

PROPELLER SHAFT & DIFFERENTIAL CARRIER

SECTION **PD**

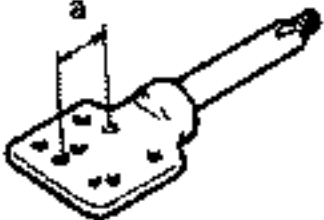
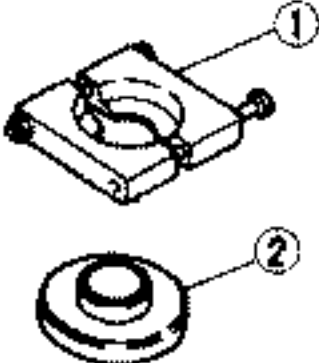
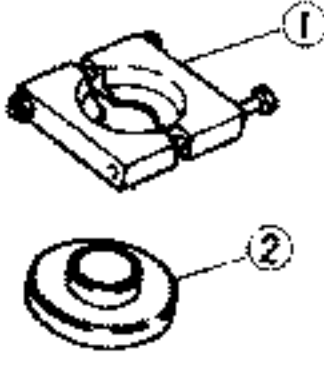
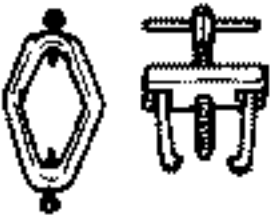
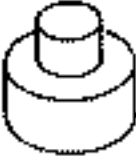
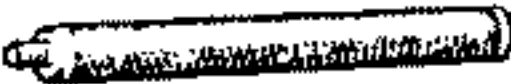
CONTENTS

PREPARATION	PD- 2
PROPELLER SHAFT	PD- 6
ON-VEHICLE SERVICE (Final drive)	PD-11
REMOVAL AND INSTALLATION	PD-13
FINAL DRIVE	PD-14
DISASSEMBLY	PD-16
INSPECTION	PD-20
ADJUSTMENT	PD-21
ASSEMBLY	PD-29
DIFFERENTIAL OIL COOLER SYSTEM	PD-35
SERVICE DATA AND SPECIFICATIONS (S.D.S.)	PD-41

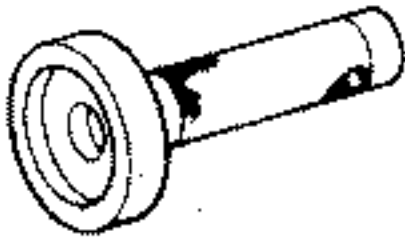
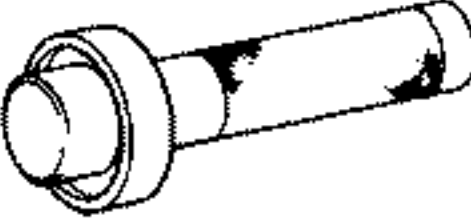
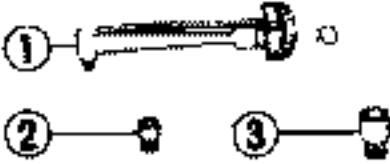
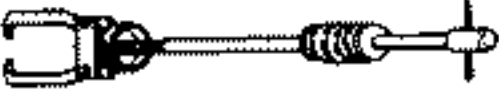
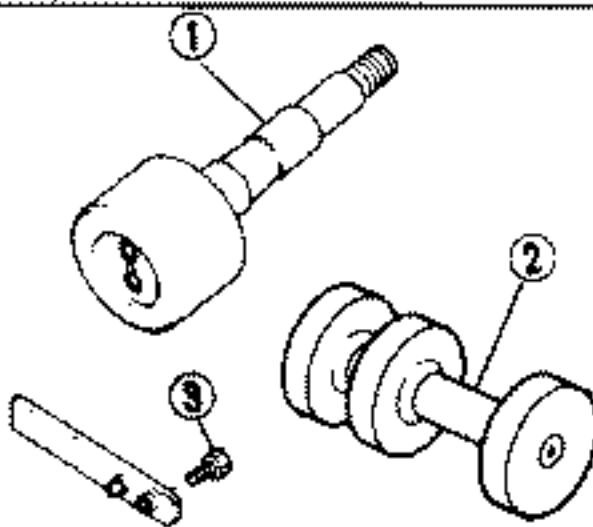
PD

PREPARATION

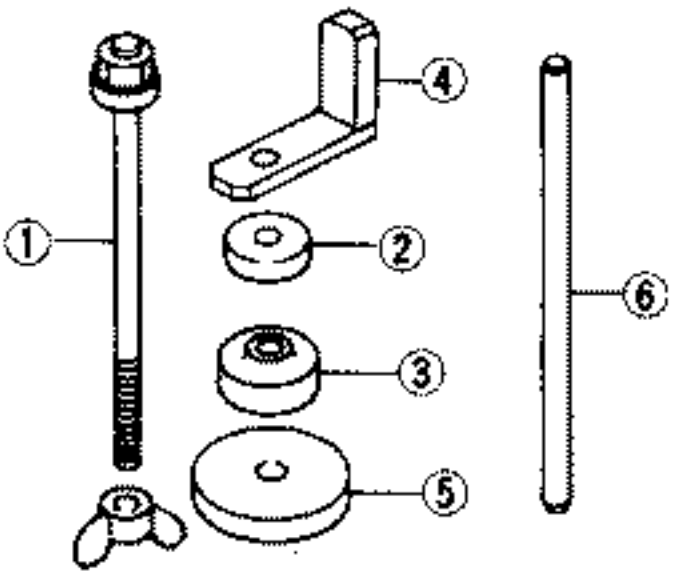
SPECIAL SERVICE TOOLS

Tool number Tool name	Description	Unit application	
		R200V	R230V
ST38060002 Drive pinion flange wrench	 Removing and installing propeller shaft lock nut, and drive pinion lock nut Use two holes and propeller shaft connecting bolt to hold companion flange.	X	—
KV38100800 Differential attachment	 Mounting final drive (To use, make a new hole.) a: 156 mm (6.14 in) — R200V 178 mm (7.01 in) — R230V	X	X
ST3090S000 Drive pinion rear inner race puller set ① ST30031000 Puller ② ST30901000 Base	 Removing and installing drive pinion rear cone	X	—
ST3002S000 Drive pinion rear inner race puller set ① ST30021000 Puller ② ST30022000 Base	 Removing and installing drive pinion rear cone	—	X
ST33051001 Differential side bearing puller body	 Removing and installing differential side bearing inner cone	X	X
ST33061000 Differential side bearing puller adapter	 Removing and installing differential side bearing inner cone	X	—
ST30611000 Drift	 Installing pinion rear bearing outer race	X	X
ST30613000 Drift	 Installing pinion front bearing outer race	X	—

PREPARATION

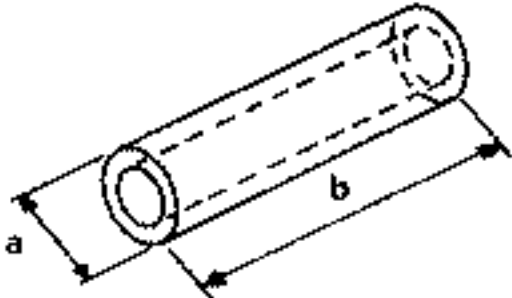
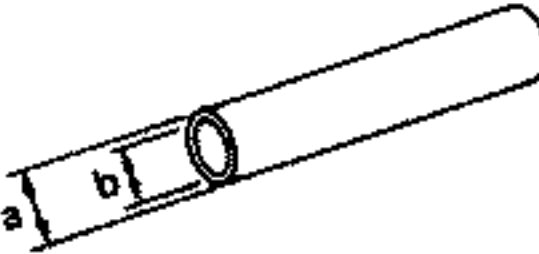
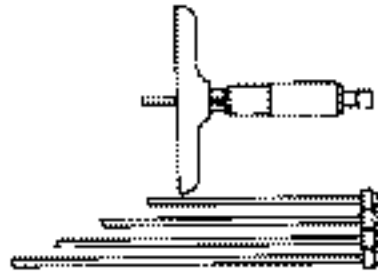
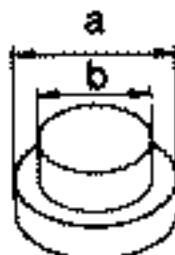
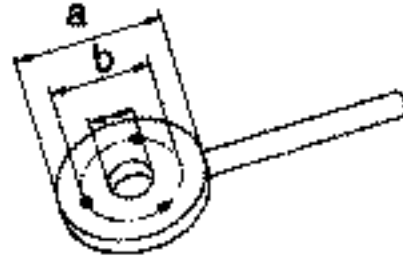
Tool number Tool name	Description	Unit application	
		R200V	R230V
KV38100200 Oil seal drift	 Installing side oil seal	X	—
KV38102510 Oil seal drift	 Installing side oil seal	—	X
KV38100300 Drift	 Installing side bearing inner cone	X	—
KV38100600 Side bearing spacer drift	 Installing side bearing spacer	X	X
ST3127S000 Preload gauge ① GG91030000 Torque wrench ② HT62940000 Socket adapter ③ HT62900000 Socket adapter	 Measuring pinion bearing preload and total preload	X	X
HT72400000 Slide hammer	 Removing differential case assembly	X	X
KV381039S0 Drive pinion height setting gauge ① KV38103910 Dummy shaft ② KV38100120 Height gauge ③ KV38100140 Stopper	 Selecting pinion height adjusting washer	X	—

PREPARATION

Tool number Tool name	Description	Unit application	
		R200V	R230V
KV381076S0 Drive pinion height setting gauge ① KV38107610 Dummy shaft ② KV38107650 Rear bearing spacer ③ KV38107640 Front bearing spacer ④ KV38107620 Height gauge ⑤ KV38107660 Side bearing adapter ⑥ KV38107630 Adapter shaft	Selecting pinion height adjusting washer 	—	X

PREPARATION

COMMERCIAL SERVICE TOOLS

Tool name	Description	Unit application	
		R200V	R230V
Drift	 Installing pinion rear bearing outer race a: 89 mm (3.50 in) dia. — R200V 89 mm (3.90 in) dia. — R230V b: 200 mm (7.87 in)	X	X
Oil seal drift	 Installing front oil seal a: 85 mm (3.35 in) dia. b: 69 mm (2.72 in) dia.	—	X
Depth micrometer	 Measuring bearing height	X	X
Drift	 Installing pinion front bearing outer race a: 79 mm (3.11 in) dia.	—	X
Drift	 Installing side bearing inner cone a: 64 mm (2.52 in) dia. b: 55.5 mm (2.185 in) dia.	—	X
Adapter	 Removing and installing differential side bearing inner cone a: 54 mm (2.13 in) dia. b: 39 mm (1.54 in) dia.	—	X
Drive pinion flange wrench	 Removing and installing propeller shaft lock nut, and drive pinion lock nut. a: 107 mm (4.21 in) dia. b: 94 mm (3.70 in) dia. c: 50 mm (1.97 in) dia.	—	X

PROPELLER SHAFT

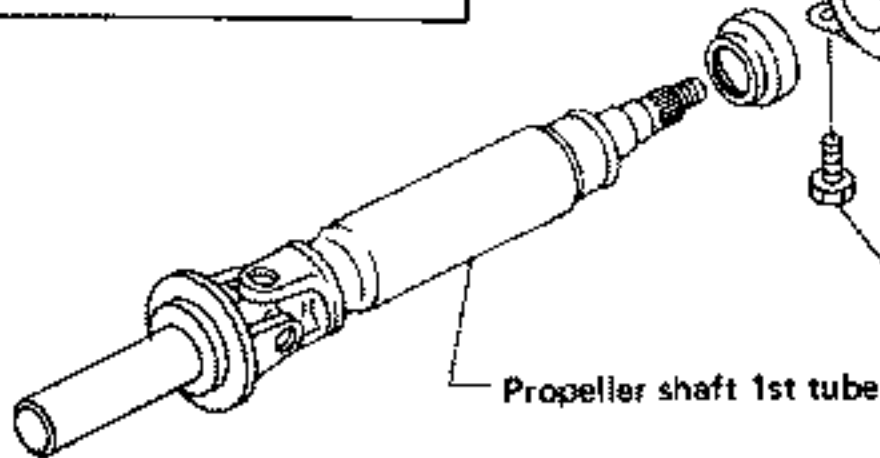
3S71A

Washer
Apply a coat of multi-purpose lithium grease containing molybdenum disulfide to the end face of the center bearing and both sides of the washer.

A/T model



M/T model



Propeller shaft 2nd tube

Final drive

Lock nut
245 - 294
(25 - 30, 181 - 217)

39 - 44
(4.0 - 4.5, 29 - 33)

39 - 44 (4.0 - 4.5, 29 - 33)

Companion flange

59 - 78
(6 - 8, 43 - 58)

: N·m (kg·m, ft·lb)

SPD985

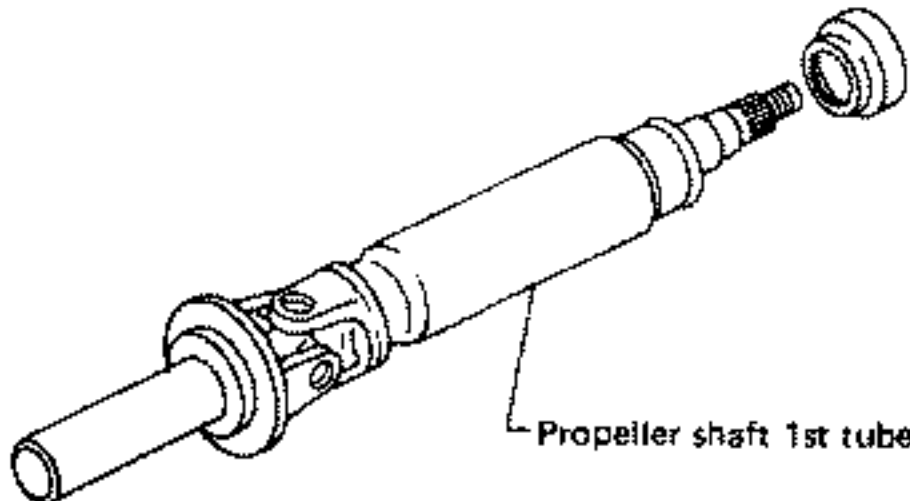
3S80A-VL107

Washer
Apply a coat of multi-purpose lithium grease containing molybdenum disulfide to the end face of the center bearing and both sides of the washer.

A/T model



M/T model



Propeller shaft 2nd tube

Final drive

Lock nut
245 - 294
(25 - 30, 181 - 217)

64 - 74
(6.5 - 7.5, 47 - 54)

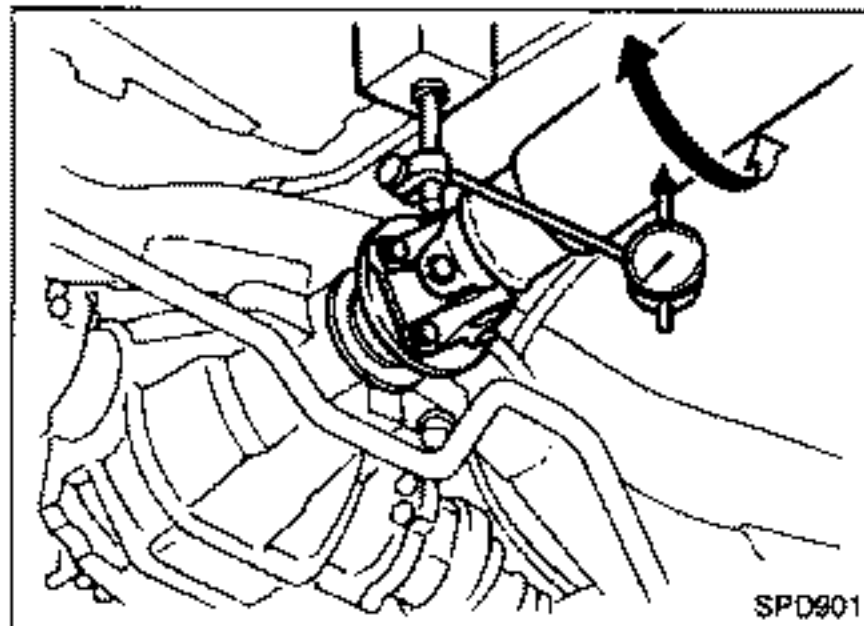
54 - 64 (5.5 - 6.5, 40 - 47)

Companion flange

59 - 78
(6 - 8, 43 - 58)

: N·m (kg·m, ft·lb)

SPD982



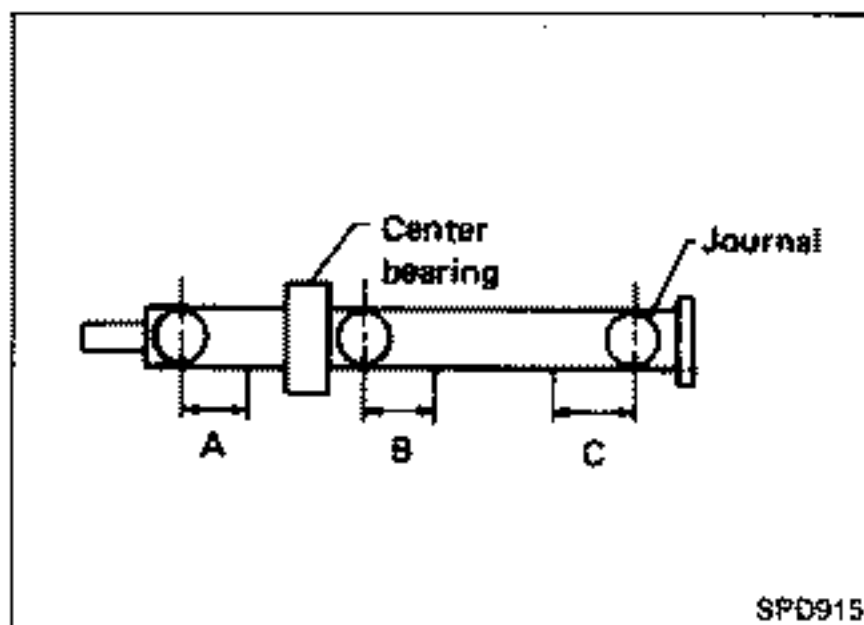
On-vehicle Service

PROPELLER SHAFT VIBRATION

If vibration is present at high speed, inspect propeller shaft runout first.

1. Raise rear wheels.
2. Measure propeller shaft runout at indicated points by rotating final drive companion flange with hands.

Runout limit: 0.6 mm (0.024 in)



Propeller shaft runout measuring points:

Distance "A":

162 mm (6.38 in)

Distance "B":

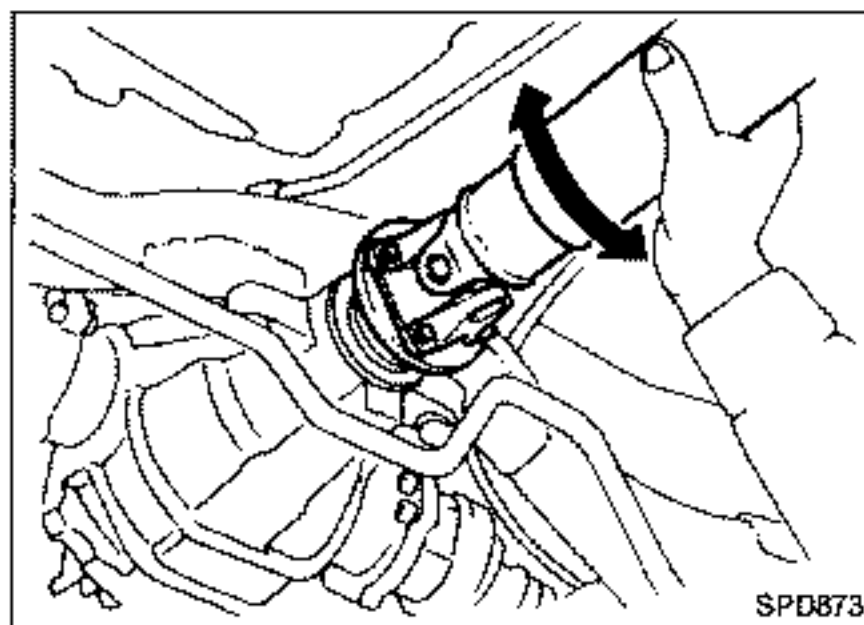
3S71A: 172 mm (6.77 in)

3S80A-VL107: 200 mm (7.87 in)

Distance "C":

3S71A: 192 mm (7.56 in)

3S80A-VL107: 200 mm (7.87 in)



3. If runout exceeds specifications, disconnect propeller shaft at final drive companion flange. Rotate companion flange 90° (3S71A) or 60° (3S80A-VL107), and reconnect propeller shaft and check runout.

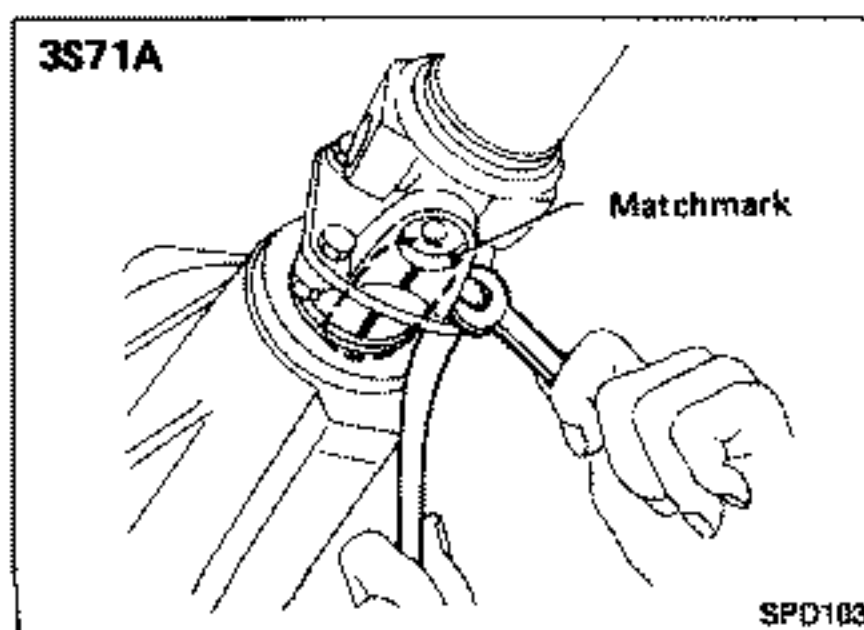
Repeat above operation when companion flange is rotated 180° (3S71A) or 120° (3S80A-VL107) and 270° (3S71A) or 180° (3S80A-VL107), respectively. Also, for 3S80A-VL107, the operation should be repeated at 240° and 300°. Securely connect propeller shaft at the point where the smallest runout of the three measurements occurs.

Runout limit: 0.6 mm (0.024 in)

4. Check runout again. If runout still exceeds specifications, replace propeller shaft assembly.
5. Perform road test.

APPEARANCE CHECKING

- Inspect propeller shaft tube surface for dents or cracks. If damaged, replace propeller shaft assembly.
- If center bearing is noisy or damaged, replace center bearing.

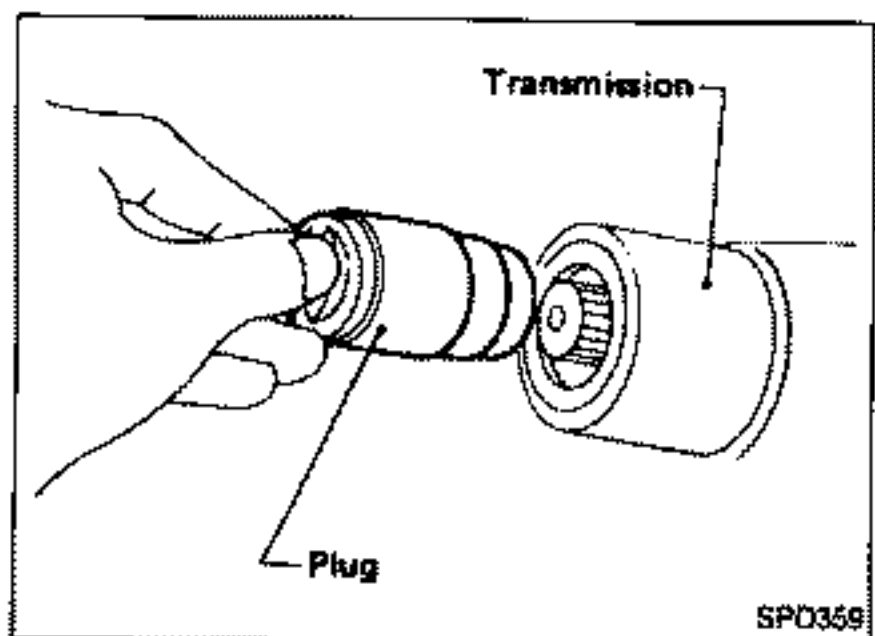
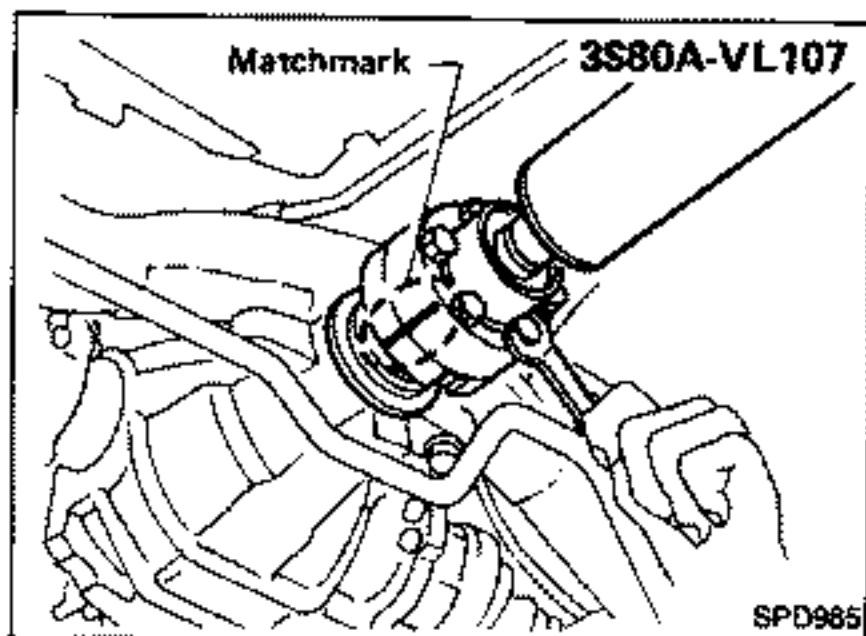


Removal

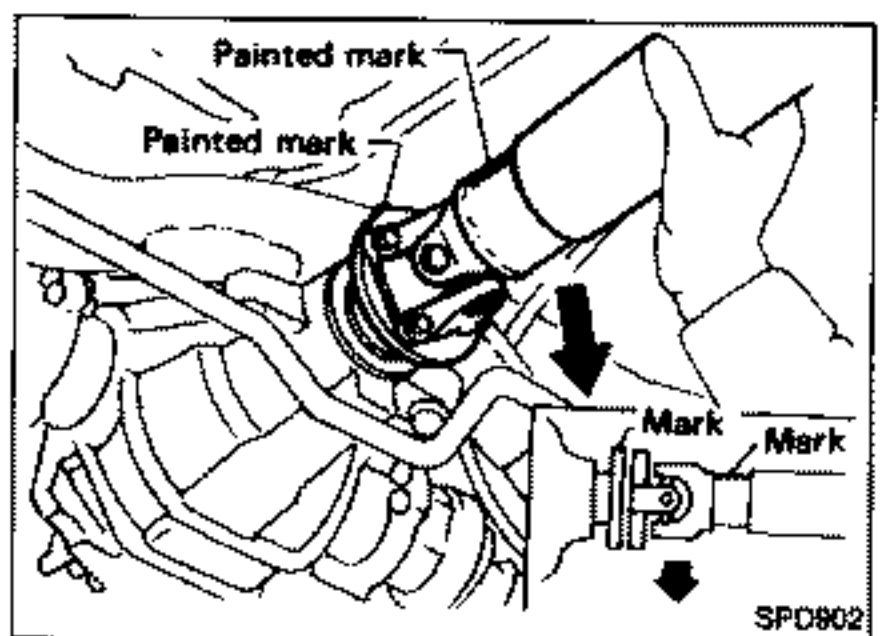
- Put matchmarks on flanges and separate propeller shaft from final drive.

PROPELLER SHAFT

Removal (Cont'd)

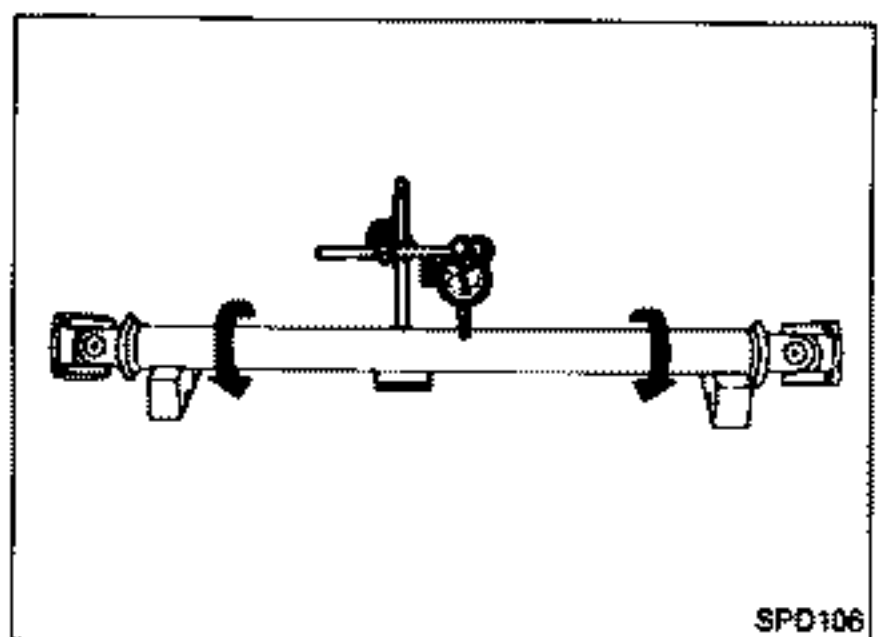


- Draw out propeller shaft from transmission and plug up rear end of transmission rear extension housing.



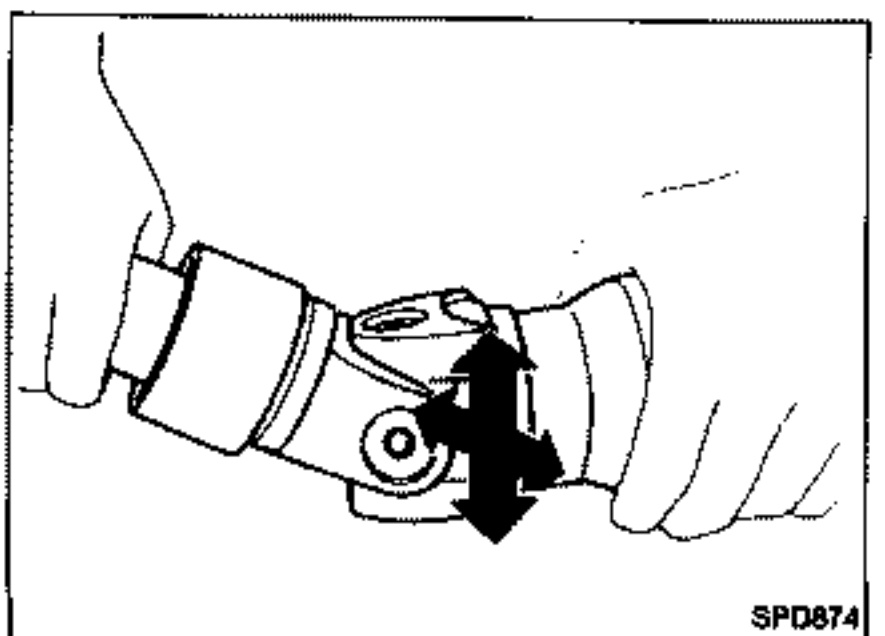
Installation

- Temporarily install differential companion flange and flange yoke so that their alignment marks (original marks) are located as close to each other as possible.
- Turn propeller shaft until alignment marks face straight upward. Securely fasten propeller shaft so that lower side wall of concave flange yoke will touch lower side wall of convex companion flange.



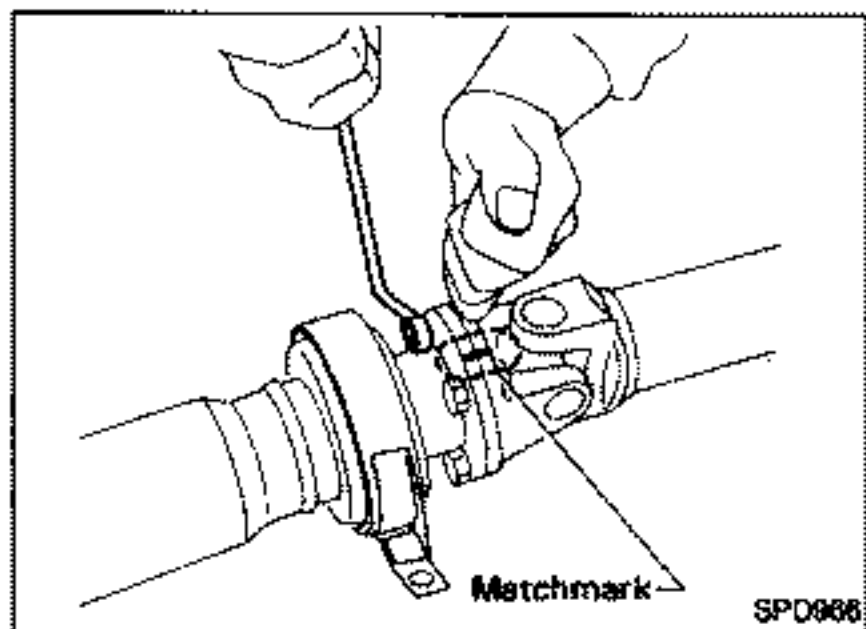
Inspection

- Inspect propeller shaft runout. If runout exceeds specifications, replace propeller shaft assembly.
Runout limit: 0.6 mm (0.024 in)



- Inspect journal axial play.
If the play exceeds specifications, replace propeller shaft assembly.
Journal axial play:
0 mm (0 in)

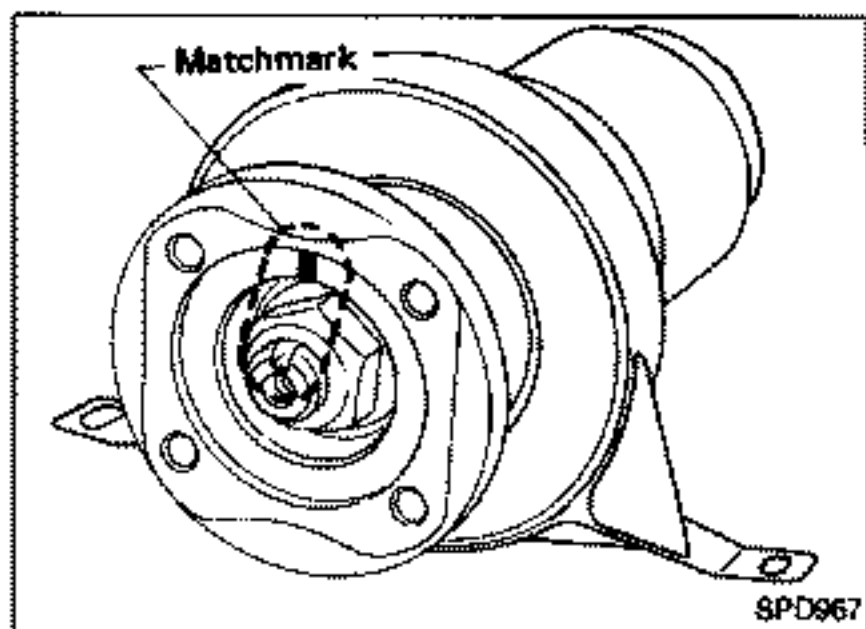
PROPELLER SHAFT



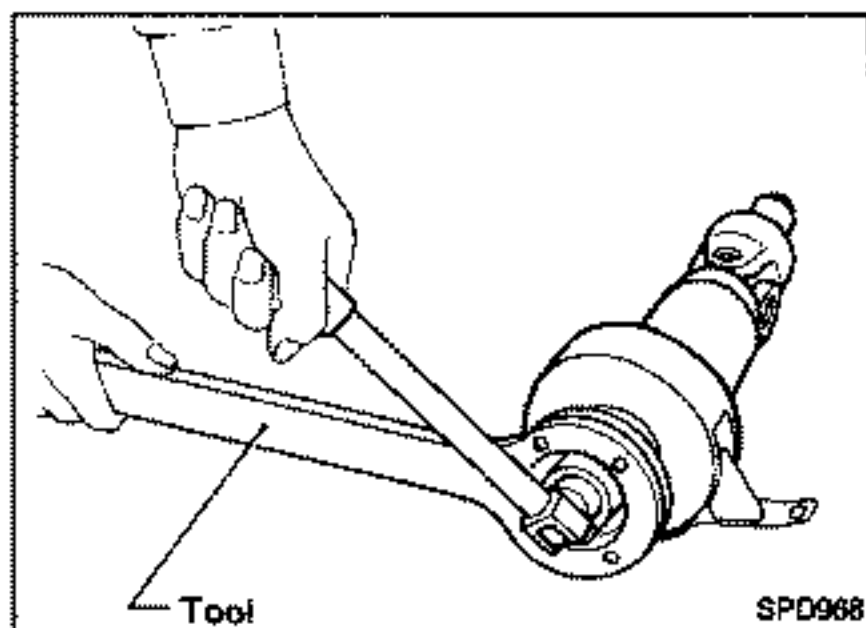
Disassembly

CENTER BEARING

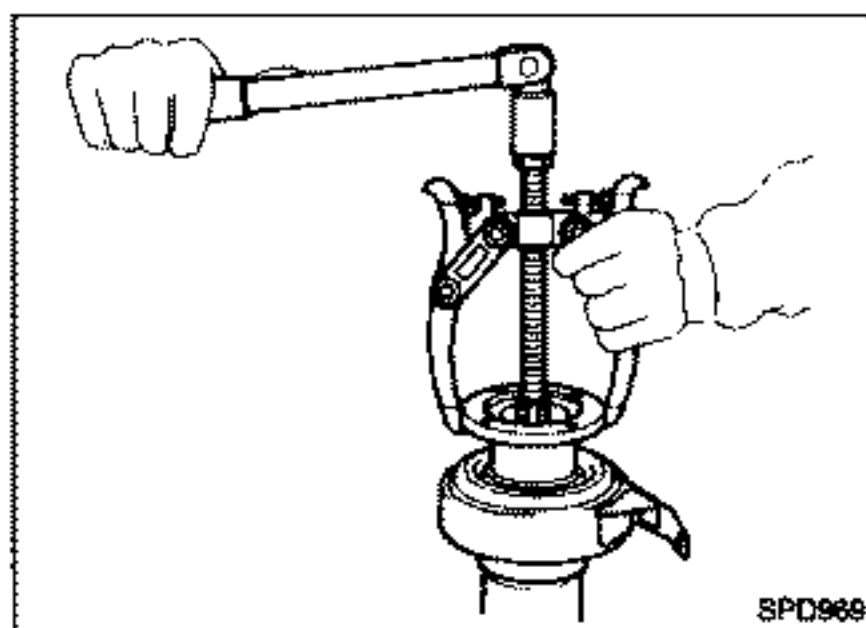
1. Put matchmarks on flanges, and separate 2nd tube from 1st tube.



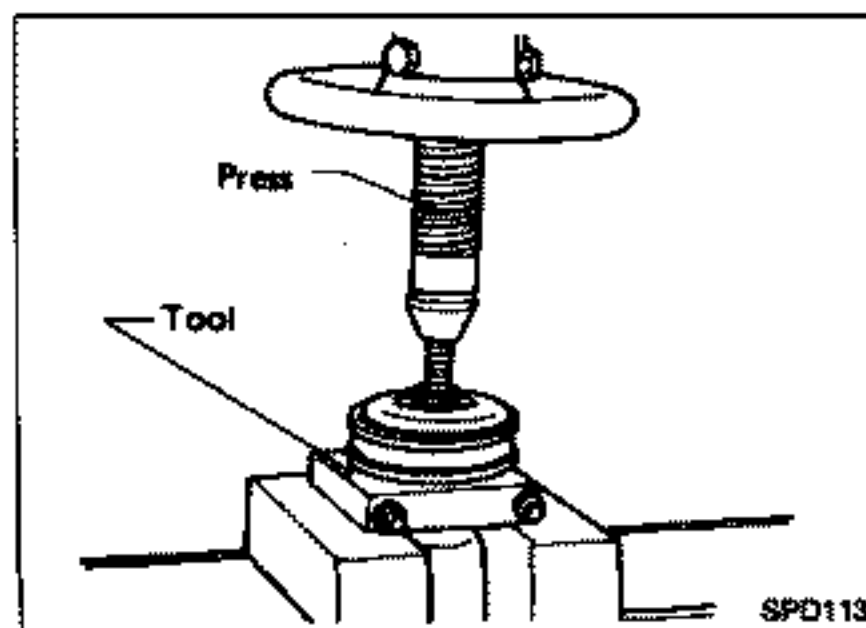
2. Put matchmarks on the flange and shaft.



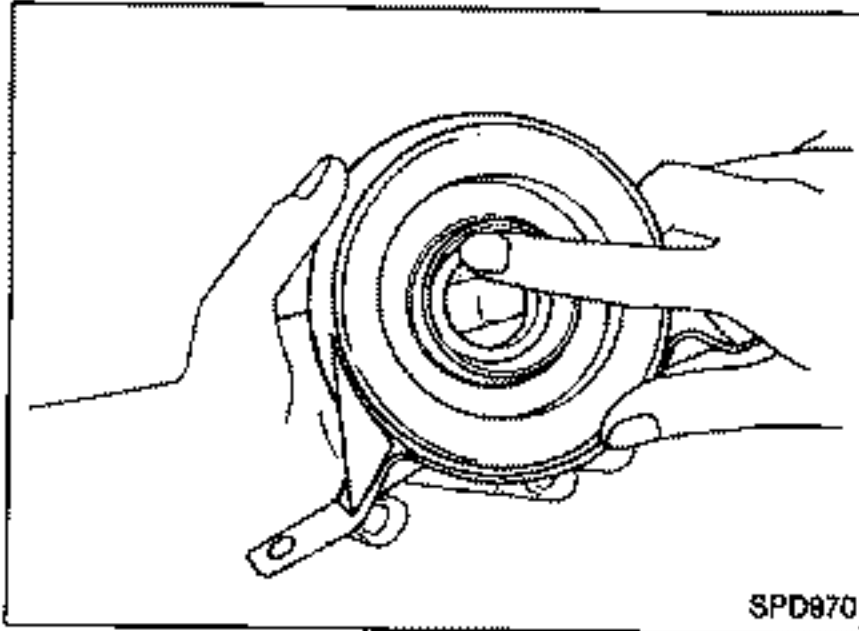
3. Remove locking nut with Tool.
Tool number:
ST38060002



4. Remove companion flange with puller.



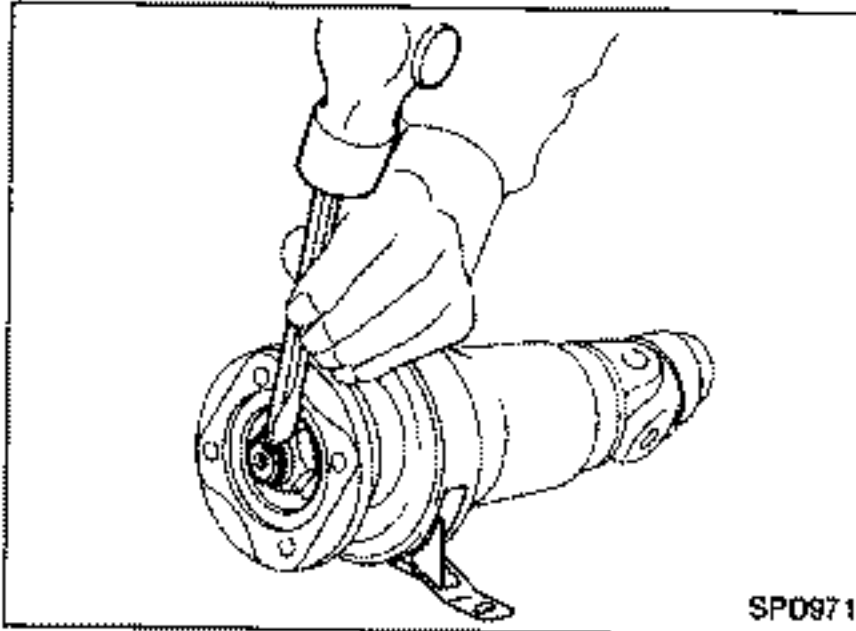
5. Remove center bearing with Tool and press.
Tool number: ST30031000



Assembly

CENTER BEARING

- Install center bearing with insulator's protrusion side facing front of vehicle.
- Apply a coat of multi-purpose lithium grease containing molybdenum disulfide to the end face of the center bearing and both sides of the washer.



- Stake the nut. Always use new one.
- Align matchmarks when assembling tubes.

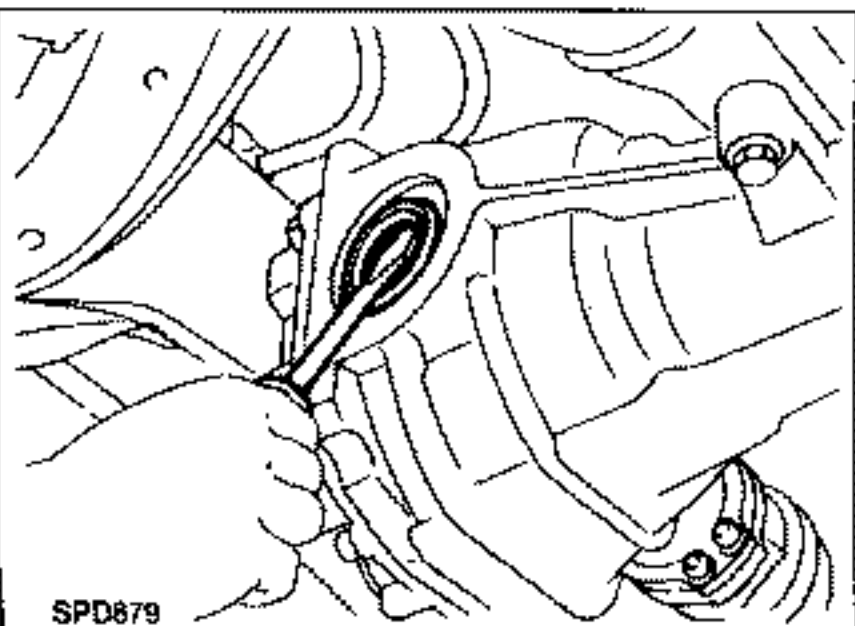
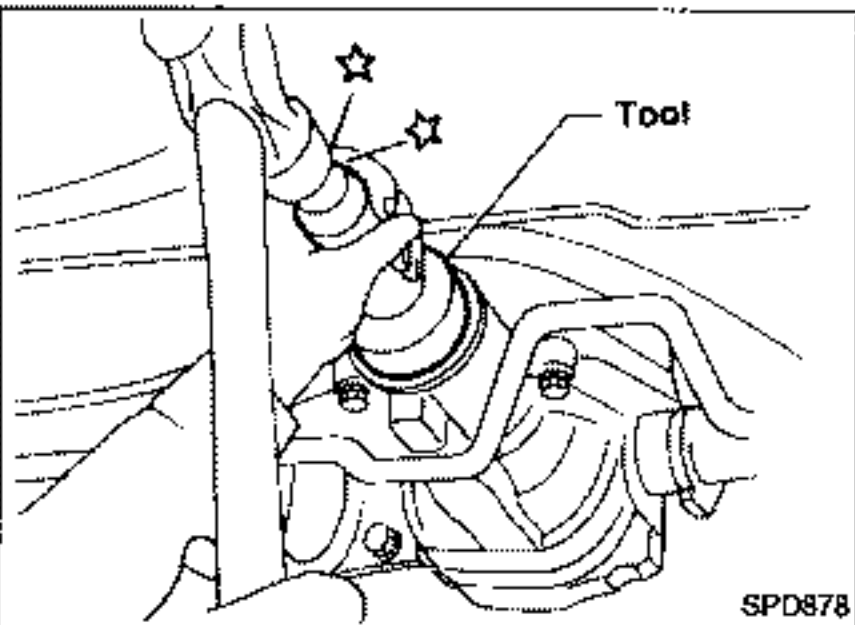
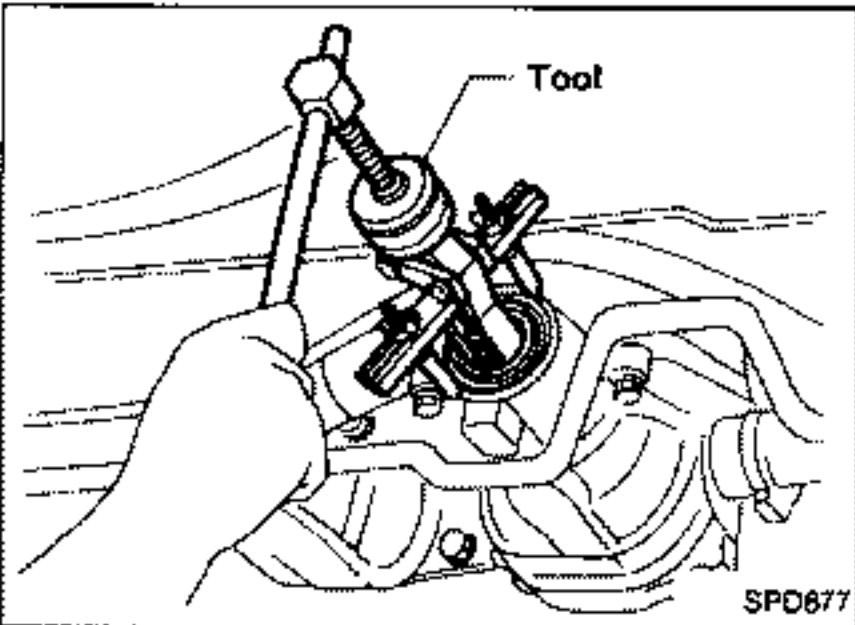
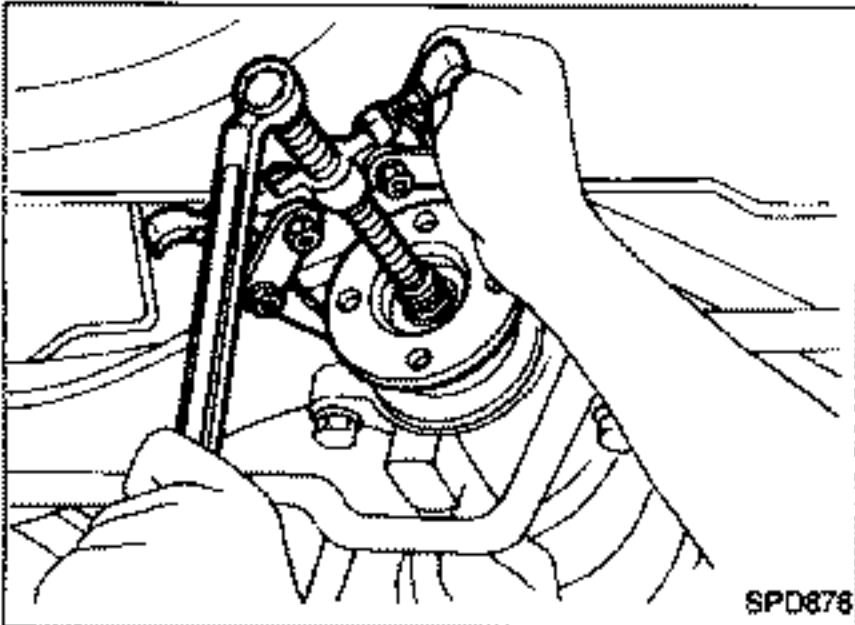
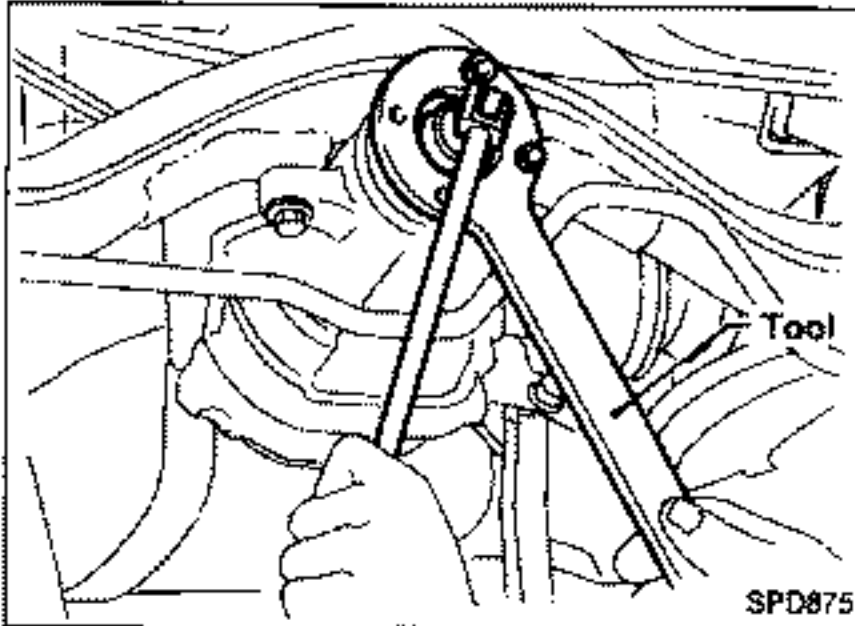
Front Oil Seal Replacement (R200V)

CAUTION:

For final drive models using collapsible spacer (R230V), bearing preload must be adjusted whenever companion flange is removed. In order to do this adjustment correctly, final drive overhaul is required.

1. Remove propeller shaft.
2. Loosen drive pinion nut with Tool.

Tool number: ST38060002



3. Remove companion flange.

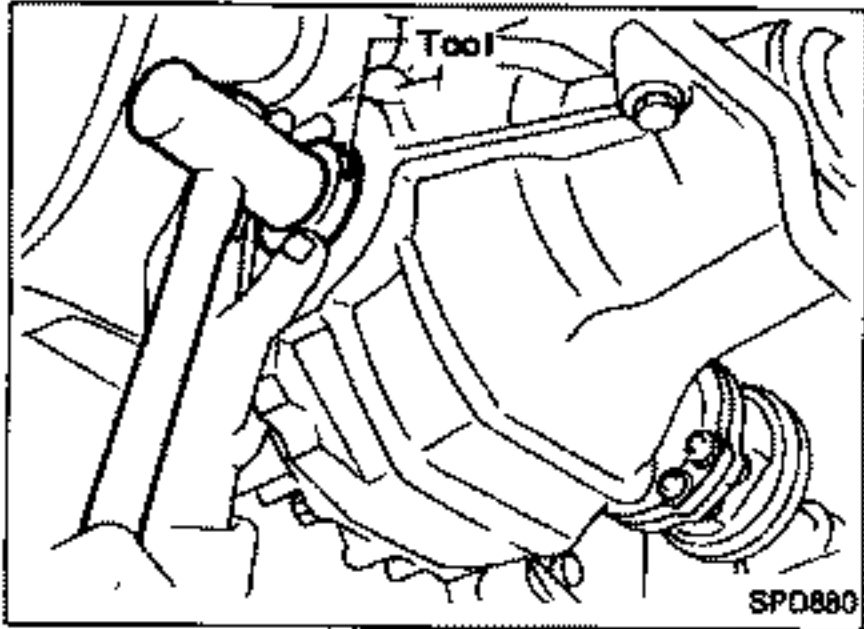
4. Remove front oil seal.

5. Apply multi-purpose grease to sealing lips of oil seal. Press front oil seal into carrier.
6. Install companion flange and drive pinion nut.
7. Install propeller shaft.

Side Oil Seal Replacement

1. Remove drive shafts.
Refer to RA section.
2. Remove final drive side flange.
3. Remove oil seal.

Side Oil Seal Replacement (Cont'd)



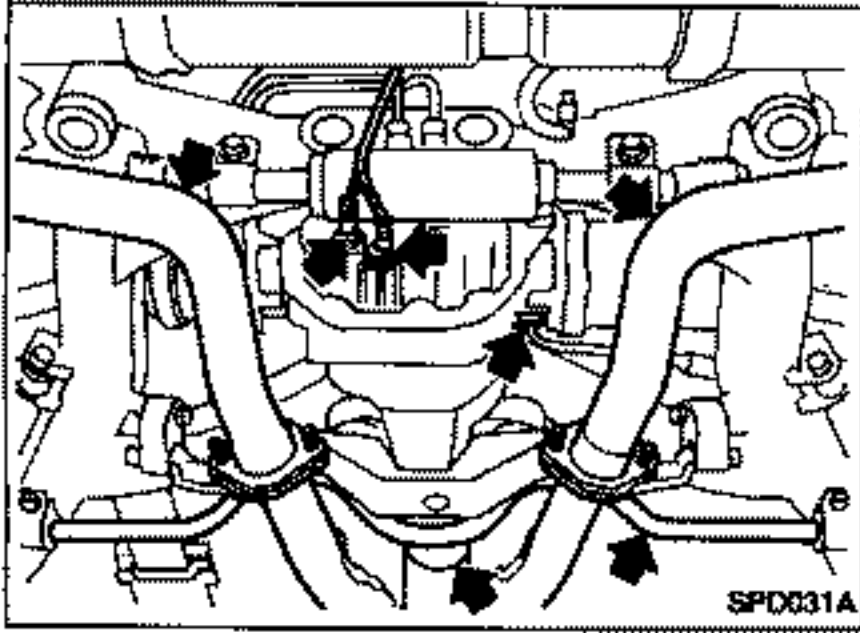
4. Apply multi-purpose grease to sealing lips of oil seal. Press-fit oil seal into carrier with Tool.

Tool number:

KV38100200 — R200V —

KV38102510 — R230V —

5. Install final drive side flange and drive shaft.



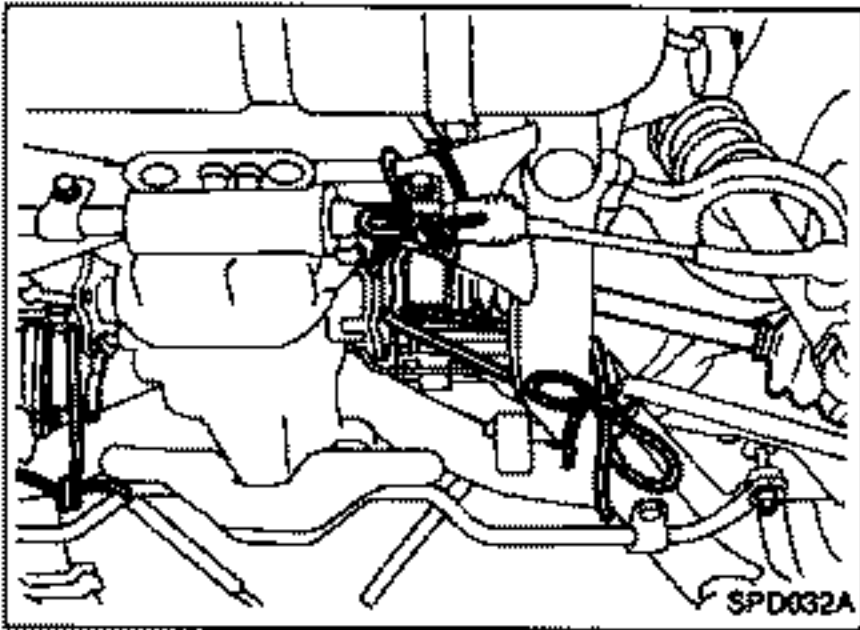
Removal

1. Remove exhaust tube.
2. Remove stabilizer bar.
3. Remove propeller shaft.

Plug rear end of transmission rear extension housing.

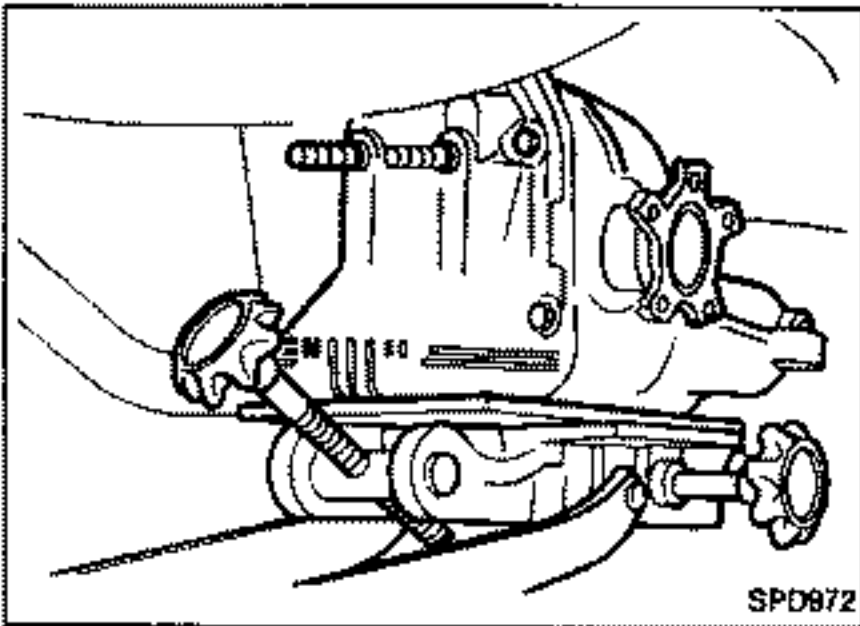
CAUTION:

- Be careful not to damage splines, sleeve yoke and transmission rear oil seal when removing propeller shaft.

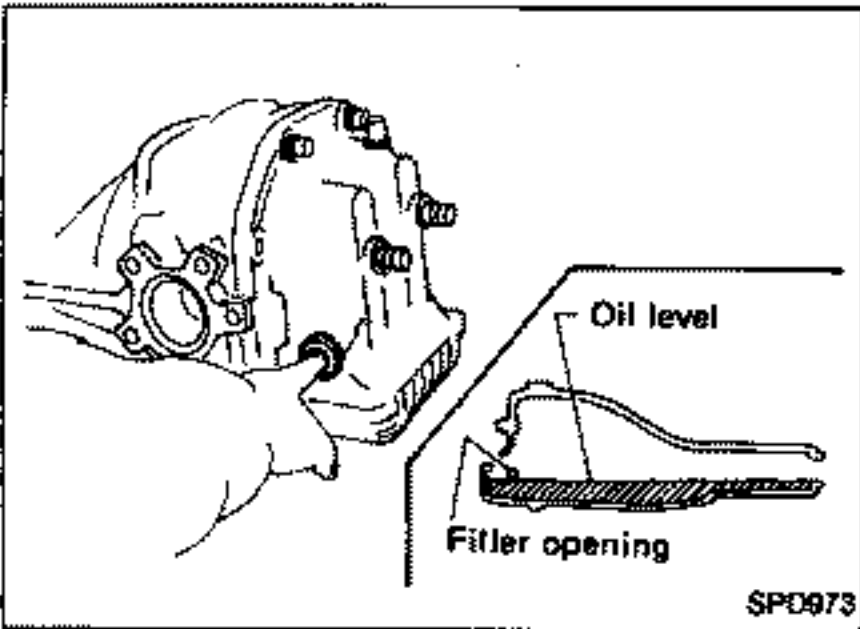


4. Disconnect drive shafts and pull them to wheel side with a wire.
5. Disconnect the following items if applicable.
 - Oil cooler warning switch connector
 - Oil cooler temperature switch connector
 - A.B.S. sensor connector
 - Hoses to oil cooler

When disconnecting oil cooler hoses, put a tray underneath.



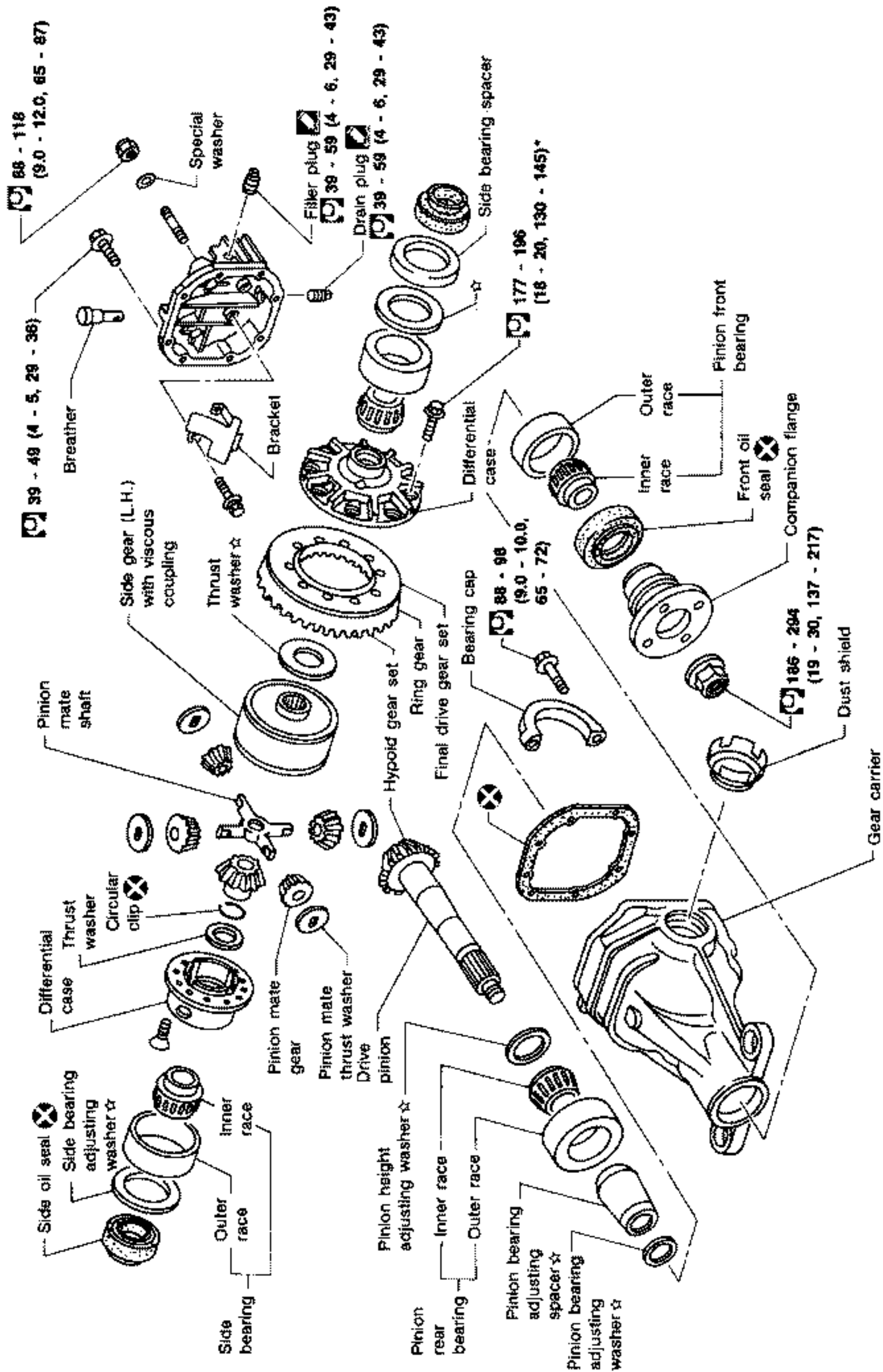
6. Support final drive with a jack.
7. Remove securing bolts and nuts from final drive.
8. Move final drive forward and lower with jack.



Installation

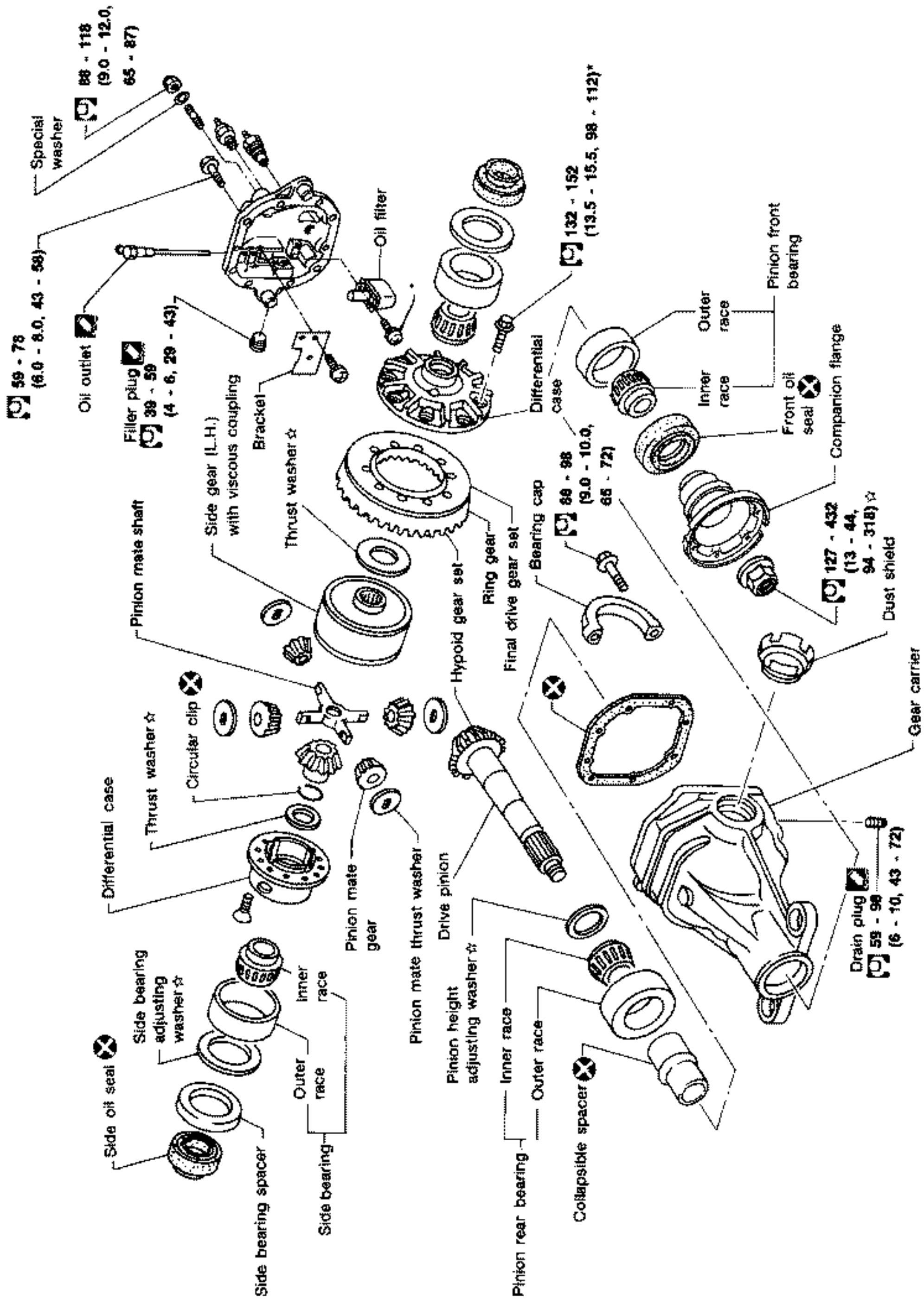
- Fill final drive with recommended gear oil.

Model R200V



☆ : Adjustment is required.
 * : Using locking agent [Locktite (Stud lock) or equivalent]
 : N·m (kg-m, ft-lb)

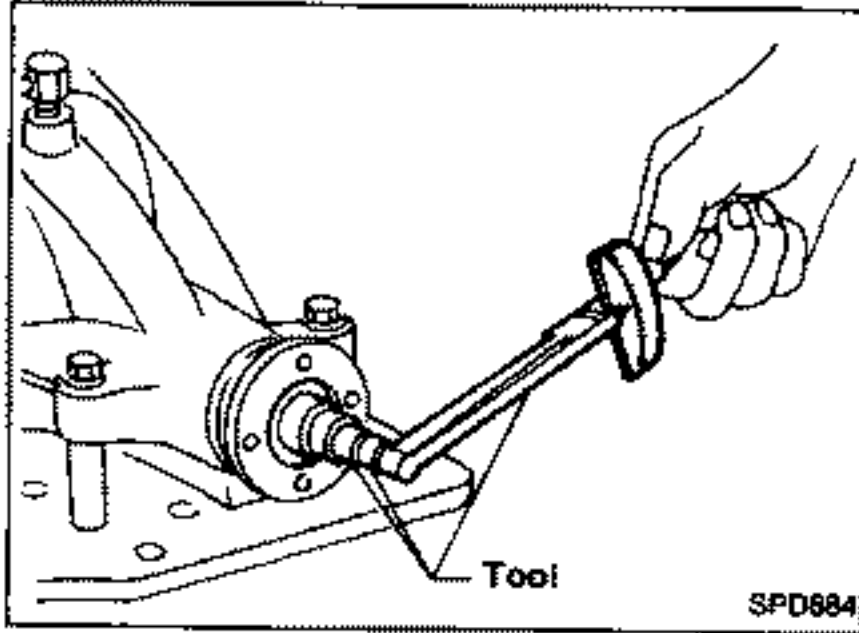
Model R230V



☆ : Adjustment is required.

• : Using locking agent [Locktite (Stud lock) or equivalent]

☐ : N·m (kg-m, ft-lb)



Pre-inspection

Before disassembling final drive, perform the following inspection.

- Total preload
 - 1) Turn drive pinion in both directions several times to set bearing rollers.
 - 2) Check total preload with Tool.

Tool number: ST3127S000

Total preload:

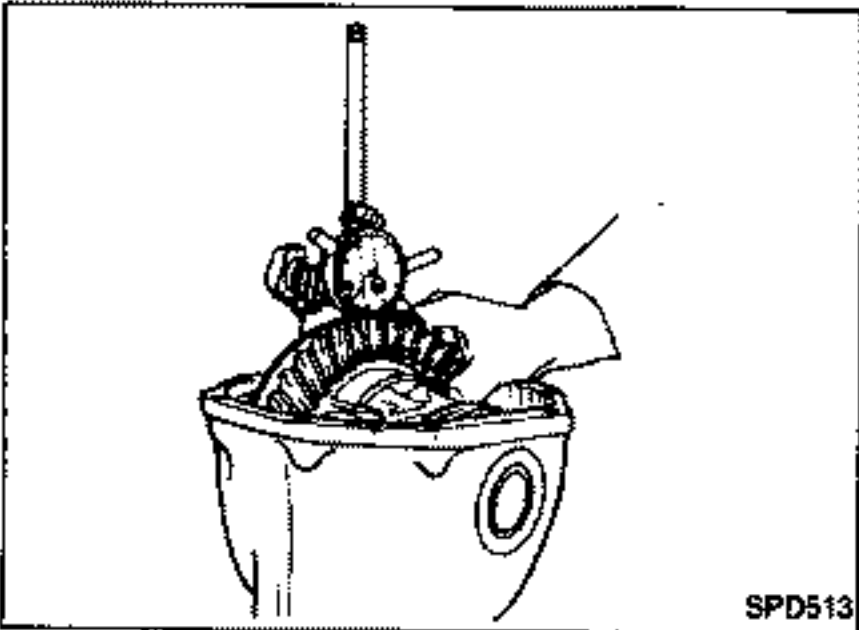
1.4 - 1.7 N·m

(14 - 17 kg-cm, 12 - 15 In-lb)

- Ring gear to drive pinion backlash
Check ring gear-to-drive pinion backlash with a dial indicator at several points.

Ring gear-to-drive pinion backlash:

0.10 - 0.15 mm (0.0039 - 0.0059 in)

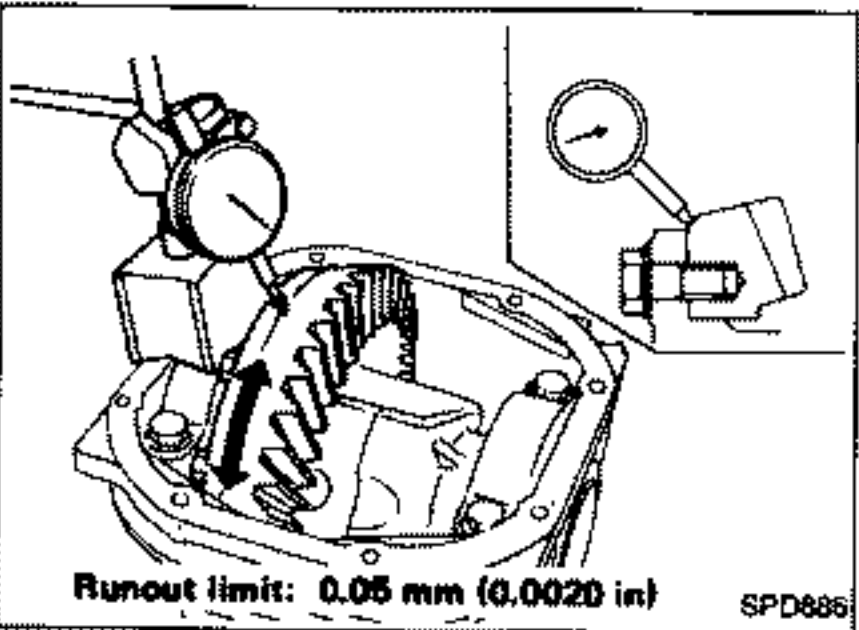


- Ring gear runout
Check runout of ring gear with a dial indicator.

Runout limit:

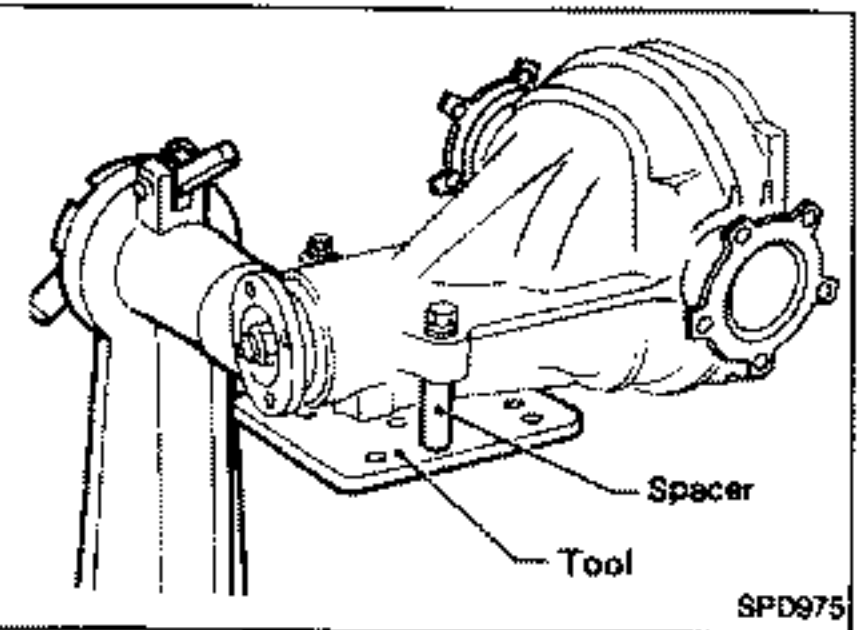
0.05 mm (0.0020 in)

- Tooth contact
Check tooth contact. (Refer to Adjustment.)



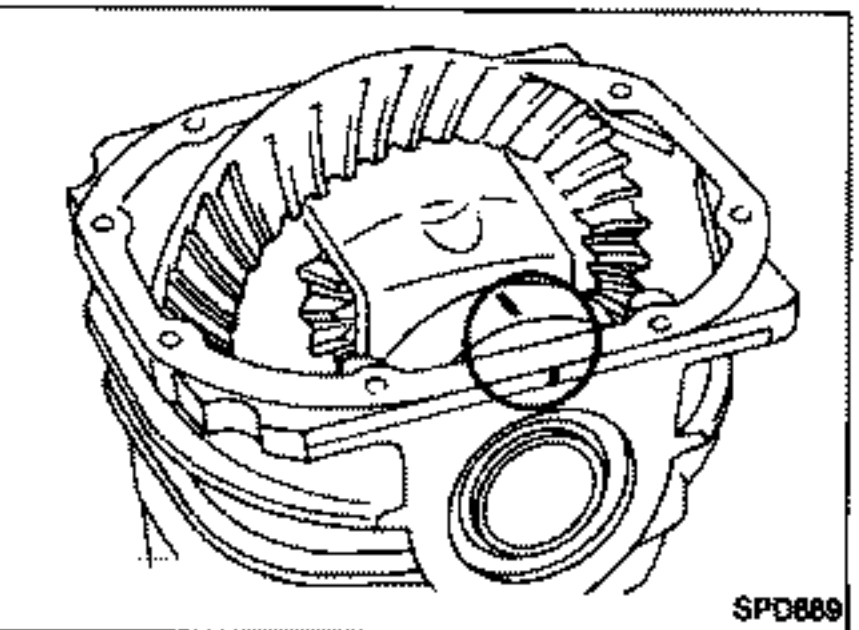
Differential Carrier

1. Using two 45 mm (1.77 in) spacers, mount carrier on Tool.
Tool number: KV38100800



2. Paint or punch matchmarks on one side of the side bearing cap so it can be properly reinstalled.

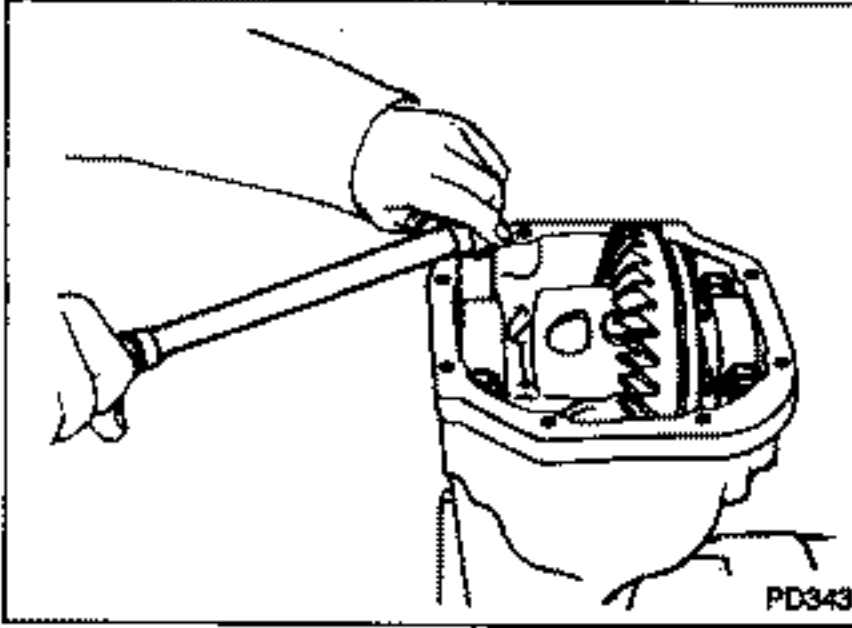
Bearing caps are line-bored during manufacture. Replace them in their proper positions.



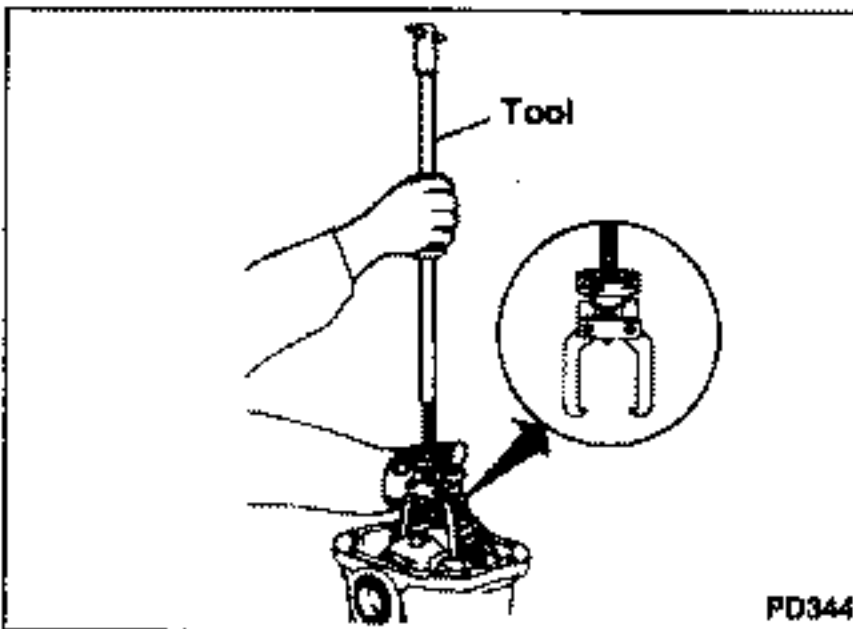
DISASSEMBLY

Differential Carrier (Cont'd)

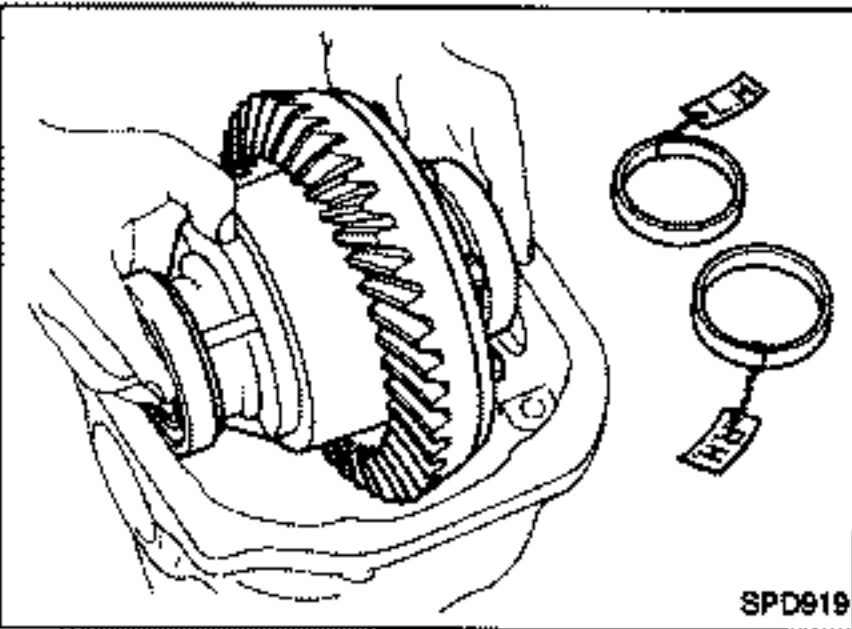
3. Remove side bearing caps.



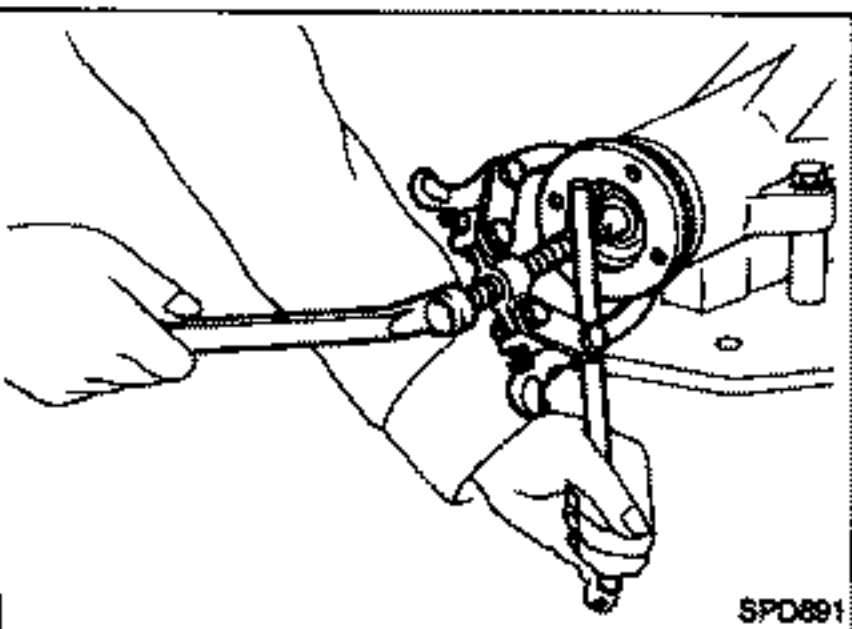
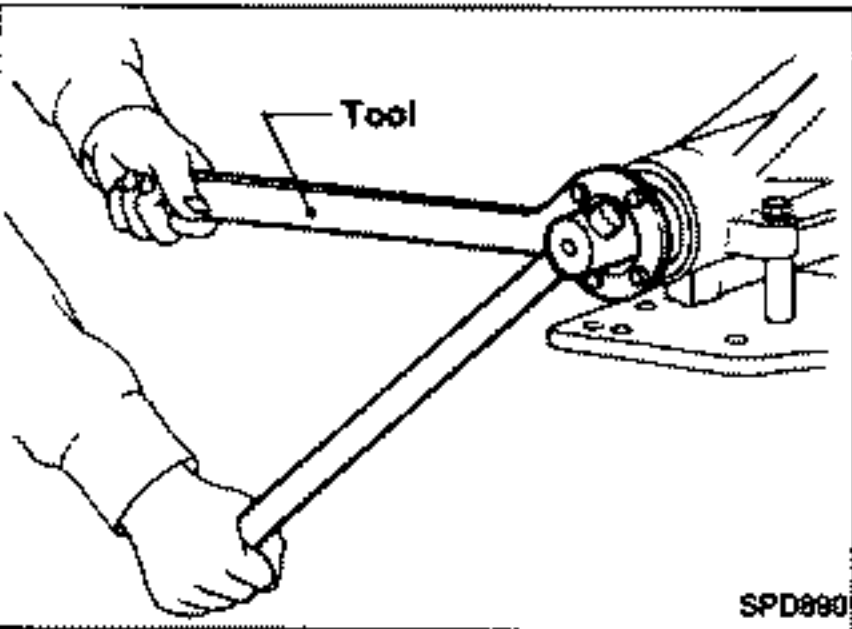
4. Lift differential case assembly out with Tool.
Tool number: HT72400000



Keep the side bearing outer races together with inner cone — do not mix them up.
Also, keep side bearing spacer and adjusting shims together with bearings.

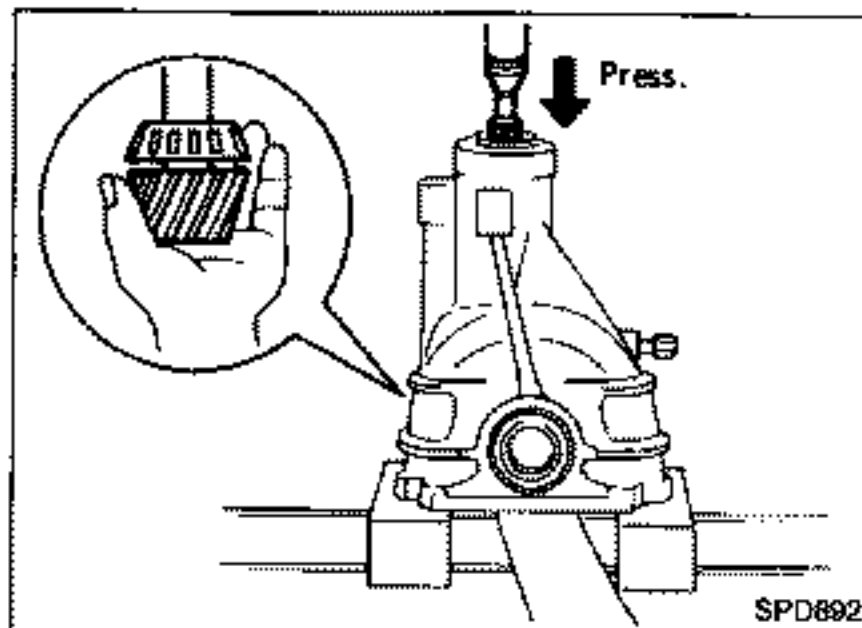


5. Loosen drive pinion nut and pull off companion flange.
Tool number:
ST38060002 — R200V —

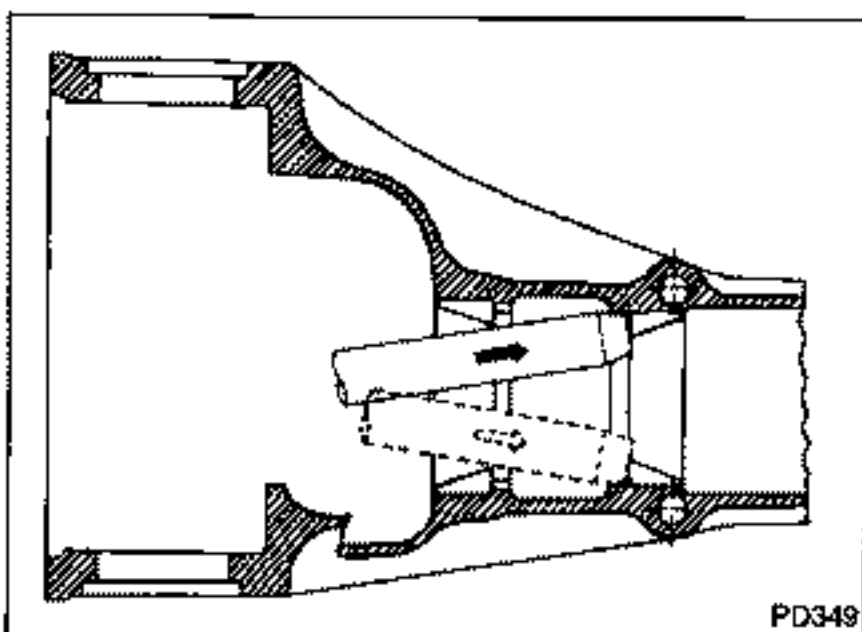


DISASSEMBLY

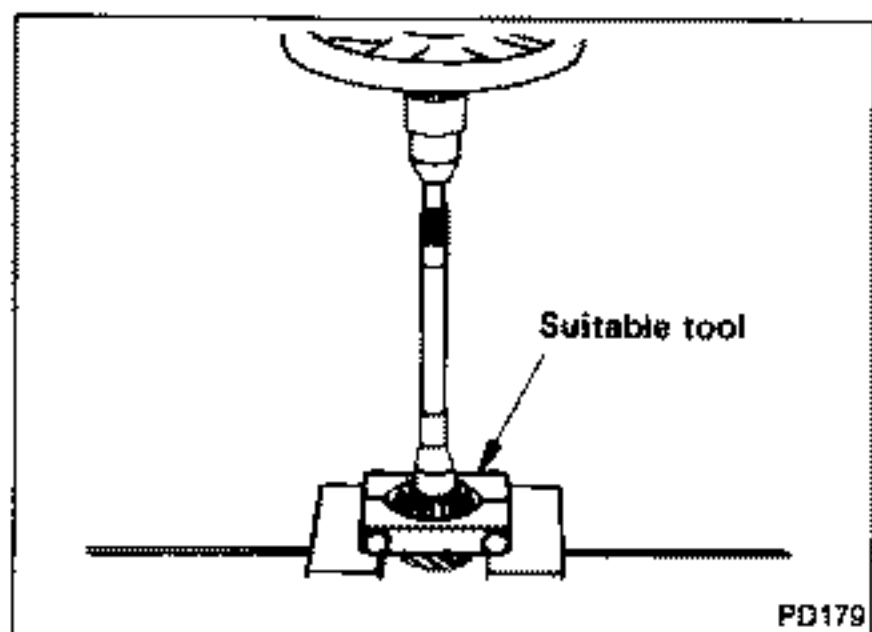
Differential Carrier (Cont'd)



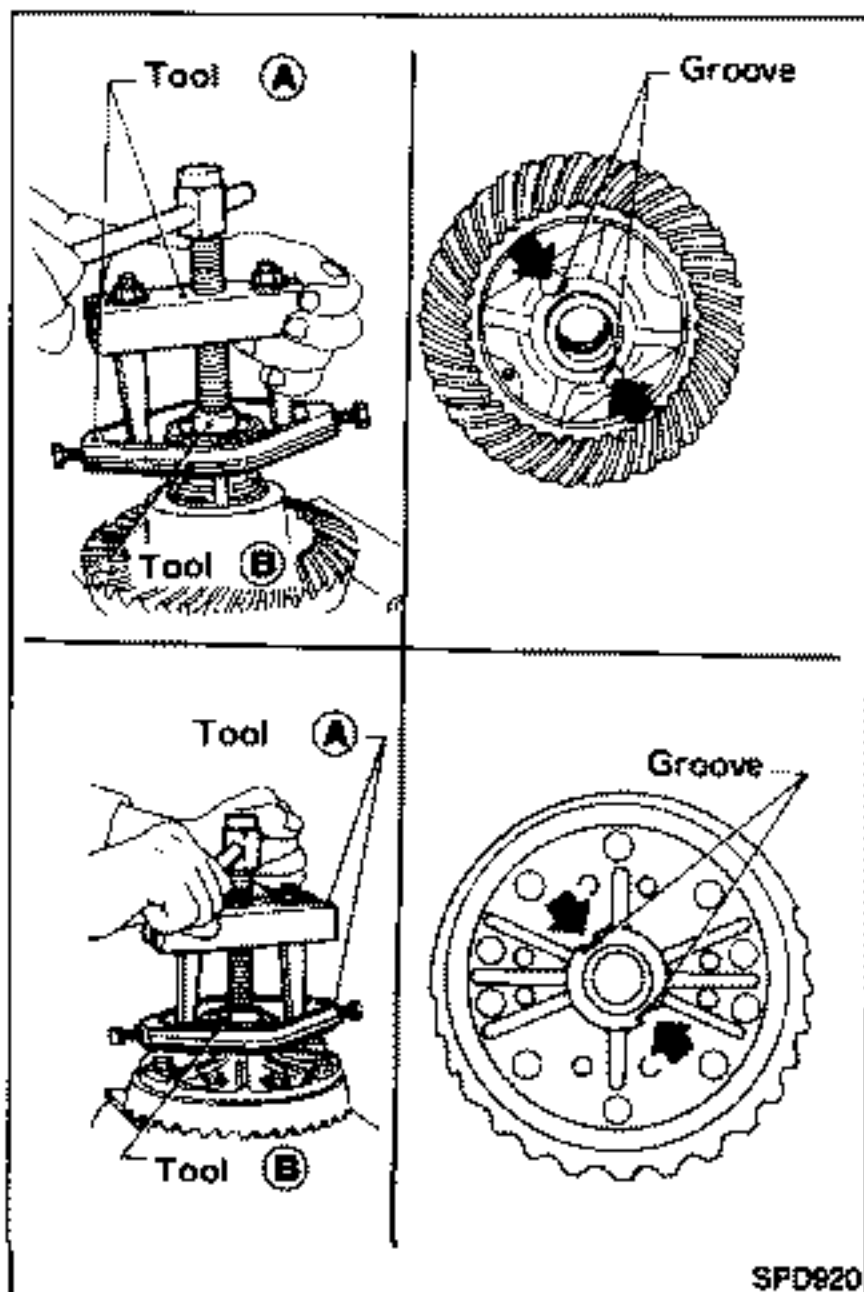
6. Take out drive pinion (together with rear bearing inner race, bearing spacer and adjusting washer).
7. Remove oil seal.
8. Remove front bearing inner race.
9. Remove side oil seal.



10. Remove pinion bearing outer races with a brass drift.



11. Remove pinion rear bearing inner race and drive pinion height adjusting washer with a suitable tool.



Differential Case

1. Remove side bearing inner cones.
To prevent damage to bearing, engage puller jaws in groove.

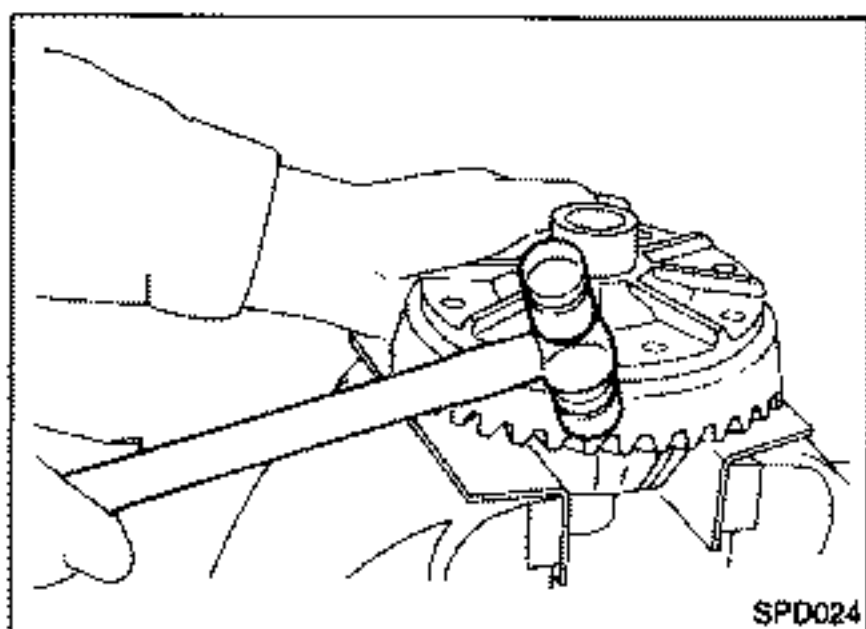
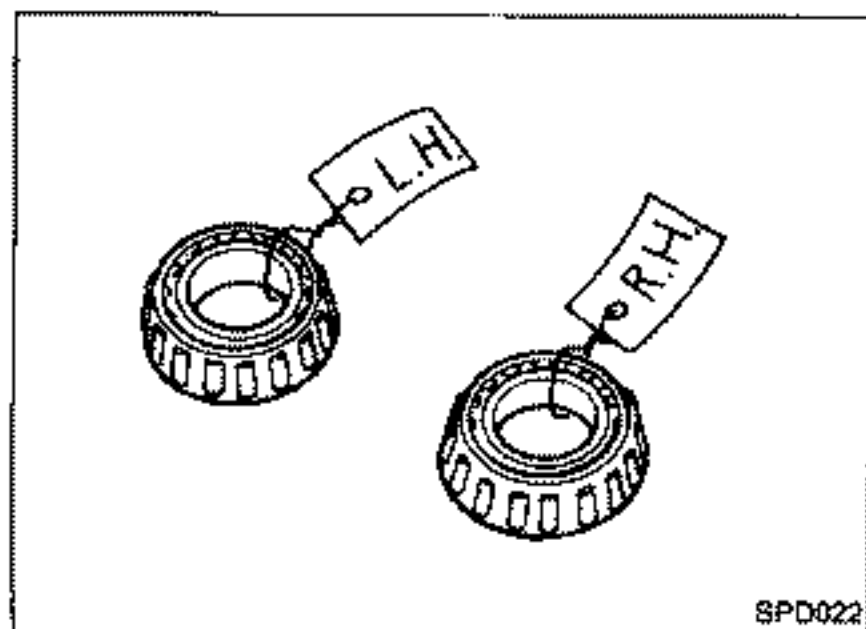
Tool number:

- Ⓐ ST33051001
- Ⓑ ST33061000 — R200V —

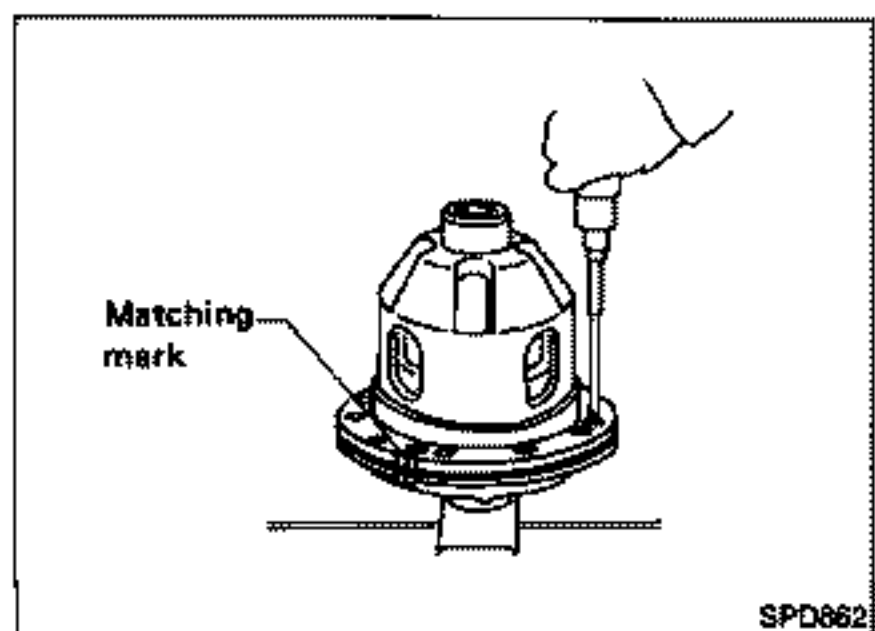
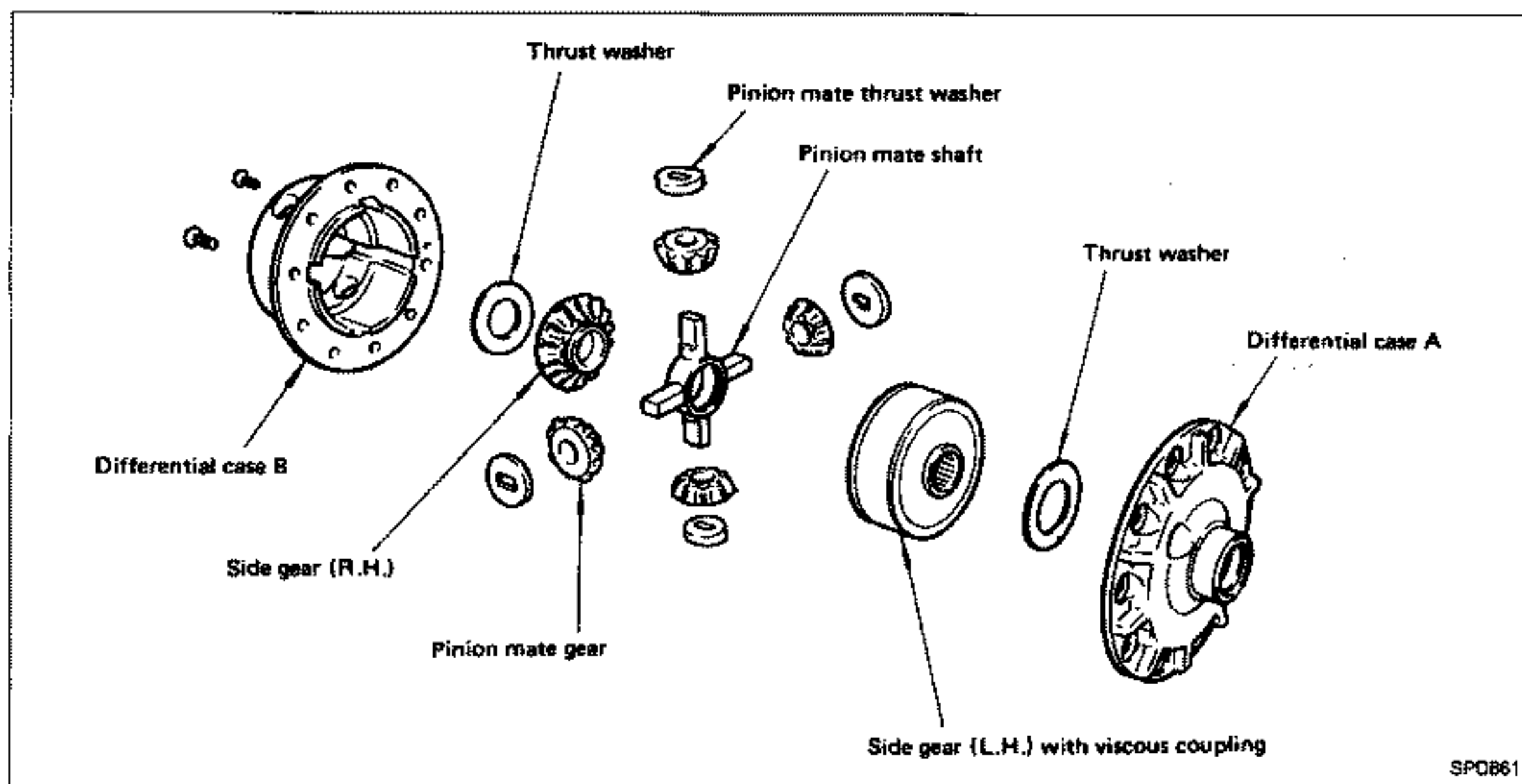
DISASSEMBLY

Differential Case (Cont'd)

Be careful not to confuse left- and right-hand parts.



2. Loosen ring gear bolts in a criss-cross fashion.
3. Tap ring gear off the differential case with a soft hammer. Tap evenly all around to keep ring gear from binding.



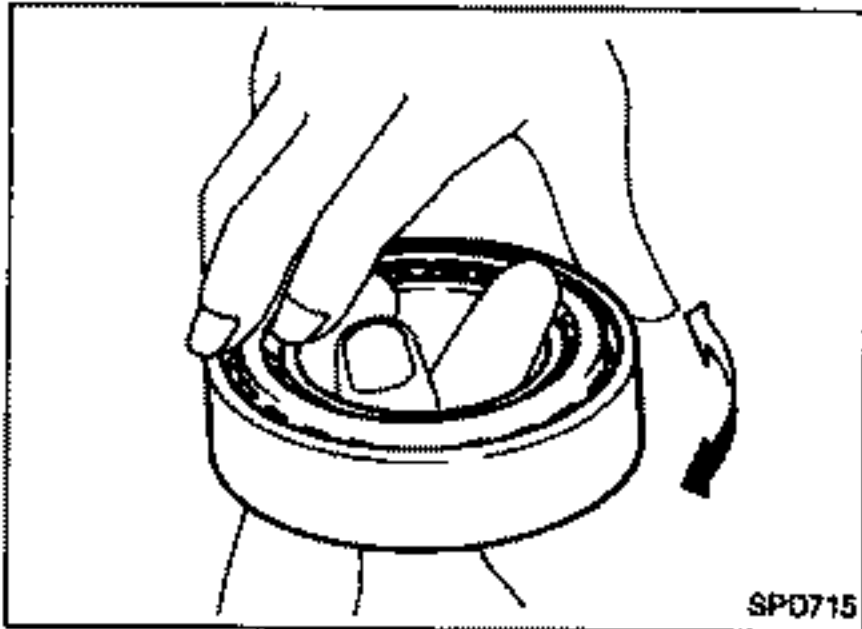
4. Loosen screws on differential cases A and B.
5. Separate differential cases A and B.

CAUTION:

Assemble differential case firmly.

Contact Surfaces

1. Clean the disassembled parts in suitable solvent and blow dry with compressed air.
2. If following surfaces are found to be burred or scratched, smooth with oil stone.
 - Differential case A
 - Differential case B
 - Side gear
 - Pinion mate gear
 - Pinion mate shaft
3. Check viscous coupling for oil leakage. If necessary, replace it with a new one.

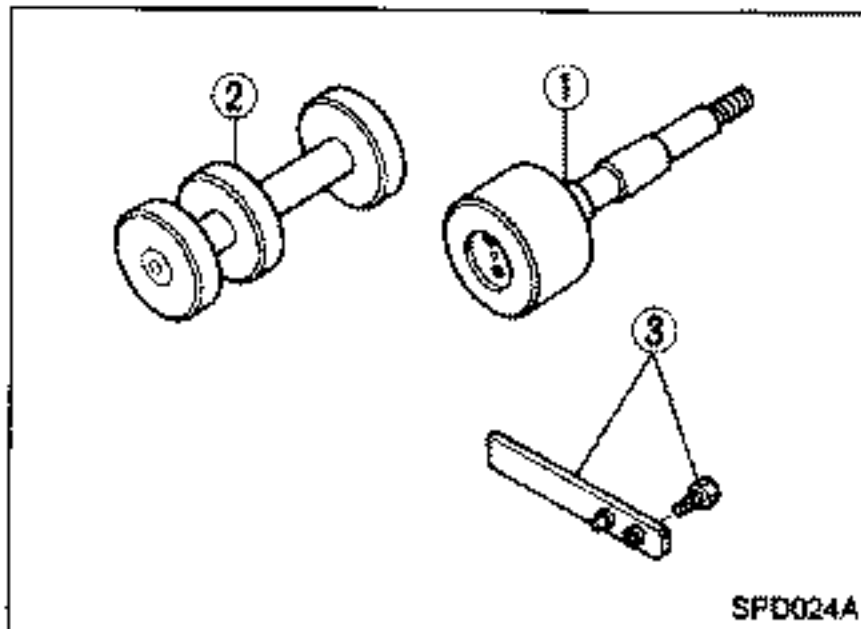


Bearing

1. Thoroughly clean bearing.
2. Check bearings for wear, scratches, pitting or flaking. Check tapered roller bearing for smooth rotation. If damaged, replace outer race and inner cone as a set.

ADJUSTMENT

To avoid confusion while calculating thickness of washers, it is absolutely necessary to stay with the metric system. If you measure anything in inches, the results must be converted to the metric system.

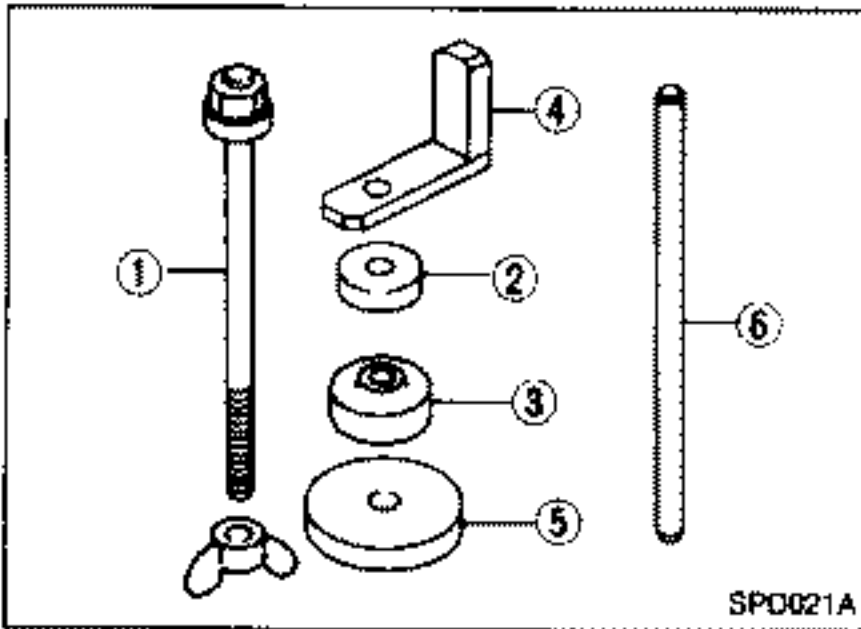


Drive Pinion Height

1. Prepare Tools for pinion height adjustment.

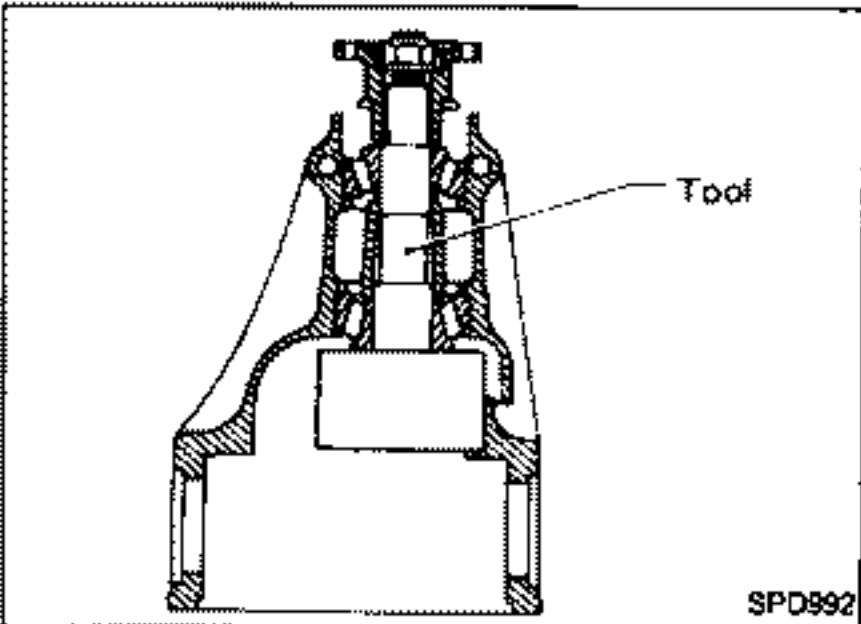
— R200V —

- ① Dummy shaft (KV38103910)
- ② Height gauge (KV38100120)
- ③ Stopper (KV38100140)



— R230V —

- ① Dummy shaft (KV38107610)
- ② Rear bearing spacer (KV38107650)
- ③ Front bearing spacer (KV38107640)
- ④ Height gauge (KV38107620)
- ⑤ Side bearing adapter (KV38107660)
- ⑥ Adapter shaft (KV38107630)



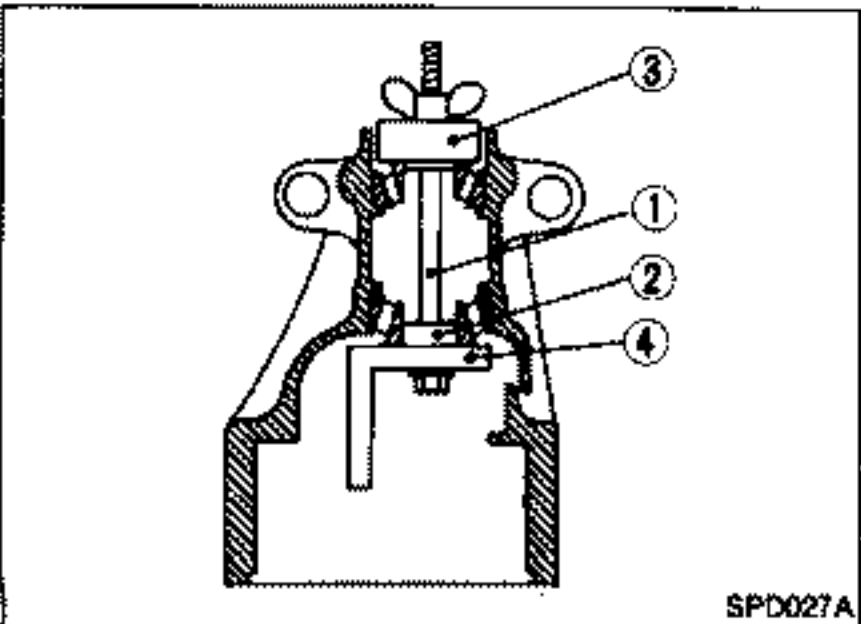
2. Lubricate bearings and set Tools as shown. Tighten nut carefully until bearings reach specified preload.

— R200V —

Tool: Dummy shaft (KV38103910)

Bearing preload:

1.0 - 1.4 N·m (10 - 14 kg-cm, 8.7 - 12.2 in-lb)



— R230V —

Tool:

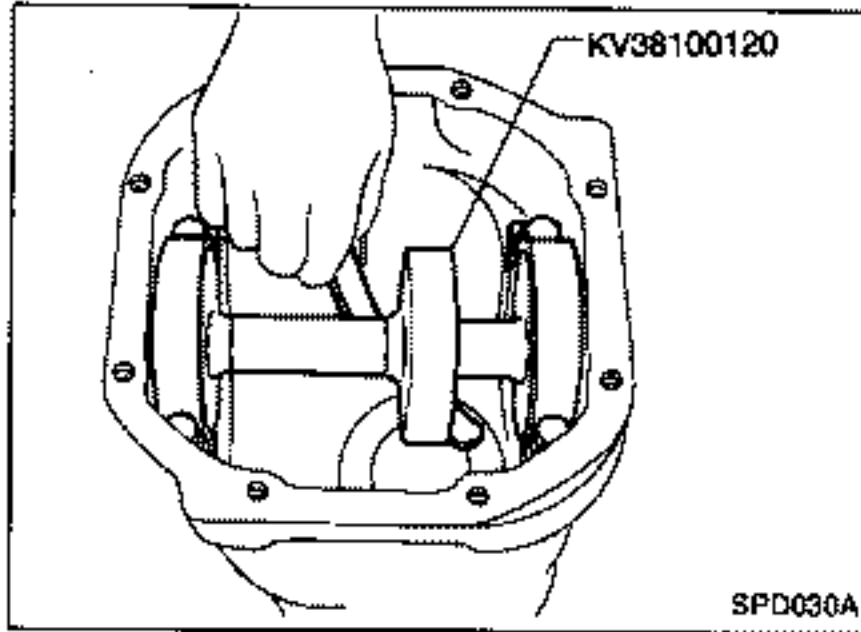
- ① Dummy shaft (KV38107610)
- ② Rear bearing spacer (KV38107650)
- ③ Font bearing spacer (KV38107640)
- ④ Height gauge (KV38107620)

Bearing preload:

1.8 - 2.6 N·m (18 - 27 kg-cm, 16 - 23 in-lb)

ADJUSTMENT

Drive Pinion Height (Cont'd)

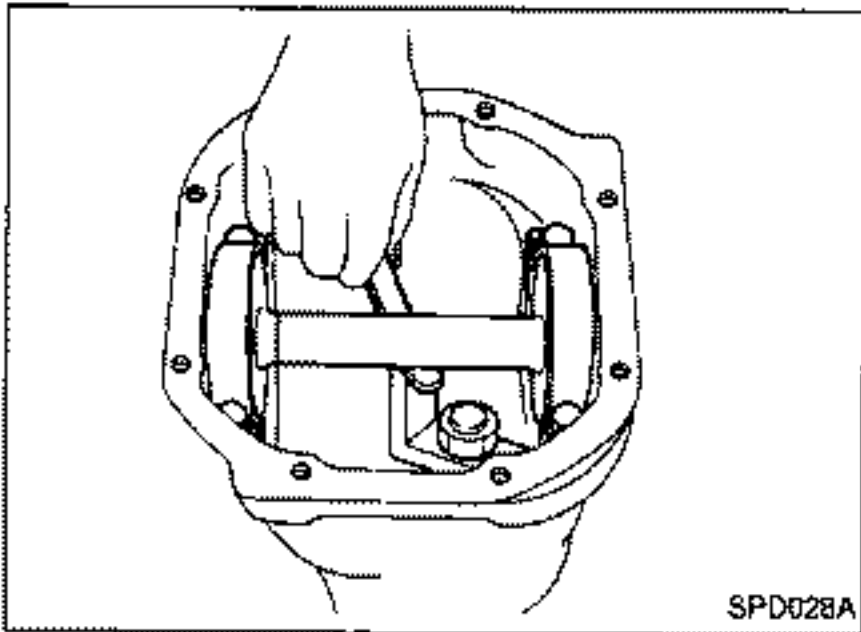


3. Attach Tools to gear carrier.

— R200V —

Measure clearance between height gauge and dummy shaft face.

Add 0.5 mm (0.020 in) to your measurement and write this figure down.

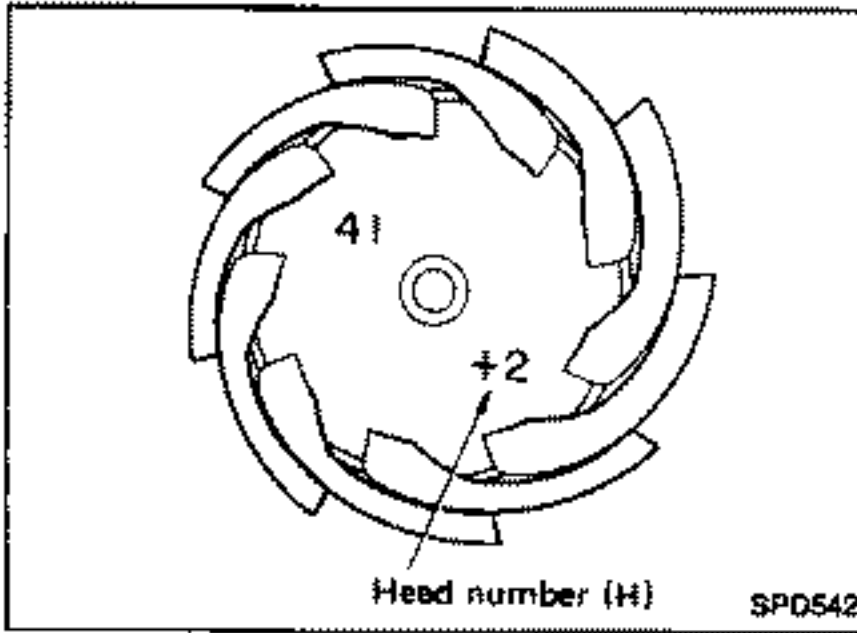


— R230V —

Measure clearance between height gauge and adapter shaft face and write this figure down.

ADJUSTMENT

Drive Pinion Height (Cont'd)



4. Correct the pinion height washer size by referring to the "pinion head number."

There are two numbers painted on the pinion gear. The first one refers to the pinion and ring gear as a matched set and should be the same as the number on the ring gear. The second number is the "pinion head height number", and it refers to the ideal pinion height from standard for quietest operation. Use the following chart to determine the correct pinion height washer.

Pinion head height number	Add or remove from the standard pinion height washer thickness measurement
-6	Add 0.06 mm (0.0024 in)
-5	Add 0.05 mm (0.0020 in)
-4	Add 0.04 mm (0.0016 in)
-3	Add 0.03 mm (0.0012 in)
-2	Add 0.02 mm (0.0008 in)
-1	Add 0.01 mm (0.0004 in)
0	Use the selected washer thickness
+1	Subtract 0.01 mm (0.0004 in)
+2	Subtract 0.02 mm (0.0008 in)
+3	Subtract 0.03 mm (0.0012 in)
+4	Subtract 0.04 mm (0.0016 in)
+5	Subtract 0.05 mm (0.0020 in)
+6	Subtract 0.06 mm (0.0024 in)

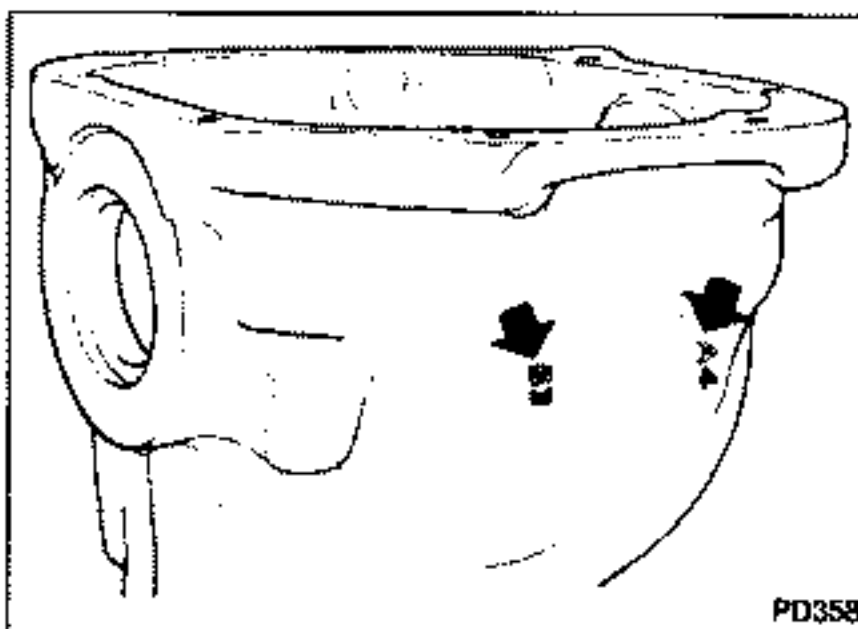
5. Select the correct pinion height washer.
Drive pinion height adjusting washer:
Refer to S.D.S.

ADJUSTMENT

Side Bearing Preload

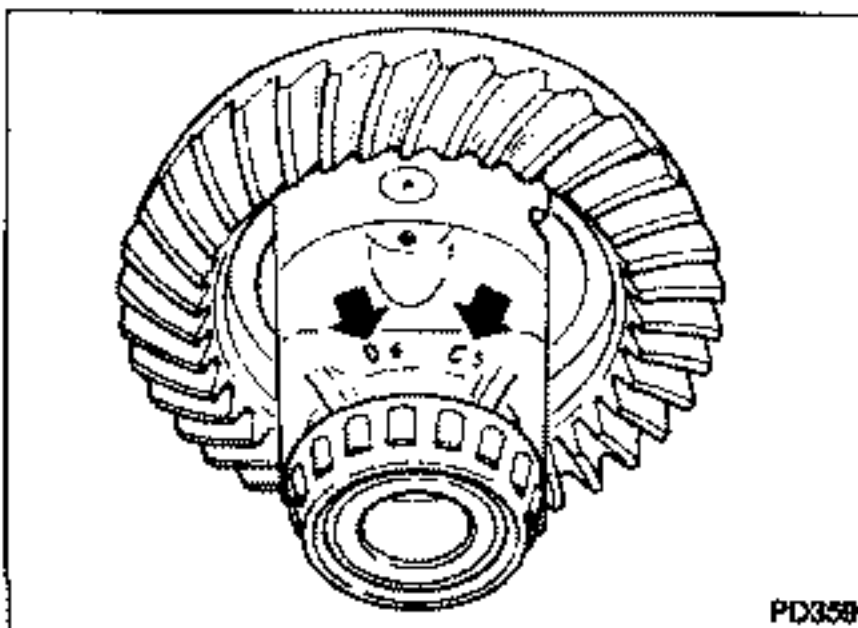
- To simplify the job, make a chart like the one below to organize your calculations.

LETTERS	VALUE	
	R200V	R230V
A: Left housing		
B: Right housing		
C: Differential case		
D: Differential case		
H: (+) or (-): ring gear		
E: Left side bearing		
R200V (= 21 - Measured height)		—
R230V (= 27 - Measured height)	—	
F: Right side bearing		
R200V (= 21 - Measured height)		—
R230V (= 27 - Measured height)	—	
G: Side bearing spacer (= 8.1 - measured thickness)		
X:	1.97	1.95
Y:	2.07	2.05



- Write the following numbers down in the chart.
If numbers for A, B, C, D and H are not given, regard them as zero.
A & B: Figures marked on gear carrier

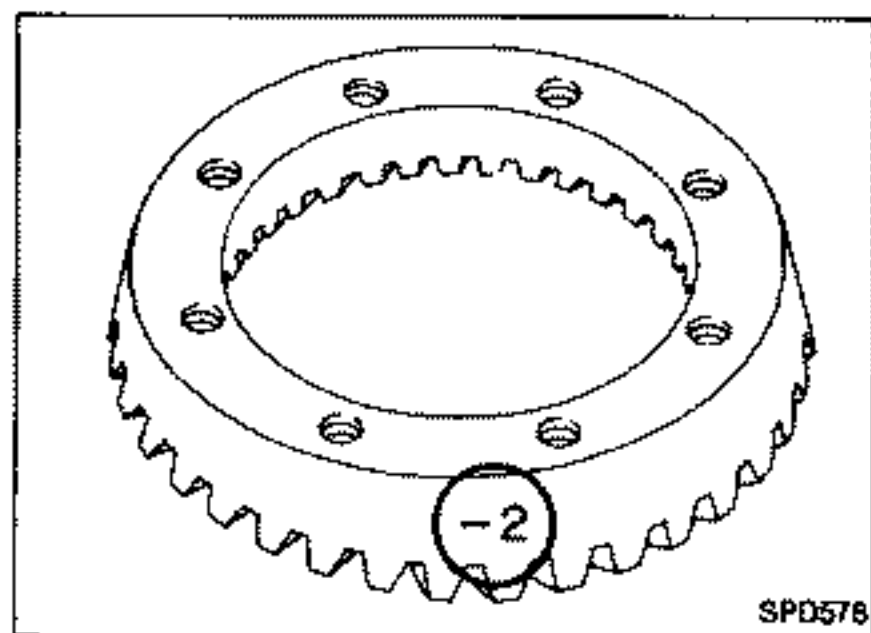
C & D: Figures marked on differential case



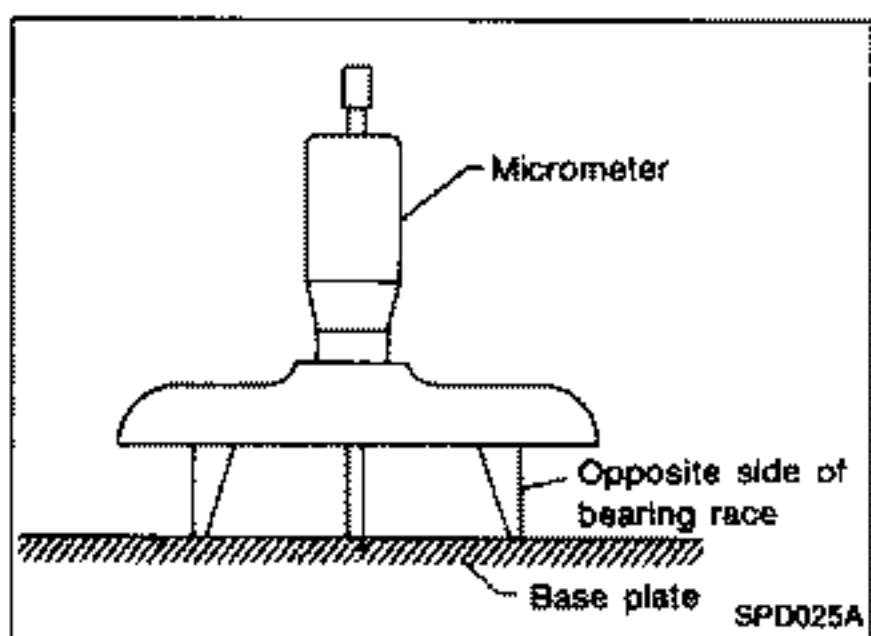
ADJUSTMENT

Side Bearing Preload (Cont'd)

H: Figure marked on ring gear
Do not confuse negative and positive values.

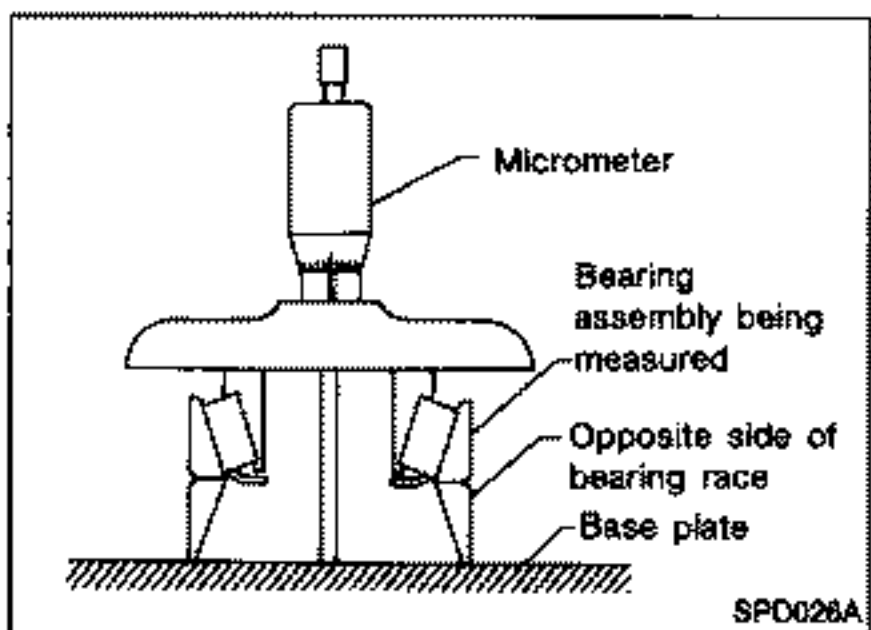


3. Calculate "E" and "F" as follows:
- R200V —
E & F = 21 mm (0.83 in) — Measured bearing height
 - R230V —
E & F = 27 mm (1.06 in) — Measured bearing height

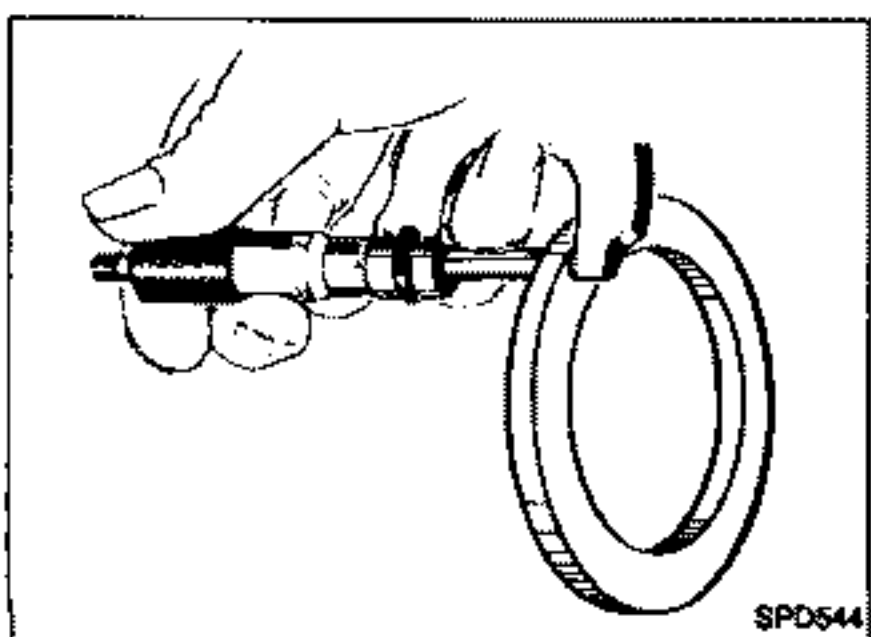


Bearing height can be measured as follows:

a. Measure height of bearing race which will be used as a base for the opposite side of a side bearing assembly.



- b. Set bearing assembly to be measured on the base race and measure the total height.
Lubricate bearing assembly and turn it several times to settle it on the base for accurate measurement.
- c. Subtract base race height from total height.



4. Calculate "G".
- G: This is the difference in thickness of side spacer from standard width [8.10 mm (0.3189 in)].
- G = 8.10 mm (0.3189 in) — Measured thickness

ADJUSTMENT

Side Bearing Preload (Cont'd)

LETTERS	VALUE	
	R200V	R230V
A: Left housing		
B: Right housing		
C: Differential case		
D: Differential case		
H: (+) or (-): ring gear		
E: Left side bearing R200V (= 21 - Measured height)		—
R230V (= 27 - Measured height)	—	
F: Right side bearing R200V (= 21 - Measured height)		—
R230V (= 27 - Measured height)	—	
G: Side bearing spacer (= 8.1 - measured thickness)		
X:	1.97	1.95
Y:	2.07	2.05

Calculations:

Side bearing spacer is used on the right

Left side washer thickness

$$T_1 = (A - C + D - H) \times 0.01 + E + Y$$

Right side washer thickness

$$T_2 = (B - D + H) \times 0.01 + F + G + X$$

Side bearing spacer is used on the left

Left side washer thickness

$$T_1 = (A - C + D - H) \times 0.01 + E + G + X$$

Right side washer thickness

$$T_2 = (B - D + H) \times 0.01 + F + Y$$

ADJUSTMENT

Side Bearing Preload (Cont'd)

Example for R200V which has a side bearing spacer on the left:

A = 4	E = 0.18
B = 3	F = 0.15
C = 5	G = 0.08
D = 6	X = 1.97
H = -2	Y = 2.07

Left side washer thickness (with spacer)

$$T_1 = (A - C + D - H) \times 0.01 + E + G + X$$

4	A	
- 5	- C	
= -1		
+ 6	+ D	
= 5		
- (- 2)	- H	
= 7		
x 0.01	x 0.01	
= 0.07		
+ 0.18	+ E	
= 0.25		
+ 0.08	+ G	
= 0.33		
+ 1.97	+ X	
= 2.30		
$T_1 = 2.30 \text{ mm}$		

Right side washer thickness (without spacer)

$$T_2 = (B - D + H) \times 0.01 + F + Y$$

3	B	
- 6	- D	
= - 3		
+ (- 2)	+ H	
= -5		
x 0.01	x 0.01	
= - 0.05		
+ 0.15	+ F	
= 0.10		
+ 2.07	+ Y	
= 2.17		
$T_2 = 2.17 \text{ mm}$		

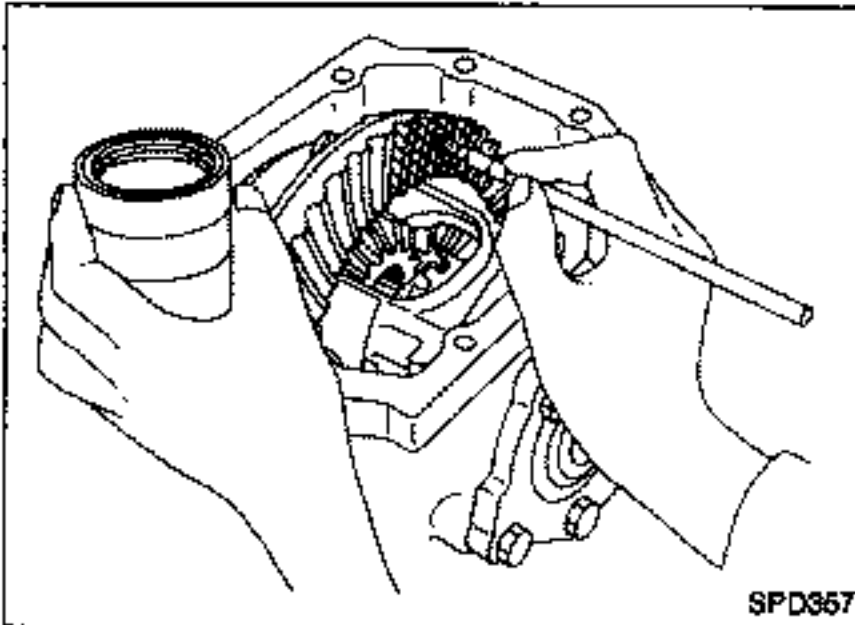
5. Select the proper shims. (Refer to S.D.S.)

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

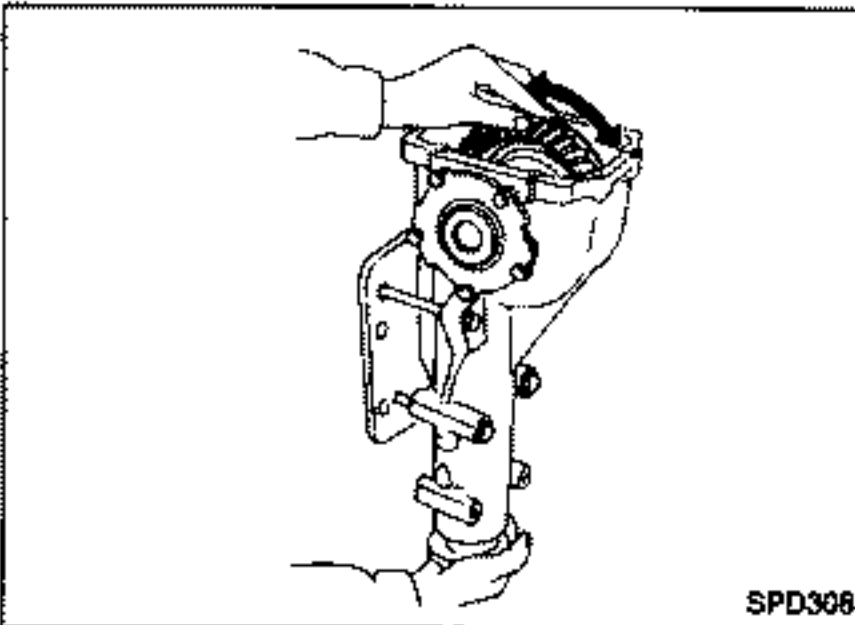
ADJUSTMENT

Tooth Contact

Checking gear tooth contact pattern is necessary to verify correct relationship between ring gear and drive pinion. Hypoid gear set which is not positioned properly in relation to one another may be noisy, or have short life or both. With the checking of gear tooth contact pattern, the most desirable contact for low noise level and long life can be assured.

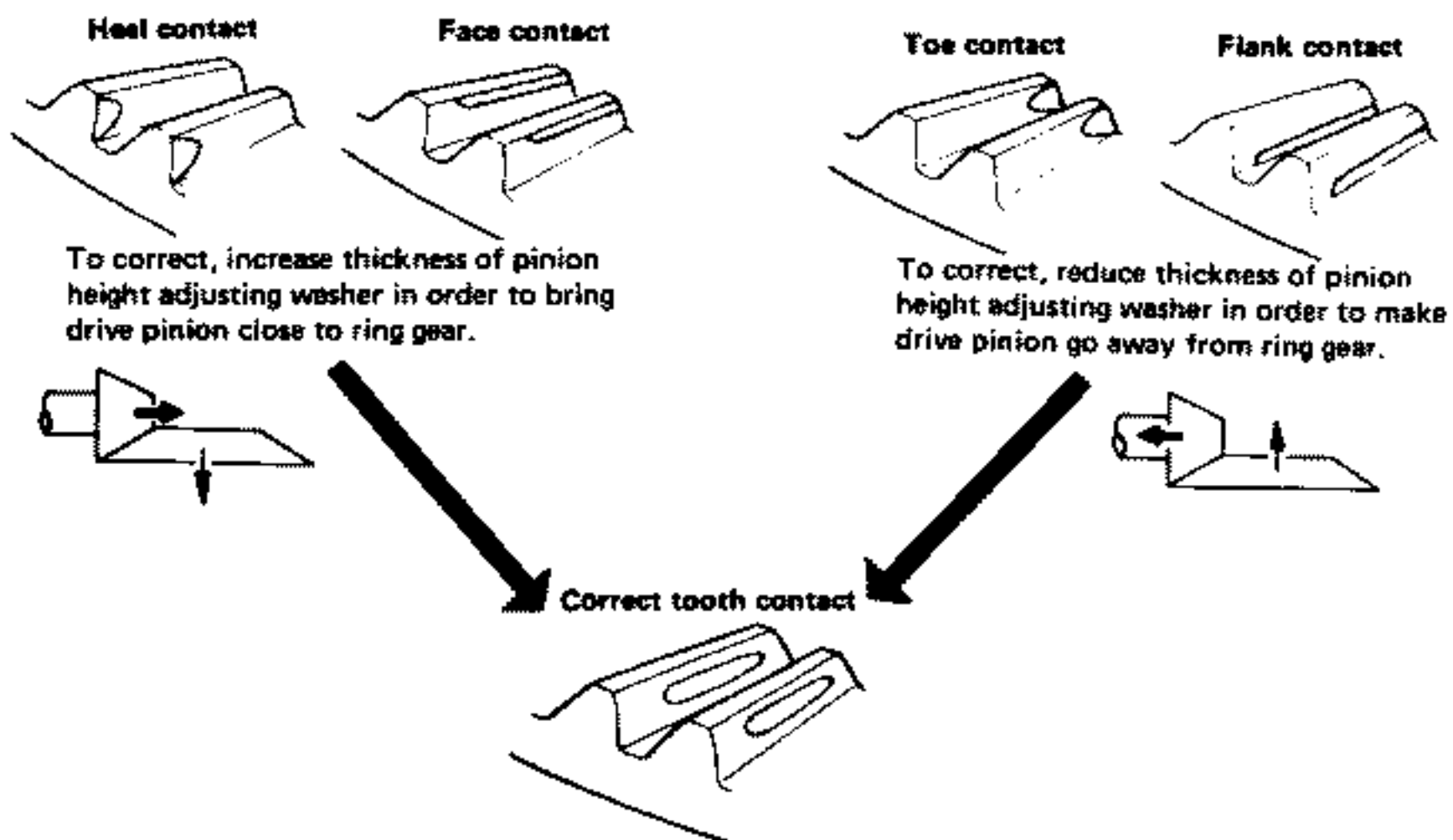


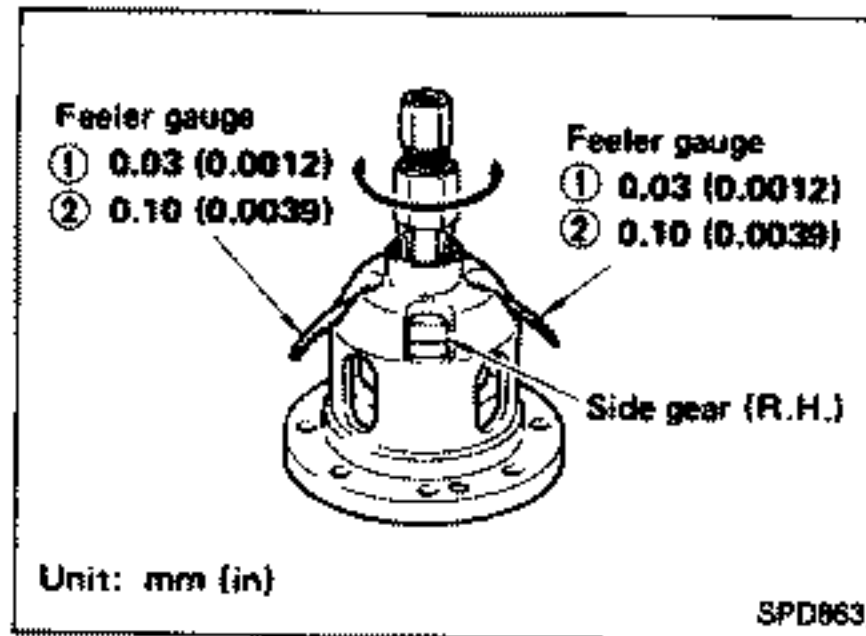
1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear drive side.



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

Usually the pattern will be correct if you have calculated the shims correctly and the backlash is correct. However, in rare cases you may 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 the final drive has been set up.





Differential Case

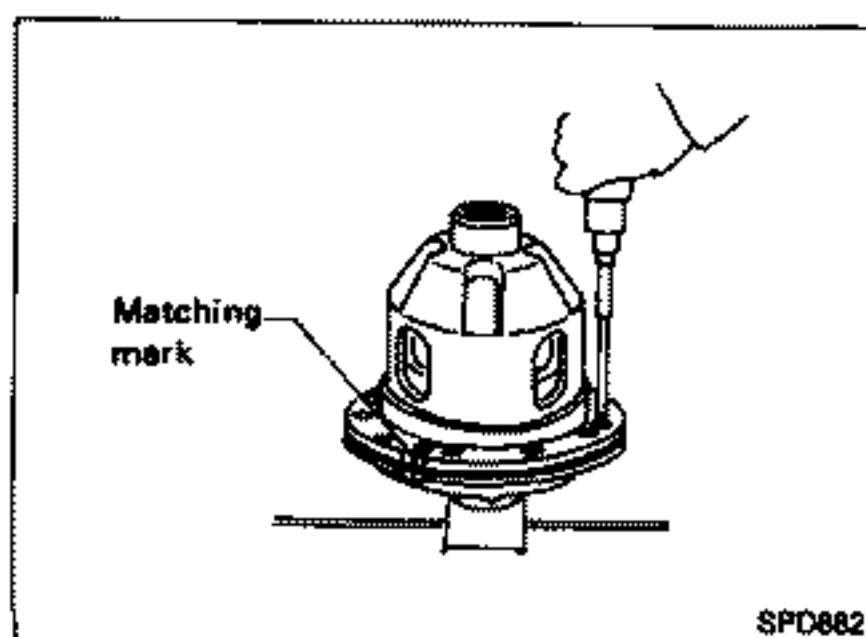
THRUST WASHER SELECTION

Whenever side gears or pinion mate gears are replaced, select suitable thrust washers as follows:

1. Clean side gears and pinion mate gears using white gasoline.
2. Before assembling gears, apply hypoid gear oil to frictional surfaces.
3. Install the previously removed thrust washer on right side gear. On left side gear, install a suitable thrust washer. Temporarily tighten differential cases using two screws.
4. Position differential assembly so that right side gear is on the upper side. Place a 0.03 mm (0.0012 in) feeler gauge (for example) between right side gear and thrust washer.

Do not insert feeler gauge in oil groove portion of differential case.

5. Also place a 0.03 mm (0.0012 in) additional feeler gauge between right side gear and thrust washer so that it is positioned diagonal to (180° apart from) the feeler gauge described previously.
6. Rotate right side gear with a suitable tool attached to splines.
If right side gear cannot be rotated, replace thrust washer used on left side gear with a thinner one.
7. Replace both 0.03 mm (0.0012 in) feeler gauges with 0.10 mm (0.0039 in) gauges. At this point, make sure right side gear does not rotate. If it does, replace thrust washer on left side gear with a thicker one so that right side gear does not rotate.
8. As explained in above example, select suitable thrust washers to ensure that:
 - a) Both side gears rotate. [0.03 mm (0.0012 in) feeler gauges are used in this case.]
 - b) Side gear is held stationary. [0.10 mm (0.0039 in) feeler gauges are used in this case.]
 (Refer to S.D.S.)

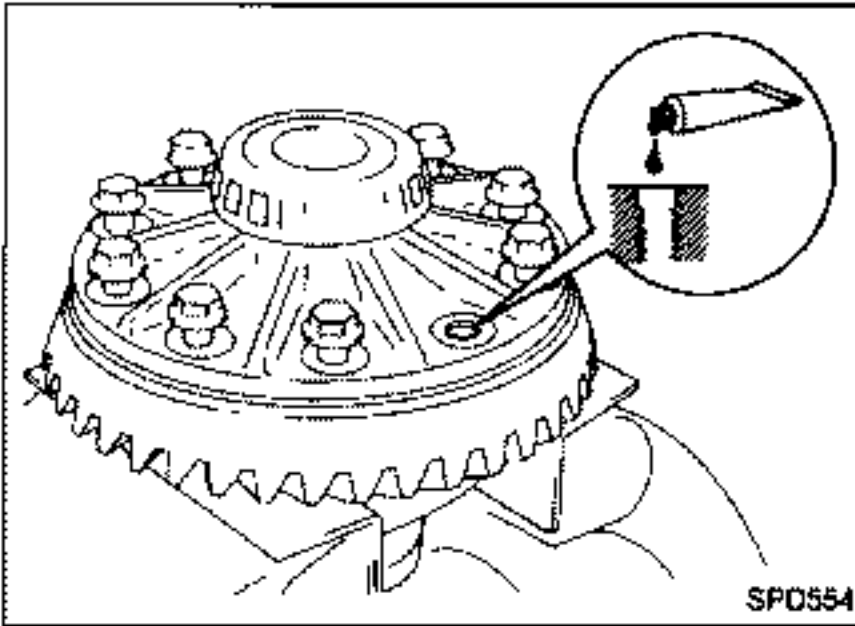


ASSEMBLY

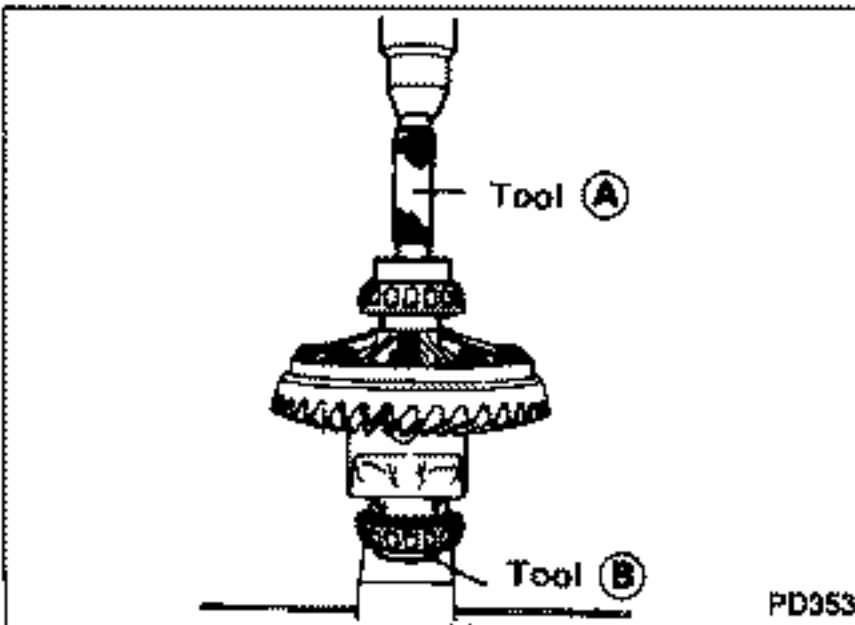
1. Install differential cases A and B.

ASSEMBLY

Differential Case (Cont'd)



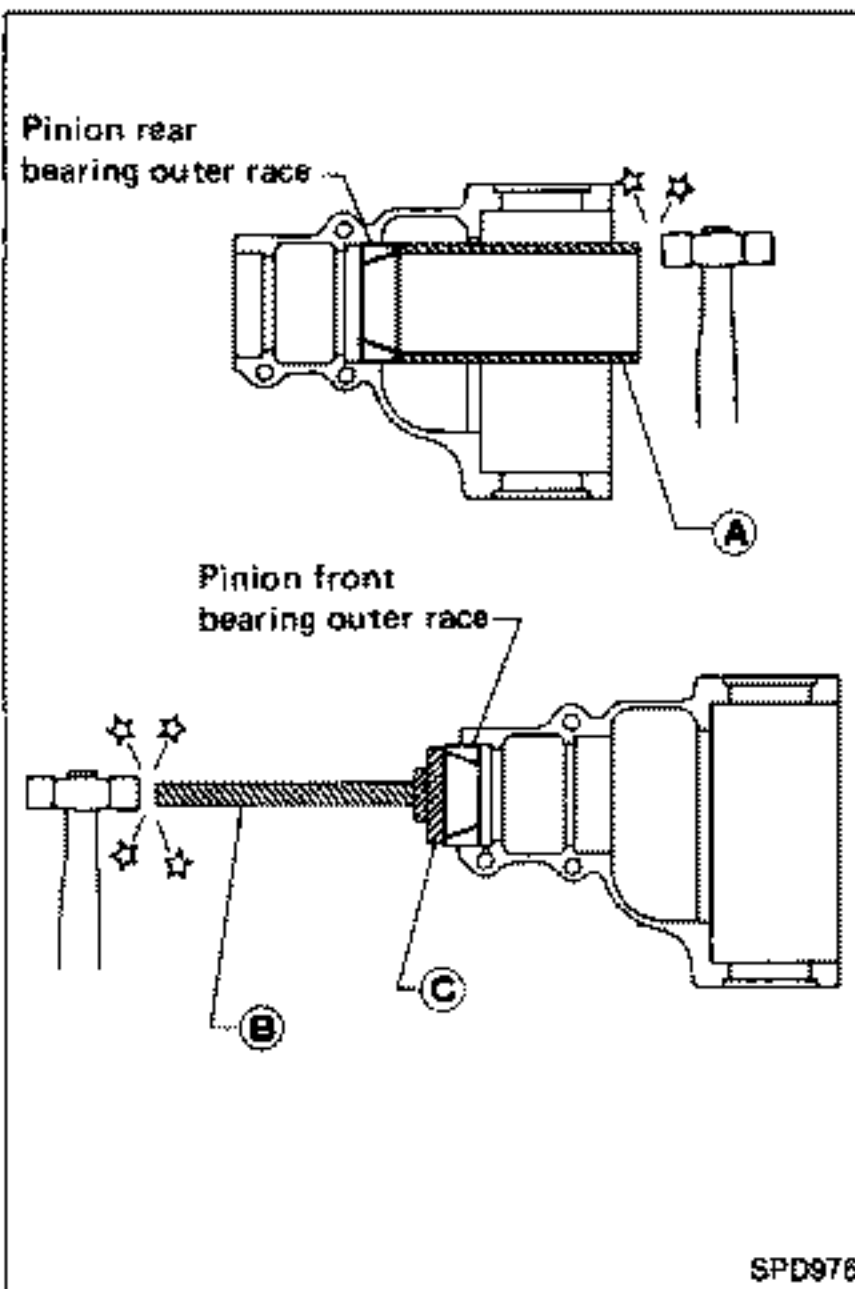
2. Place differential case on ring gear.
3. Apply locking sealant to ring gear bolts, and install them. **Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.**



4. Press-fit side bearing inner cones on differential case with Tool.

Tool number:

- (A) KV38100300 — R200V —
- (B) ST33061000 — R200V —



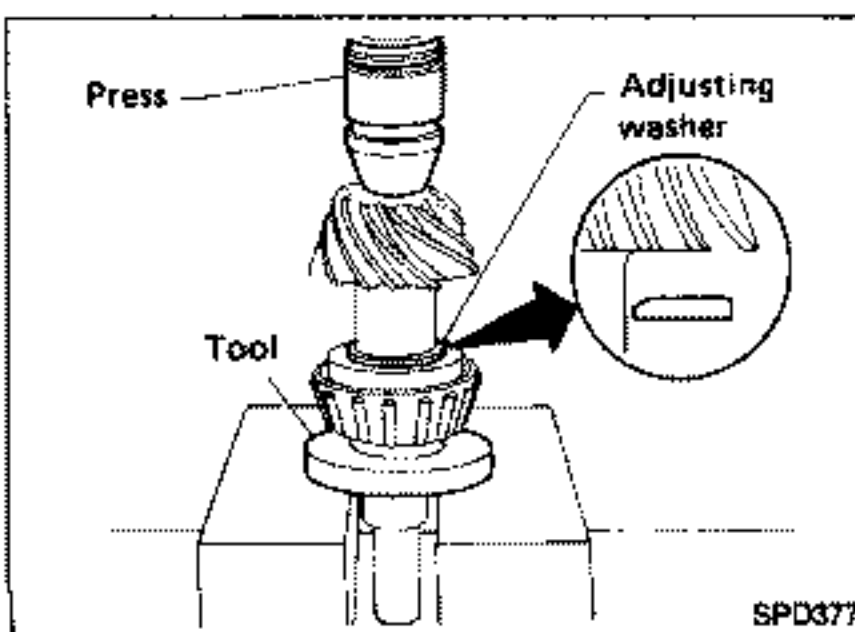
Differential Carrier

1. Press-fit front and rear bearing outer races with Tools.

Tool number:

- (A) suitable tool
- (B) ST30611000
- (C) ST30613000 — R200V —

2. Select pinion bearing adjusting washer and drive pinion bearing spacer, referring to ADJUSTMENT.



3. Install selected drive pinion height adjusting washer in drive pinion, and press-fit pinion rear bearing inner cone in it, using press and Tool.

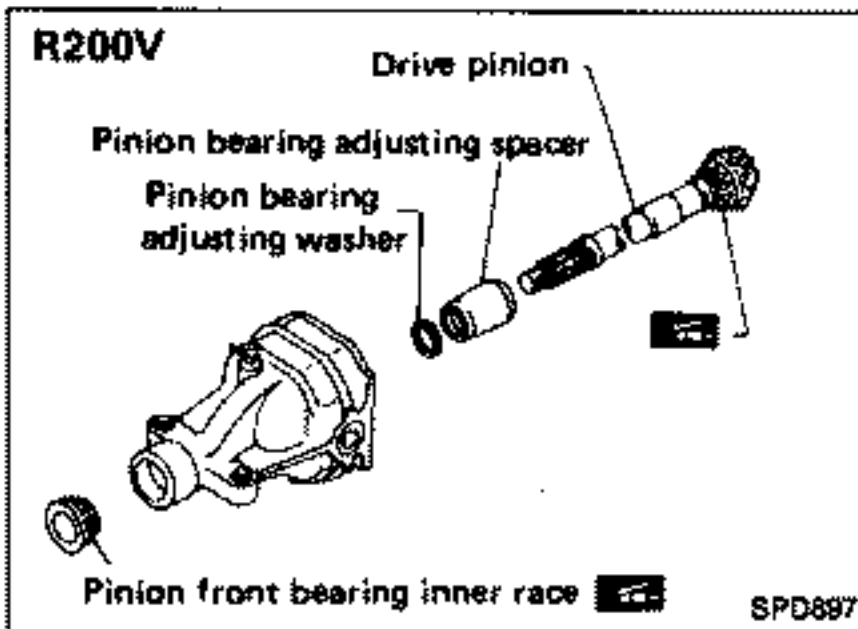
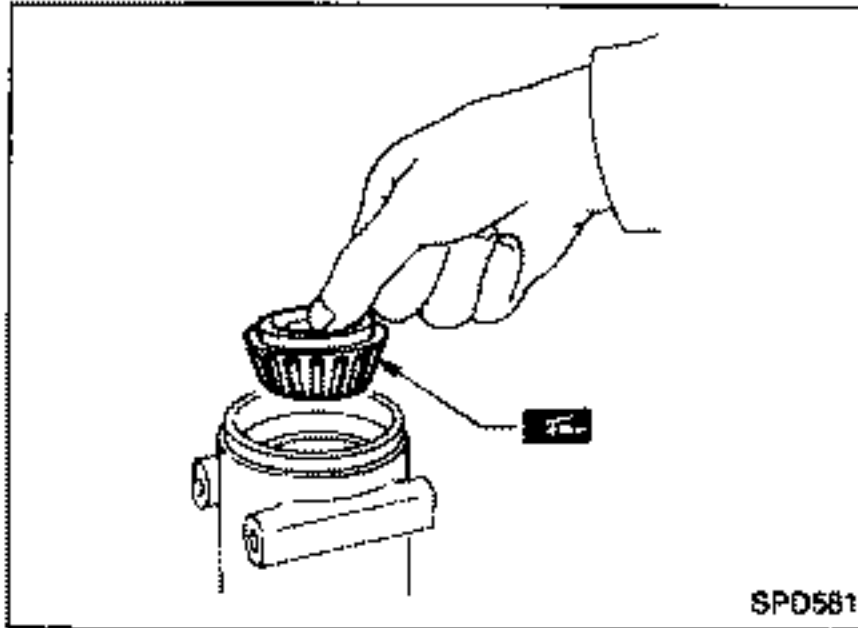
Tool number:

- ST30901000 — R200V —

ASSEMBLY

Differential Carrier (Cont'd)

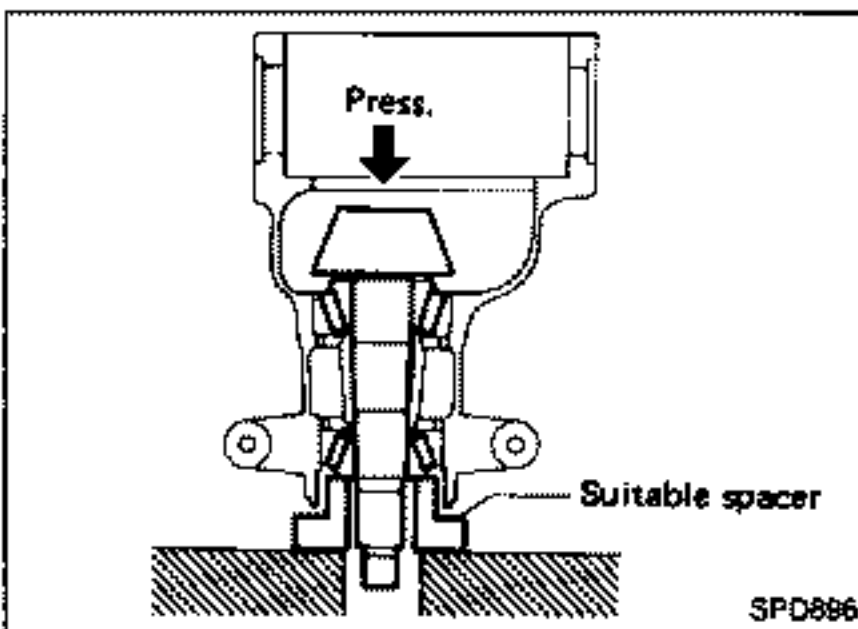
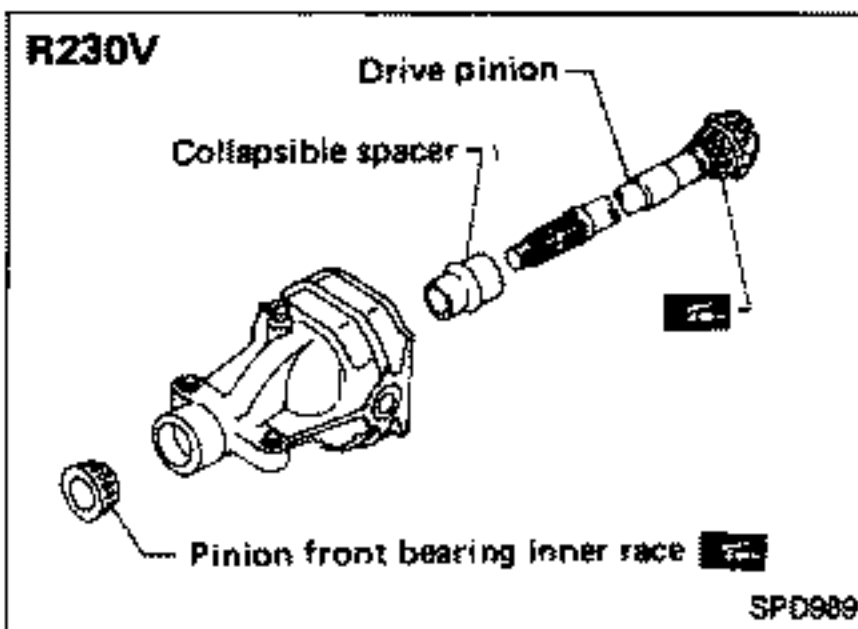
4. Place pinion front bearing inner cone in final drive housing.



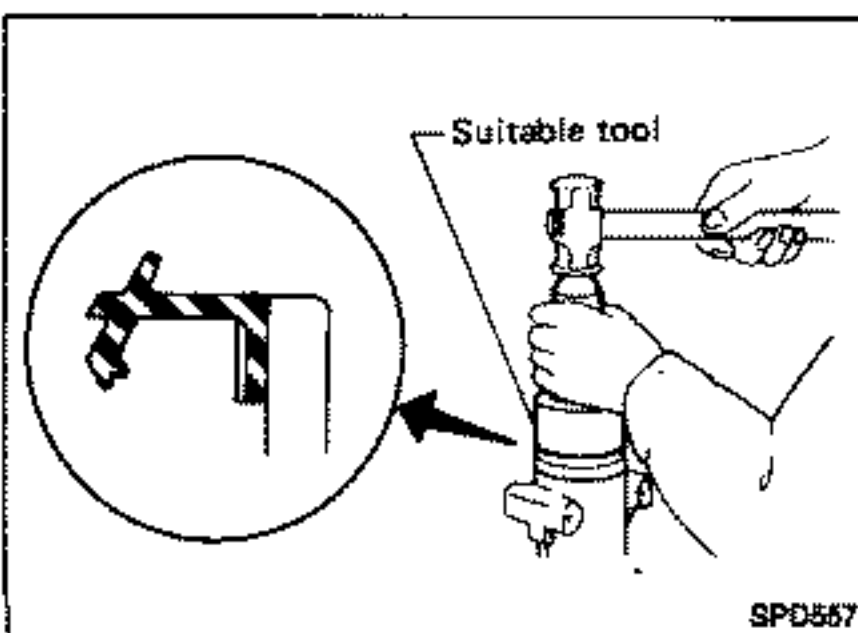
5. Set drive pinion assembly (as shown in figures at left) in differential carrier and install drive pinion, with press and a suitable tool.

Stop when drive pinion touches bearing.

Apply multi-purpose grease to pinion rear bearing inner race, pinion front bearing inner race and front pilot bearing.

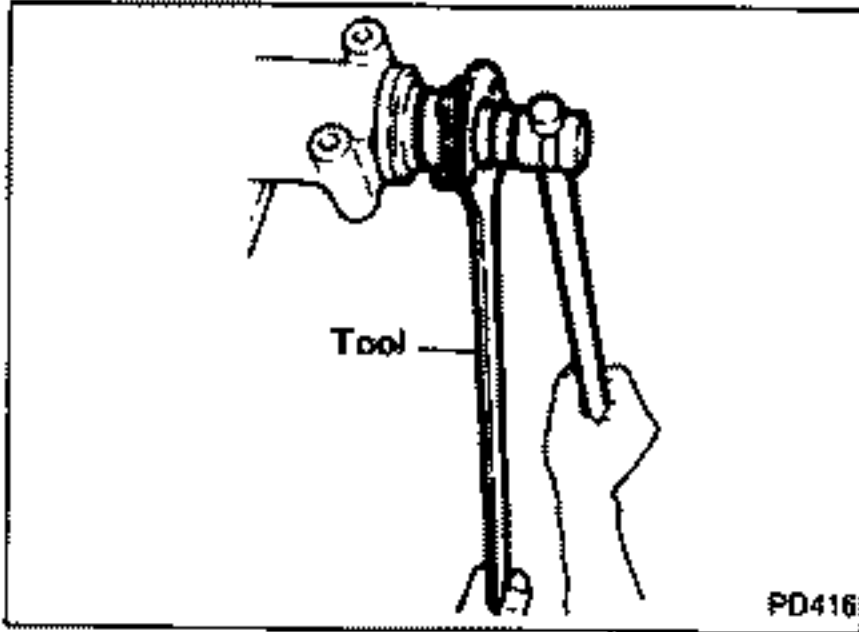


6. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install front oil seal with a suitable tool.



ASSEMBLY

Differential Carrier (Cont'd)



7. Install companion flange.

— R200V —

Tighten pinion nut to specified torque with Tool.

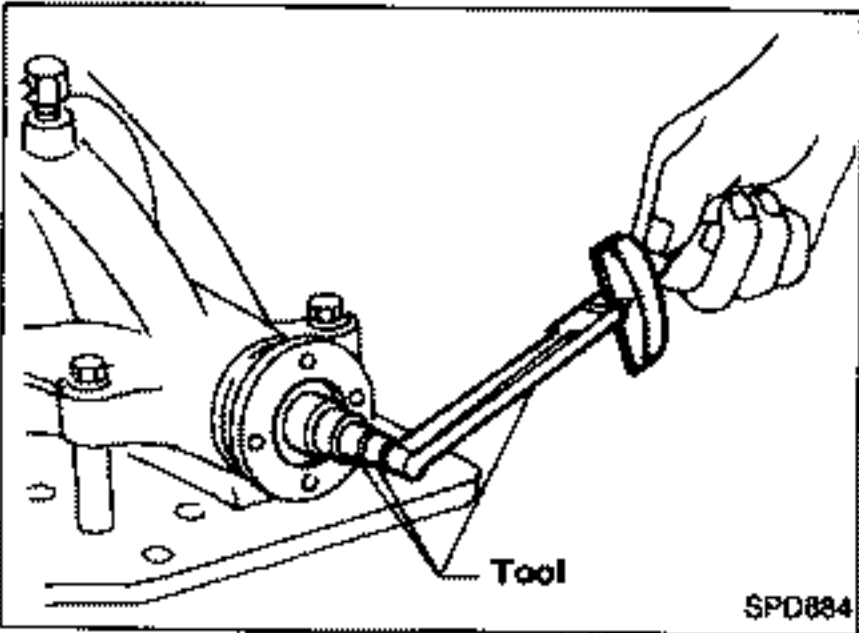
— R230V —

Tighten pinion nut to 127 N·m (13 kg-m, 94 ft-lb).

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

Tool number:

ST38060002 — R200V —



8.

— R200V —

Turn drive pinion in both directions several times, and measure pinion bearing preload.

Pinion bearing preload:

1.1 - 1.4 N·m

(11 - 14 kg-cm, 9.5 - 12.2 in-lb)

When pinion bearing preload is outside the specifications, replace pinion bearing adjusting washer and spacer with a different thickness.

— R230V —

Tighten the pinion nut by very small degrees until the specified preload is achieved. When checking the preload, turn the drive pinion in both directions several times to set the bearing rollers.

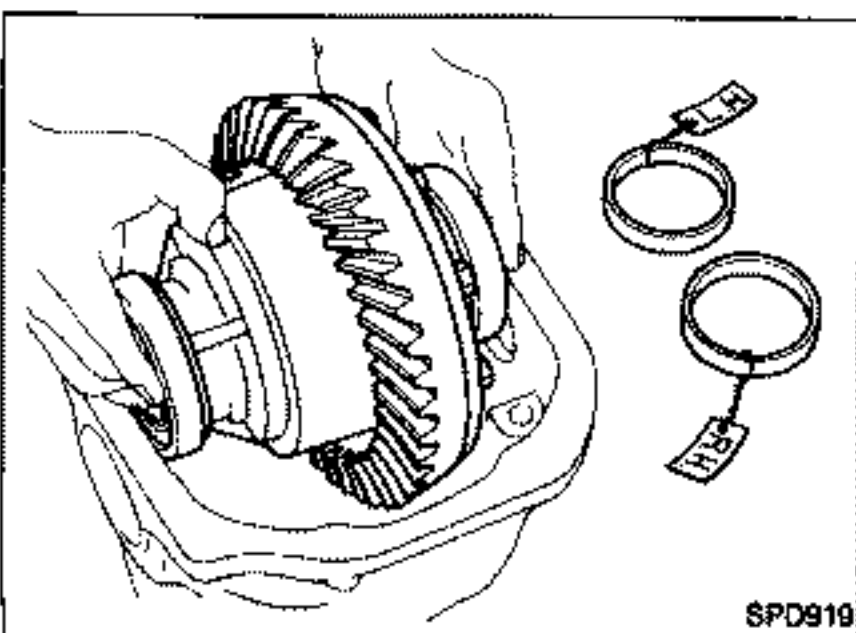
Pinion bearing preload:

1.8 - 2.6 N·m

(18 - 27 kg-cm, 16 - 23 in-lb)

This procedure will have to be repeated if:

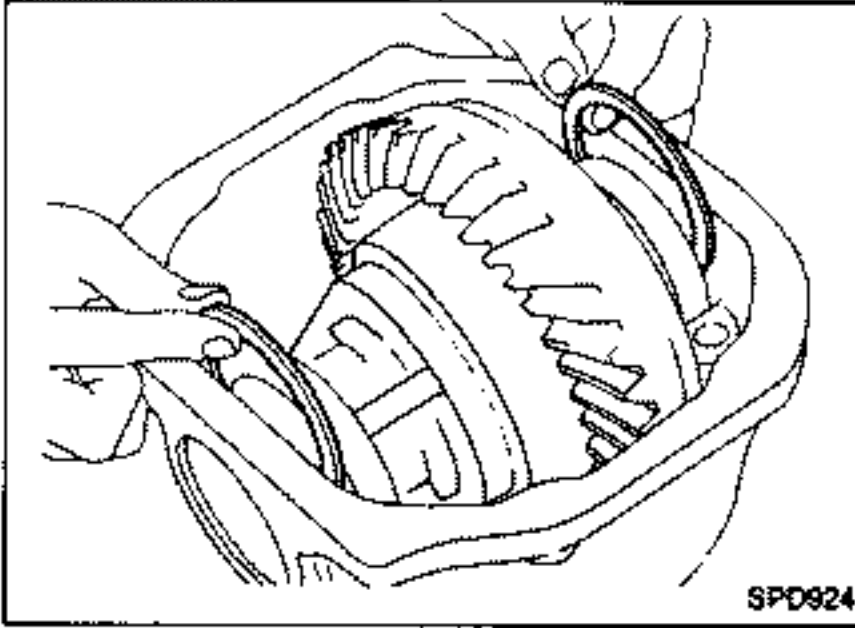
- **Maximum preload is achieved before the minimum pinion nut torque is reached.**
- **Minimum preload is not achieved before the maximum pinion nut torque is reached.**



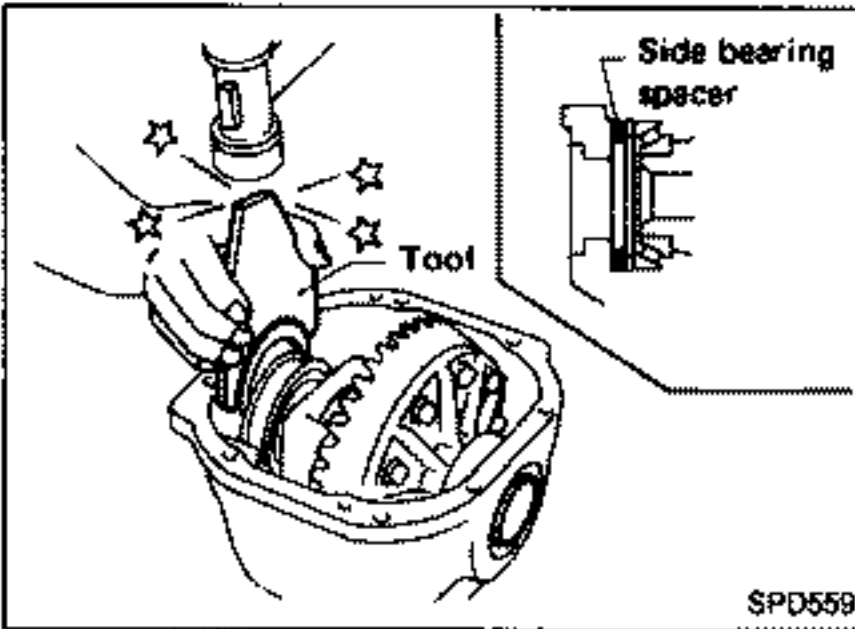
9. Install differential case assembly with side bearing outer races into gear carrier.

ASSEMBLY

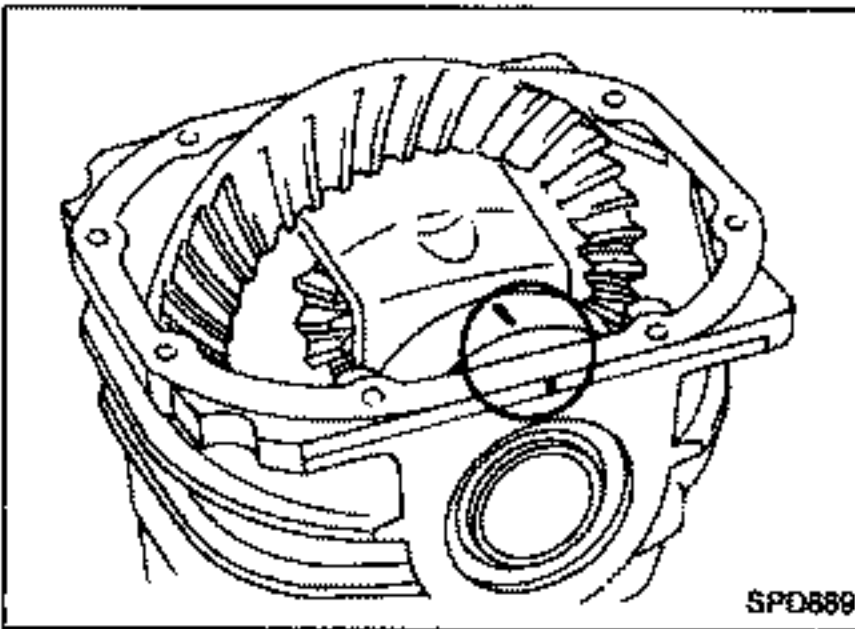
Differential Carrier (Cont'd)



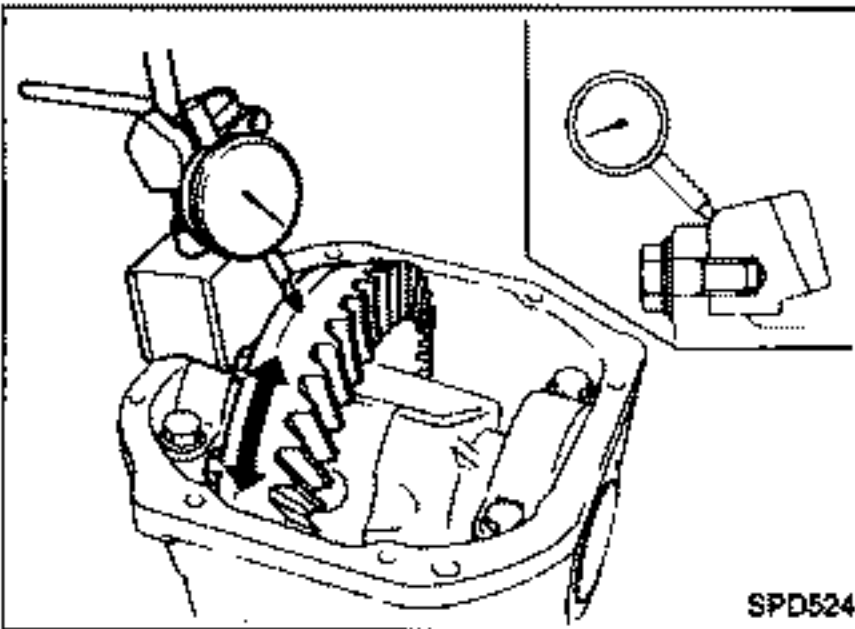
10. Insert left and right side bearing adjusting washers in place between side bearings and carrier.



11. Drive in side bearing spacer with Tool.
Tool number:
KV38100600



12. Align mark on bearing cap with that on gear carrier and install bearing cap on gear carrier.



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

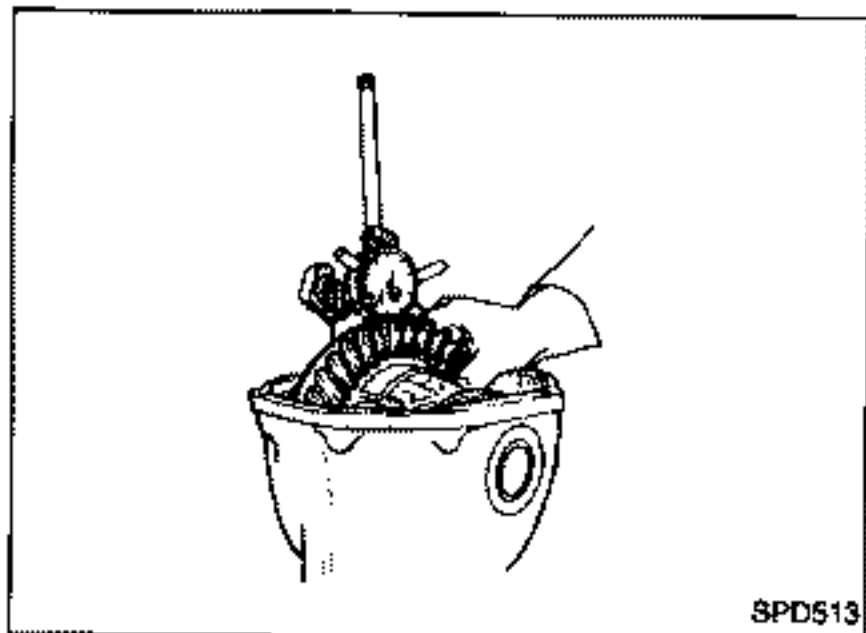
Runout limit:

0.05 mm (0.0020 in)

- If backlash varies excessively in different places, foreign matter may be caught between the ring gear and the differential case.

ASSEMBLY

Differential Carrier (Cont'd)



14. Measure ring gear-to-drive pinion backlash with a dial indicator.

Ring gear-to-drive pinion backlash:

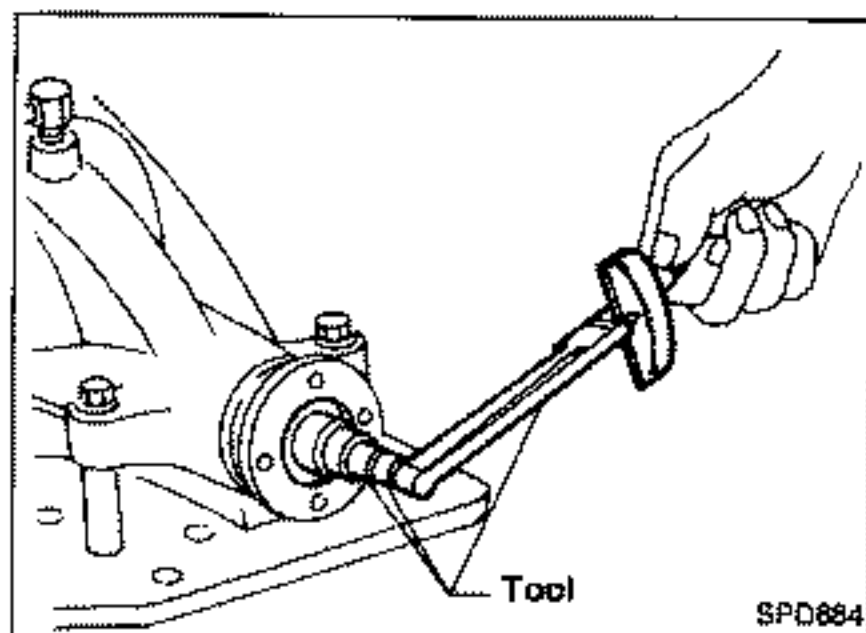
0.10 - 0.15 mm (0.0039 - 0.0059 in)

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

If backlash is too great, reverse the above procedure.

Never change the total amount of washer thickness as this will change the bearing preload.

- If the backlash varies greatly when the ring gear runout is within the specified range, replace the hypoid gear set or differential case.



15. Check total preload with Tool.

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

Total preload:

Value more than 0.29 N·m (3.0 kg-cm, 2.6 in-lb) added on measured value of drive pinion preload

- If preload is too great, decrease the same amount of washer thickness from each side.
- If preload is too small, increase the same amount of washer thickness to each side.

Never increase or decrease different amounts of washer thickness for each side as this will change ring gear-to-drive pinion backlash.

16. Recheck ring gear-to-drive pinion backlash because increase or decrease in thickness of washer will cause change of ring gear-to-pinion backlash.

17. Check tooth contact.
Refer to ADJUSTMENT.

18. Install rear cover.

Description

M/T MODEL

- The differential and transmission oil pumps automatically repeat ON-OFF operation according to the differential gear oil temperature.

OFF → ON 130°C (266°F)

ON → OFF 120°C (248°F)

However, the pumps will not operate when the vehicle speed is less than 120 km/h (75 MPH).

- When the oil temperature becomes excessively high, the warning lamp in the combination meter will illuminate and both oil pumps will activate regardless of vehicle speed.

Differential gear oil:

OFF → ON 180°C (356°F)

ON → OFF 150°C (302°F)

Transmission gear oil:

OFF → ON 180°C (356°F)

ON → OFF 150°C (302°F)

A/T MODEL

- The differential oil pump automatically repeats ON-OFF operation according to the temperature of the differential gear oil.

OFF → ON 130°C (266°F)

ON → OFF 120°C (248°F)

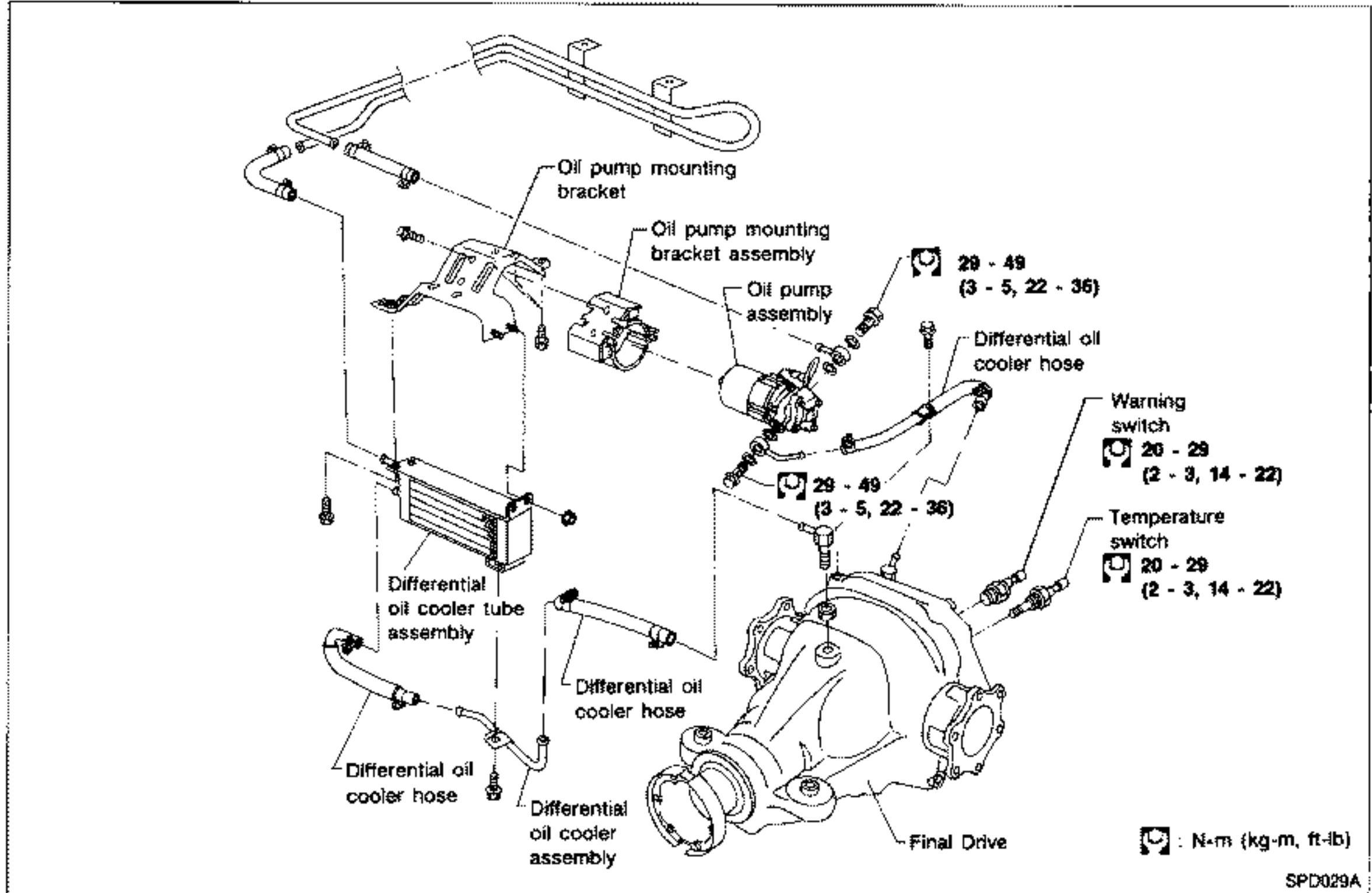
However, the pump will not operate when the vehicle speed is less than 10 km/h (6 MPH).

- When the oil temperature becomes excessively high, the warning lamp in the combination meter will illuminate and the oil pump will activate regardless of vehicle speed.

OFF → ON 180°C (356°F)

ON → OFF 150°C (302°F)

Removal and Installation



DIFFERENTIAL OIL COOLER SYSTEM

Removal and Installation (Cont'd)

REMOVAL

The oil cooler assembly and the oil pump can be removed together or separately without removing the final drive.

1. Remove right side rear exhaust tube.
2. Disconnect right side drive shaft from final drive.

Be careful not to damage drive shaft boot.

3. Disconnect oil cooler hoses which connect to final drive.

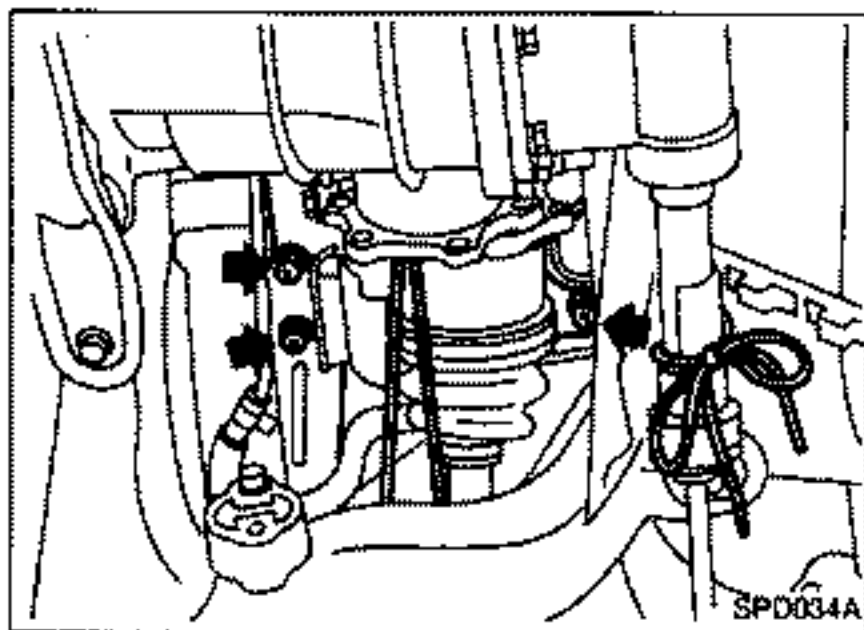
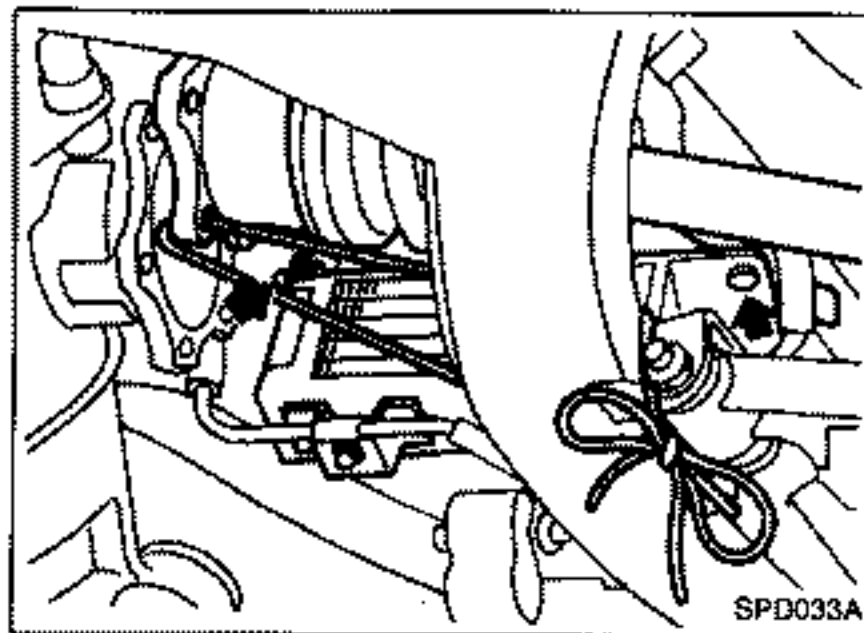
When disconnecting hoses, put a tray underneath to catch oil.

4. Remove securing nuts and bolts from oil cooler assembly.

5. Remove mounting bracket securing bolts.

6. Disconnect electric connector from oil pump.

7. Remove oil cooler assembly with oil pump.

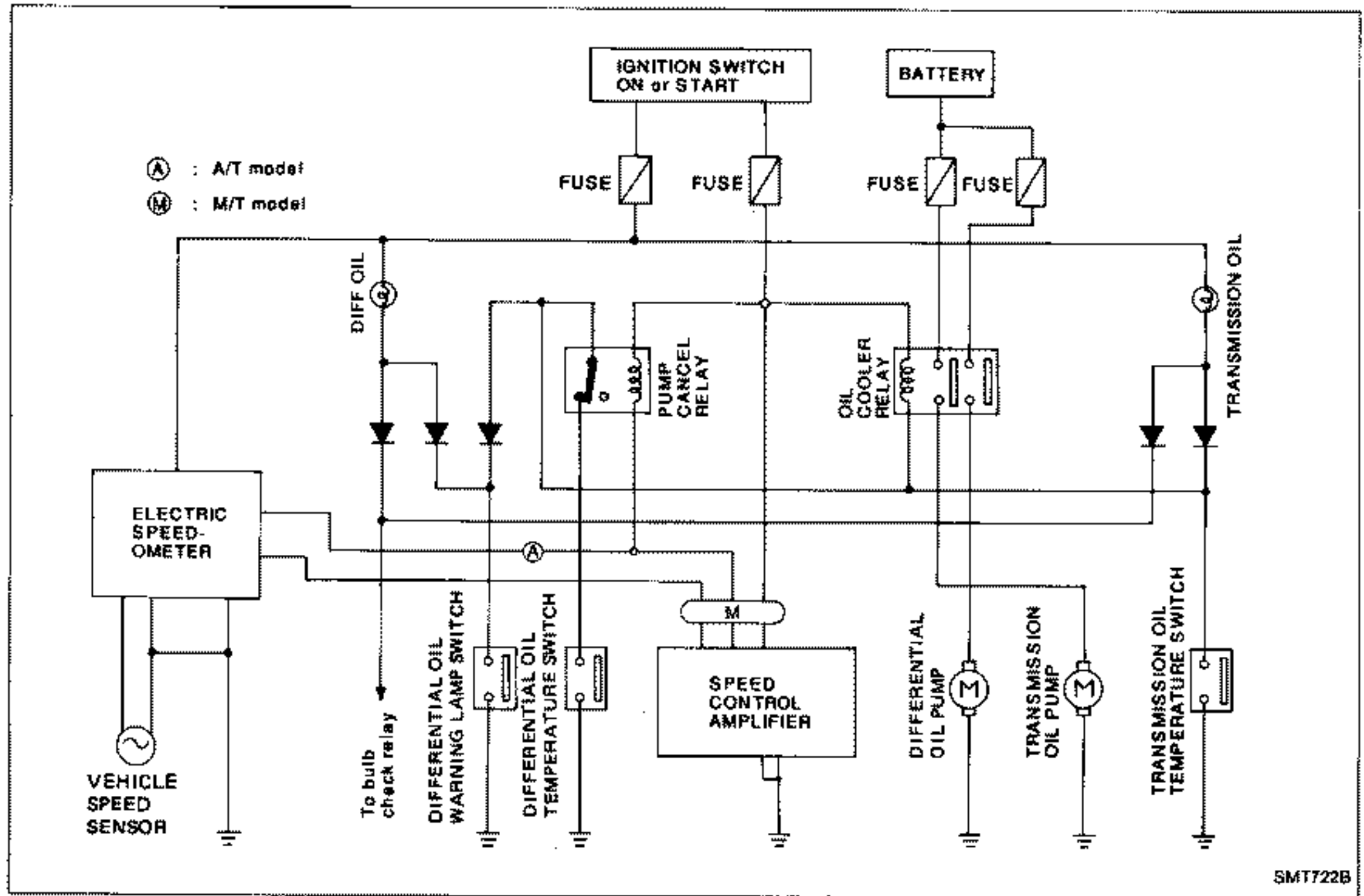


INSTALLATION

Oil level and oil leak from hoses must be checked after the oil cooler has been operated.

DIFFERENTIAL OIL COOLER SYSTEM

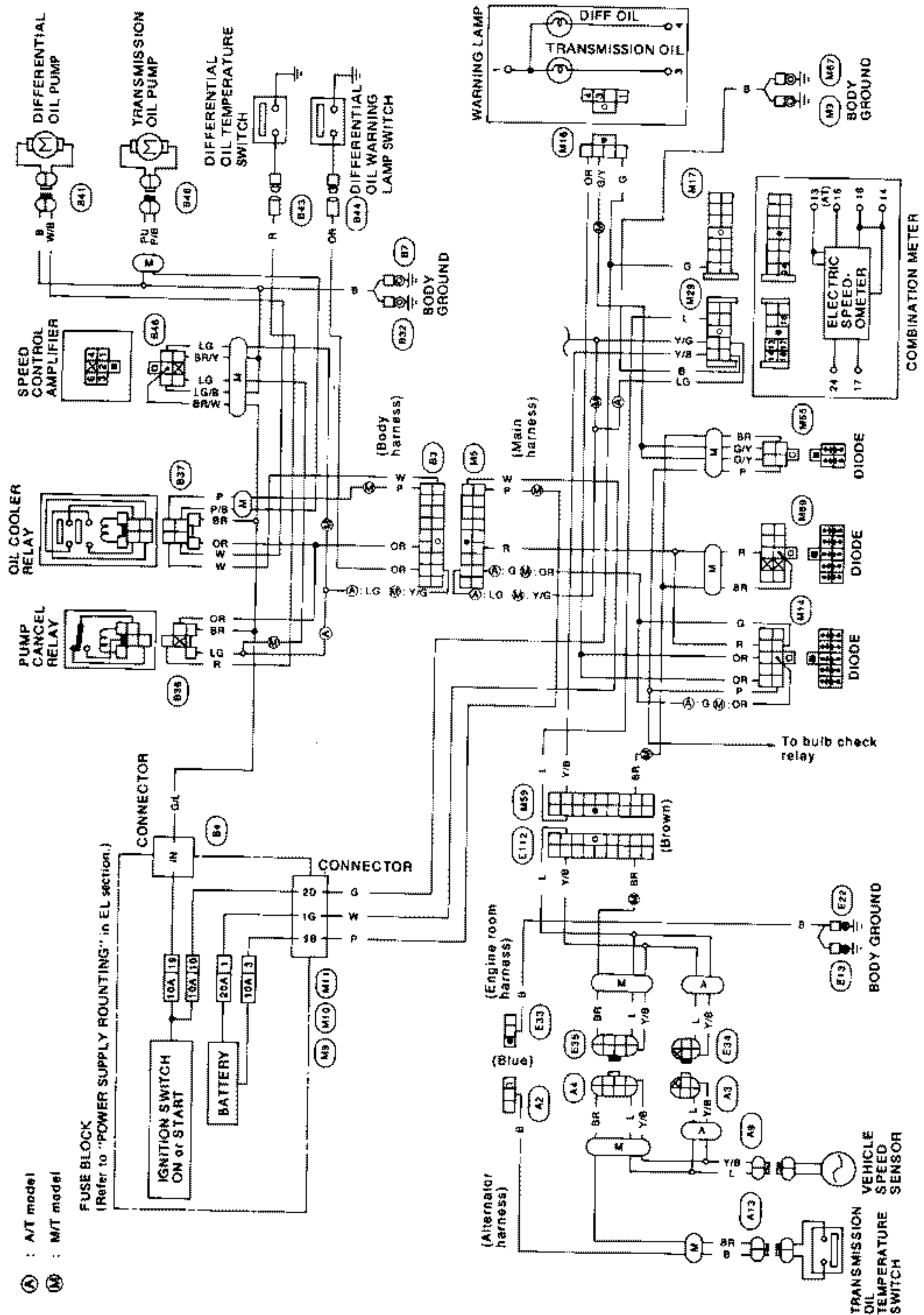
Circuit Diagram



DIFFERENTIAL OIL COOLER SYSTEM

Wiring Diagram

L.H.D. MODEL



Wiring Diagram (Cont'd)

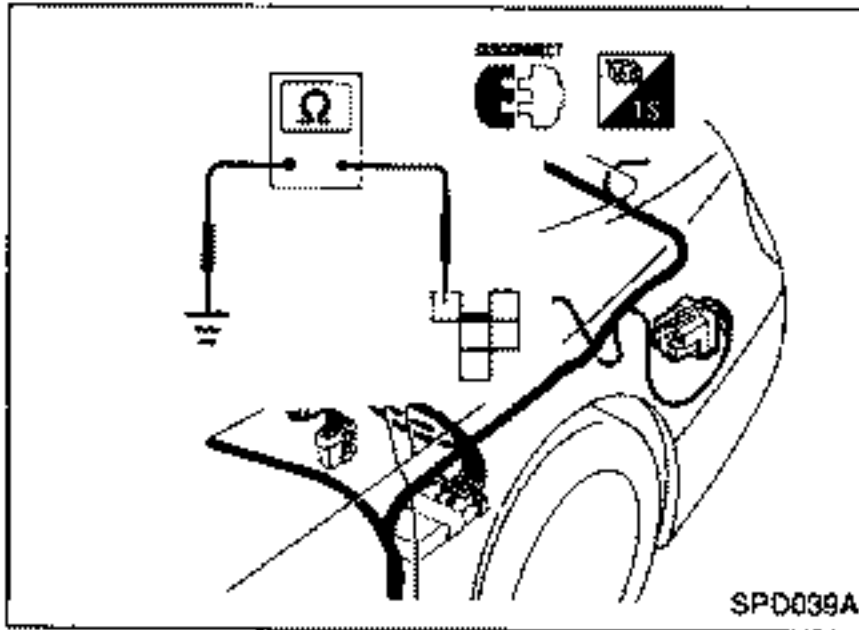
[illegible]

Inspection

Thoroughly clean all parts in cleaning solvent and blow dry with compressed air, if available.

OIL PUMP ASSEMBLY

Replace oil pump assembly when motor does not rotate because of motor seizure or other damage.



SPEEDOMETER AMPLIFIER

Check speedometer amplifier operation as follows:

1. Disconnect differential oil pump cancel relay from connector and connect circuit tester to connector for the relay as shown.
2. Raise rear wheels.
3. Drive vehicle slowly and check the voltage.

M/T model:

Less than 120 km/h (75 MPH) ... Continuity exists.

More than 120 km/h (75 MPH) ... Continuity does not exist.

A/T model:

Less than 10 km/h (6 MPH) ... Continuity exists

More than 10 km/h (6 MPH) ... Continuity does not exist.

OIL COOLER ASSEMBLY, OIL TUBE ASSEMBLY, OIL HOSE

If oil leakage is detected during removal, replace oil cooler assembly or oil tube.

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

Propeller Shaft

GENERAL SPECIFICATIONS

Engine	VG30DE		VG30DETT	
Transmission	M/T	A/T	M/T	A/T
Propeller shaft model	3S71A		3S80A-VL107	
Number of joints	3			
Coupling method with transmission	Sleeve type			
Types of journal bearings	Shell type (non-disassembly type)		Shell type (non-disassembly type) x 2, CVJ* x 1	
Distance between yokes	mm (in)	71.0 (2.795)	80.0 (3.150)	
Shaft length (Spider to spider)	mm (in)			
1st		606 (23.86)	510 (20.08)	606 (23.86) 489 (19.25)
2nd		539 (21.22)		508 (20.00)
Shaft outer diameter	mm (in)			
1st		75 (2.95)		82.6 (3.252)
2nd		75 (2.95)		82.6 (3.252)

* Constant velocity joint

INSPECTION AND ADJUSTMENT

Unit: mm (in)

Propeller shaft model	3S71A	3S80A-VL107
Journal axial play	0 (0)	
Propeller shaft runout limit	0.6 (0.024)	

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

Final Drive

GENERAL SPECIFICATIONS

Final drive model	R200V	R230V
Ring gear pitch diameter mm (in)	205 (8.07)	230 (9.06)
Gear ratio	4.083	3.692
Number of teeth (Ring gear/Drive pinion)	49/12	48/13
Oil capacity (approx.) ℓ (Imp pt)	1.5 (2-5/8)	2.1 (3-3/4)
Side bearing spacer location	Left	Right

INSPECTION AND ADJUSTMENT (R200V)

Ring gear runout

Ring gear runout limit mm (in)	0.05 (0.0020)
-----------------------------------	---------------

Side gear adjustment

Side gear backlash (Clearance between side gear and differential case) mm (in)	0.03 - 0.09 (0.0012 - 0.0035)
---	-------------------------------

Available side gear thrust washers

Thickness mm (in)	Part number
0.80 (0.0315)	38424-40F60
0.83 (0.0327)	38424-40F61
0.86 (0.0339)	38424-40F62
0.89 (0.0350)	38424-40F63
0.92 (0.0362)	38424-40F64
0.95 (0.0374)	38424-40F65
0.98 (0.0386)	38424-40F66
1.01 (0.0398)	38424-40F67
1.04 (0.0409)	38424-40F68
1.07 (0.0421)	38424-40F69
1.10 (0.0433)	38424-40F70
1.13 (0.0445)	38424-40F71
1.16 (0.0457)	38424-40F72
1.19 (0.0469)	38424-40F73
1.22 (0.0480)	38424-40F74
1.25 (0.0492)	38424-40F75
1.28 (0.0504)	38424-40F76
1.31 (0.0516)	38424-40F77
1.34 (0.0528)	38424-40F78
1.37 (0.0539)	38424-40F79
1.40 (0.0551)	38424-40F80
1.43 (0.0563)	38424-40F81
1.46 (0.0575)	38424-40F82
1.49 (0.0587)	38424-40F83

Drive pinion height adjustment

Available pinion height adjusting washers

Thickness mm (in)	Part number
3.09 (0.1217)	38154-P6017
3.12 (0.1228)	38154-P6018
3.15 (0.1240)	38154-P6019
3.18 (0.1252)	38154-P6020
3.21 (0.1264)	38154-P6021
3.24 (0.1276)	38154-P6022
3.27 (0.1287)	38154-P6023
3.30 (0.1299)	38154-P6024
3.33 (0.1311)	38154-P6025
3.36 (0.1323)	38154-P6026
3.39 (0.1335)	38154-P6027
3.42 (0.1346)	38154-P6028
3.45 (0.1358)	38154-P6029
3.48 (0.1370)	38154-P6030
3.51 (0.1382)	38154-P6031
3.54 (0.1394)	38154-P6032
3.57 (0.1406)	38154-P6033
3.60 (0.1417)	38154-P6034
3.63 (0.1429)	38154-P6035
3.66 (0.1441)	38154-P6036

Drive pinion preload adjustment

Drive pinion preload with front oil seal N·m (kg-cm, in-lb)	1.1 - 1.4 (11 - 14, 9.5 - 12.2)
--	---------------------------------

Available drive pinion bearing preload adjusting washers

Thickness mm (in)	Part number
3.80 - 3.82 (0.1496 - 0.1504)	38125-61001
3.82 - 3.84 (0.1504 - 0.1512)	38126-61001
3.84 - 3.86 (0.1512 - 0.1520)	38127-61001
3.86 - 3.88 (0.1520 - 0.1528)	38128-61001
3.88 - 3.90 (0.1528 - 0.1535)	38129-61001
3.90 - 3.92 (0.1535 - 0.1543)	38130-61001
3.92 - 3.94 (0.1543 - 0.1551)	38131-61001
3.94 - 3.96 (0.1551 - 0.1559)	38132-61001
3.96 - 3.98 (0.1559 - 0.1567)	38133-61001
3.98 - 4.00 (0.1567 - 0.1575)	38134-61001
4.00 - 4.02 (0.1575 - 0.1583)	38135-61001
4.02 - 4.04 (0.1583 - 0.1591)	38136-61001
4.04 - 4.06 (0.1591 - 0.1598)	38137-61001
4.06 - 4.08 (0.1598 - 0.1606)	38138-61001
4.08 - 4.10 (0.1606 - 0.1614)	38139-61001

Available drive pinion bearing preload adjusting spacers

Length mm (in)	Part number
45.60 (1.7953)	38165-10V05
45.90 (1.8071)	38165-10V06
46.20 (1.8189)	38165-10V07
46.50 (1.8307)	38165-10V08
46.80 (1.8425)	38165-10V01

SERVICE DATA AND SPECIFICATIONS (S.D.S.)**Final Drive (Cont'd)****Side bearing adjustment****Available side bearing adjusting washers**

Thickness mm (in)	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

Total preload

Total preload	Value of more than 0.29 N·m (3.0 kg-cm, 2.6 in-lb) added on to measured value of drive pinion preload
Ring gear backlash mm (in)	0.10 - 0.15 (0.0039 - 0.0059)

INSPECTION AND ADJUSTMENT (R230V)**Ring gear runout**

Ring gear runout limit mm (in)	0.05 (0.0020)
-----------------------------------	---------------

Side gear adjustment

Side gear backlash (Clearance between side gear and differential case) mm (in)	0.03 - 0.09 (0.0012 - 0.0035)
---	----------------------------------

Available side gear thrust washers

Thickness mm (in)	Part number
1.10 (0.0433)	38424-40P71
1.15 (0.0453)	38424-40P72
1.20 (0.0472)	38424-40P73
1.25 (0.0492)	38424-40P74
1.30 (0.0512)	38424-40P75
1.35 (0.0531)	38424-40P76
1.40 (0.0551)	38424-40P77
1.45 (0.0571)	38424-40P78
1.50 (0.0591)	38424-40P79

Drive pinion height adjustment**Available pinion height adjusting washers**

Thickness mm (in)	Part number
2.59 (0.1020)	38154-40P00
2.61 (0.1028)	38154-40P01
2.63 (0.1035)	38154-40P02
2.65 (0.1043)	38154-40P03
2.67 (0.1051)	38154-40P04
2.69 (0.1059)	38154-40P05
2.71 (0.1067)	38154-40P06
2.73 (0.1075)	38154-40P07
2.75 (0.1083)	38154-40P08
2.77 (0.1091)	38154-40P09
2.79 (0.1098)	38154-40P10
2.81 (0.1106)	38154-40P11
2.83 (0.1114)	38154-40P12
2.85 (0.1122)	38154-40P13
2.87 (0.1130)	38154-40P14
2.89 (0.1138)	38154-40P15
2.91 (0.1146)	38154-40P16
2.93 (0.1154)	38154-40P17
2.95 (0.1161)	38154-40P18
2.97 (0.1169)	38154-40P19

Drive pinion preload adjustment

Drive pinion preload with front oil seal N·m (kg-cm, in-lb)	1.8 - 2.6 (18 - 27, 16 - 23)
--	---------------------------------

Side bearing adjustment**Available side bearing adjusting washers**

Thickness mm (in)	Part number
2.00 (0.0787)	38453-40P00
2.05 (0.0807)	38453-40P01
2.10 (0.0827)	38453-40P02
2.15 (0.0846)	38453-40P03
2.20 (0.0866)	38453-40P04
2.25 (0.0886)	38453-40P05
2.30 (0.0906)	38453-40P06
2.35 (0.0925)	38453-40P07
2.40 (0.0945)	38453-40P08
2.45 (0.0965)	38453-40P09
2.50 (0.0984)	38453-40P10
2.55 (0.1004)	38453-40P11
2.60 (0.1024)	38453-40P12

Total preload

Total preload	Value of more than 0.29 N·m (3.0 kg-cm, 2.6 in-lb) added on to measured value of drive pinion preload
Ring gear backlash mm (in)	0.13 - 0.18 (0.0051 - 0.0071)