PROPELLER SHAFT & DIFFERENTIAL CARRIER

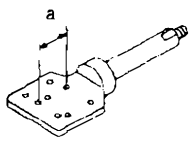
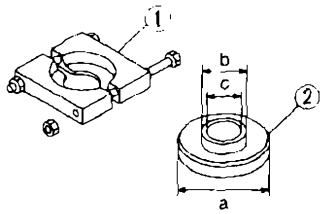
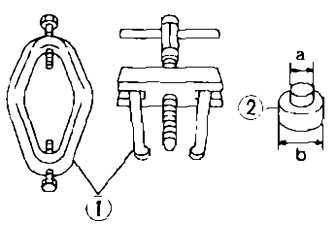
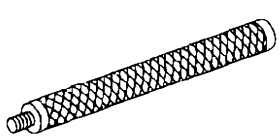
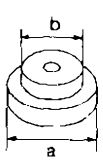
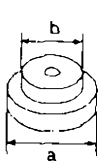
SECTION PD

CONTENTS

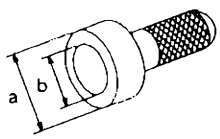
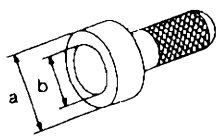
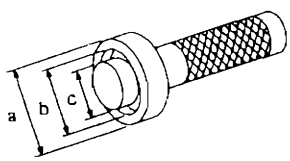
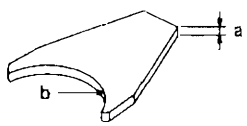
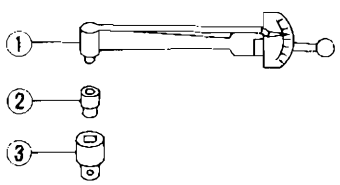
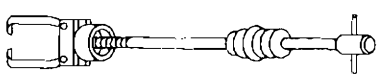
When you read wiring diagrams:
- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**

When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSIS" and "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT".

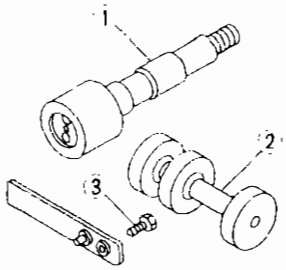
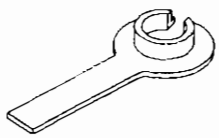
Special Service Tools

Tool number Tool name	Description	
KV38100800 Differential attachment	 NT119	Mounting final drive (To use, make a new hole) **a: 152 mm (5.98 in)**
ST3090S000 Drive pinion rear inner race puller set ① ST30031000 Puller ② ST30901000 Base	 NT527	Removing and installing drive pinion rear cone **a: 79 mm (3.11 in) dia.** **b: 45 mm (1.77 in) dia.** **c: 35 mm (1.38 in) dia.**
ST3306S001 Differential side bearing puller set ① ST3305S001 Body ② ST33061000 Adapter	 NT072	Removing and installing differential side bearing inner cone **a: 28.5 mm (1.122 in) dia.** **b: 38 mm (1.50 in) dia.**
ST30611000 Drift	 NT090	Installing pinion rear bearing outer race
ST30613000 Drift	 NT073	Installing pinion front bearing outer race **a: 72 mm (2.83 in) dia.** **b: 48 mm (1.89 in) dia.**
ST30621000 Drift	 NT073	Installing pinion rear bearing outer race **a: 79 mm (3.11 in) dia.** **b: 59 mm (2.32 in) dia.**

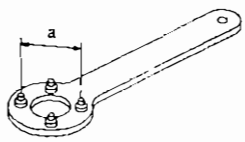
Special Service Tools (Cont'd)

Tool number Tool name	Description	
KV38100200 Gear carrier side oil seal drift	 NT115	Installing side oil seal **a: 65 mm (2.56 in) dia.** **b: 49 mm (1.93 in) dia.**
KV38100500 Gear carrier front oil seal drift	 NT115	Installing front oil seal **a: 85 mm (3.35 in) dia.** **b: 60 mm (2.36 in) dia.**
KV38100300 Differential side bearing inner cone	 NT085	Installing side bearing inner cone **a: 54 mm (2.13 in) dia.** **b: 46 mm (1.81 in) dia.** **c: 32 mm (1.26 in) dia.**
KV38100600 Side bearing spacer drift	 NT528	Installing side bearing spacer **a: 8 mm (0.31 in)** **b: R42.5 mm (1.673 in)**
ST3127S000 Preload gauge ① GG91030000 Torque wrench ② HT62940000 Socket adapter ③ HT62900000 Socket adapter	 NT124	Measuring pinion bearing preload and total preload
HT72400000 Slide hammer	 NT125	Removing differential case assembly

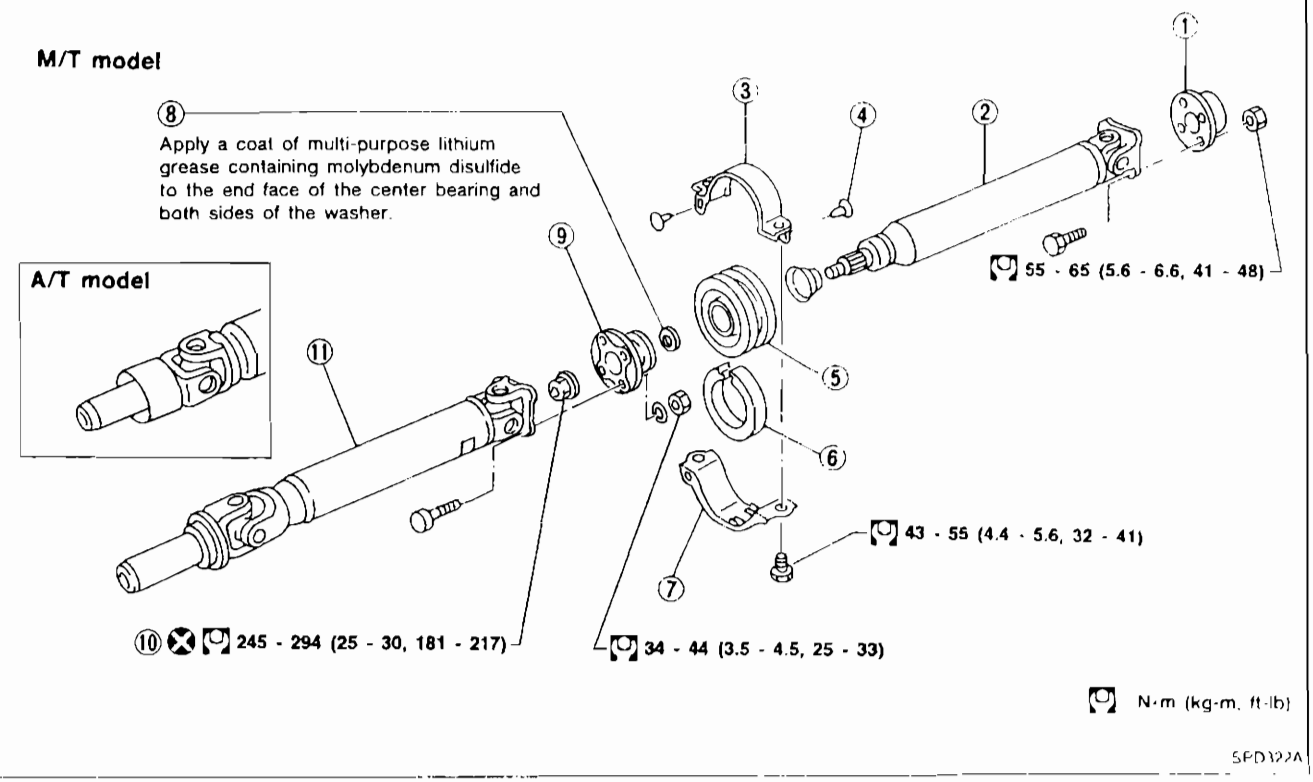
Special Service Tools (Cont'd)

Tool number Tool name	Description	
KV381039S0 Drive pinion height setting gauge (1) KV38103910 Dummy shaft (2) KV38100120 Height gauge (3) KV38100140 Stopper	 NT226	Selecting pinion height adjusting washer
KV38107900 Side oil seal protector	 NT129	Installing final drive side flange

Commercial Service Tool

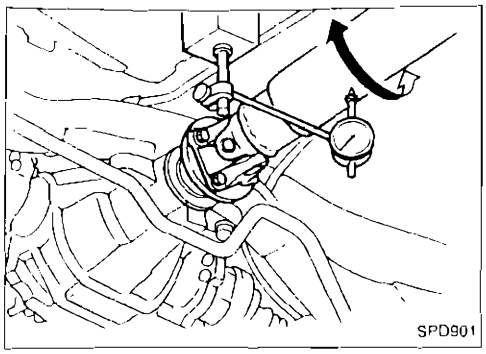
Tool name	Description	
Drive pinion flange wrench	 NT355	Removing and installing propeller shaft lock nut, and drive pinion lock nut. **a: 81.25 mm (3.1988 in)**

SEC. 370
3S71A



① Final drive companion flange
② Propeller shaft 2nd tube
③ Center bearing upper mounting bracket
④ Clip
⑤ Center bearing
⑥ Center bearing cushion
⑦ Center bearing lower mounting bracket
⑧ Washer
⑨ Companion flange
⑩ Lock nut
⑪ Propeller shaft 1st tube

PD

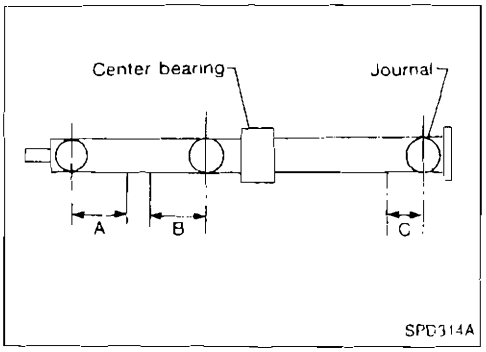

SPD901

On-vehicle Service

PROPELLER SHAFT VIBRATION

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

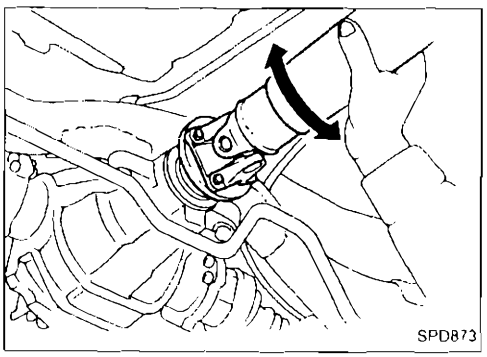
1. Raise rear wheels.
2. Measure propeller shaft runout at indicated points by rotating final drive companion flange with hands.
   Runout limit: 0.6 mm (0.024 in)



SPD314A

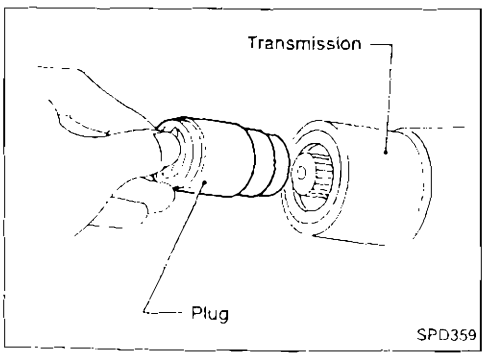
Propeller shaft runout measuring points:
Distance:
"A" 155 mm (6.10 in)
"B" 165 mm (6.50 in)
"C" 185 mm (7.28 in)

3 If runout exceeds specifications, disconnect propeller shaft at final drive companion flange. Then rotate companion flange 90, 180 or 270 degrees and reconnect propeller shaft.
   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.


SPD873

APPEARANCE CHECKING

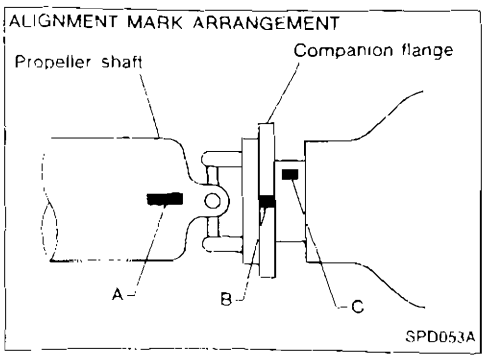
- Inspect propeller shaft tube surface for dents or cracks. If damaged, replace propeller shaft assembly.
- If center bearing is noisy or damaged, replace it.



SPD359

Removal

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

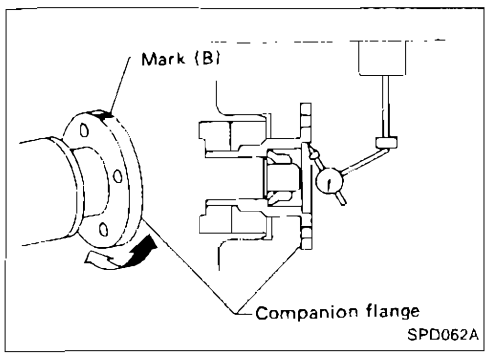


SPD053A

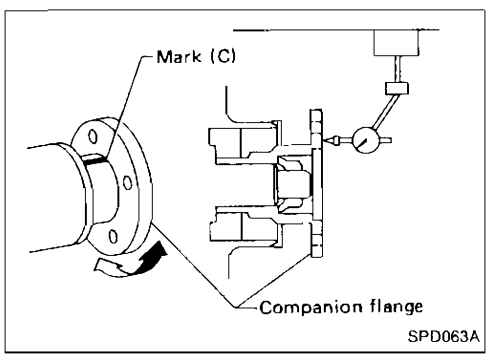
Installation

If companion flange has been removed, put new alignment marks B and C on it. Then reassemble using the following procedure. Perform step 4 when final drive and propeller shaft are separated from each other. Also perform step 4 when either of these parts is replaced with a new one.

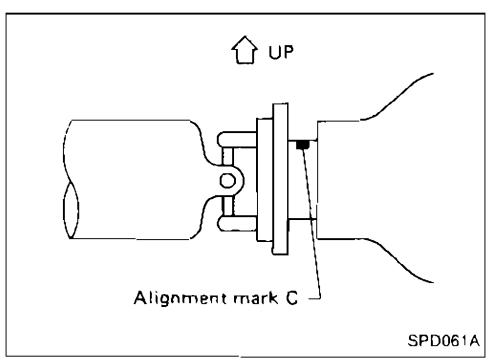
Installation (Cont'd)



1. Erase original marks B and C from companion flange with suitable solvent.
2. Mark (B)
   A. Measure companion flange vertical runout.
   B. Determine the position where maximum runout is read on dial gauge. Put mark (shown by B in figure at left) on flange perimeter corresponding to maximum runout position.



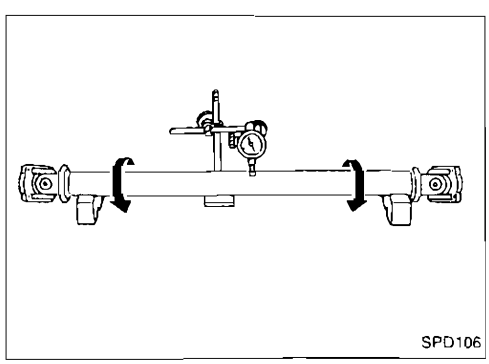
3. Mark (C)
   A. Measure companion flange surface runout.
   B. Determine the position where maximum runout is read on dial gauge. Put mark (shown by C in figure at left) on flange perimeter corresponding to maximum runout position.



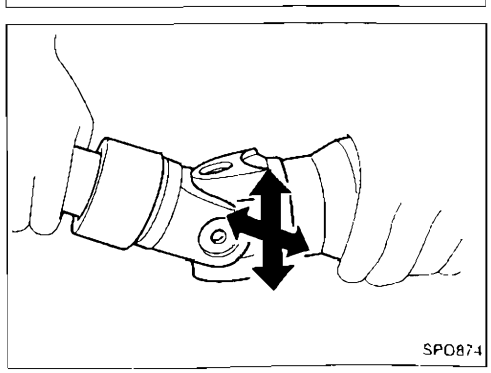
4. Position companion flange and propeller shaft using alignment marks A and B. Set the marks A and B as close to each other as possible. Temporarily attach bolts and nuts.
5. Press down propeller shaft with alignment mark C facing upward. Then tighten the lower nut to specified torque.
6. Tighten remaining nuts to specified torque.

PD

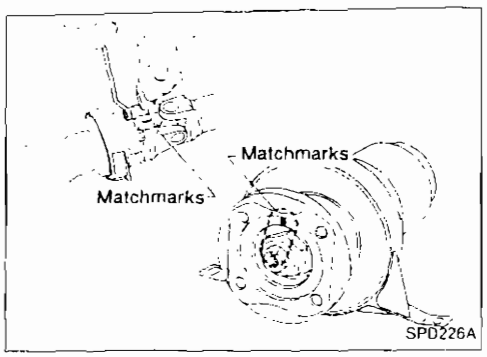
Inspection



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



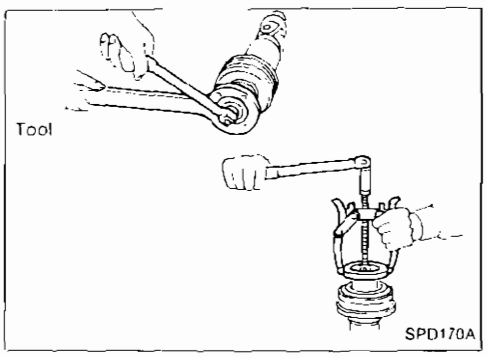
- Inspect journal axial play.
  If the play exceeds specifications, replace propeller shaft assembly.
  Journal axial play:
  0 mm (0 in)



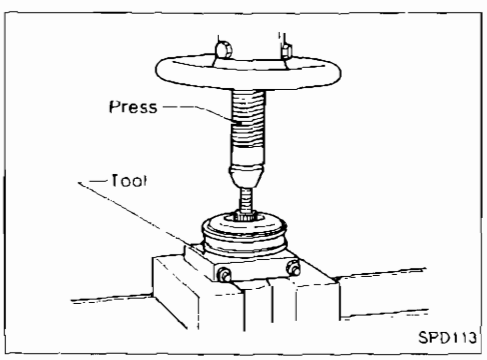
Disassembly

CENTER BEARING

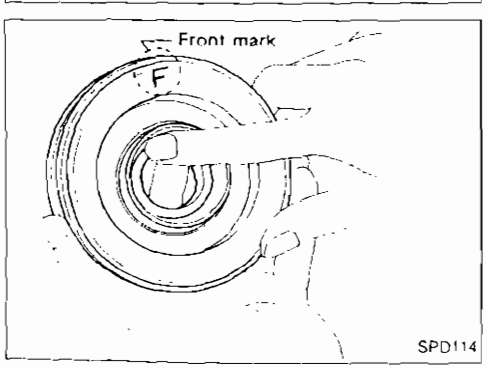
1. Put matchmarks on flanges, and separate 2nd tube from 1st tube
2. Put matchmarks on the flange and shaft.



3. Remove locking nut with suitable tool.
4. Remove companion flange with puller.



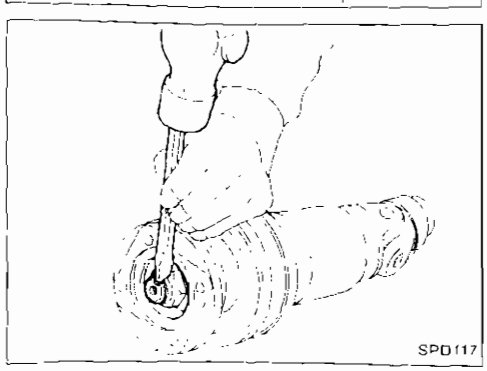
5. Remove center bearing with Tool and press.
   Tool number: ST30031000



Assembly

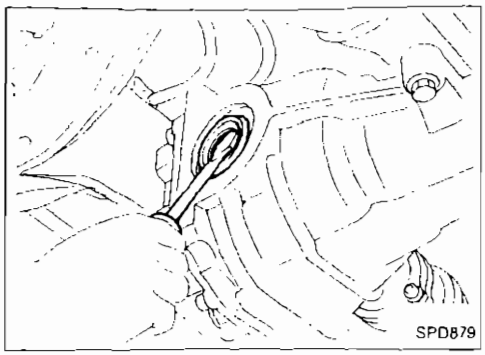
CENTER BEARING

- When installing center bearing, position the "F" mark on center bearing toward rear of vehicle.
- **Apply a coat of grease to the end face of center bearing and both sides of washer.**
  Use multi-purpose lithium grease that contains molybdenum disulfide.

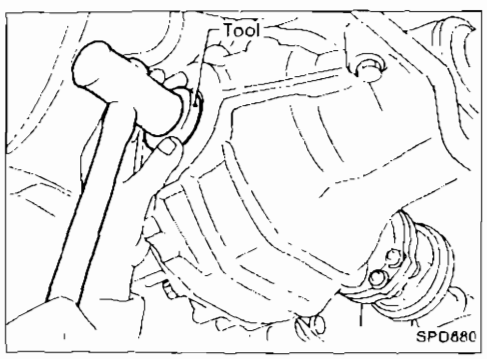


- Stake the nut. Always use new one.
- Align matchmarks when assembling tubes.

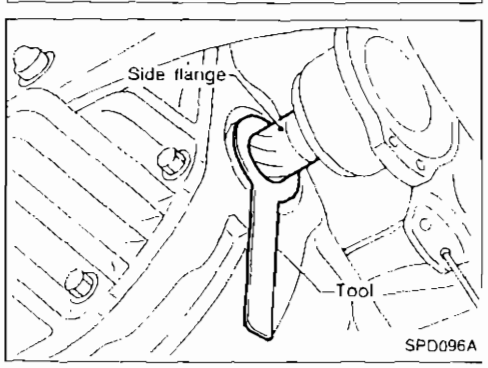
Side Oil Seal Replacement (Cont'd)



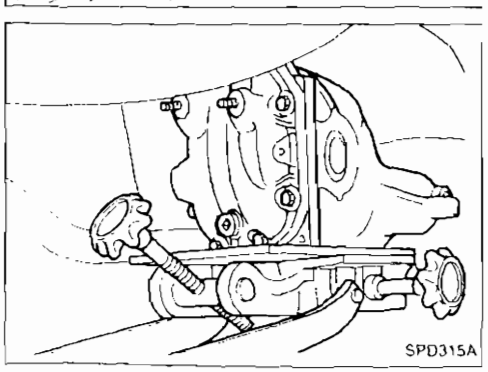
3. Remove oil seal.



4. Apply multi-purpose grease to sealing lips of oil seal. Press-fit oil seal into carrier with Tool.
   Tool number: KV38100200



5. Install final drive side flange.
   Use Tool to prevent side oil seal from being damaged by spline portion of side flange.
   Tool number: KV38107900
6. Install drive shaft.



Removal

CAUTION:

Before removing the final drive assembly, disconnect the ABS sensor from the assembly. Then move it away from the final drive assembly. Failure to do so may result in damage to the sensor wires and the sensor becoming inoperative.

- Remove propeller shaft.

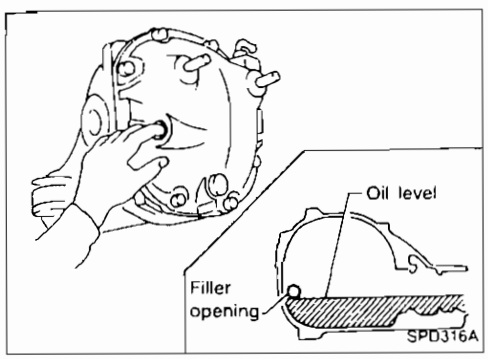
Plug up rear end of transmission rear extension housing.

- Remove drive shafts.
  Refer to "Drive Shaft" of "REAR AXLE" in RA section.
- Remove nuts securing final drive rear cove to suspension member.
- Support weight of final drive using jack.
- Remove final drive mounting member from front of final drive.
- Move final drive forward together with jack. Remove rear cover stud bolts from suspension member.
- Lower final drive using jack. Remove jack from rear of vehicle.

Removal (Cont'd)

CAUTION:

- **Be careful not to damage spline, sleeve yoke and front oil seal, when removing propeller shaft.**
- **After removal, support suspension member on a stand to prevent its insulators from being twisted or damaged.**

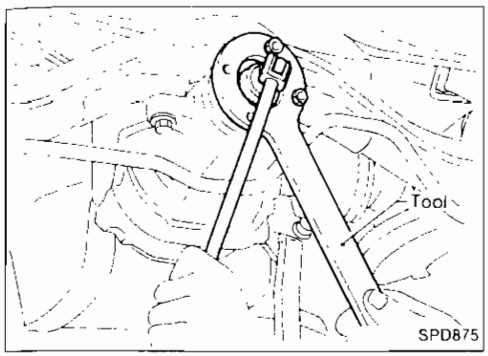


Installation

- Fill final drive with recommended gear oil.

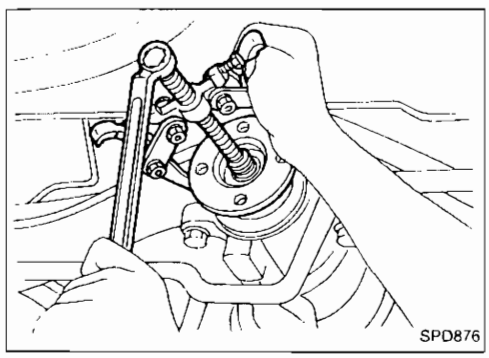
— Models equipped with oil cooler system —

- Check oil level and for oil leakage from hoses after oil cooler has been operated.

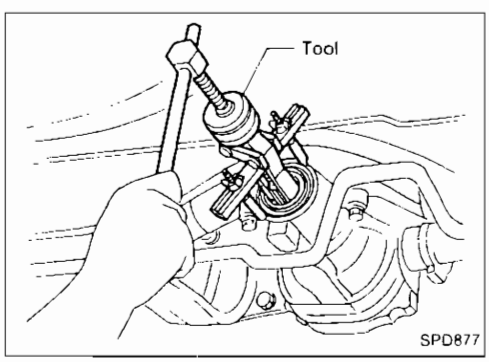


Front Oil Seal Replacement

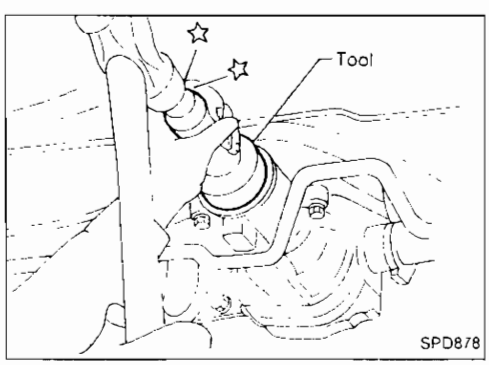
1. Remove propeller shaft.
2. Loosen drive pinion nut with suitable tool.



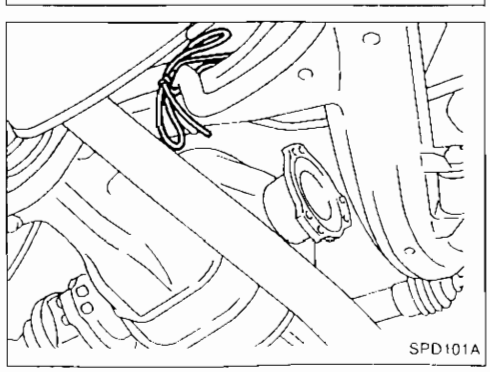
3. Remove companion flange.



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.

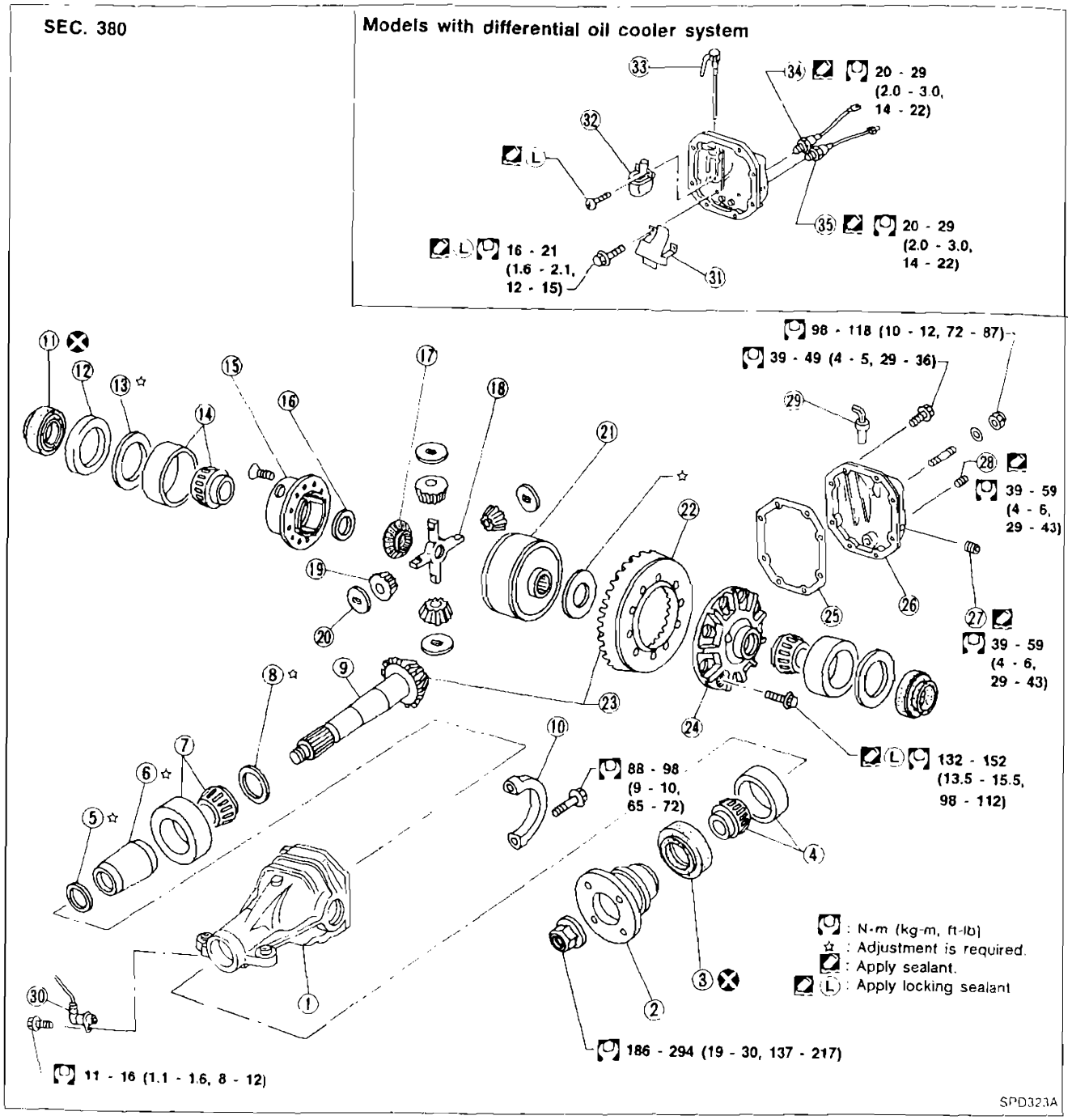


Side Oil Seal Replacement

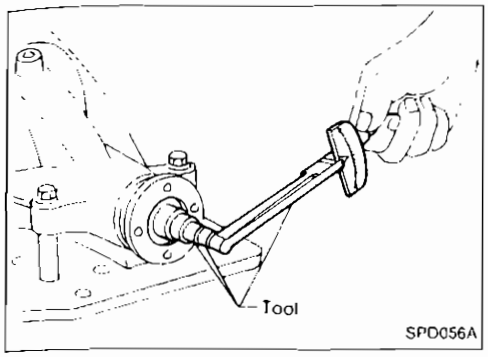
1. Disconnect final drive side flange and drive shaft flange and suspend drive shaft flange with wire.
2. Remove final drive side flange.

R200V

SEC. 380



1. Gear carrier
2. Companion flange
3. Front oil seal
4. Pinion front bearing
5. Pinion bearing adjusting washer
6. Pinion bearing adjusting spacer
7. Pinion rear bearing
8. Pinion height adjusting washer
9. Drive pinion
10. Bearing cap
11. Side oil seal
12. Side bearing spacer
13. Side bearing adjusting washer
14. Side bearing
15. Differential case B
16. Side gear thrust washer
17. Side gear (RH)
18. Pinion mate shaft
19. Pinion mate gear
20. Pinion mate thrust washer
21. Side gear (LH) with viscous coupling
22. Ring gear
23. Hypoid gear set
24. Differential case A
25. Gasket
26. Rear cover
27. Filler plug
28. Drain plug
29. Breather
30. ABS sensor
31. Bracket
32. Oil filter
33. Oil outlet
34. Warning lamp switch
35. Oil temperature switch

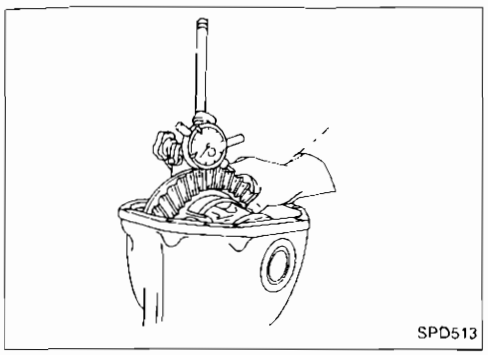


Pre-inspection

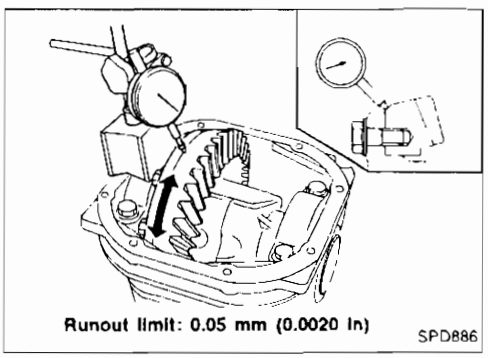
Before disassembling final drive, perform the following inspection.

- Total preload

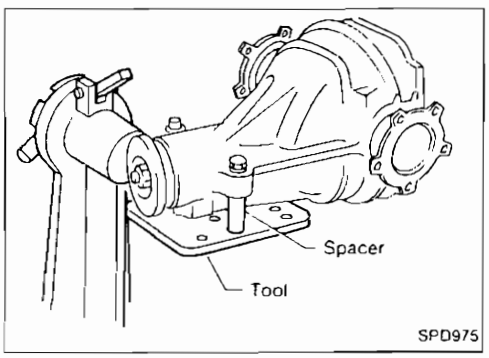
1) Turn drive pinion in both directions several times to set bearing rollers.
2) Check total preload with Tool.
   Tool number: ST3127S000
   Total preload:
   1.4 - 3.1 N·m (14 - 32 kg-cm, 12 - 28 in-lb)



- 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)

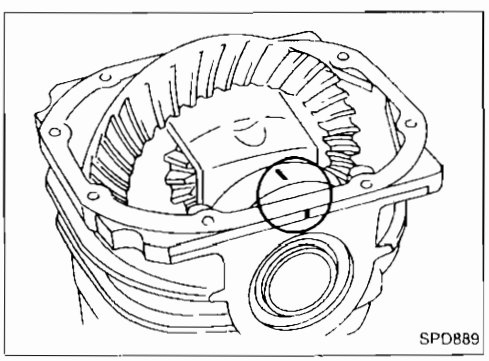


- Ring gear runout
  Check runout of ring gear with a dial indicator.
  Runout limit: 0.05 mm (0.0020 in)
- Tooth contact
  Check tooth contact. Refer to Adjustment (PD-23).



Differential Carrier

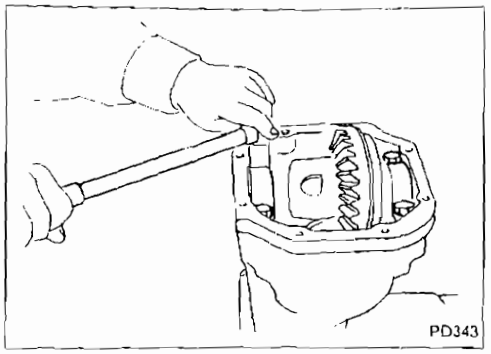
1. Using two 45 mm (1.77 in) spacers, mount carrier on Tool.
   Tool number: KV38100800



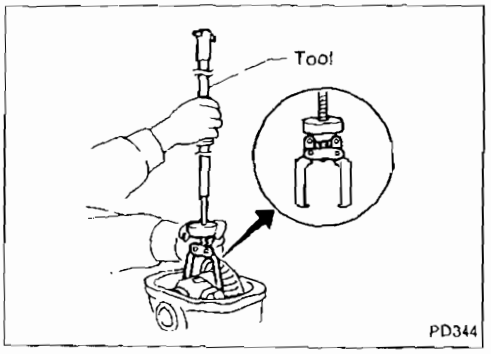
2. For proper reinstallation, paint or punch matchmarks on one side of the side bearing cap.

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

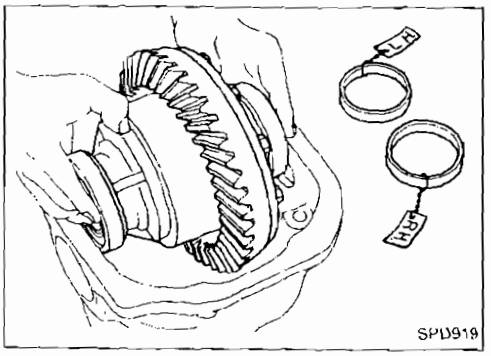
Differential Carrier (Cont'd)



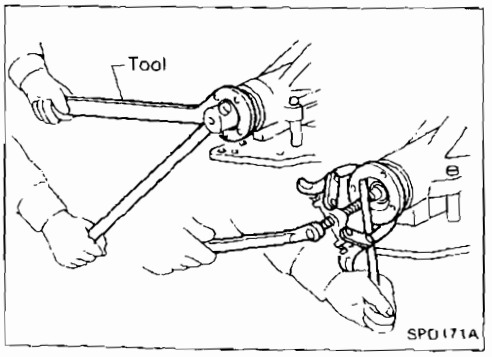
3. Remove side bearing caps.



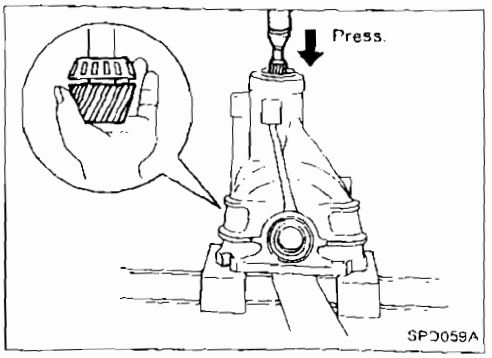
4. Lift differential case assembly out with Tool.
   Tool number: HT72400000



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.

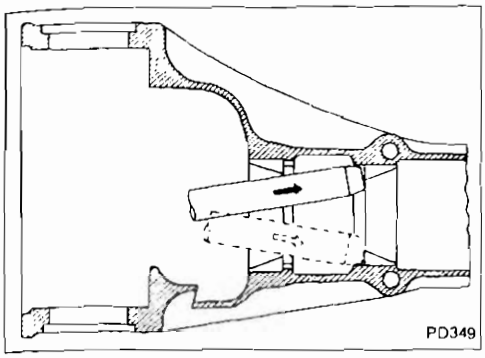


5. Loosen drive pinion nut and pull off companion flange.

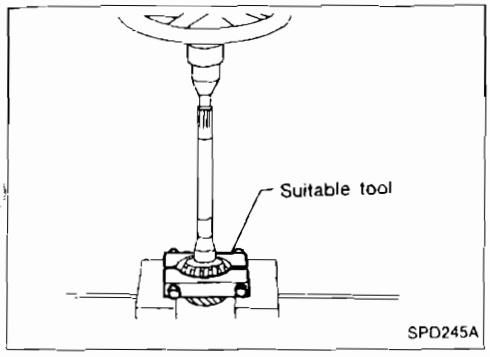


6. Take out drive pinion (together with rear bearing inner race, bearing spacer and adjusting washer).
7. Remove oil seal.
8. Remove front bearing inner race.
9. Remove side oil seal.

Differential Carrier (Cont'd)

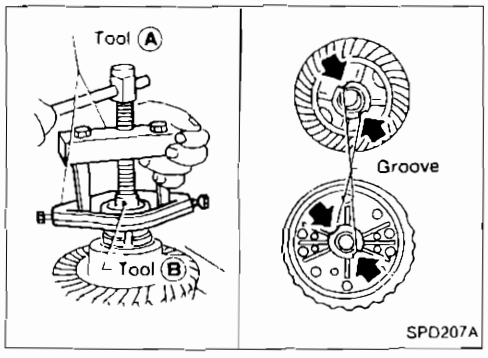


10. Remove pinion bearing outer races with a brass drift.



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

Differential Case



1. Remove side bearing inner cones.

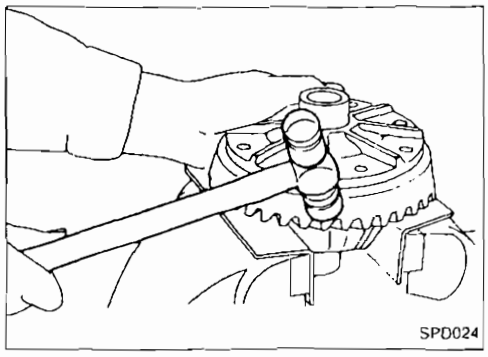
To prevent damage to bearing, engage puller jaws in groove.

Tool number:

Ⓐ ST3305S001

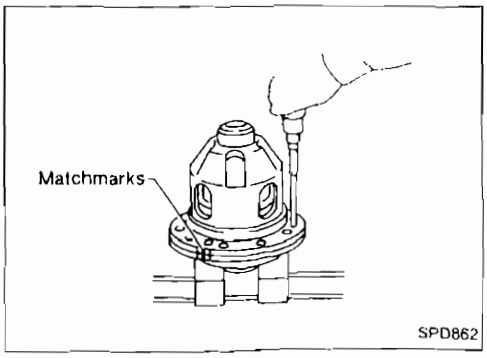
Ⓑ ST33061000

Be careful not to confuse left- and right-hand parts. Keep bearing and bearing race for each side together.

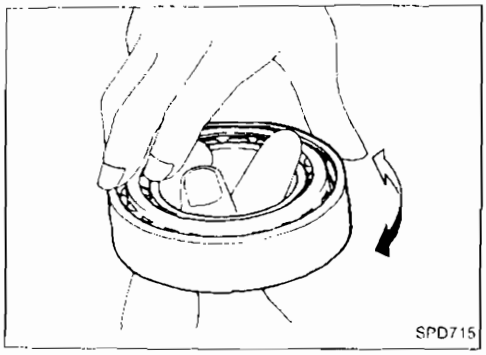


2. Loosen ring gear bolts in a criss-cross fashion.
3. Tap ring gear off the differential case with a soft hammer.

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.



Ring Gear and Drive Pinion

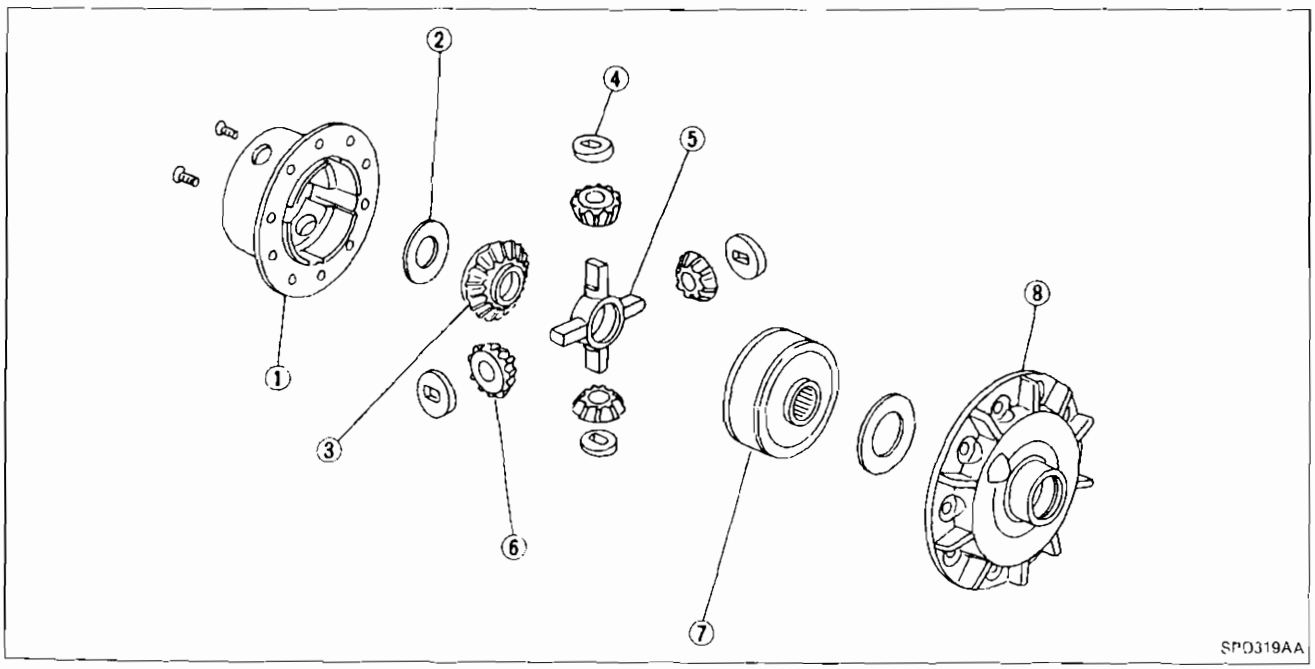
Check gear teeth for scoring, cracking or chipping. If any part is damaged, replace ring gear and drive pinion as a set (hypoid gear set).

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.

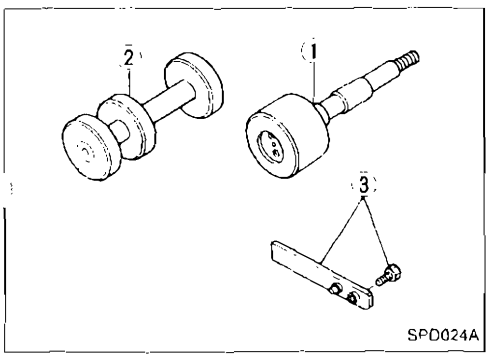
Differential Case Assembly

- Check mating surfaces of differential case, side gears, pinion mate gears, pinion mate shaft and thrust washers.
- Check viscous coupling for oil leakage. If necessary, replace it with new one.



1. Differential case B
2. Side gear thrust washer
3. Side gear (RH)
4. Pinion mate thrust washer
5. Pinion mate shaft
6. Pinion mate gear
7. Side gear (LH) with viscous coupling
8. Differential case A

To avoid confusion while calculating bearing shims, 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.**

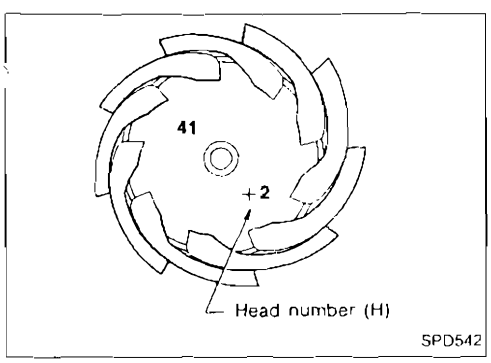


Drive Pinion Height

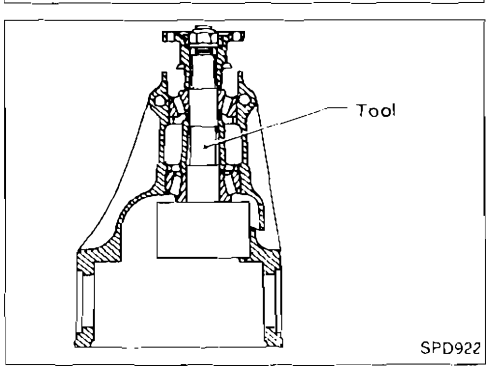
1. First prepare Tools for pinion height adjustment.
   ① Dummy shaft (KV38103910)
   ② Height gauge (KV38100120)
   ③ Stopper (KV38100140)
2. To simplify the job, make a chart, like the one below, to organize your calculations.

LETTERS	HUNDREDTHS OF A MILLIMETER
H: Head number	
N: Measuring clearance	

PD

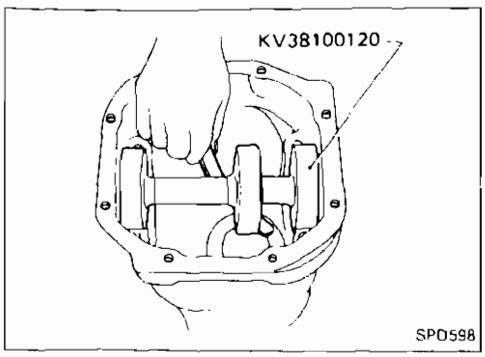


3. Write the following numbers down the chart.
   H: Head number



4. Set Tool (Dummy shaft) as shown below and tighten drive pinion nut carefully to correct preload of 1.0 to 1.3 N·m (10 to 13 kg-cm, 8.7 to 11.3 in-lb).
   Tool number: KV38103910

Drive Pinion Height (Cont'd)



5. Attach Tool (Height gauge) to gear carrier, and measure the clearance between the height gauge and the dummy shaft face.
6. Substitute these values into the equation to calculate the thickness of the washer.

If value signifying H is not given, regard it as zero and calculate.

T (Thickness of washer) = N – (H x 0.01) + 3.00

Example:

N = 0.23

H = 1

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

(1)	H	1
		+1
(2)		+1
		x 0.01
		+ 0.01
(3)	N	0.23
		– (+0.01)
		0.22
(4)		0.22
		+3.00
		3.22
		∴T = 3.22

7. Select the proper pinion height washer.

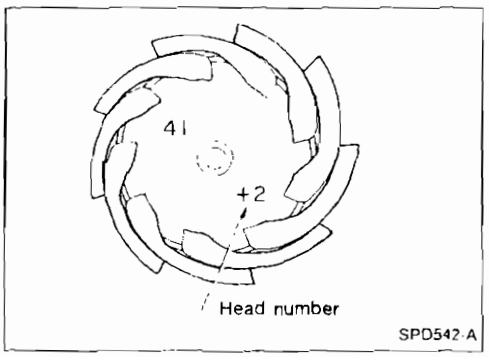
Drive pinion height adjusting washer:
Refer to SDS (PD-36).

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

Example:

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

Drive Pinion Height (Cont'd)



— Washer selection when replacing hypoid gear set —

Drive pinions may be different in height due to the manufacturing process. Use a washer of proper thickness to adjust the height of new drive pinion. Select the washer as follows:

$T = (t_1 - t_2) \times 0.01 + T_0$

where T: thickness of the washer to select
T_0: thickness of the washer used
t_1: old drive pinion head number
t_2: new drive pinion head number

Example:

$T_0 = 3.21$, $t_1 = +2$, $t_2 = -1$

$T = \{2 - (-1)\} \times 0.01 + 3.21$
$= 3 \times 0.01 + 3.21$
$= 0.03 + 3.21$
$= 3.24$

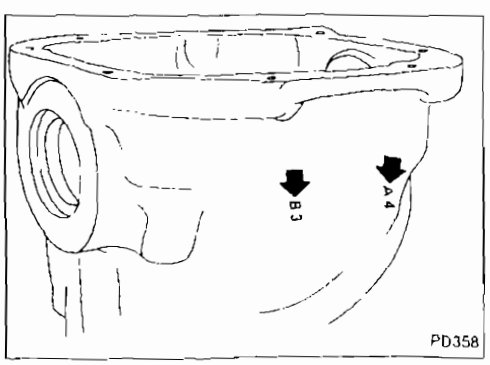
T = 3.24 mm

Drive pinion height adjusting washer:
Refer to SDS (PD-36).

Side Bearing Preload

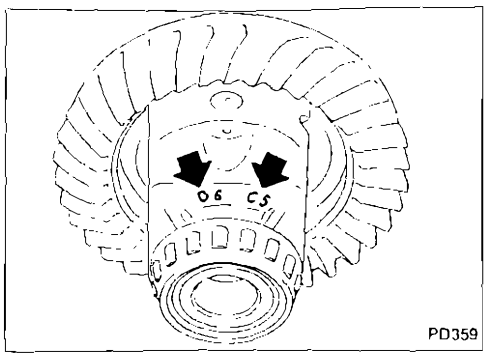
1. To simplify the job, make a chart like the one below to organize your calculations.

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

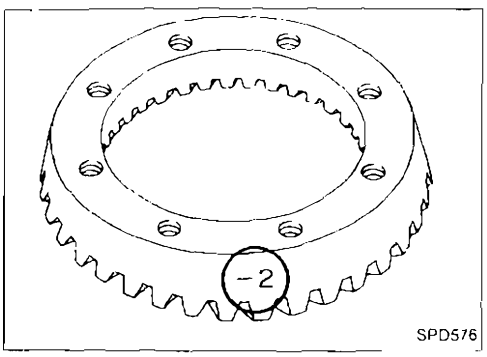


2. Write the following numbers down in the chart.
If numbers for A, B, C, D and H are not given, regard them as zero.
A & B: Figures marked on gear carrier

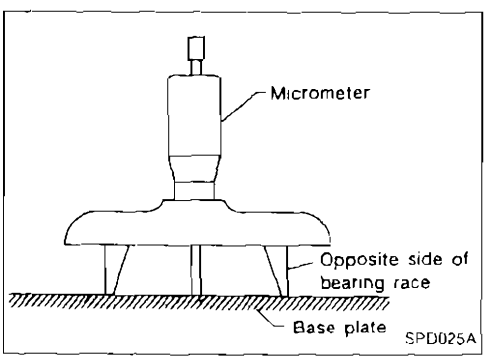
Side Bearing Preload (Cont'd)



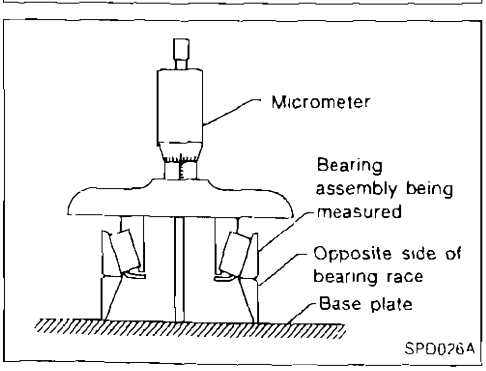
C & D: Figures marked on differential case



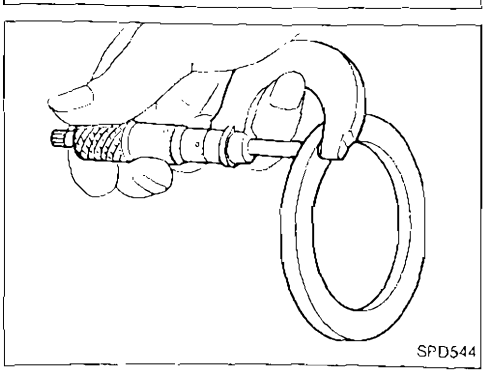
H: Figure marked on ring gear
Do not confuse negative and positive values.



3. Calculate "E" and "F" as follows.
   E & F = 21 mm (0.83 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

Side Bearing Preload (Cont'd)

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

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

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

PD

Side Bearing Preload (Cont'd)

Example for R200V which has a side bearing spacer on the right

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 (without spacer)
T_1 = (A − C + D − H) x 0.01 + E + Y

4 − 5	A − C	
= −1 + 6	+ D	
= 5 − (−2)	− H	
= 7 x 0.01	x 0.01	
= 0.07 + 0.18	+ E	
= 0.25 + 2.07	+ Y	
= 2.32 **T_1 = 2.32 mm**		

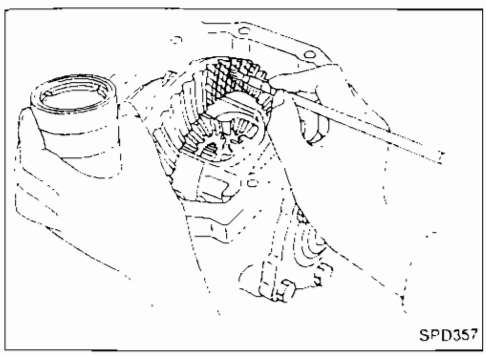
Right side washer thickness (with spacer)
T_2 = (B − D + H) x 0.01 + F + G + X

3 − 6	B D	
= −3 + (−2)	+ H	
= −5 x 0.01	x 0.01	
= −0.05 + 0.15	+ F	
= 0.10 + 0.08	+ G	
− 0.18 + 1.97	+ X	
= 2.15 **T_2 = 2.15 mm**		

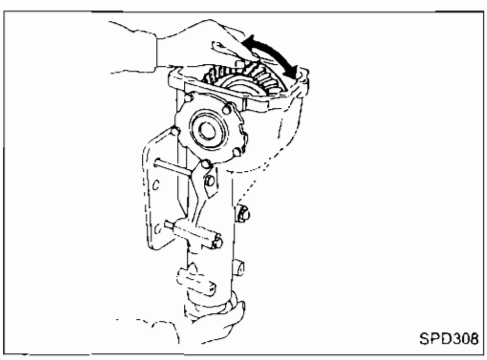
5. Select the proper shims. Refer to SDS (PD-36).
If you cannot find the desired thickness of shims, use shims with the total thickness closest to the calculated value.

Tooth Contact

Checking gear tooth contact pattern is necessary to verify correct relationship between ring gear and drive pinion.
Hypoid gears which are not positioned in proper arrangement may be noisy and/or have a short life. Check gear tooth contact pattern to obtain the best contact for low noise and long life.

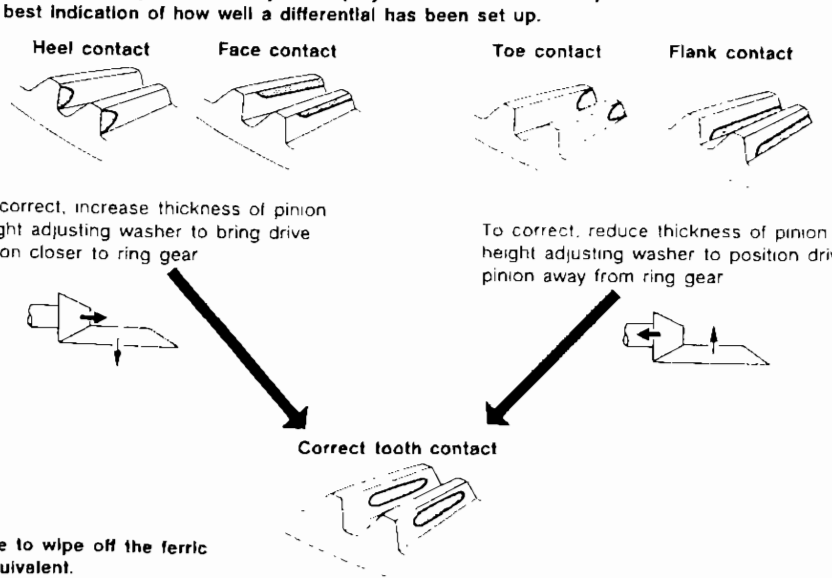

SPD357

1. Thoroughly clean ring gear and drive pinion teeth
2. Lightly apply a mixture of powdered titanium oxide and oil or the equivalent. Apply it to 3 or 4 teeth of ring gear drive side.


SPD308

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

Usually the pattern will be correct if shims are correctly calculated and the backlash is correct.
However, in rare cases, trial and error processes may be employed to obtain a correct pattern.
The tooth pattern is the best indication of how well a differential has been set up.



After adjustment, be sure to wipe off the ferric oxide and oil or their equivalent.

SPD007 A

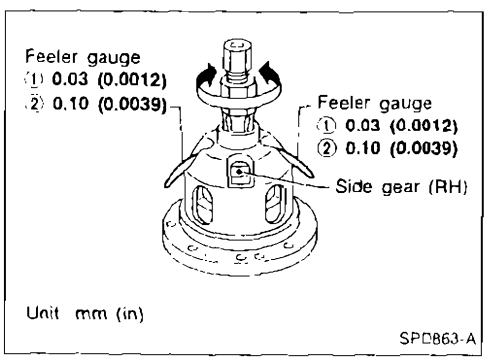
PD

Differential Case

Whenever side gears or pinion mate gears are replaced, selection of thrust washers should be carried out
Before selecting thrust washers, make sure all parts are clean and well lubricated with hypoid gear oil.

THRUST WASHER SELECTION

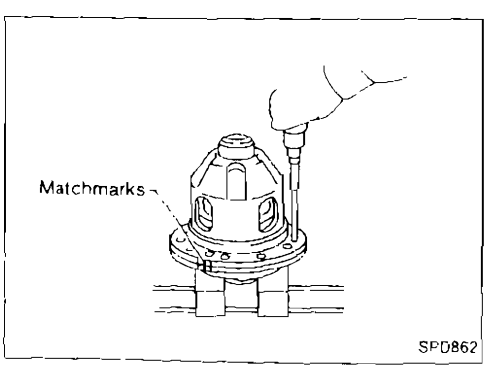
1. Install the previously removed thrust washer on right side gear. On left side gear, install a suitable thrust washer. Temporarily tighten differential cases using two screws.



2. Position differential assembly so that right side gear is on the upper side. Place two feeler gauges of 0.03 mm (0.0012 in) thickness between right side gear and thrust washer as shown.

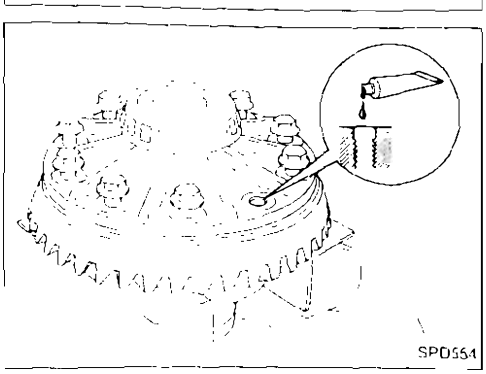
Do not insert feeler gauge in oil groove portion of differential case.

3. Rotate right side gear with a suitable tool attached to splines.
   If hard to rotate, replace thrust washer on left side gear with a thinner one.
4. 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 rotates, replace thrust washer on left side gear with a thicker one to prevent rotation



ASSEMBLY

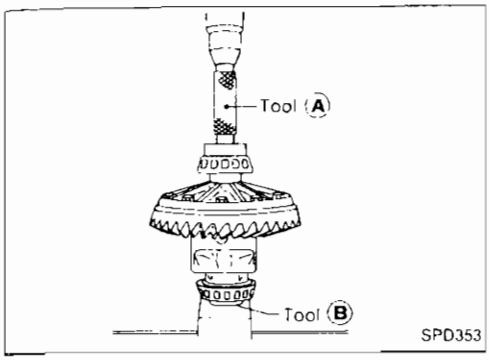
1. Install differential case A and B.



2. Place differential case on ring gear.
3. Apply locking sealant to ring gear bolts, and install them.

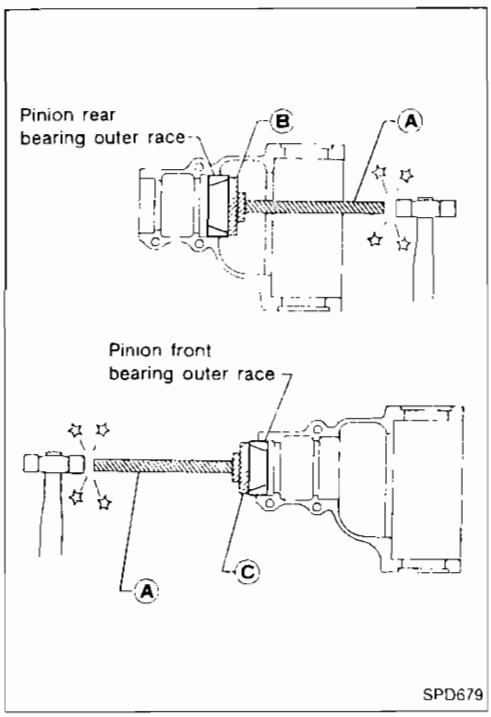
Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

Differential Case (Cont'd)

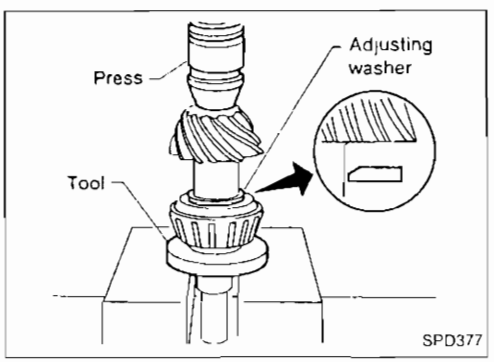


4. Press-fit side bearing inner cones on differential case with Tool.
   Tool number:
   - Ⓐ **KV38100300**
   - Ⓑ **ST33061000**

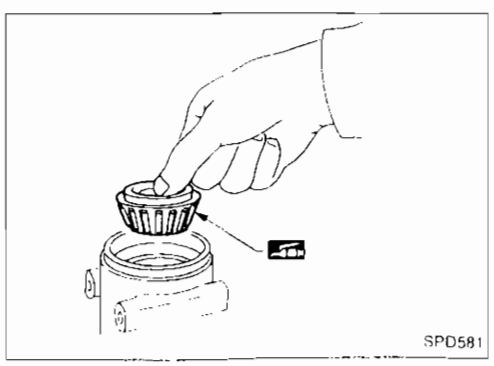
Differential Carrier



1. Press-fit front and rear bearing outer races with Tools
   Tool number:
   - Ⓐ **ST30611000**
   - Ⓑ **ST30621000**
   - Ⓒ **ST30613000**
2. Select pinion bearing adjusting washer and drive pinion bearing spacer. Refer to ADJUSTMENT (PD-17).

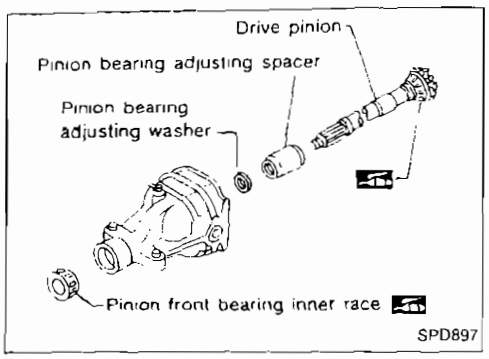


3. Install selected drive pinion height adjusting washer in drive pinion. Using press and Tool, press-fit pinion rear bearing inner cone into it.
   Tool number: ST30901000



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

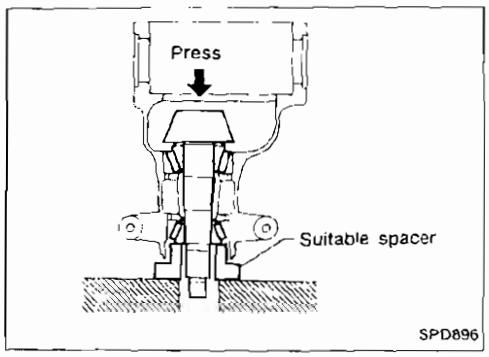
Differential Carrier (Cont'd)

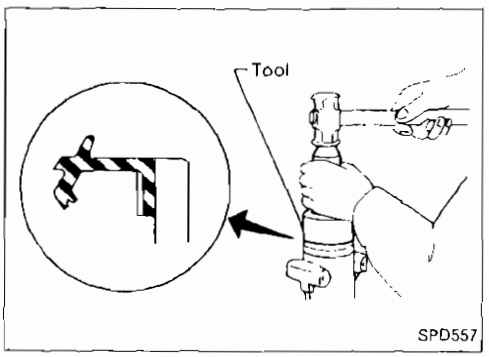


5. Set drive pinion assembly (as shown in figure at left) in differential carrier and install drive pinion, with press and suitable tool.

Stop when drive pinion touches bearing.

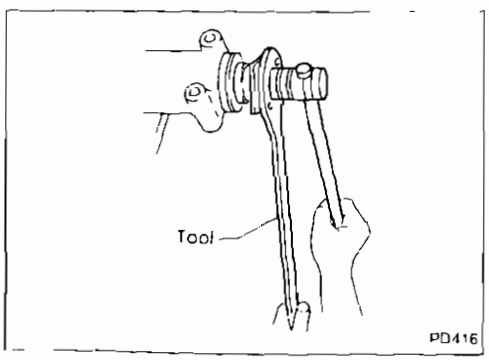
Apply multi-purpose grease to pinion rear bearing inner race, pinion front bearing inner race.





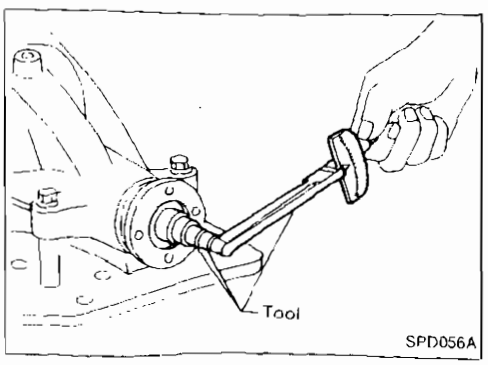
6. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install front oil seal with Tool.

Tool number: KV38100500



7. Install companion flange, and tighten pinion nut to specified torque with suitable tool.

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



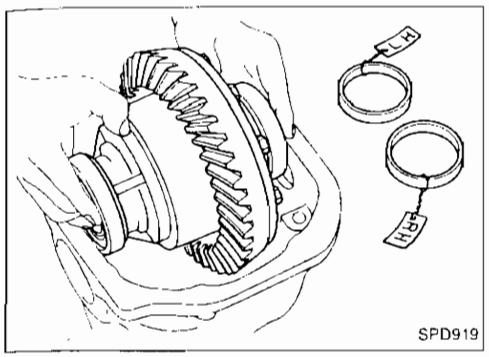
8. Turn drive pinion in both directions several times, and measure pinion bearing preload.

Pinion bearing preload:

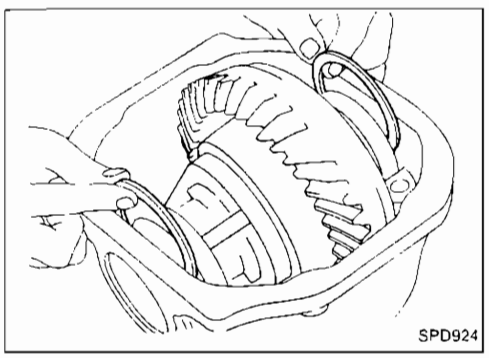
1.1 - 1.4 N·m (11 - 14 kg-cm, 9.5 - 12.2 in-lb)

When pinion bearing preload is outside specifications, replacement is required for pinion bearing adjusting washer and spacer. Replace with those of different thickness.

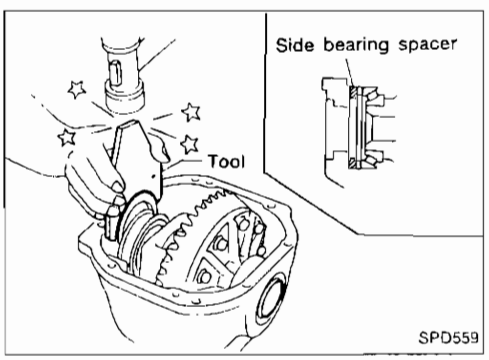
Differential Carrier (Cont'd)



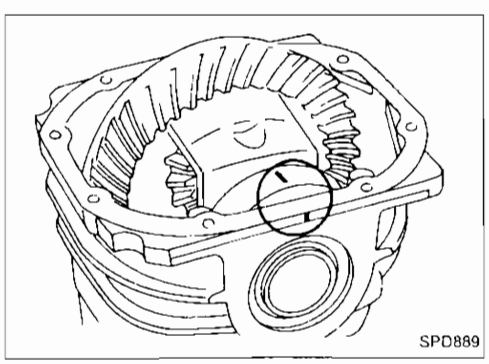
9. Select side bearing adjusting washer. Refer to ADJUSTMENT (PD-19).
10. Install differential case assembly with side bearing outer races into gear carrier.



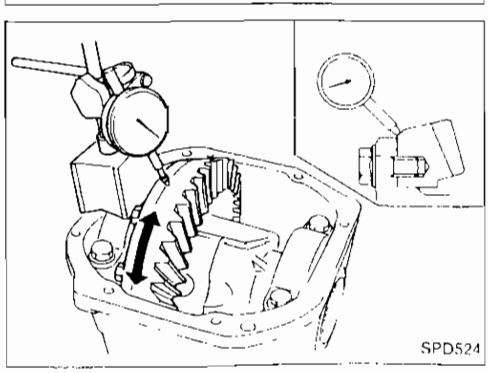
11. Insert left and right side bearing adjusting washers in place between side bearings and carrier.



12. Drive in side bearing spacer with Tool.
    Tool number: KV38100600
    Spacer location: Right side

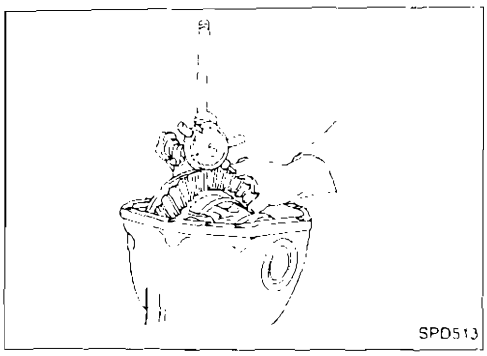


13. Align mark on bearing cap with that on gear carrier and install bearing cap on gear carrier.



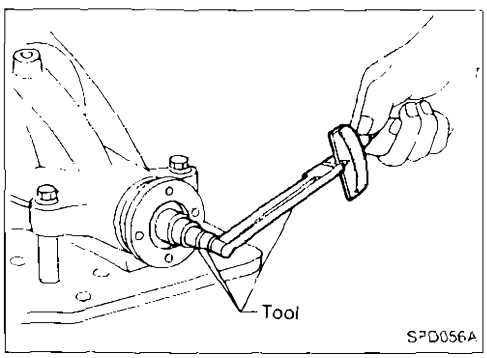
14. Check runout of ring gear with a dial indicator.
    Runout limit: 0.05 mm (0.0020 in)

Differential Carrier (Cont'd)



15. 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, adjustment of shim thickness is required. Decrease thickness of left shim and increase thickness of right shim by the same amount.
  If backlash is too great, reverse the above procedure.

Never change the total amount of shims as it will change the bearing preload.



16. Check total preload with Tool.

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

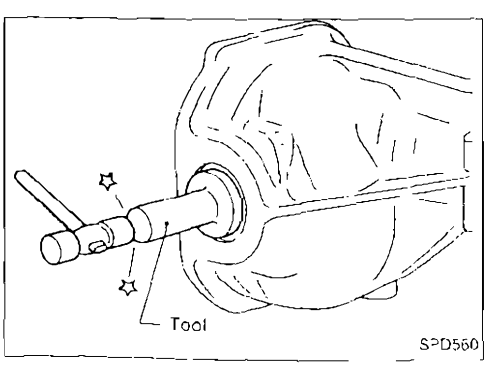
Total preload:
1.4 - 3.1 N·m (14 - 32 kg-cm, 12 - 28 in-lb)

- If preload is too great, remove the same amount of shim from each side.
- If preload is too small, add the same amount of shim to each side.

Never add or remove a different number of shims for each side. Difference in number of shims will change ring gear to drive pinion backlash.

17. Recheck ring gear to drive pinion backlash. Increase or decrease in thickness of shims will cause change to ring gear to pinion backlash.
- Check whether the backlash varies excessively in different places. Foreign matter may be caught between the ring gear and the differential case causing the trouble.
- The backlash can vary greatly even when the ring gear runout is within a specified range. In that case, replace the hypoid gear set or differential case.

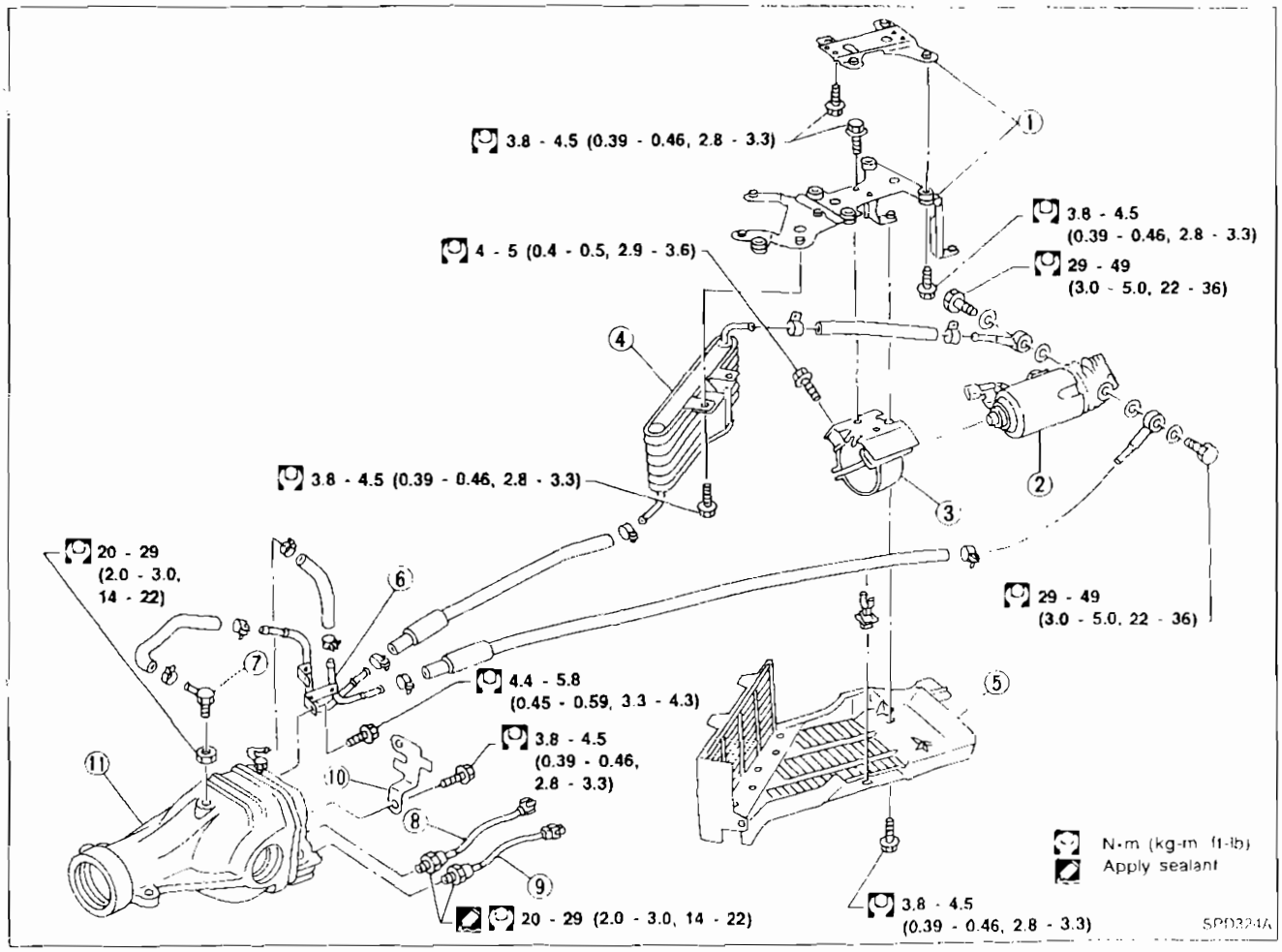
18. Check tooth contact.
    Refer to ADJUSTMENT (PD-23).
19. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install side oil seal.
    Tool number: KV38100200
20. Install rear cover and gasket.



Description

- The differential 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.
  Differential gear oil:
  OFF → ON 180°C (356°F)
  ON → OFF 150°C (302°F)

Removal and Installation

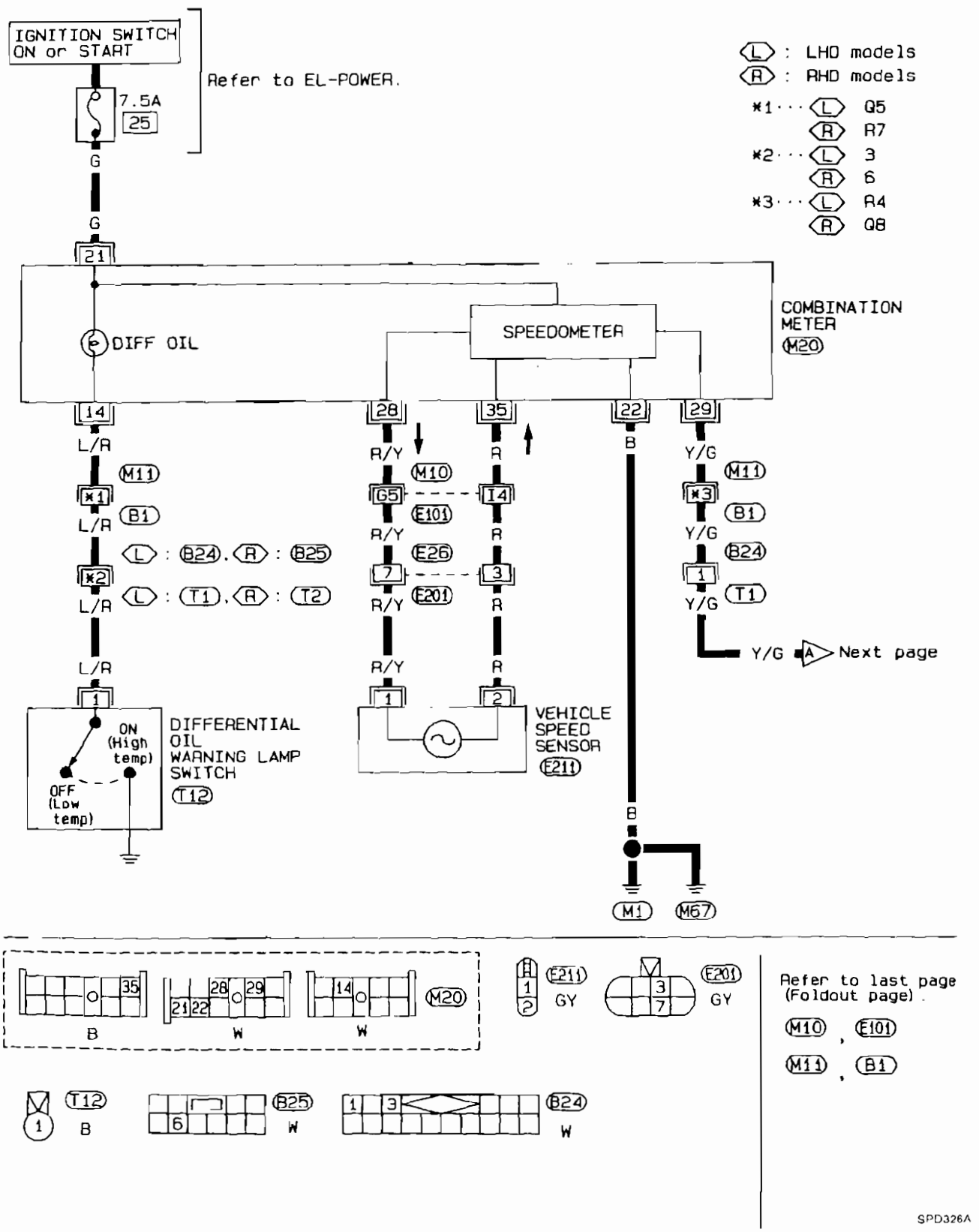


1. Oil pump mounting bracket
2. Oil pump assembly
3. Oil pump bracket
4. Oil cooler assembly
5. Oil cooler protector
6. Oil cooler tube assembly
7. Inlet connector
8. Warning lamp switch
9. Oil temperature switch
10. Connector bracket
11. Final drive

PD

Wiring Diagram

PD-DIFF-01



Refer to last page (Foldout page).

M10 , E101

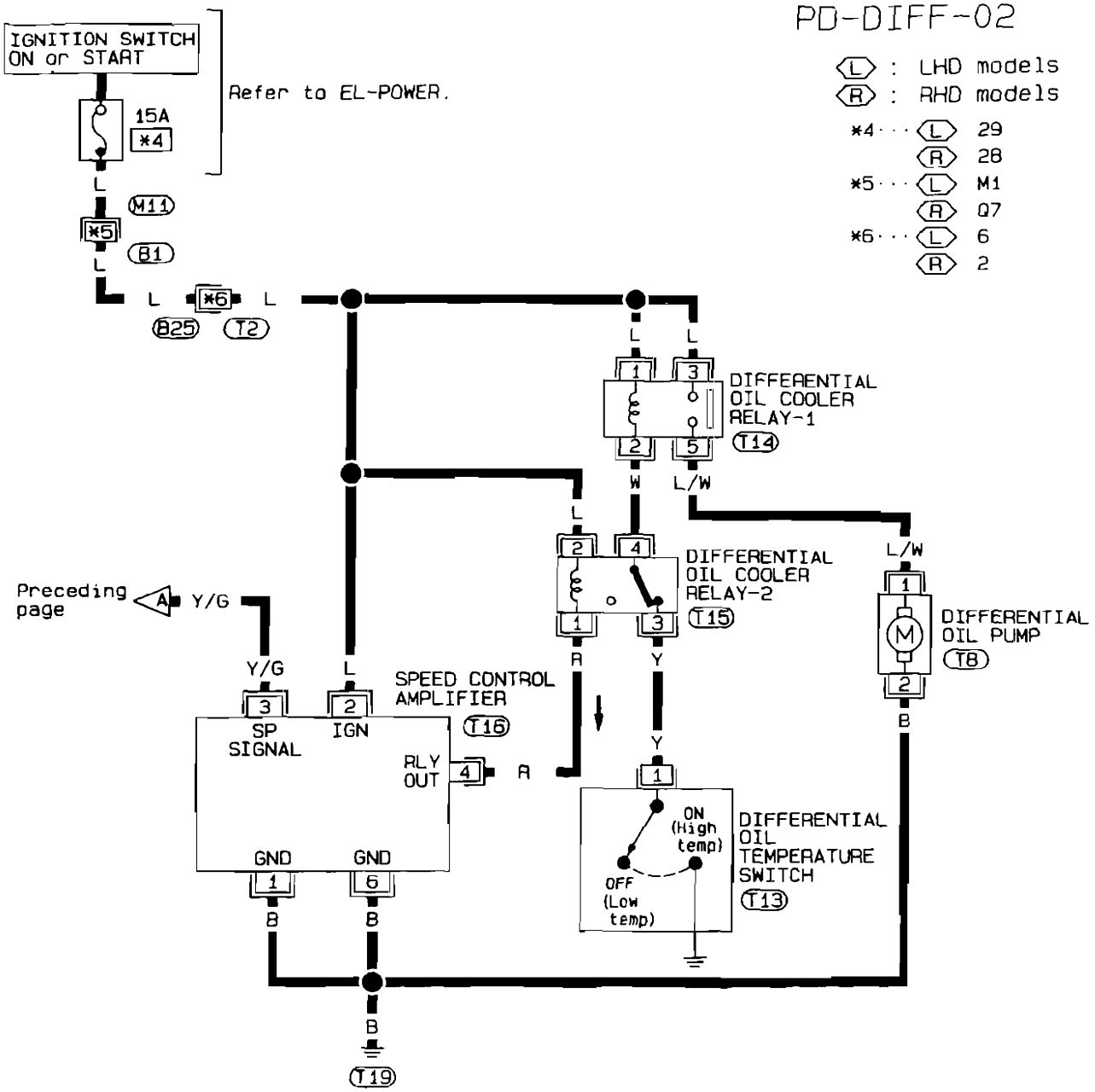
M11 , B1

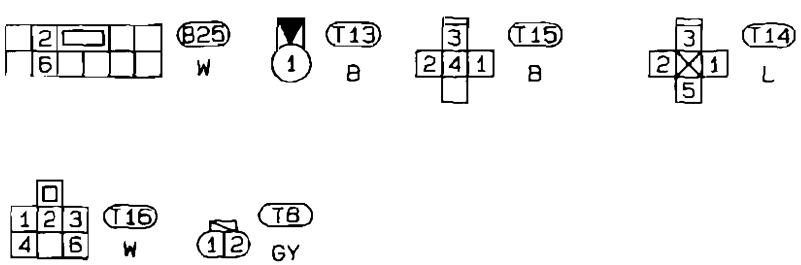
SPD326A

Wiring Diagram (Cont'd)

PD-DIFF-02

Ⓛ : LHD models
Ⓡ : RHD models
*4 ··· Ⓛ 29
Ⓡ 28
*5 ··· Ⓛ M1
Ⓡ 07
*6 ··· Ⓛ 6
Ⓡ 2





Refer to last page (Foldout page)

M11 , B1

SPD327A

Inspection

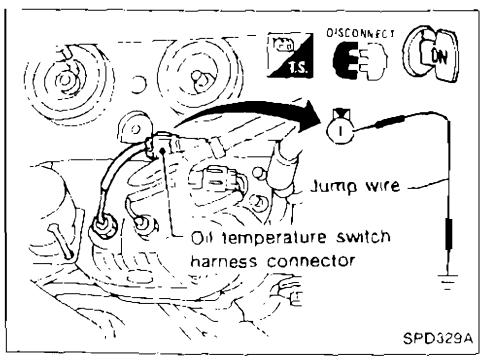
Thoroughly clean all parts in cleaning solvent and blow dry with compressed air, if available.

OIL PUMP ASSEMBLY

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

OIL COOLER ASSEMBLY, OIL TUBE ASSEMBLY, OIL HOSE

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



Trouble Diagnoses

SYMPTOM:

Oil pump does not rotate.

CHECK OIL PUMP OPERATION

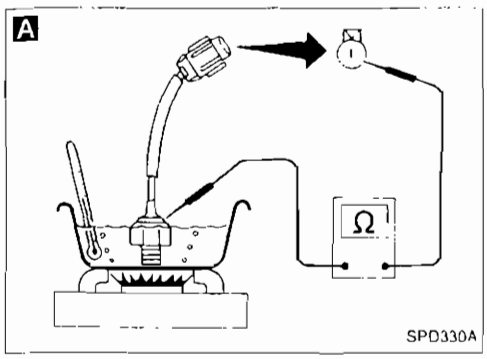
1. Disconnect speed control amplifier harness connector.
2. Disconnect oil pump temperature switch harness connector.
3. Turn ignition switch "ON".
4. Connect jump wire between oil temperature switch harness connector terminal (1) and ground.

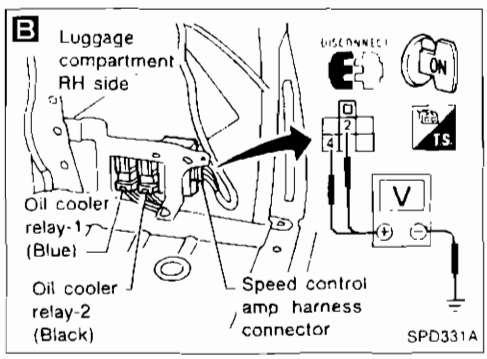
Oil pump rotates:
Refer to Procedure A.

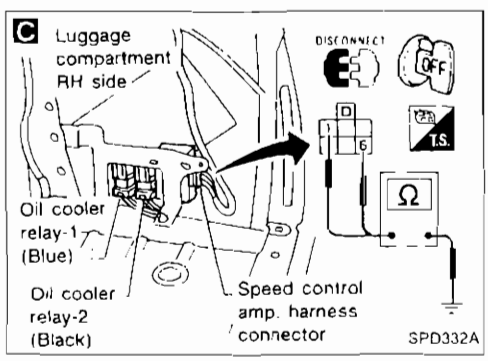
Oil pump does not rotate:
Refer to Procedure B.

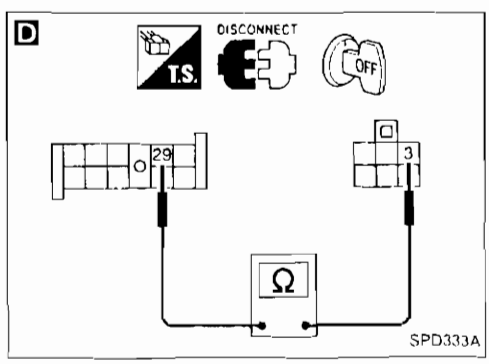
Trouble Diagnoses (Cont'd)

Procedure A









A

CHECK OIL TEMPERATURE SWITCH
1) Remove oil temperature switch
2) Check proper operation
Operating temperature:
OFF → ON 130°C (266°F)

NG → Replace oil temperature switch

OK ↓

B

CHECK SPEED CONTROL AMPLIFIER POWER SUPPLY
1) Disconnect speed control amplifier harness connector
2) Turn ignition switch "ON"
3) Check voltage between ②, ④ and ground.
Battery voltage should exist.

NG → Check and repair the following parts:
- Harness continuity between speed control amplifier harness connector terminal ② and fuse
- Harness continuity between speed control amplifier harness connector terminal ④ and oil cooler relay-2 harness connector terminal ①
- Harness continuity between oil cooler relay-2 harness connector terminal ② and fuse
- Oil cooler relay-2

OK ↓

C

CHECK SPEED CONTROL AMPLIFIER GROUND CIRCUIT.
1) Turn ignition switch "OFF"
2) Disconnect speed control amplifier harness connector
3) Check harness continuity between ①, ⑥ and ground.
Continuity should exist.

NG → Repair or replace harness.

OK ↓

D

CHECK SPEED SIGNAL INPUT CIRCUIT.
1) Disconnect speed control amplifier harness connector and combination meter harness connector.
2) Check harness continuity between speed control amplifier harness connector terminal ③ and combination meter harness connector terminal ㉙.
Continuity should exist.

NG → Repair or replace harness

OK ↓

CHECK VEHICLE SPEED SENSOR.
Refer to "METER AND GAUGES" in EL section.

NG → Replace vehicle speed sensor

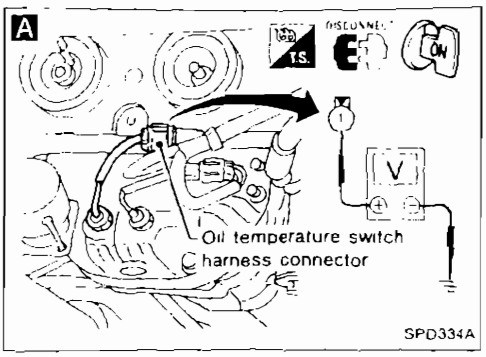
OK ↓

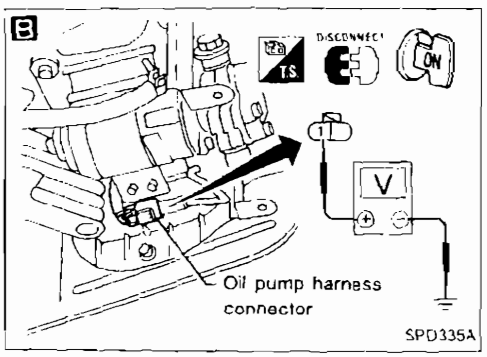
Replace speed control amplifier

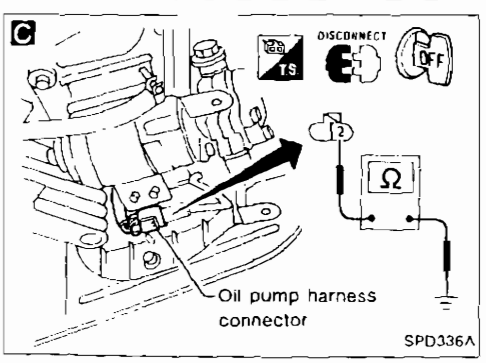
PD

Trouble Diagnoses (Cont'd)

Procedure B







A

CHECK POWER SUPPLY
1) Disconnect oil temperature switch harness connector and speed control amplifier harness connector
2) Turn ignition switch "ON"
3) Check voltage between oil temperature switch harness connector terminal ① and ground
Battery voltage should exist.

NG → Check and repair the following parts:
- Harness continuity between oil cooler relay-1 harness connector terminal ① and fuse
- Fuse
- Harness continuity between oil cooler relay-1 harness connector terminal ② and oil cooler relay-2 harness connector terminal ④
- Oil cooler relay-1
- Oil cooler relay-2
- Harness continuity between oil cooler relay-2 harness connector terminal ③ and oil temperature switch harness connector terminal ①

OK ↓

B

1) Disconnect oil pump harness connector.
2) Turn ignition switch "ON"
3) Check voltage between oil pump harness connector terminal ① and ground.
Battery voltage should exist.
If NG, check and repair the following parts:
- Harness continuity between oil cooler relay-1 harness connector terminal ③ and fuse
- Fuse
- Harness continuity between oil cooler relay-1 harness connector terminal ⑤ and oil pump harness connector terminal ①
- Oil cooler relay-1

OK ↓

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF"
2) Disconnect oil pump harness connector.
3) Check harness continuity between oil pump harness connector terminal ② and ground.
Continuity should exist.
If NG, repair or replace harness

OK ↓

Replace oil pump

Propeller Shaft

GENERAL SPECIFICATIONS

Unit: mm (in)

Applied model	M/T	A/T
Propeller shaft model	3S71A	
Number of joints	3	
Coupling method with transmission	Sleeve type	
Type of journal bearings	Shell type (Non-disassembly type)	
Distance between yokes	63.0 (2.480)	
Shaft length (Spider to spider)		
1st	421.0 (16.57)	441.0 (17.36)
2nd		
Without ABS	650.0 (25.59)	
With ABS	636.0 (25.04)	
Shaft outer diameter		
1st	75.0 (2.953)	
2nd	75.0 (2.953)	50.8 (2.000)

SPECIFICATIONS AND ADJUSTMENT

Unit: mm (in)

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

Final Drive

GENERAL SPECIFICATIONS

Applied model	M/T	A/T
Final drive model	R200V	
Ring gear pitch diameter mm (in)	205 (8.07)	
Gear ratio	3.692	3.916
Number of teeth (Ring gear/drive pinion)	48/13	47/12
Oil capacity ℓ (Imp pt)	1.2 - 1.4 (2-1/8 - 2-1/2)	
Number of pinion gears	4	
Side gear bearing spacer location	Right	

INSPECTION AND ADJUSTMENT

Ring gear runout

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

Side gear adjustment

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

Final Drive (Cont'd)

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 bearing adjusting method	Pinion bearing adjusting washer and spacer
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
54.50 (2.1457)	38165-B4000
54.80 (2.1575)	38165-B4001
55.10 (2.1693)	38165-B4002
55.40 (2.1811)	38165-B4003
55.70 (2.1929)	38165-B4004
56.00 (2.2047)	38165-61001

Total preload adjustment

Drive pinion to ring gear backlash mm (in)	0.10 - 0.15 (0.0039 - 0.0059)
Total preload N·m (kg-cm, in-lb)	1.4 - 3.1 (14 - 32, 12 - 28)
Side bearing adjusting method	Adjusting washer

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
2.65 (0.1043)	38453-N3113