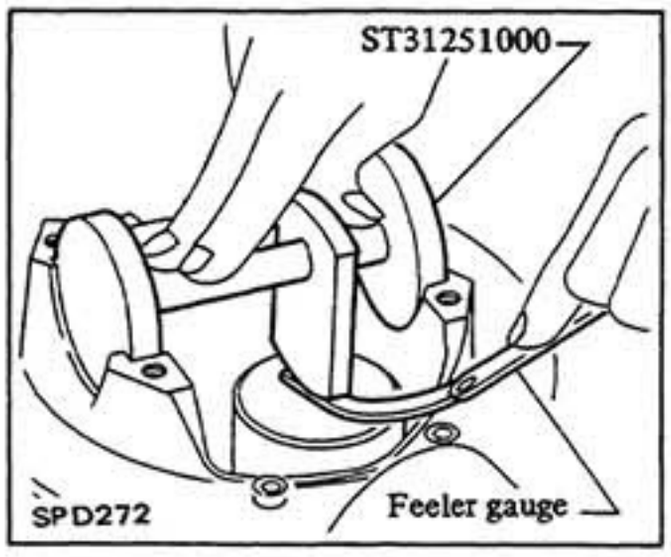
2. Assemble dummy shaft and rear bearing spacer on rear bearing inner race, and fit it into carrier.





3. Attach Height Gauge to carrier.

Using a feeler gauge, measure the clearance between the height gauge tip and the dummy shaft face.



4. Substitute these values into the equation to calculate the thickness of the washer.

If values signifying H, D' and S are not given, regard them as zero and calculate.

After assembly, check to see that tooth contact is correct. If not, re-adjust.

Example:

N = 0.31
H = 2
D′ = –1
S = 0

T = N – [(H – D′ – S) × 0.01] + 0.55
= 0.31 – [(2 – (–1) –0) × 0.01] + 0.55

(1) H 2
–D′ ..... – (–1)
3
–S ..... –0
3

(2) 3
× 0.01
0.03

(3) N 0.31
–0.03
0.28

(4) 0.28
+0.55
0.83

∴ T = 0.83

5. Select the proper shims **(Refer to S.D.S.).**

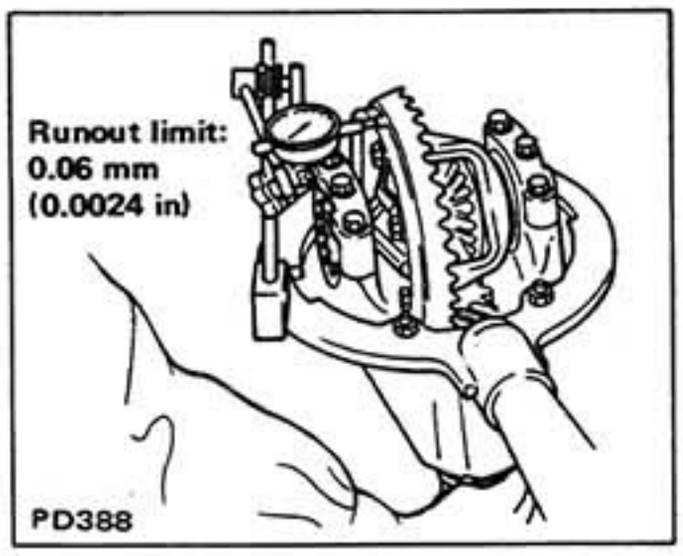
If you cannot find the desired thickness of shims, use shims so that the total thickness is the closest to the calculated value.

Example:

Calculated value T = 0.83 mm			
Used shims			
Thickness		Quantity	
0.40	×	1	= 0.40
0.45	×	1	= 0.45
Total thickness			0.85 mm

FINAL VERIFICATION

1. Check runout of ring gear with a dial indicator.



If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.

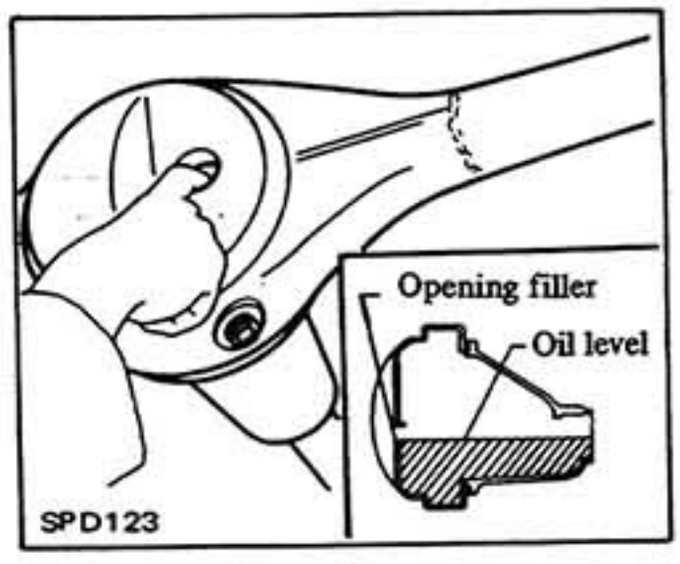
If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

2. Install the differential carrier in the vehicle **(Refer to Section RA for installation).**

Gasket should be replaced by new one each time the differential carrier is removed.

Then fill with gear oil.

With limited slip differentials, use Gear Oil Hypoid L.S.D. (Service part number: KL430-14002-03).

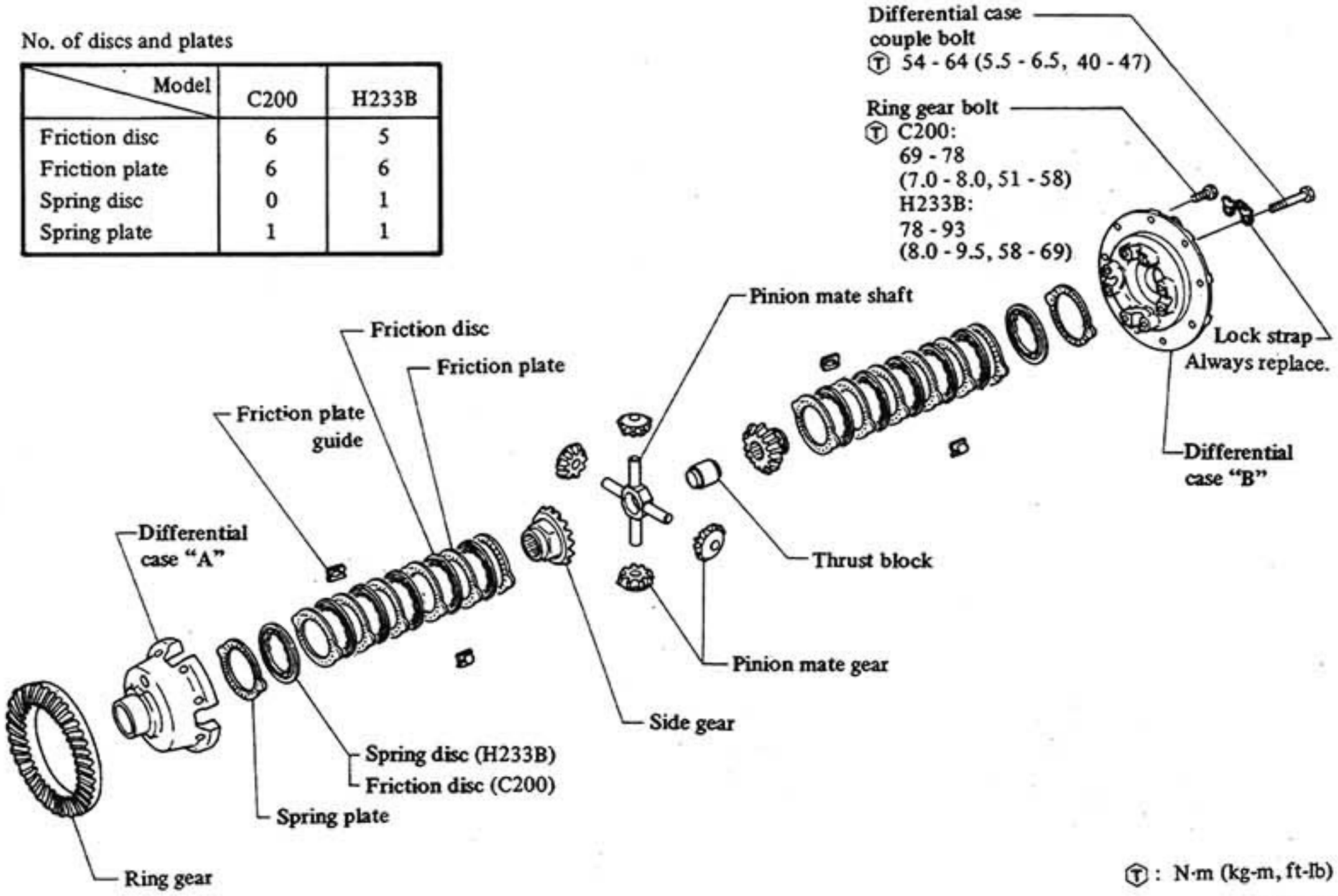


Ⓣ : Differential carrier fixing nut
27 - 36 N·m
(2.8 - 3.7 kg-m,
20 - 27 ft-lb)
Drain and filler plugs
59 - 98 N·m
(6 - 10 kg-m,
43 - 72 ft-lb)
Gear oil capacity
2.0 liters
(3-1/2 Imp pt)

LIMITED SLIP DIFFERENTIAL

No. of discs and plates

Model	C200	H233B
Friction disc	6	5
Friction plate	6	6
Spring disc	0	1
Spring plate	1	1



CAUTION:
When jacking up vehicle equipped with this unit, be sure to jack up both rear wheels before starting engine.

PREPARATION FOR DISASSEMBLY

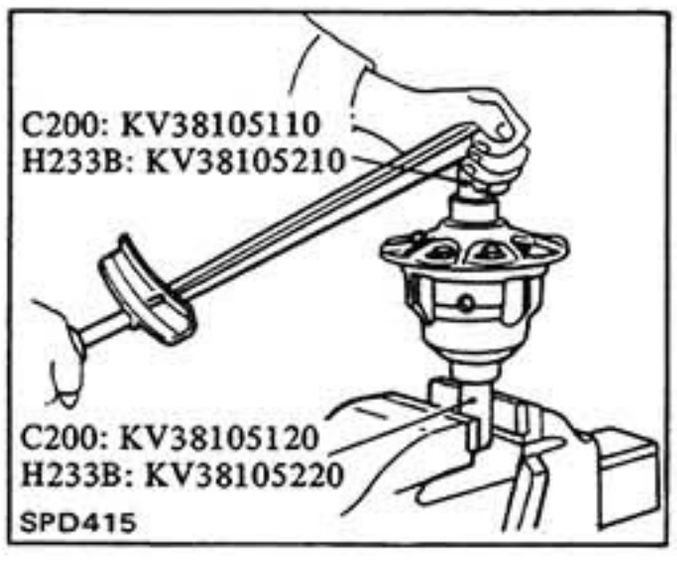
REMOVAL, PRE-DISASSEMBLY INSPECTION AND TOOTH CONTACT

Refer to Differential Carrier (Final drive).

CHECKING PRELOAD

Check the limited slip differential for preload using **Tool.**

Preload:
C200
147 - 216 N·m
(15 - 22 kg-m,
108 - 159 ft-lb)
H233B
294 - 392 N·m
(30 - 40 kg-m,
217 - 289 ft-lb)



DISASSEMBLY

DIFFERENTIAL CARRIER

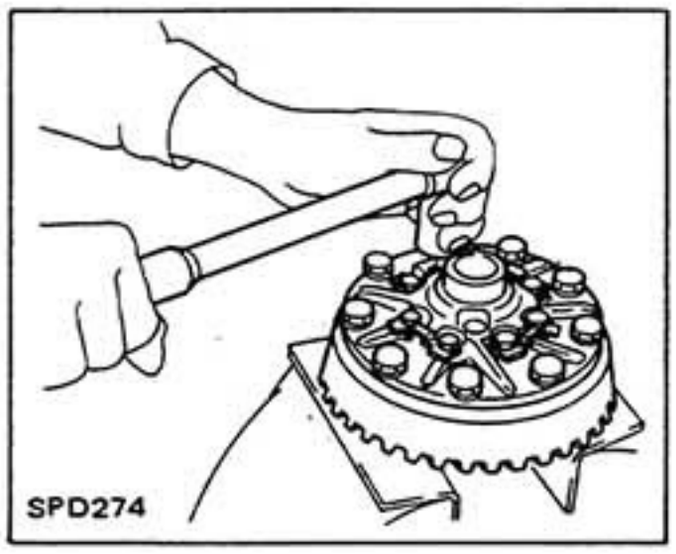
Refer to Differential Carrier (Final drive).

DIFFERENTIAL CASE

1. Remove side bearing inner race **using Tool.**

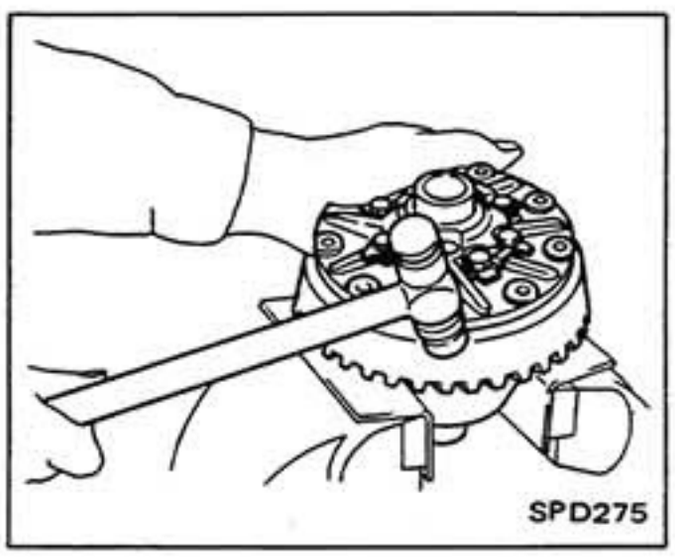
Refer to Differential Carrier (Final drive) for disassembly.

2. Remove ring gear by spreading out lock straps (H233B only) and loosening ring gear bolts in a criss-cross fashion.

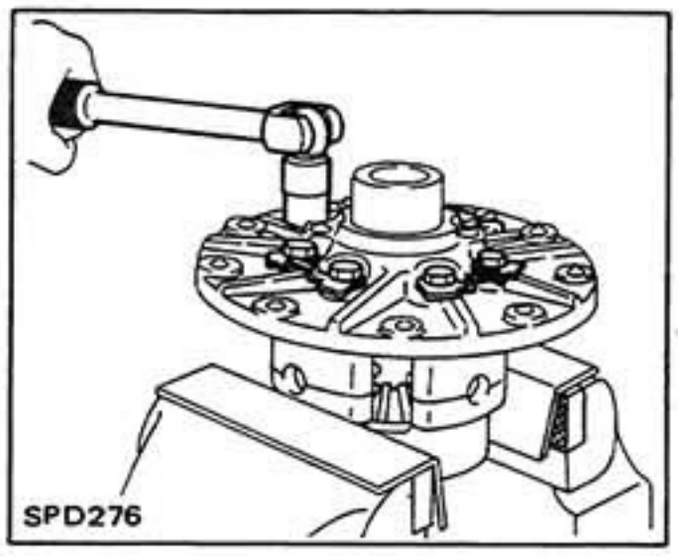

SPD274

3. Tap ring gear off gear case using a soft hammer.

Tap evenly all around to keep ring gear from binding.

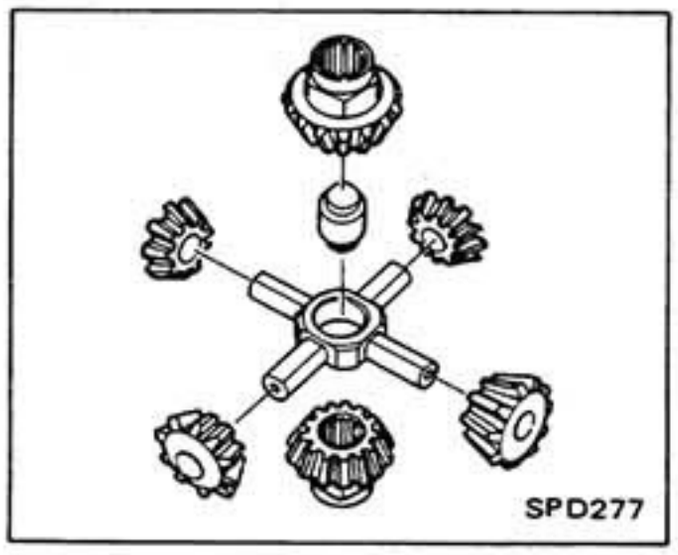

SPD275

4. Spread out lock straps. Then loosen differential case couple bolts and remove differential case "B" on ring gear side.


SPD276

5. Separate each part.

Put marks on gears so that they can be reinstalled in their original positions from which they were removed.

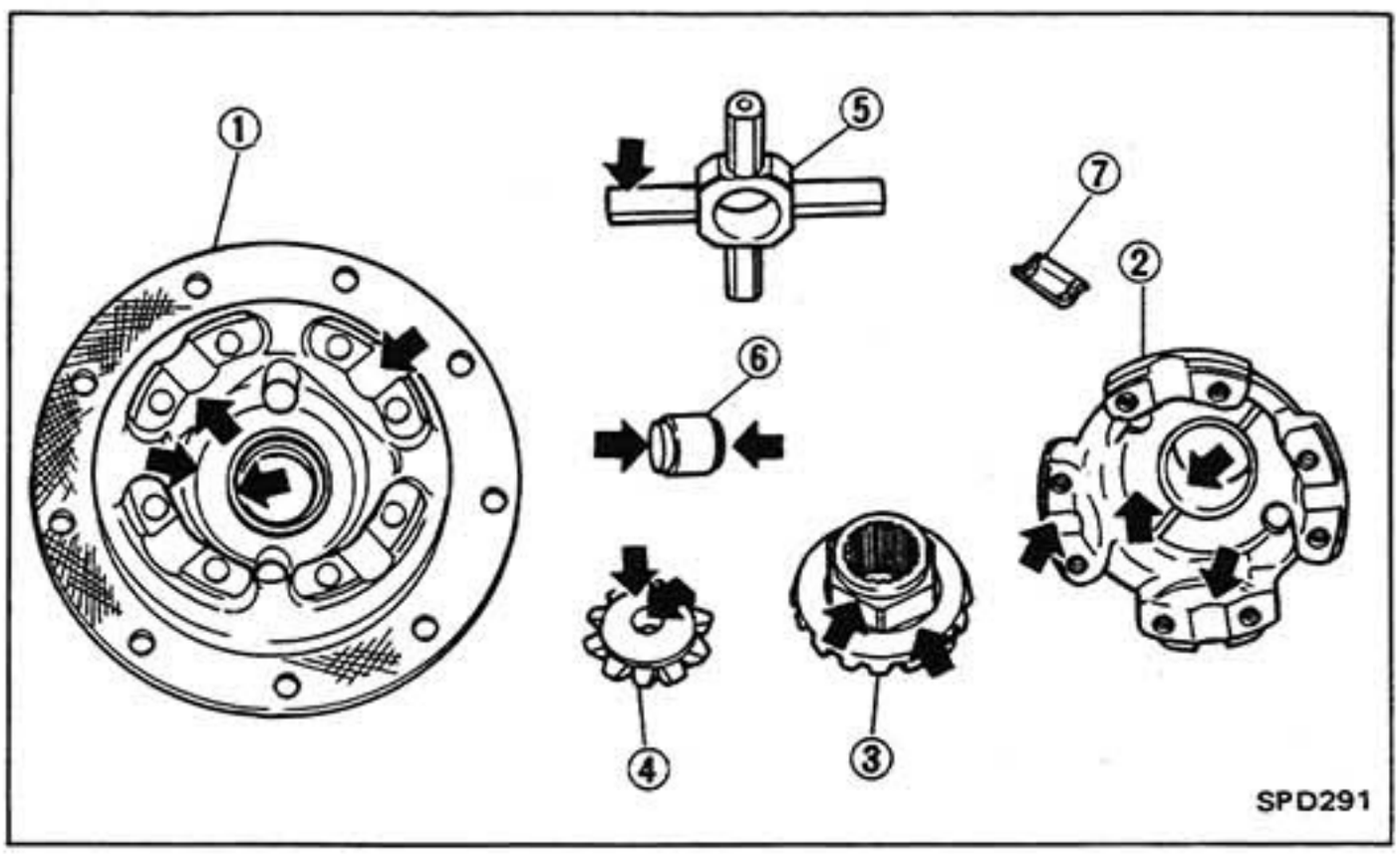

SPD277

INSPECTION

CONTACT SURFACES

1. Clean the disassembled parts in suitable solvent and blow dry with compressed air.
2. If following surfaces are found with burrs or scratches, smooth with oil stone.
   ① Differential case "A" (Ring gear side)
   ② Differential case "B" (Opposite side of ring gear)
   ③ Side gear
   ④ Pinion mate gear
   ⑤ Pinion mate shaft
   ⑥ Thrust block
   ⑦ Friction plate guide

Repair or replace damaged or faulty parts.

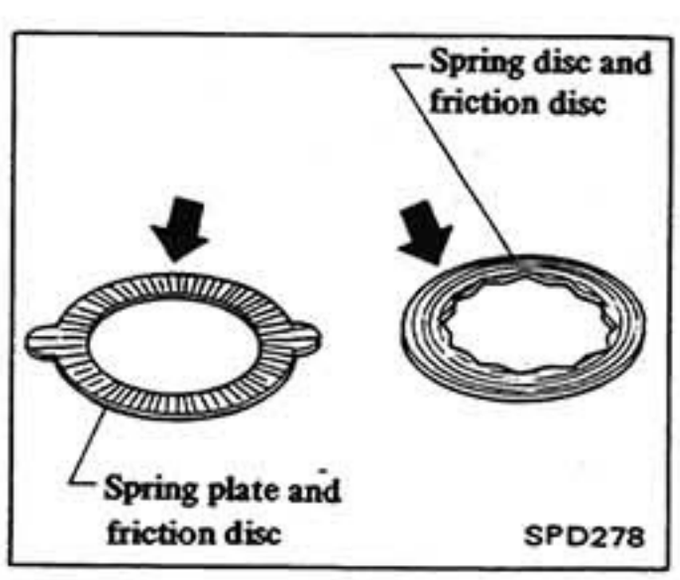


SPD291

DISC AND PLATE

1. Clean the discs and plates in suitable solvent and blow dry with compressed air.
2. Inspect each disc and plate for wear, nicks or burrs.

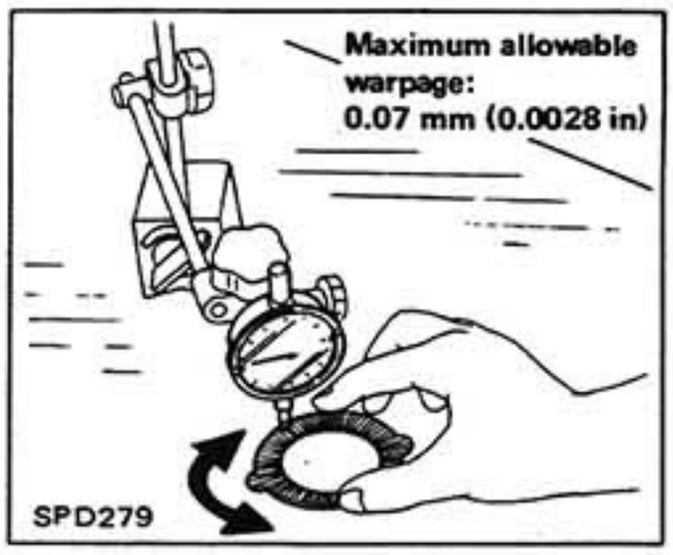
Replace with new parts if worn or damaged.



SPD278

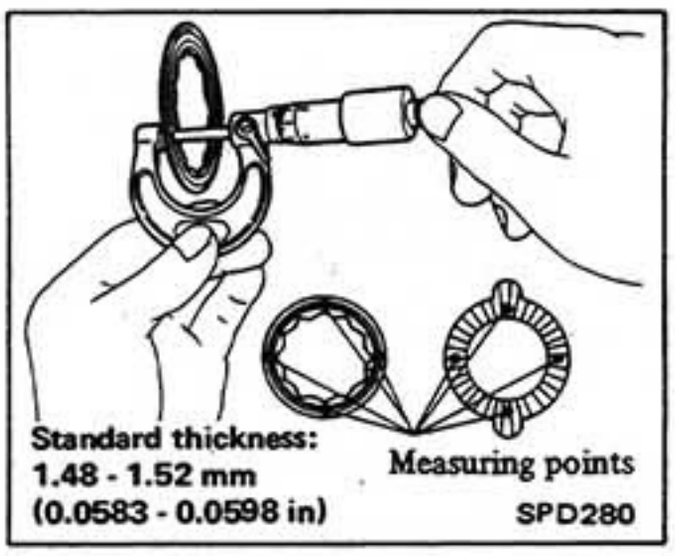
3. Inspect each disc and plate for distortion.

If it exceeds above limits, replace with a new disc or plate to eliminate possibility of clutch slippage or sticking.



SPD279

4. Measure thickness of friction disc, friction plate, spring disc and spring plate in 4 places as shown in the figure and compute mean value. If excessively worn, replace.



Standard thickness:
1.48 - 1.52 mm
(0.0583 - 0.0598 in)

Measuring points

SPD280

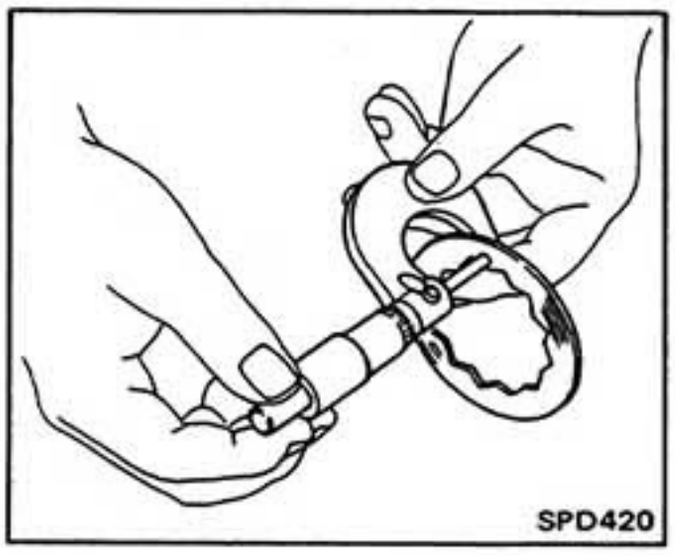
ADJUSTMENT

FRICTION DISC AND FRICTION PLATE END PLAY

End play of friction disc and friction plate can be calculated by using following equation and should be adjusted within following range.

Adjustment can be made by selecting friction disc having two different thicknesses.

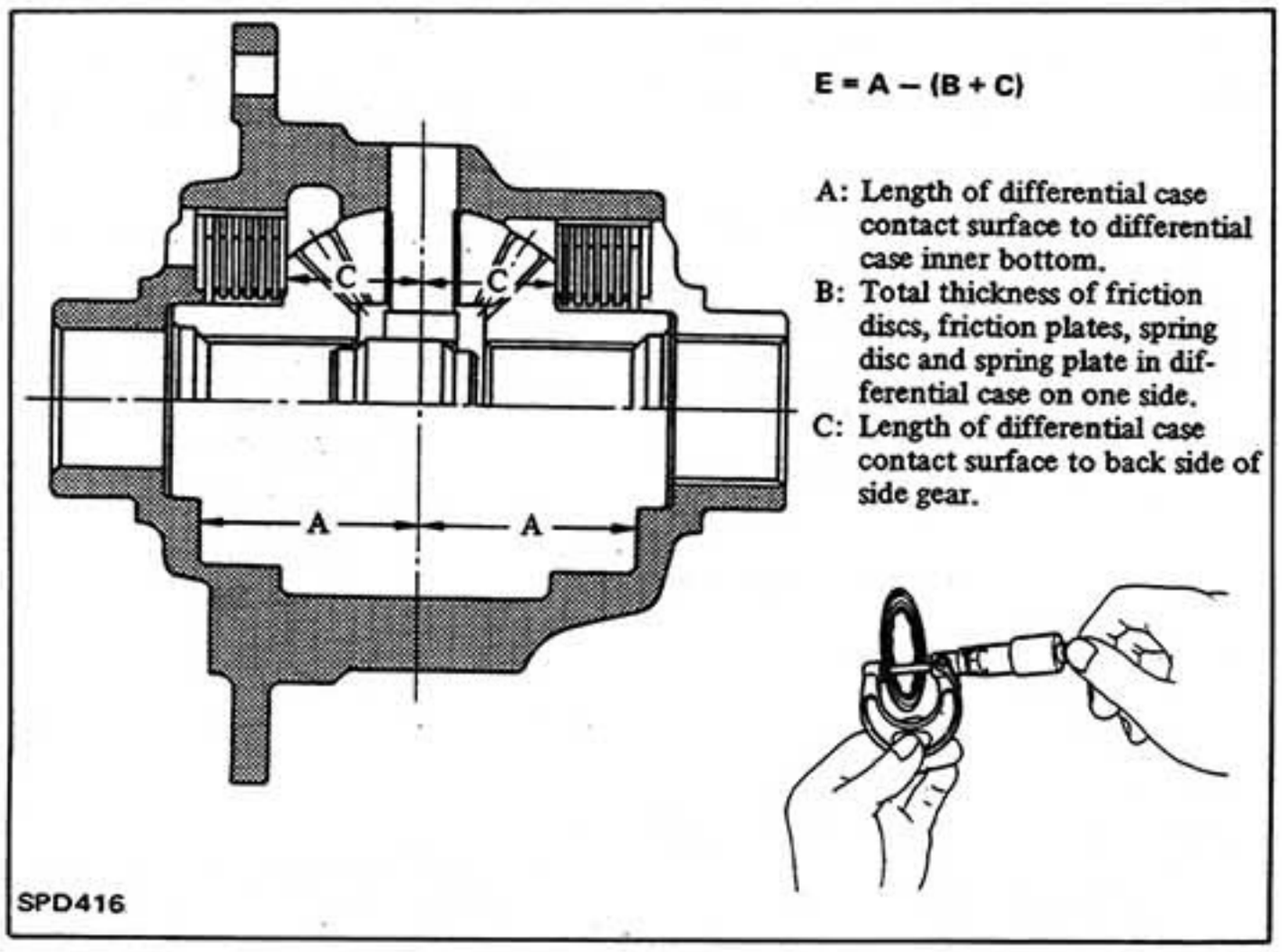
End play E:
0.10 - 0.30 mm
(0.0039 - 0.0118 in)



SPD420

No. of discs and plates

Model	C200	H233B
Friction disc	6	5
Friction plate	6	6
Spring disc	0	1
Spring plate	1	1



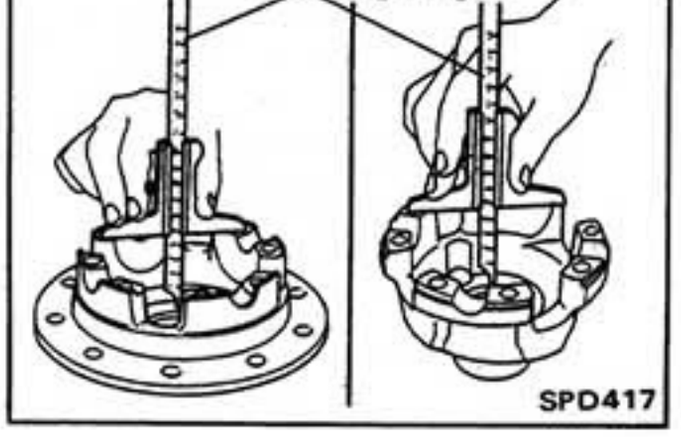
E = A – (B + C)

A: Length of differential case contact surface to differential case inner bottom.
B: Total thickness of friction discs, friction plates, spring disc and spring plate in differential case on one side.
C: Length of differential case contact surface to back side of side gear.

SPD416

1. Measure values of "A".

Standard length A:
49.50 - 49.55 mm
(1.9488 - 1.9508 in)



SPD417

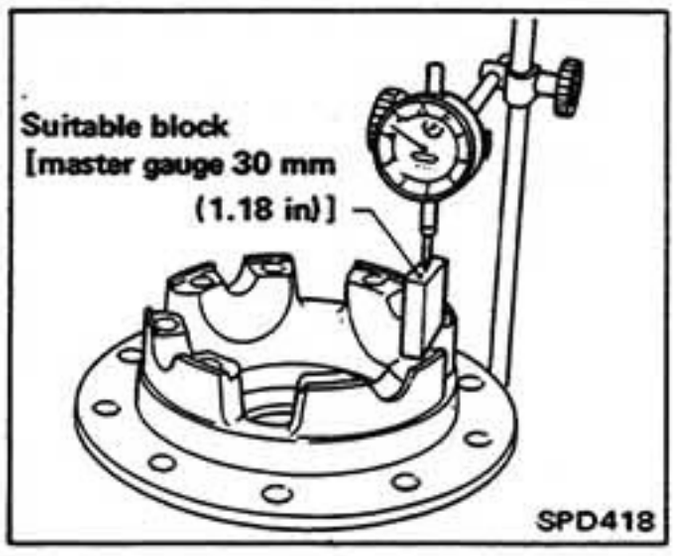
2. Measure thickness of each disc and plate.

Total thickness "B":
H233B
19.24 - 20.26 mm
(0.7575 - 0.7976 in)
C200
19.24 - 20.36 mm
(0.7575 - 0.8016 in)

3. Measure values of "C".

(1) Attach a dial indicator to the base plate.
(2) Place differential case B on the base plate, and install a master gauge on case B.

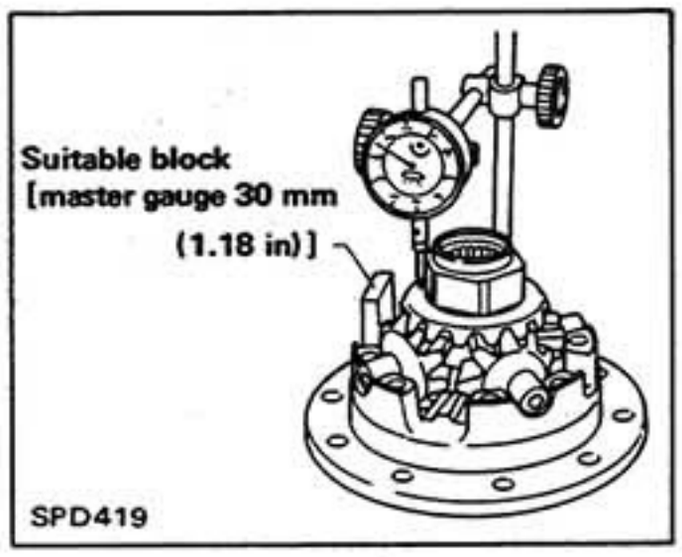
Then adjust the dial indicator scale to zero with its tip on the master gauge.



SPD418

(3) Install pinion mate gears, side gears and pinion mate shaft in differential case B.

(4) Set dial indicator's tip on the side gear, and read the indication.



Example:

E = A – D
= A – (B + C)
= 0.1 to 0.3 mm
(0.004 to 0.012 in)
A = 49.52 mm (1.9496 in)
B = 19.45 mm (0.7657 in)
C = 29.7 mm (1.169 in)
D = B + C

	B ...	19.45 (0.7657)
+	C ...	29.7 (1.169)
		49.15 (1.9347)

E = A – D

	A ...	49.52 (1.9496)
–	D ...	49.15 (1.9347)
		0.37 (0.0149)

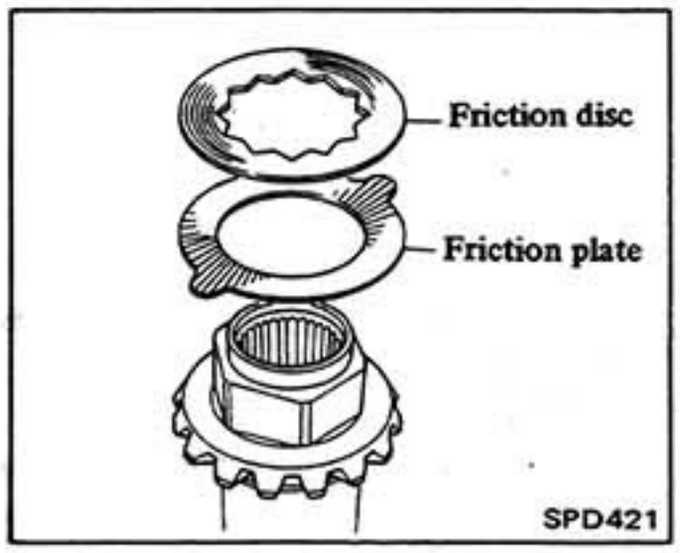
From the above equation, end play of 0.37 mm (0.0149 in) exceeds the specified range of 0.1 to 0.3 mm (0.004 to 0.012 in). Select suitable discs and plates to adjust correctly.

ASSEMBLY

Prior to assembling discs and plates, properly lubricate them by dipping them **in limited slip differential oil.**

1. Alternately position specified number of friction plates and friction discs on rear of side gear.

Always position a friction plate first on rear of side gear.

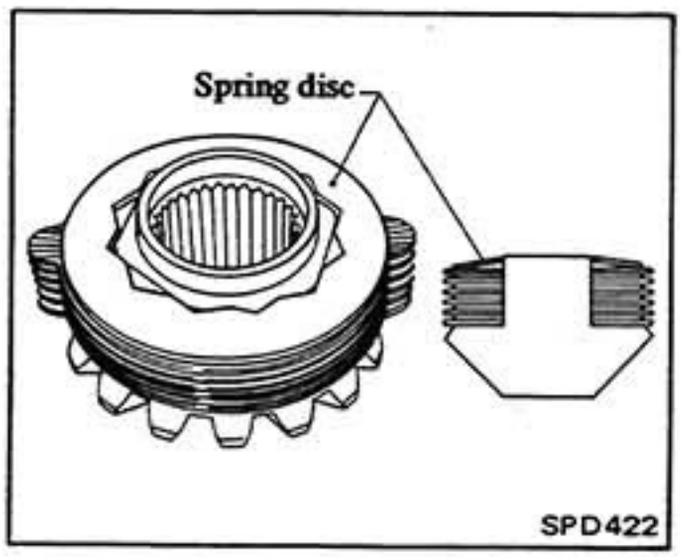


No. of friction plates and friction discs

Model	C200	H233B
Friction plates	6	6
Friction discs	6	5

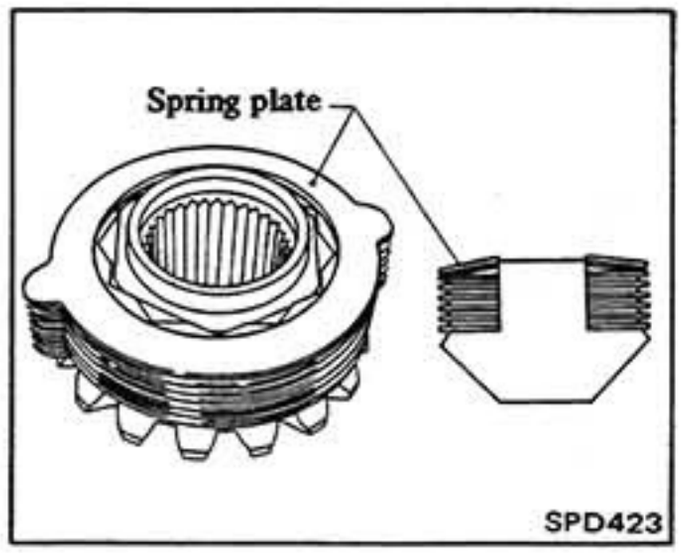
2. Install spring disc. (Model H233B differential only)

a. **Align the twelve angular holes in spring disc with the hexagonal area of the side gear.**
b. **Always position side gear correctly (See Figure).**

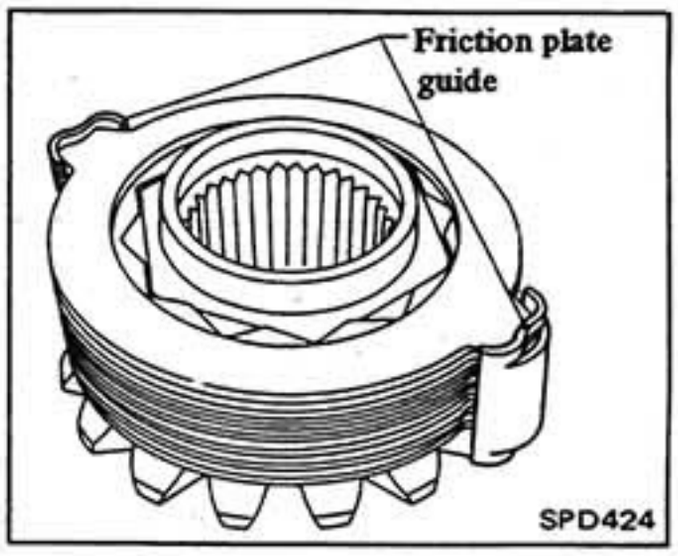


3. Install spring plate.

Always position side gear correctly (See Figure).

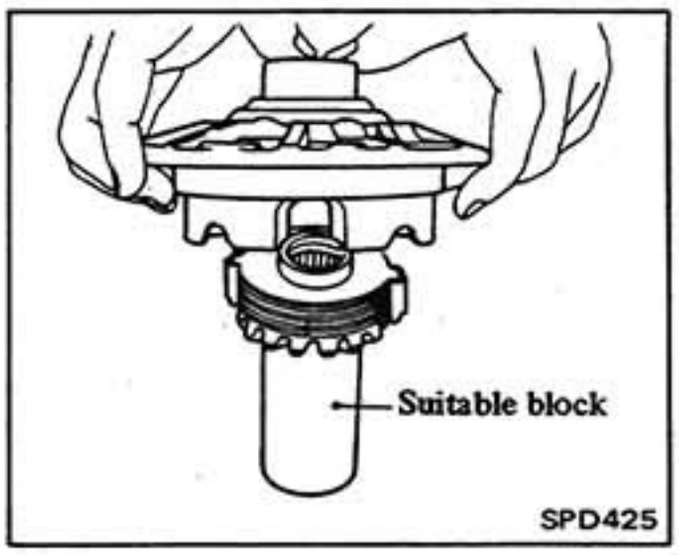


4. Install friction plate guides.



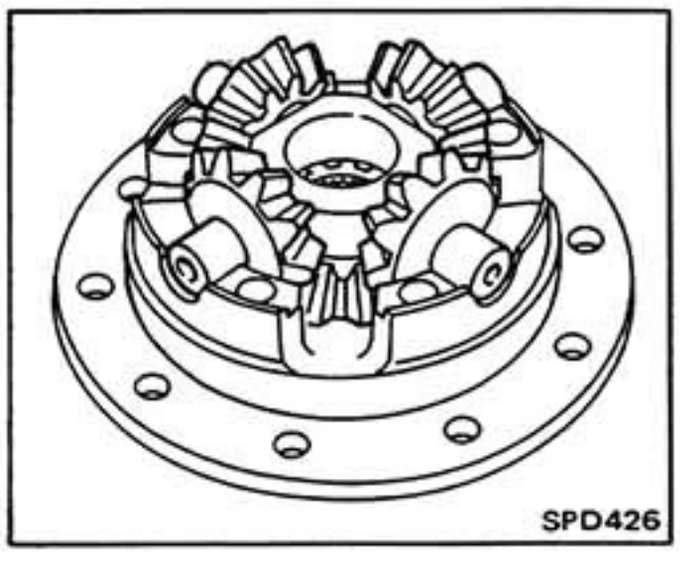
Correctly align the raised portions of friction plates, and apply grease to inner surfaces of friction plate guides to prevent them from falling.

5. Install differential case B over side gear, discs, plates and friction plate guide assembly.

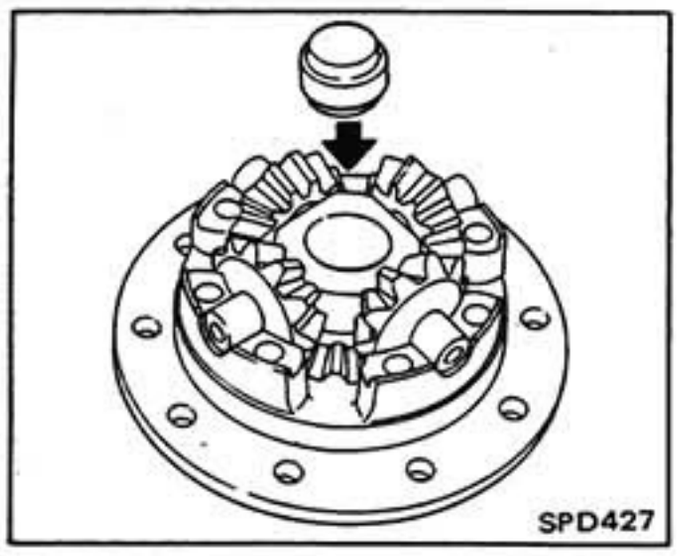


a. **Install differential case B while supporting friction plate guides with your middle finger inserted through oil hole in differential case.**
b. **Be careful not to detach spring disc from the hexagonal part of the side gear.**

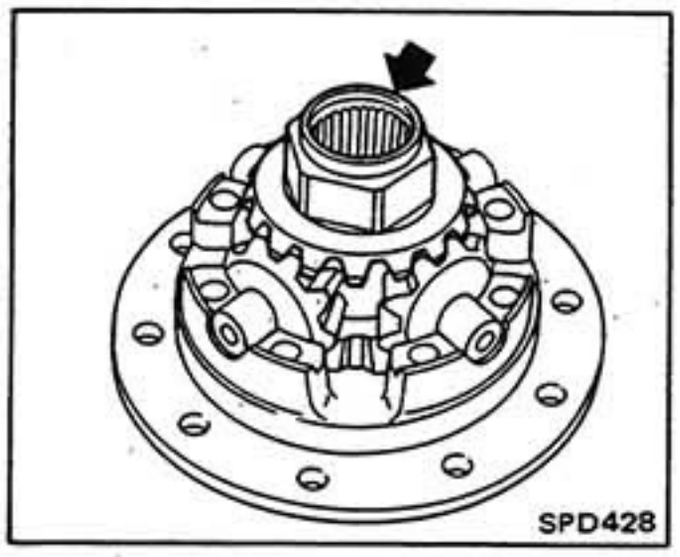
6. Install pinion mate gears and pinion shaft to differential case B.



7. Install thrust block.

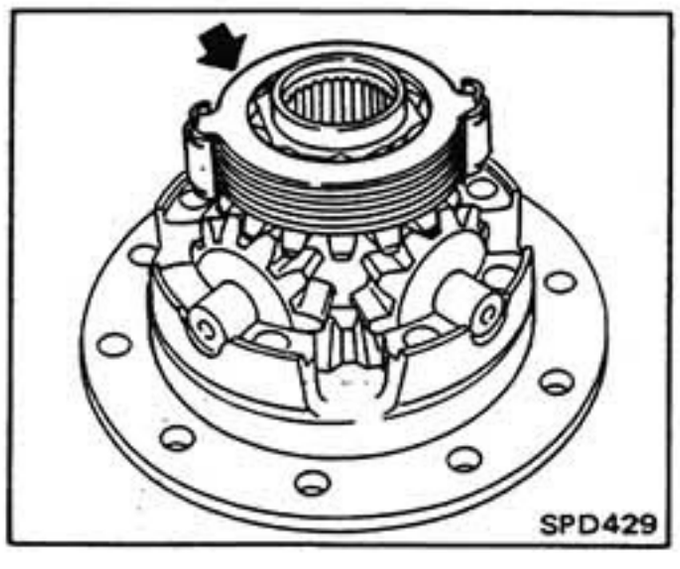


8. Install side gear to pinion mate gears.



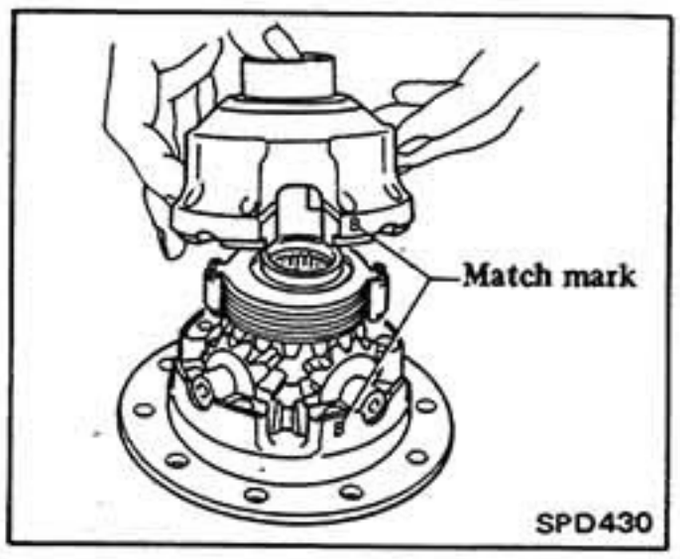
9. Install each disc and plate.

Use same procedures as outlined in steps 1. through 4. above.

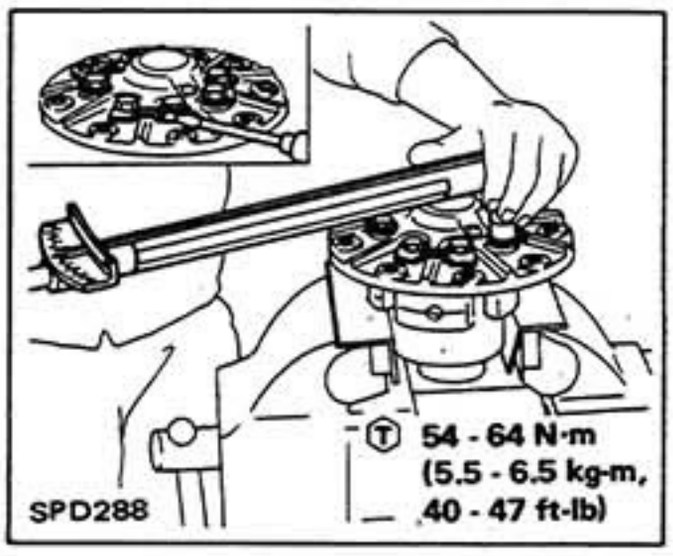


10. Install differential case A.

Position differential cases A and B by correctly aligning marks stamped on cases.



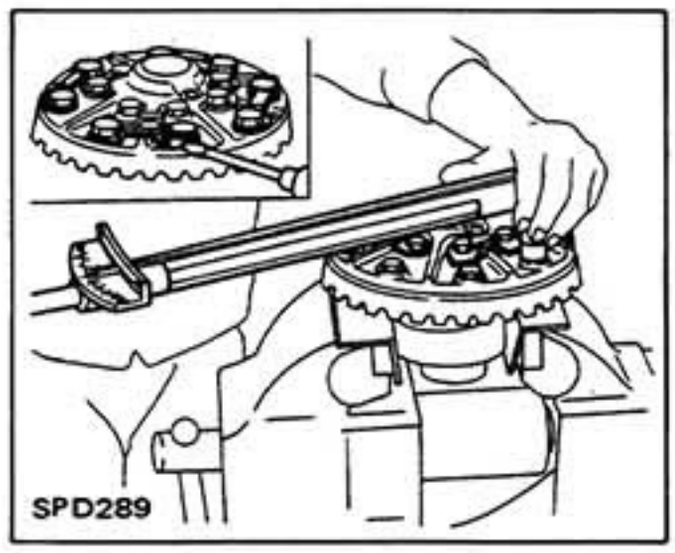
11. Tighten differential case bolts.



12. Place ring gear on differential case and install new lock straps and bolts.

Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

Then bend up lock straps to lock the bolts in place.



T : Ring gear bolt
C200
69 - 78 N·m
(7 - 8 kg-m,
51 - 58 ft-lb)
H233B
78 - 93 N·m
(8.0 - 9.5 kg-m,
58 - 69 ft-lb)

13. Install the shims behind each bearing and press on the bearings, using **Tool. Refer to Differential Carrier (Final drive) for assembly.**

14. Check preload of differential case clutch mechanism.

Refer to Checking Preload (Preparation for disassembly).

PROPELLER SHAFT

GENERAL SPECIFICATIONS

Primary propeller shaft and front propeller shaft

Applied model	Primary propeller shaft (L28 engine, long wheelbase)		Front propeller shaft		
			P40 and SD33 engine	L28 engine	
	M/T	A/T		Short wheelbase	Long wheelbase
Model	2S80B		2F80B	2F80B-D	
Number of joints	2			3	
Coupling method with transmission or transfer	Transmission side: Sleeve type Transfer side: Flange type		Flange type		
Distance between yokes mm (in)	80 (3.15)				
Type of journal bearing	Solid type (Disassembly type)				
Shaft length (Spider to spider) mm (in)	158 (6.22)	68 (2.68)	600 (23.62) *1 650 (25.59) *2	510 (20.08)	895 (35.24)
Shaft outer diameter mm (in)	45 (1.77)				

*1: Model 160
*2: Model 61

Rear propeller shaft

Applied model	Hardtop		High-roof Hardtop				Pick-up, Van, Station Wagon		Canvas Top	
			Light duty model		Heavy duty model					
	P40 and SD33 engine	L28 engine	P40 and SD33 engine	L28 engine	P40 and SD33 engine	L28 engine	P40 and SD33 engine	L28 engine	Light duty model	Heavy duty model
Model	2F80B									
Number of joints	2									
Coupling method with transfer	Flange type									
Distance between yokes mm (in)	80 (3.15)									
Type of journal	Solid type (Disassembly type)									
Shaft length [Spider to spider] mm (in)	616 (24.25)	690 (27.17)	616 (24.25)	690 (27.17)	590 (23.23)	665 (26.18)	1,210 (47.64)	910 (35.83)	710 (27.95)	690 (27.17)
Shaft outer diameter mm (in)	75 (2.95)									

SERVICE DATA

Unit: mm (in)

Propeller shaft runout limit	0.6 (0.024)
Journal axial play	Less than 0.02 (0.0008)

Snap ring (2F80B)

Unit: mm (in)

Tickness	Color	Part number
1.49 (0.0587)	White	39646-21001
1.52 (0.0598)	Yellow	39647-21001
1.55 (0.0610)	Red	39648-21001
1.58 (0.0622)	Green	39649-21001
1.61 (0.0634)	Blue	39646-21002
1.64 (0.0646)	Light brown	39647-21002
1.67 (0.0657)	Black	39648-21002

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Propeller shaft to differential carrier or transfer	78 - 88	8 - 9	58 - 65

DIFFERENTIAL CARRIER

GENERAL SPECIFICATIONS

Front differential carrier

*1: Middle East *2: High-roof Hardtop

Applied model	Hardtop and High-roof Hardtop						Pick-up			Van and Station Wagon		Canvas Top	
	Light duty model			Heavy duty model			P40 engine	SD33 engine	L28 engine	P40 engine	SD33 and L28 engine	Light duty model	Heavy duty model
	P40 engine	SD33 engine	L28 engine	P40 engine	SD33 engine	L28 engine							
Model	C200												
Type	Cast center												
Ring gear pitch diameter mm (in)	200 (7.87)												
Gear ratio	3.364	4.111	4.375 4.625*2	4.111 3.900*1	4.625		4.111 3.900*1	4.625	4.625 4.875*1	3.900	4.625	3.364	4.111
Number of teeth (Ring gear/Drive gear)	37/11	37/9	35/8 37/8*2	37/9 39/10*1	37/8		37/9 39/10*1	37/8	37/8 39/8*1	39/10	37/8	37/11	37/9
Oil capacity liter (Imp. pt)	1.5 (2-5/8)												

Rear differential carrier

*1: Middle East *2: High-roof Hardtop

Applied model	Hardtop and High-roof Hardtop						Pick-up			Van and Station Wagon		Canvas Top	
	Light duty model			Heavy duty model			P40 engine	SD33 engine	L28 engine	P40 engine	SD33 and L28 engine	Light duty model	Heavy duty model
	P40 engine	SD33 engine	L28 engine	P40 engine	SD33 engine	L28 engine							
Model	C200			H233B								C200	H233B
Type	Cast center			Rigid axle suspension								Cast center	Rigid axle suspension
Ring gear pitch diameter mm (in)	200 (7.87)			233 (9.17)								200 (7.87)	233 (9.17)
Gear ratio	3.364	4.111	4.375 4.625*2	4.111 3.900*1	4.625		4.111 3.900*1	4.625	4.625 4.875*1	3.900	4.625	3.364	4.111
Number of teeth (Ring gear/Drive gear)	37/11	37/9	35/8 37/8*2	37/9 39/10*1	37/8		37/9 39/10*1	37/8	37/8 39/8*1	39/10	37/8	37/11	37/9
Oil capacity liter (Imp. pt)	1.3 (2-1/4)			2.0 (3-1/2)								1.3 (2-1/4)	2.0 (3-1/2)

SERVICE DATA

Model			C200	H233B
Drive pinion bearing adjusting method			Collapsible spacer	Solid spacer
Drive pinion preload (With front oil seal)		N·m (kg-cm, in-lb)	1.1 - 1.7 (11 - 17, 9.5 - 14.8)	0.5 - 1.0 (5 - 10, 4.3 - 8.7)
Side bearing adjusting method			Shim	Side adjuster
Backlash	Drive pinion to ring gear	mm (in)	0.13 - 0.18 (0.0051 - 0.0071)	0.15 - 0.20 (0.0059 - 0.0079)
	Side gear to pinion mate gear (Clearance between side gear to differential case)	mm (in)	0.10 - 0.20 (0.0039 - 0.0079)	0.15 - 0.20 (0.0059 - 0.0079)
Ring gear runout limit		mm (in)	0.05 (0.0020)	0.06 (0.0024)
Total preload		N·m (kg-cm, in-lb)	1.2 - 2.3 (12 - 23, 10 - 20)	0.7 - 1.4 (7 - 14, 6.1 - 12.2)

Side gear thrust washer

Unit: mm (in)

Model	Thickness	Part number
C200	0.775 (0.0305)	38424-N3100
	0.825 (0.0325)	38424-N3101
	0.875 (0.0344)	38424-N3102
H233B	1.60 (0.0630)	38424-T4000
	1.80 (0.0709)	38424-T4001

Side bearing adjusting shim (C200)

Unit: mm (in)

Thickness	Part number
2.00 (0.0787)	38453-N3100
2.05 (0.0807)	38453-N3101
2.10 (0.0827)	38453-N3102
2.15 (0.0846)	38453-N3103
2.20 (0.0866)	38453-N3104
2.25 (0.0886)	38453-N3105
2.30 (0.0906)	38453-N3106
2.35 (0.0925)	38453-N3107
2.40 (0.0945)	38453-N3108
2.45 (0.0965)	38453-N3109
2.50 (0.0984)	38453-N3110
2.55 (0.1004)	38453-N3111
2.60 (0.1024)	38453-N3112

Pinion height adjusting washer (C200)

Unit: mm (in)

Thickness	Part number
3.09 (0.1217)	38154-B4017
3.12 (0.1228)	38154-B4018
3.15 (0.1240)	38154-B4019
3.18 (0.1252)	38154-B4020
3.21 (0.1264)	38154-E4600
3.24 (0.1276)	38154-E4601
3.27 (0.1287)	38154-E4602
3.30 (0.1299)	38154-E4603
3.33 (0.1311)	38154-E4604
3.36 (0.1323)	38154-E4605
3.39 (0.1335)	38154-E4606
3.42 (0.1346)	38154-E4607
3.45 (0.1358)	38154-E4608
3.48 (0.1370)	38154-E4609
3.51 (0.1382)	38154-E4610
3.54 (0.1394)	38154-E4611
3.57 (0.1406)	38154-E4612
3.60 (0.1417)	38154-E4613
3.63 (0.1429)	38154-E4614
3.66 (0.1441)	38154-E4615

Front bearing shim (H233B)

Unit: mm (in)

Thickness	Part number
0.40 (0.0157)	24127-4301P
0.45 (0.0177)	24127-4302P
0.50 (0.0197)	24127-4303P
0.55 (0.0217)	24127-4304P
0.60 (0.0236)	24127-4305P
0.65 (0.0256)	24127-4306P
0.70 (0.0276)	24127-4307P
0.75 (0.0295)	24127-4308P

Rear bearing shim (H233B)

Unit: mm (in)

Thickness	Part number
0.40 (0.0157)	24128-6401P
0.45 (0.0177)	24128-6402P
0.50 (0.0197)	24128-6403P
0.55 (0.0217)	24128-6404P
0.60 (0.0236)	24128-6405P
0.65 (0.0256)	24128-6406P
0.70 (0.0276)	24128-6407P
0.75 (0.0295)	24128-6408P

DISCS AND PLATES (Limited slip differential)

Unit: mm (in)

Part name	Thickness	Part number
Friction plate	1.48 - 1.52 (0.0583 - 0.0598)	38432-C6000
Friction disc	1.48 - 1.52 (0.0583 - 0.0598)	38433-C6000 (Standard type)
	1.58 - 1.62 (0.0622 - 0.0638)	38433-C6001 (Adjusting type)
Spring disc	1.48 - 1.52 (0.0583 - 0.0598)	38436-C6000
Spring plate	1.48 - 1.52 (0.0583 - 0.0598)	38435-C6000

TIGHTENING TORQUE

Model	C200			H233B		
Unit	N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
Drive pinion nut	127 - 294	13 - 30	94 - 217	196 - 245	20 - 25	145 - 181
Ring gear bolt	69 - 78	7 - 8	51 - 58	78 - 93	8.0 - 9.5	58 - 69
Side bearing cap bolt	88 - 98	9 - 10	65 - 72	93 - 103	9.5 - 10.5	69 - 76
Drain and filler plugs	39 - 59	4 - 6	29 - 43	59 - 98	6 - 10	43 - 72
Differential carrier to propeller shaft	78 - 88	8 - 9	58 - 65	78 - 88	8 - 9	58 - 65
Differential carrier to rear axle case (H233B)	–	–	–	27 - 36	2.8 - 3.7	20 - 27
Differential carrier rear cover bolt (C200)	11 - 14	1.1 - 1.4	8 - 10	–	–	–
Differential case couple bolt (Limited slip differential)	54 - 64	5.5 - 6.5	40 - 47	54 - 64	5.5 - 6.5	40 - 47

TROUBLE DIAGNOSES AND CORRECTIONS

PROPELLER SHAFT

Condition	Probable cause	Corrective action
Vibration during at medium or high speed.	Worn or damaged journal bearing.	Replace journal assembly.
	Unbalance due to bent or dented propeller shaft.	Replace propeller shaft assembly.
	Loose propeller shaft installation.	Retighten.
	Tight journal.	Tap yokes with hammer to free journal. Replace joint if unable to free or if journal feels rough when rotated by hand.
	Undercoating or mud on the shaft causing unbalance.	Clean up shaft.
	Tire unbalance.	Balance wheel and tire assembly or replace with correctly balanced tire.
	Balance weights missing.	Replace propeller shaft assembly.
Knocking sound during starting or noise during coasting on propeller shaft.	Worn or damaged journal.	Replace journal assembly.
	Worn sleeve yoke and mainshaft spline.	Replace propeller shaft assembly.
	Loosen propeller shaft installation.	Retighten.
	Loose joint installation.	Replace journal assembly or adjust snap ring.

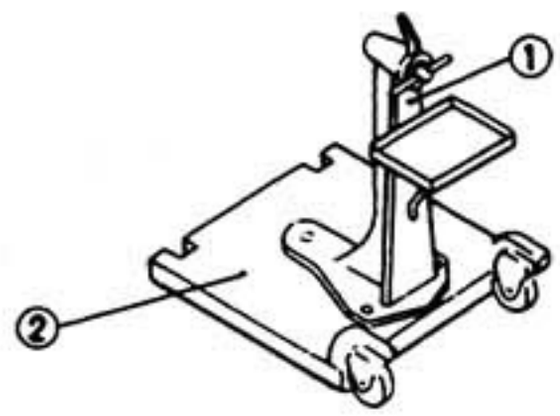
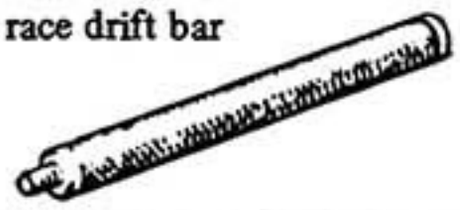
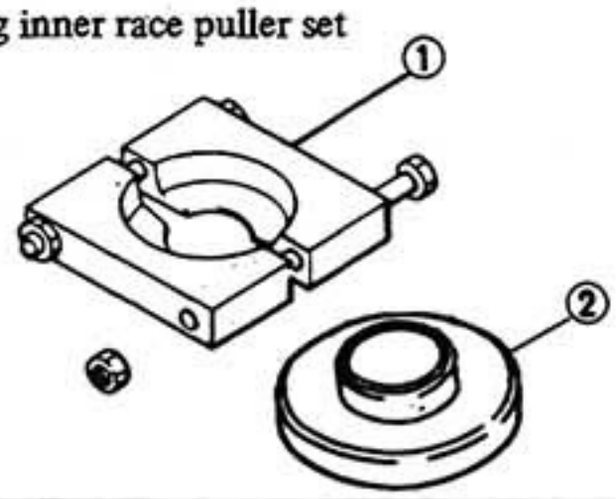
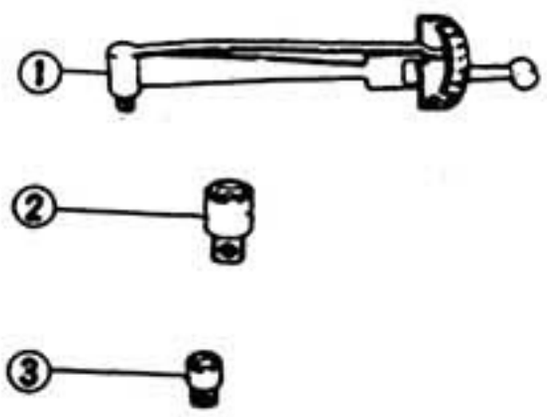
DIFFERENTIAL CARRIER

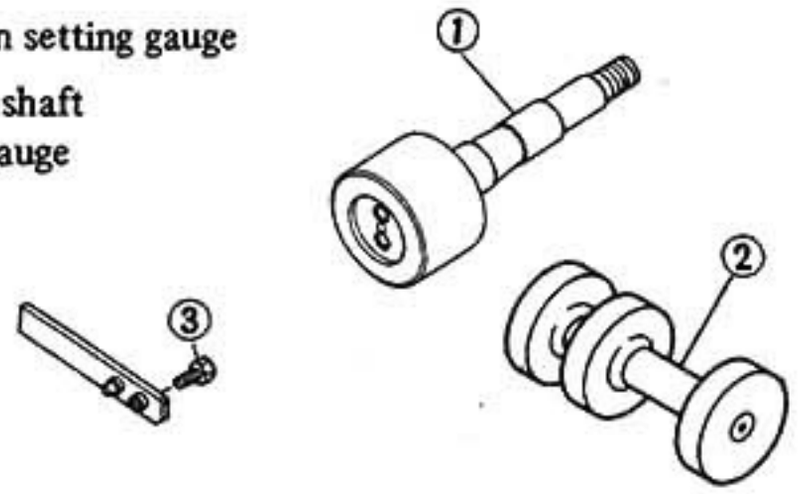
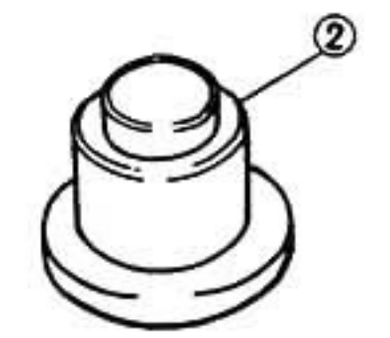
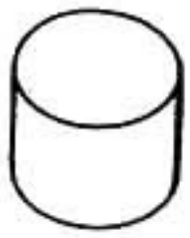
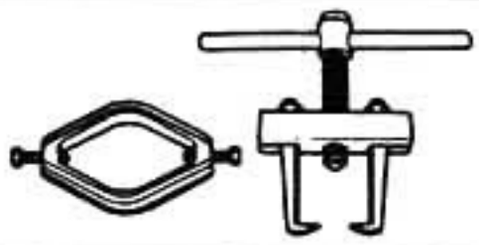
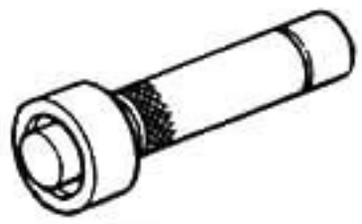
When a differential carrier is suspected of being noisy, it is advisable to make a thorough test to determine whether the noise originates in the tires, road surface, exhaust, universal joint, propeller shaft, wheel bearings, engine, transmission, transfer, or differential carrier. Noise which originates in other places cannot be corrected by adjustment or replacement of parts in differential carrier.

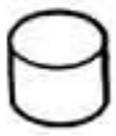
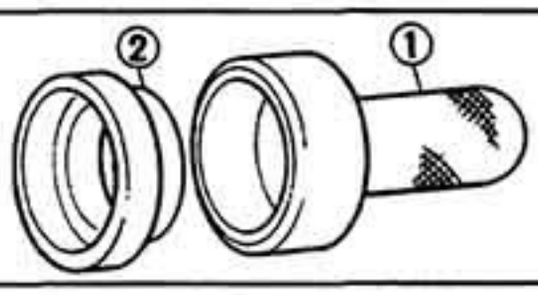
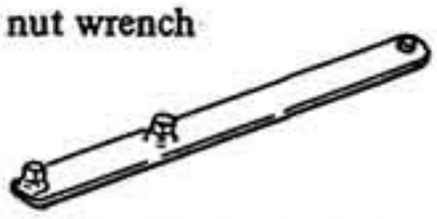
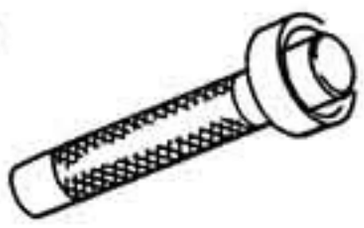
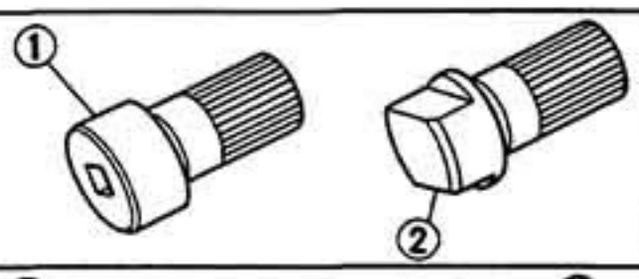
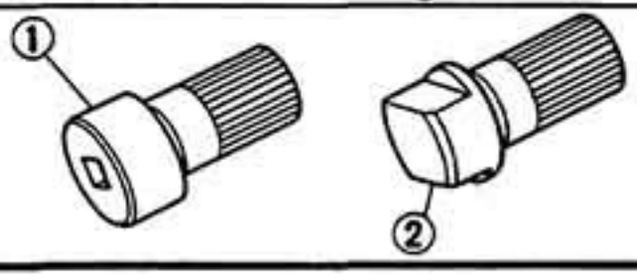
Condition	Probable cause	Corrective action
Noise on drive, coast and float.	Shortage of oil.	Supply gear oil. Rebuild gear carrier if necessary.
	Incorrect tooth contact between ring gear and drive pinion.	Adjust tooth contact or replace the hypoid gear set.
	Incorrect backlash between ring gear and drive pinion.	Adjust backlash or replace the hypoid gear set if necessary.
	Seized up or damaged ring gear and drive pinion.	Replace the hypoid gear set.
	Seized up, damaged or broken drive pinion bearing.	Replace the pinion bearing and faulty parts.
	Seized up, damaged or broken side bearing.	Replace the side bearing and faulty parts.
	Loose clamp bolts or nuts holding ring gear, bearing cap, etc.	Clamp them to specified torque, and replace faulty parts.

Condition	Probable cause	Corrective action
Noise on turn.	Seized up, damaged or broken side gear and pinion mate gear.	Replace faulty parts.
	Seized up, damaged or broken side gear and pinion mate gear thrust washers.	Replace faulty parts.
	Pinion mate gears too tight on their shaft or thrust block.	Replace faulty parts.
Knocking sound during starting or gear shifting	Excessive backlash.	
	Incorrect backlash ring gear-to-drive pinion or side gear-to-pinion mate gear.	Adjust backlash.
	Worn gears or case.	Replace worn parts.
	Worn rear axle shaft and side gear spline.	Replace worn parts.
	Pinion bearing under preload.	Adjust preload.
	Loose drive pinion nut.	Replace or tighten bolt.
	Loose bolts and nuts, such as ring gear bolts.	Replace faulty parts or tighten bolts.
Seizure of breakage.	Shortage of oil or use of unsuitable oil.	Replace faulty parts and use recommended gear oil.
	Excessively small backlash.	Adjust backlash and replace as required.
	Incorrect adjustment of bearings or gears.	Replace faulty parts.
	Severe service due to an excessive loading, improper use of clutch.	Replace faulty parts.
	Loose bolts and nuts, such as ring gear bolts.	Replace faulty parts or tighten bolts.
Oil leakage.	Worn-out, damaged or improperly driven front oil seal, side oil seal, or bruised, dented or abnormally worn slide face or companion flange.	Replace damaged oil seal. Repair flange with sandpaper or replace if necessary.
	Loose bolts holding gear carrier.	Tighten the bolts to specified torque.
	Damaged gasket.	Replace.
	Loose filler or drain plug.	Tighten.
	Clogged or damaged breather.	Repair or replace.

SPECIAL SERVICE TOOLS

Tool number	Tool name	Unit application	
		C200	H233B
ST0501S000 ① ST05011000 ② ST05012000	Engine stand Engine stand Base 	–	X
ST06340000	Diff. attachment 	–	X
ST30611000	Drive pinion bearing outer race drift bar 	X	X
ST30613000	Drive pinion **front** bearing outer race drift 	X	X
ST30621000	Drive pinion **rear** bearing outer race drift 	X	X
ST3090S000 ① ST30031000 ② ST30901000	Drive pinion rear bearing inner race puller set Puller Base 	X	X
ST3127S000 ① GG91030000 ② HT62900000 ③ HT62940000	Preload gauge Torque wrench Socket adapter (1/2") Socket adapter (3/8") 	X	X

Tool number	Tool name	Unit application	
		C200	H233B
KV381039S0 ① KV38103910 ② KV38100120 ③ KV38100140	Drive pinion setting gauge Dummy shaft Height gauge Stopper 	X	–
ST3125S000 ① ST31251000 ② ST31181001	Drive pinion setting gauge set Drive pinion height gauge Dummy shaft 	–	X
KV38104700	Drive pinion flange wrench 	X	X
ST32501000	Weight block 	X	X
ST33051001	Diff. side bearing puller 	X	X
ST33061000	Adapter 	X	X
ST33230000	Diff. side bearing drift 	X	X

Tool number	Tool name	Unit application	
		C200	H233B
KV31100300	Fork rod pin punch 	X	X
KV38102000	Master gauge [21.0 mm (0.827 in)] 	X	–
KV381025S0 ① ST30720000 ② KV38102510	Oil seal fitting tool Drift bar Drift 		X
ST32580000	Diff. side bearing adjusting nut wrench 	–	X
ST33190000	Diff. side bearing drift 	–	X
ST33081000	Side bearing puller adapter 	–	X
KV381051S0 ① KV38105110 ② KV38105120	Rear axle shaft dummy Torque wrench side Vice side 	X	–
KV381052S0 ① KV38105210 ② KV38105220	Rear axle shaft dummy Torque wrench side Vice side 	–	X