

# PROPELLER SHAFT & DIFFERENTIAL CARRIER

## SECTION PD

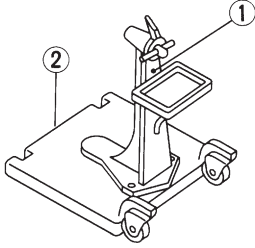
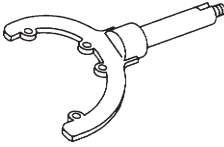
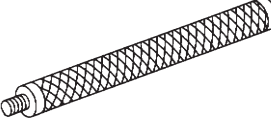
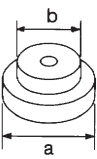
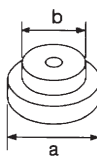
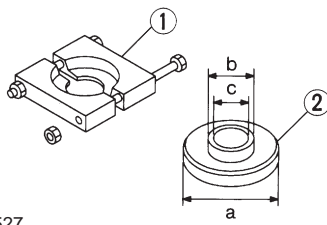
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# PREPARATION

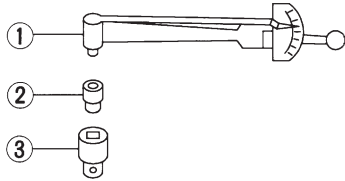
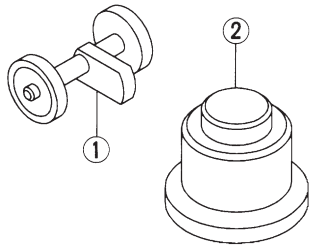
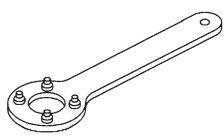
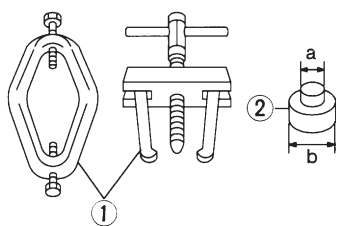
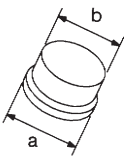
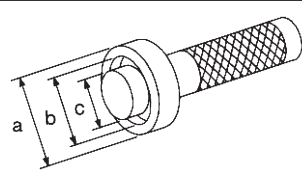
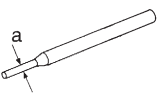
## Special Service Tools

\*: For front differential carrier only

Tool number Tool name	Description	Unit application	
		H233B	
ST0501S000 Engine stand ① ST05011000 Engine stand ② ST05012000 Base	 NT042	Mounting differential attachment	X
ST06340000 Differential attachment	 NT140	Mounting final drive	X
ST30611000 Drive pinion bearing outer race drift bar	 NT090	Installing pinion rear bearing outer race (Use with ST30621000 or ST30613000)	X
ST30613000 Drive pinion front bearing outer race drift	 NT073	Installing pinion front bearing outer race (Use with ST30613000)  <b>a: 71.5 mm (2.815 in) dia.</b> <b>b: 47.5 mm (1.870 in) dia.</b>	X
ST30621000 Drive pinion rear bearing outer race drift	 NT073	Installing pinion rear bearing outer race (Use with ST30613000)  <b>a: 79 mm (3.11 in) dia.</b> <b>b: 59 mm (2.32 in) dia.</b>	X*
ST3090S000 Drive pinion rear bearing inner race puller set ① ST30031000 Puller ② ST30911000 Base	 NT527	Removing and installing drive pinion rear inner race	X

## PREPARATION

### Special Service Tools (Cont'd)

Tool number Tool name	Description	Unit application
		H233B
ST3127S000 Preload gauge ① GG91030000 Torque wrench ② HT62900000 Socket adapter (1/2") ③ HT62940000 Socket adapter (3/8")	 <p>NT124</p>	X
ST3125S000 Drive pinion setting gauge set ① ST31251000 Drive pinion height gauge ② ST31181001 Dummy shaft	 <p>NT524</p>	X
KV40104000 Drive pinion flange wrench	 <p>NT113</p>	X
ST0237S000 Differential side bearing puller set ① ST33051001 Puller ② ST02371000 Adapter	 <p>NT072</p> <p><b>a: 40 mm (1.57 in) dia.</b> <b>b: 50 mm (1.97 in) dia.</b></p>	X
ST33081000 Adapter	 <p>NT431</p> <p><b>a: 43 mm (1.69 in) dia.</b> <b>b: 33.5 mm (1.319 in) dia.</b></p>	X
ST33190000 Differential side bearing drift	 <p>NT085</p> <p><b>a: 52 mm (2.05 in) dia.</b> <b>b: 45.5 mm (1.791 in) dia.</b> <b>c: 34 mm (1.34 in) dia.</b></p>	X
KV31100300 Fork rod pin punch	 <p>NT410</p> <p><b>a: 4.5 mm (0.177 in) dia.</b></p>	X



# NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

## NVH Troubleshooting Chart

Use the chart below to help you find the cause of the symptom. If necessary, repair or replace these parts.

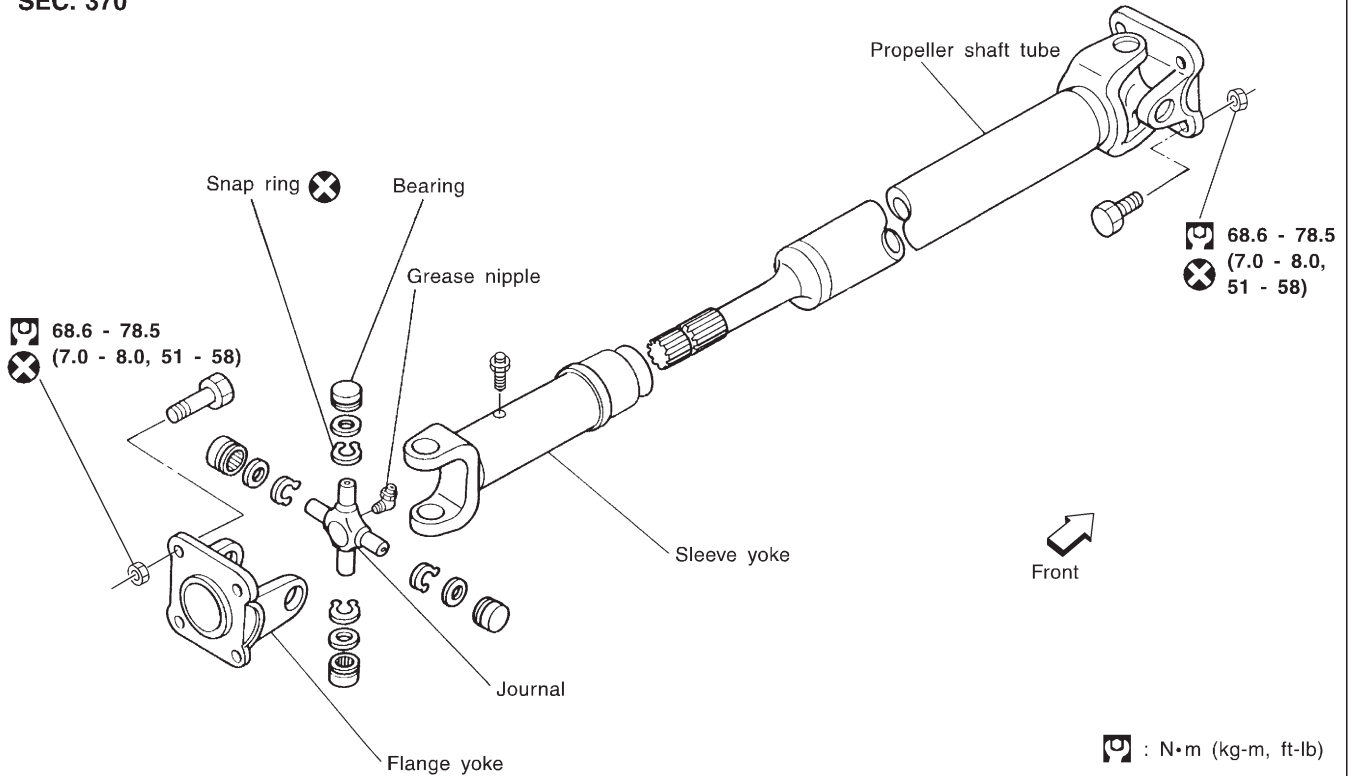
Symptom		Possible cause and SUSPECTED PARTS																	
		Uneven rotation torque	Excessive joint angle	Rotation imbalance	Excessive runout	Rough gear tooth	Improper gear contact	Tooth surfaces worn	Incorrect backlash	Companion flange excessive runout	Improper gear oil	PROPELLER SHAFT	DIFFERENTIAL	AXLE AND SUSPENSION	TIRES	ROAD WHEEL	DRIVE SHAFT	BRAKES	STEERING
Reference page		—	—	PD-6	PD-6	PD-19	PD-29	PD-19	PD-14	—	Refer to MA section.	Refer to PROPELLER SHAFT in this chart.	Refer to DIFFERENTIAL in this chart.	NVH in FA, RA section	NVH in FA section	NVH in FA section	NVH in RA section	NVH in BR section	NVH in ST section
	PROPELLER SHAFT	Noise	X	X	X	X							X	X	X	X	X	X	X
		Shake		X										X	X	X	X	X	X
		Vibration	X	X	X	X								X	X		X		X
	DIFFERENTIAL	Noise				X	X	X	X	X	X	X		X	X	X	X	X	X

X: Applicable

# PROPELLER SHAFT

## Front Propeller Shaft

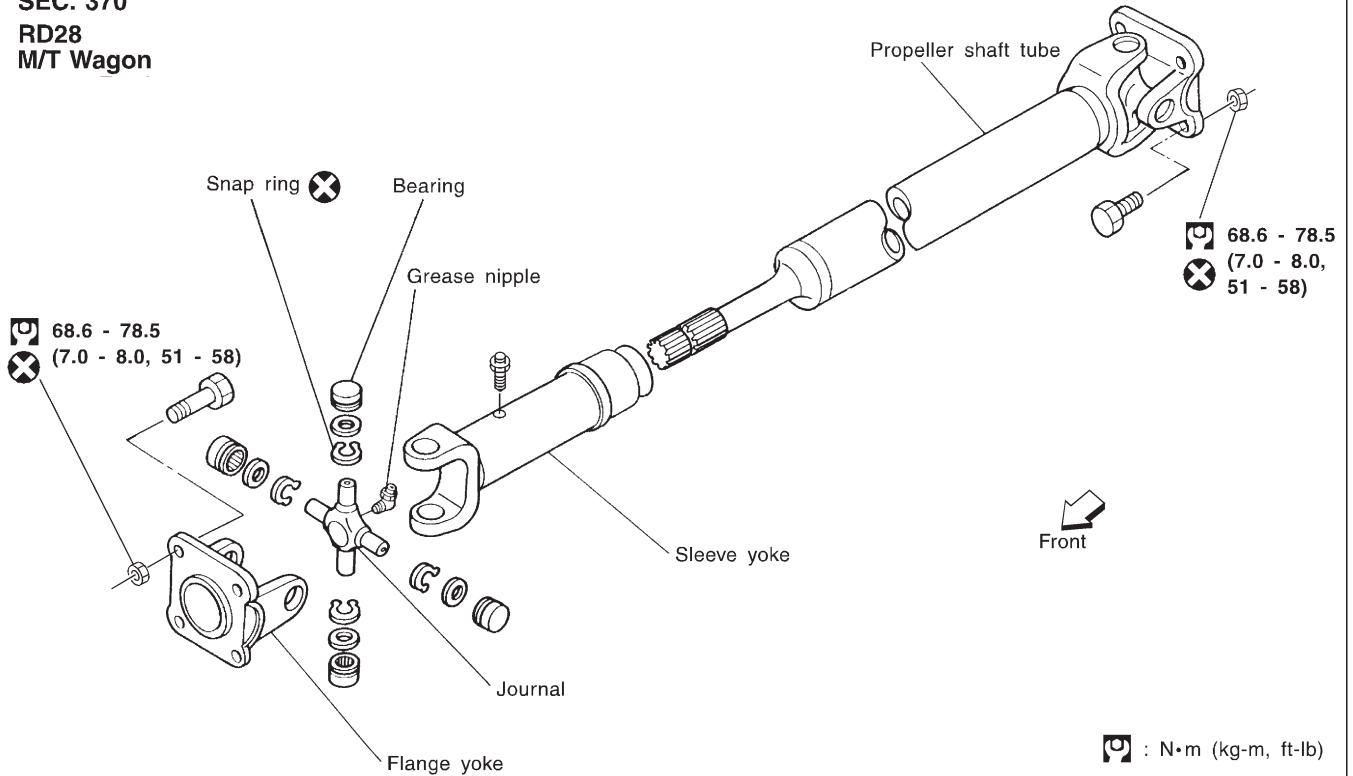
Model 2F80B  
SEC. 370



SPD434A

## Rear Propeller Shaft

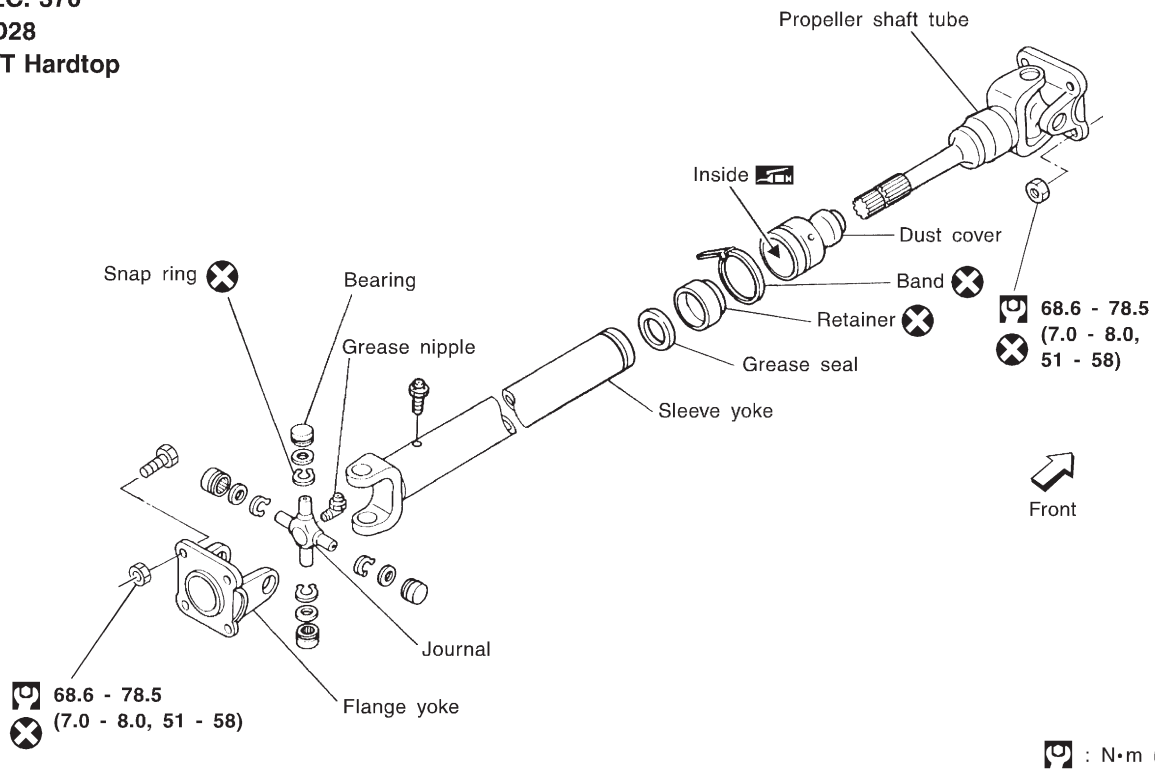
Model 2F80B  
SEC. 370  
RD28  
M/T Wagon



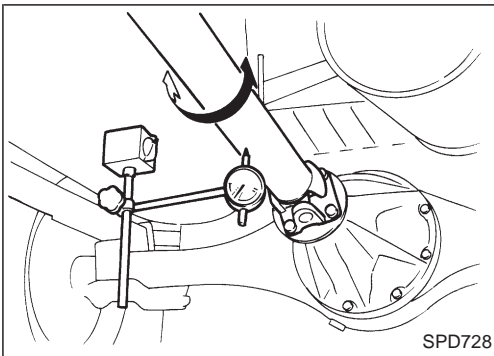
SPD457A

# PROPELLER SHAFT

Model 2F100H  
SEC. 370  
RD28  
M/T Hardtop



SPD458A



## On-vehicle Service

### PROPELLER SHAFT VIBRATION

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

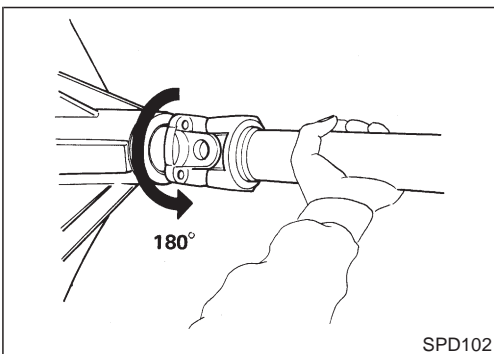
1. Raise front and rear wheels.
2. Measure propeller shaft runout at several points by rotating final drive companion flange with hands.

**Runout limit: 0.6 mm (0.024 in)**

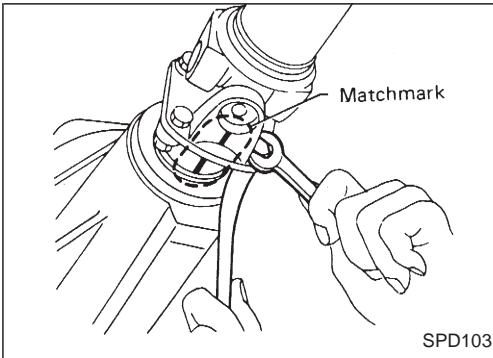
3. If runout exceeds specifications, disconnect propeller shaft at final drive companion flange; then rotate companion flange 180 degrees and reconnect propeller shaft.
4. Check runout again. If runout still exceeds specifications, replace propeller shaft assembly.
5. Perform road tests.

### APPEARANCE CHECKING

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

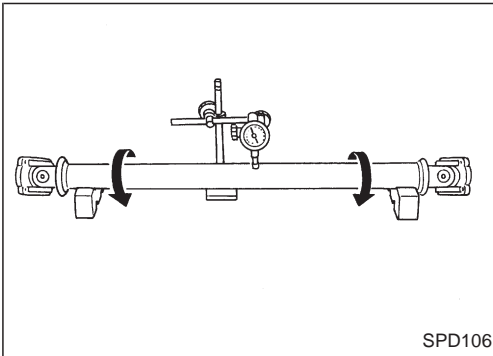


# PROPELLER SHAFT



## Removal and Installation

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

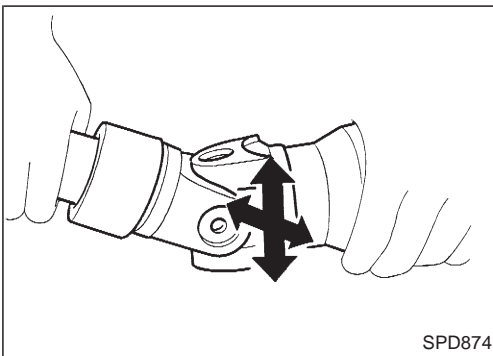


### CAUTION:

When installing the propeller shaft, make sure it is facing the correct direction. Each model is different.

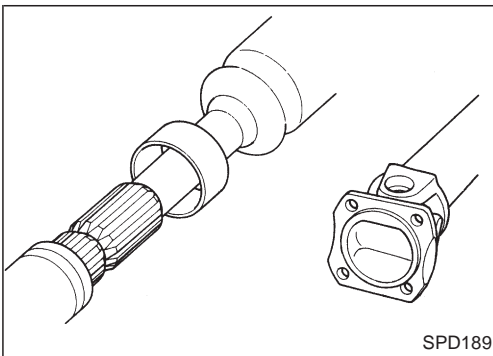
## Inspection

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

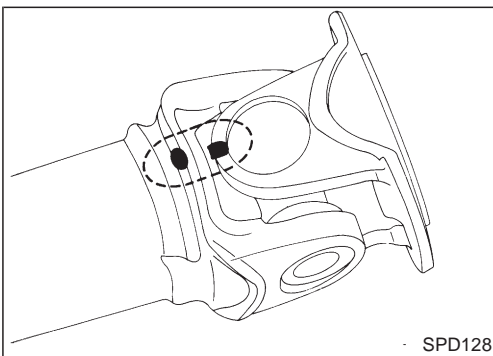


- Inspect journal axial play. If the play exceeds specifications, replace propeller shaft assembly.

**Journal axial play:**  
**0.02 mm (0.0008 in) or less**



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



## Disassembly

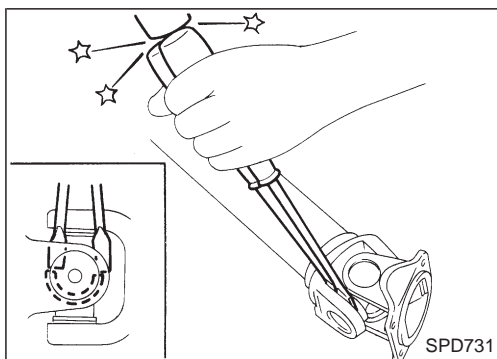
### JOURNAL

1. Put matchmarks on shaft and flange or yoke.

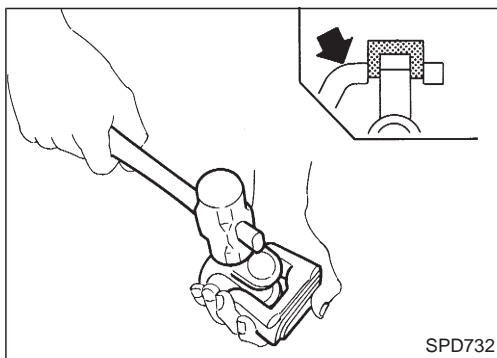


## PROPELLER SHAFT

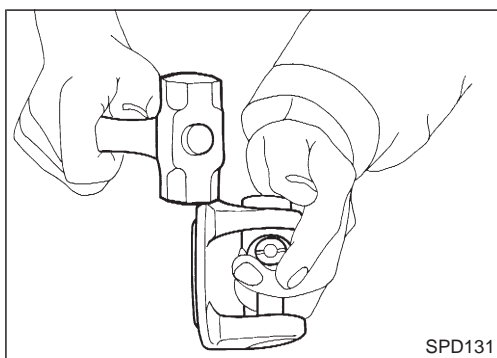
### Disassembly (Cont'd)



2. Remove snap ring.

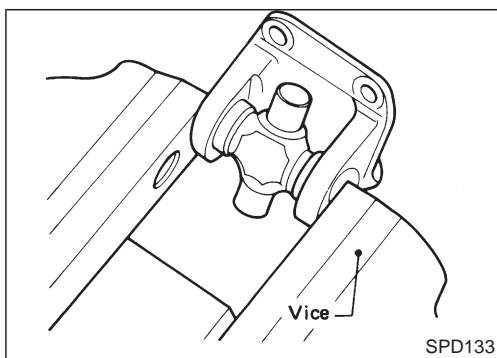


3. Remove pushed out journal bearing by lightly tapping yoke with a hammer, taking care not to damage journal and yoke hole.



4. Remove bearing at opposite side in above operation.

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

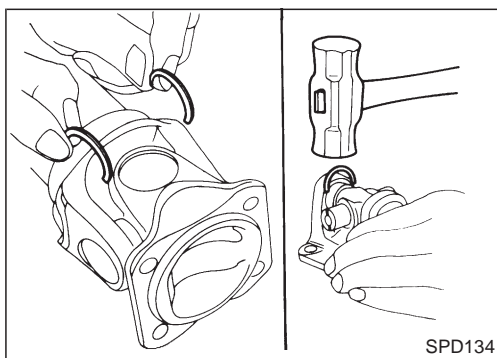


### Assembly

#### JOURNAL

1. Assemble journal bearing. Apply recommended multi-purpose grease on bearing inner surface.

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

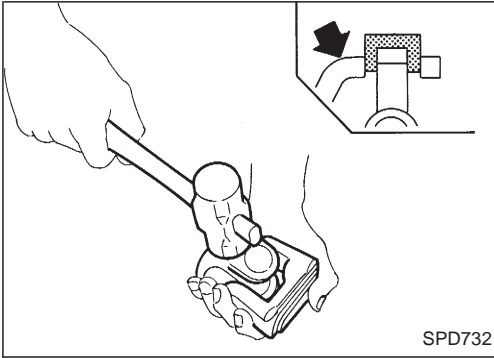


2. Select snap ring that will provide specified play in axial direction of journal, and install them. (Refer to SDS.)

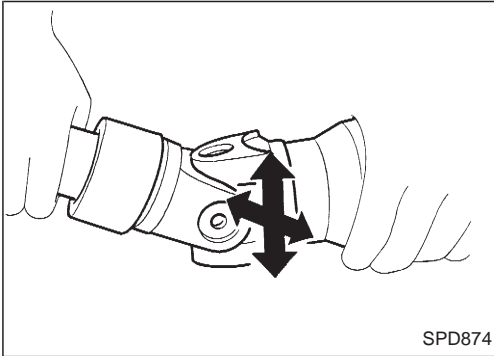
**Select snap rings with a difference in thickness at both sides within 0.06 mm (0.0024 in).**

## PROPELLER SHAFT

### Assembly (Cont'd)



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



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

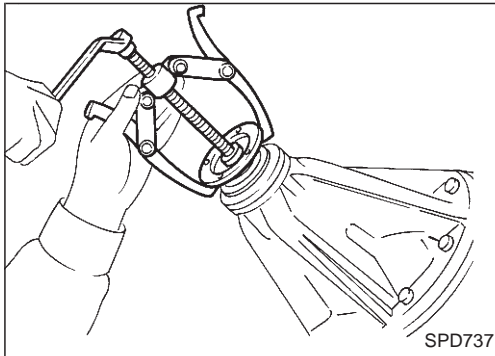
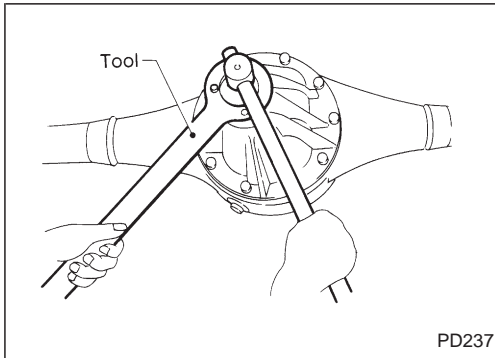
**Axial play: 0.02 mm (0.0008 in) or less**

## ON-VEHICLE SERVICE (Final Drive)

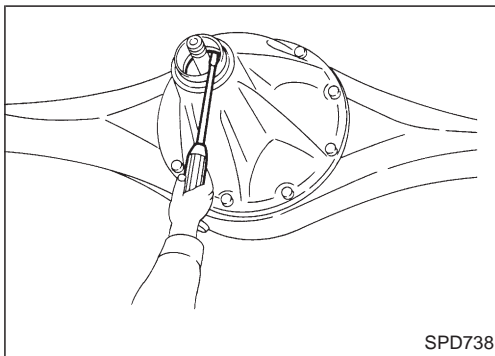
### Front Oil Seal Replacement

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

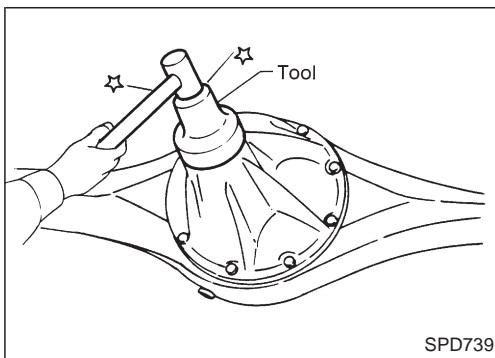
**Tool number:  
KV40104000**



3. Remove companion flange.



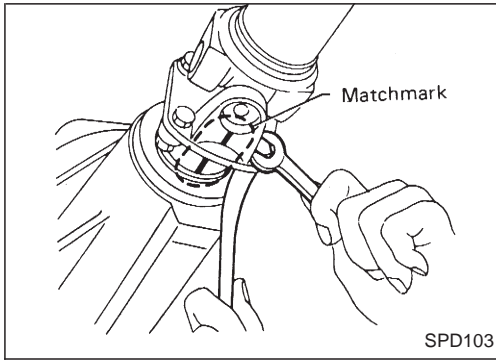
4. Remove front oil seal.



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

**Tool number: KV381025S0**

## REMOVAL AND INSTALLATION

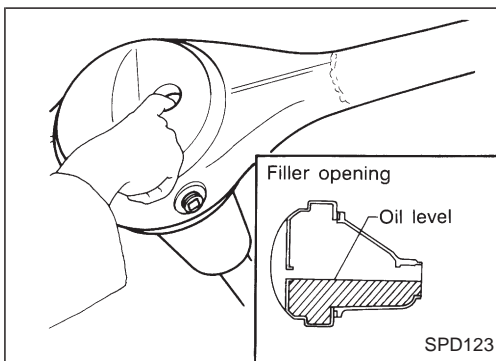


### Removal

- Remove propeller shaft.
- Remove drive shaft. Refer to FA section (“FRONT AXLE — Knuckle Flange”).
- Remove axle shaft. Refer to RA section (“REAR AXLE”).
- Remove front and rear final drive mounting bolts.

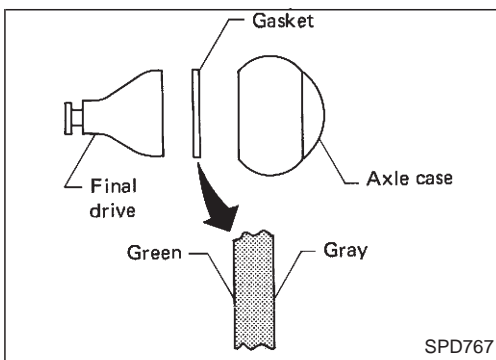
### CAUTION:

- Be careful not to damage spline, sleeve yoke and front oil seal when removing propeller shaft.
- Before removing the final drive assembly or rear axle assembly, disconnect the ABS sensor harness connector from the assembly and move it away from the final drive/rear axle assembly area. Failure to do so may result in the sensor wires being damaged and the sensor becoming inoperative.



### Installation

- Fill final drive with recommended gear oil.

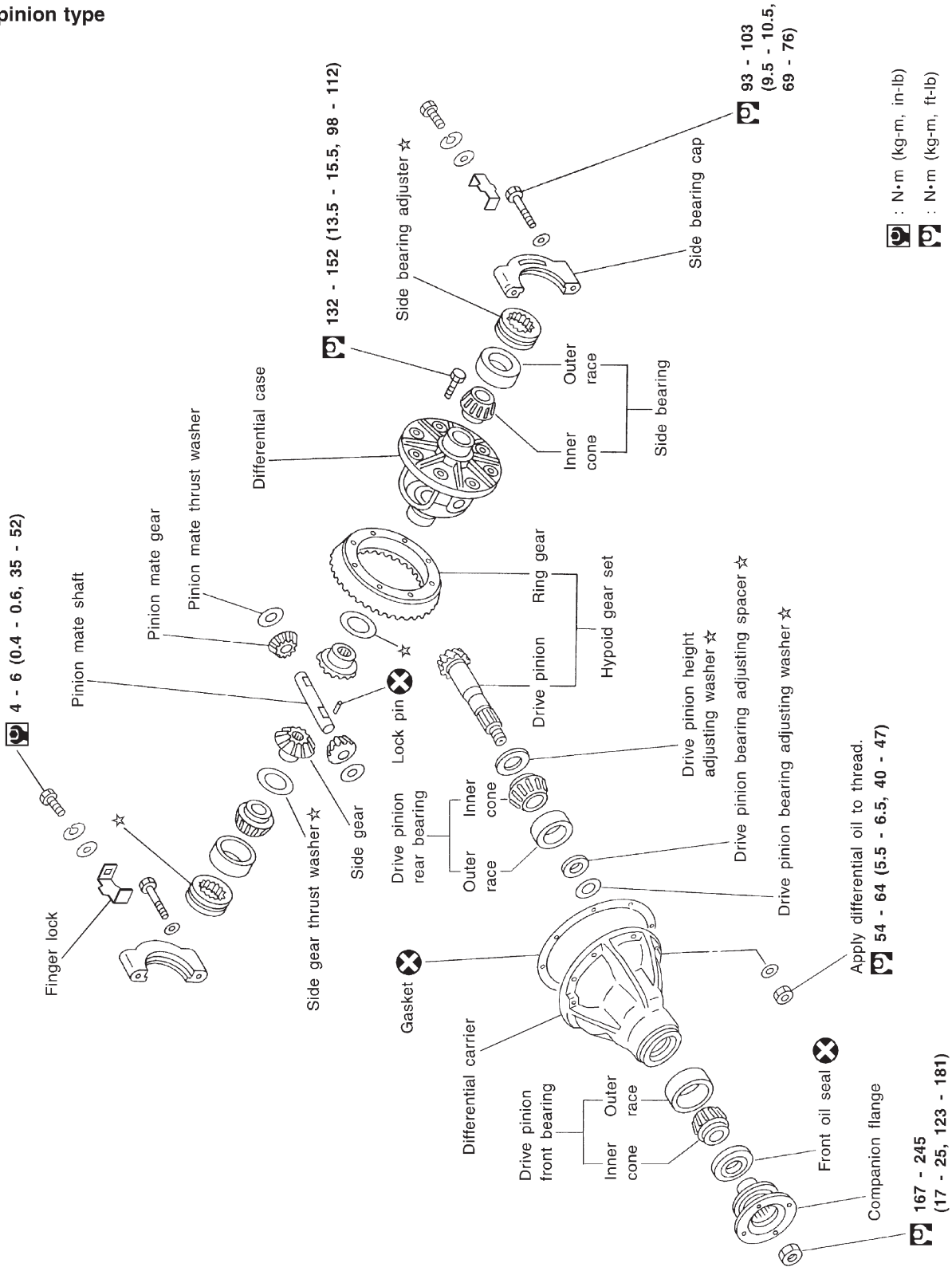


- Pay attention to the direction of gasket.

# FRONT FINAL DRIVE

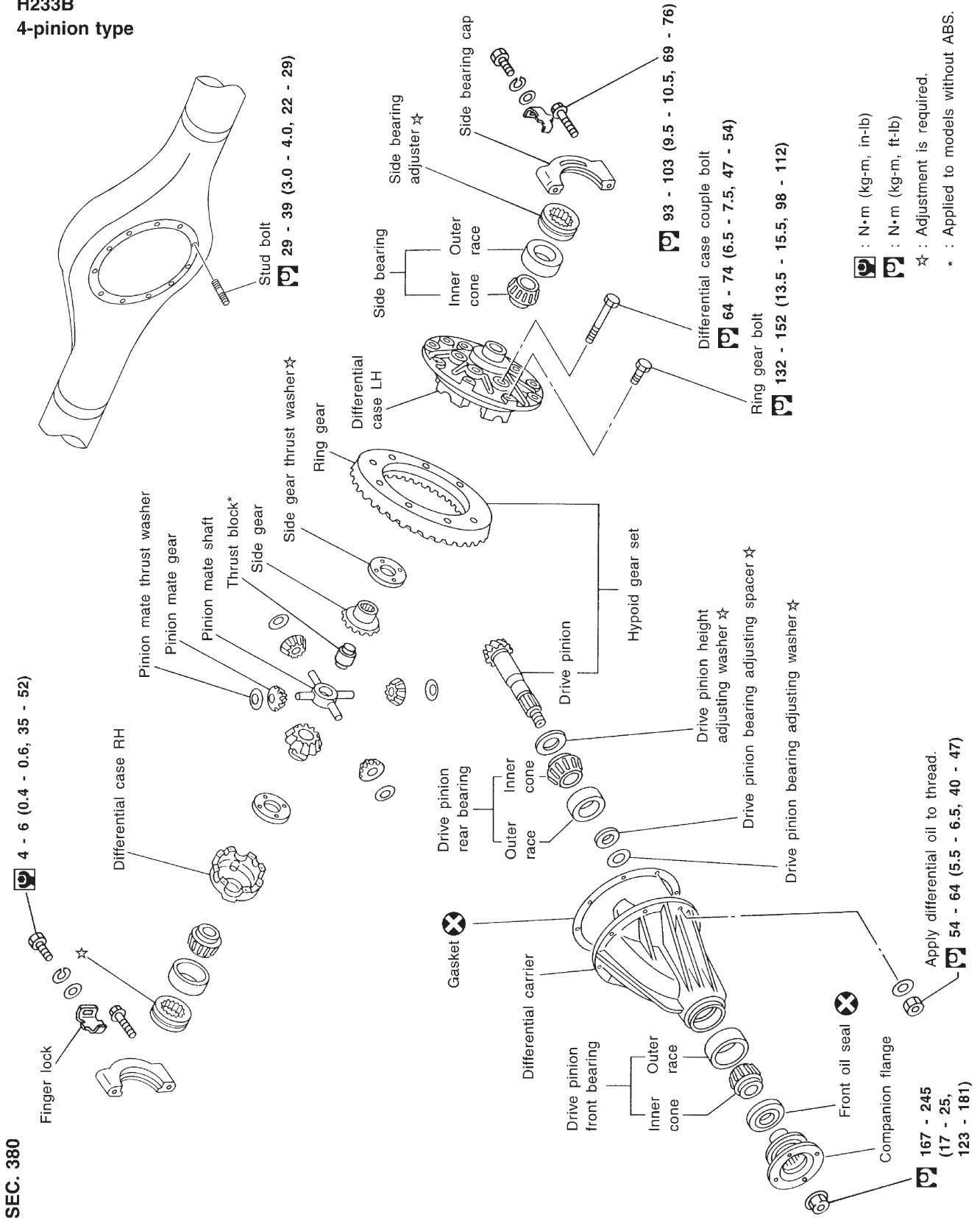
H233B  
2-pinion type

SEC. 380



# REAR FINAL DRIVE

H233B  
4-pinion type



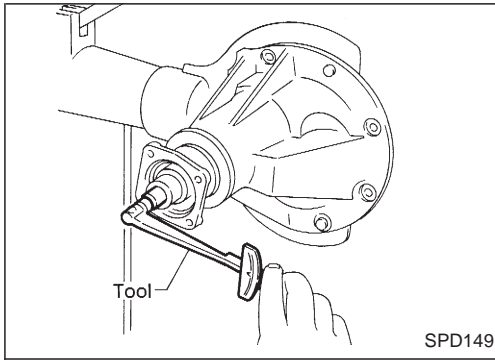
: N•m (kg-m, in-lb)

: N•m (kg-m, ft-lb)

\* : Adjustment is required.

\* : Applied to models without ABS.

## DISASSEMBLY



### 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 (with front oil seal):**

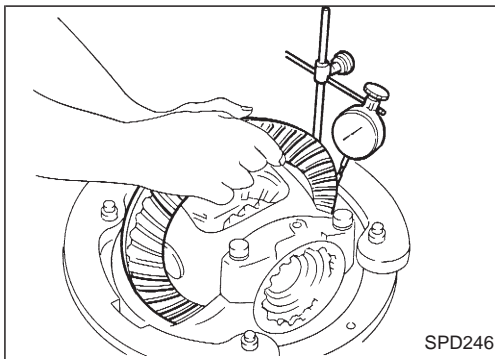
**Drive pinion bearing**

**New parts**

**1.7 - 2.5 N·m (17 - 25 kg-cm, 15 - 22 in-lb)**

**Used parts**

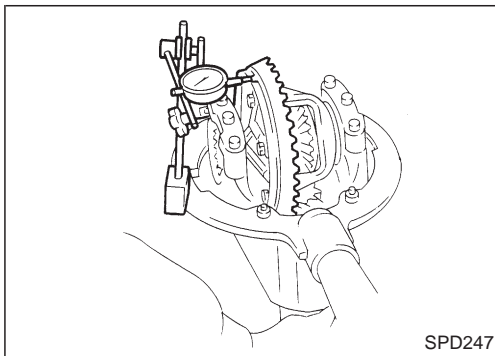
**1.5 - 1.7 N·m (15 - 17 kg-cm, 13 - 15 in-lb)**



- 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:**

**0.15 - 0.20 mm (0.0059 - 0.0079 in)**

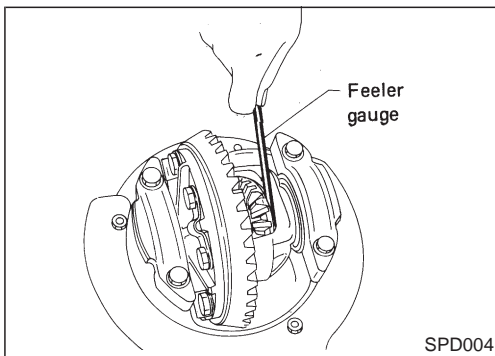


- Ring gear runout  
Check runout of ring gear with a dial indicator.

**Runout limit:**

**0.08 mm (0.0031 in)**

- Tooth contact  
Check tooth contact. Refer to ADJUSTMENT (PD-27).



- Side gear to pinion mate gear backlash  
Measure clearance between side gear thrust washer and differential case with a feeler gauge.

**Clearance between side gear thrust washer and differential case:**

**0.15 - 0.20 mm (0.0059 - 0.0079 in)**

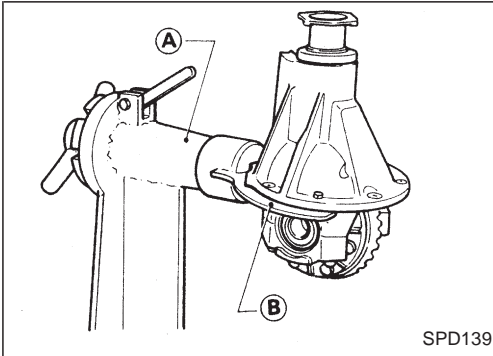
## DISASSEMBLY

### Differential Carrier

1. Mount differential carrier on Tools.

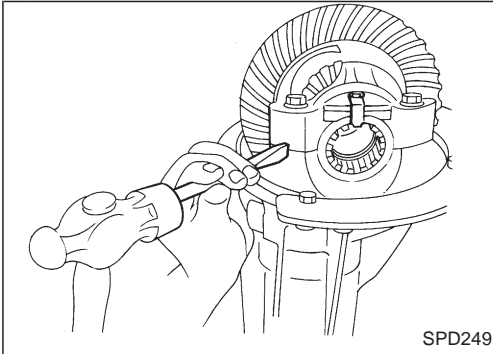
**Tool number:**

- Ⓐ ST0501S000
- Ⓑ ST06340000

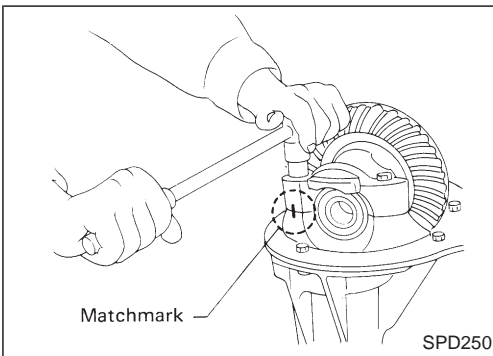


2. Put matchmarks on one side of side bearing cap with paint or punch to ensure that it is replaced in proper position during reassembly.

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



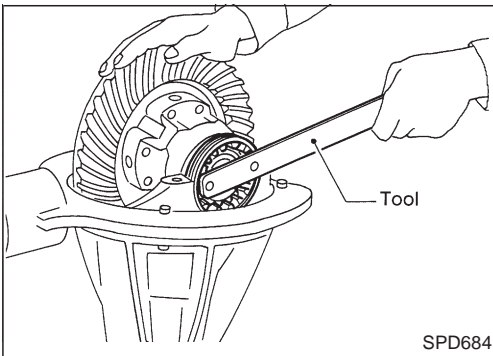
3. Remove side lock fingers and side bearing caps.



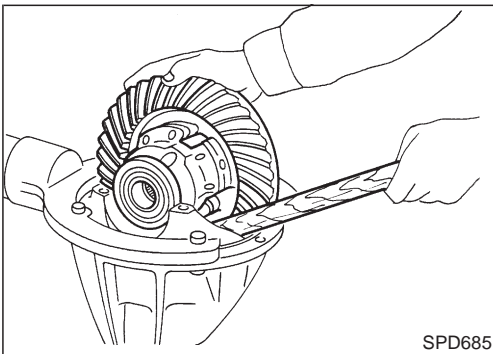
4. Remove side bearing adjuster with Tool.

**Tool number:**

**ST32580000**



5. Remove differential case assembly with a pry bar.

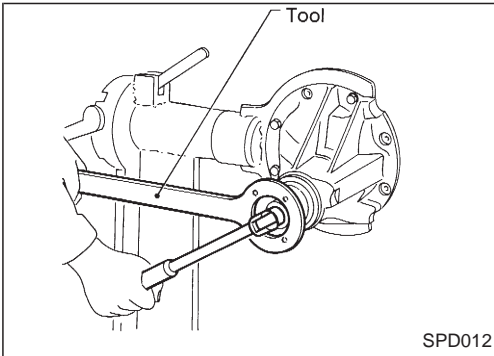
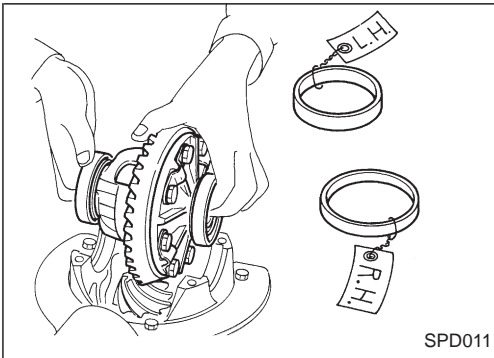




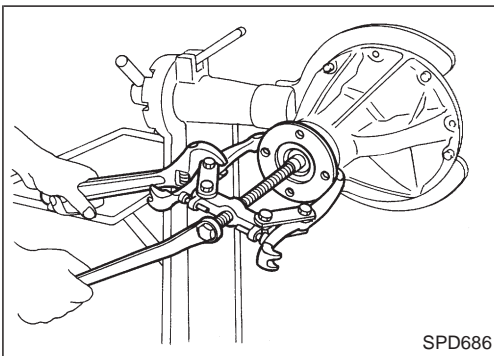
## DISASSEMBLY

### Differential Carrier (Cont'd)

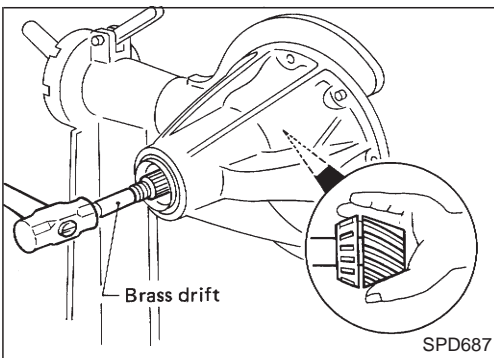
Be careful to keep the side bearing outer races together with their respective inner cones — do not mix them up.



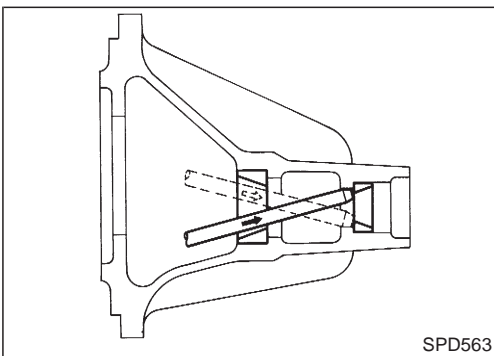
6. Loosen drive pinion nut with Tool.  
**Tool number: KV38104700**



7. Remove companion flange with puller.



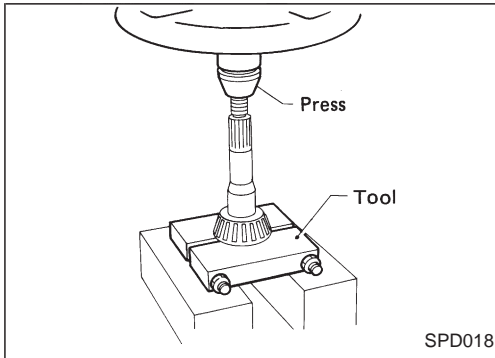
8. Take out drive pinion together with pinion rear bearing inner cone, drive pinion bearing spacer and pinion bearing adjusting shim with soft hammer.



9. Remove front oil seal and pinion front bearing inner cone.
10. Remove pinion bearing outer races with a brass drift.

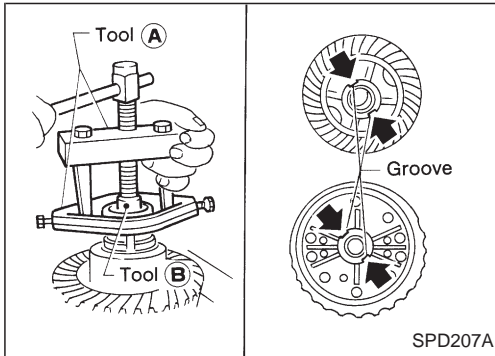
## DISASSEMBLY

### Differential Carrier (Cont'd)



11. Remove pinion rear bearing inner cone and drive pinion height adjusting washer with press and Tool.

**Tool number: ST30031000**



### Differential Case

1. Remove side bearing inner cones.

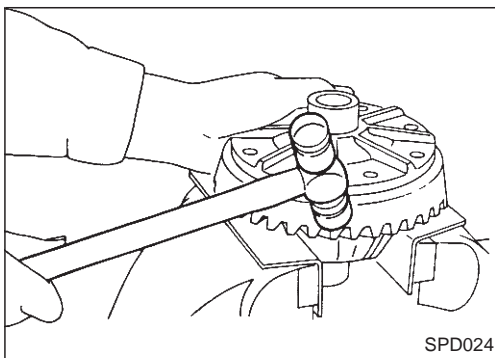
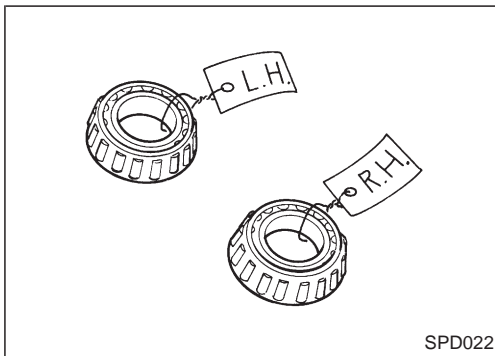
**To prevent damage to bearing, engage puller jaws in groove.**

**Tool number:**

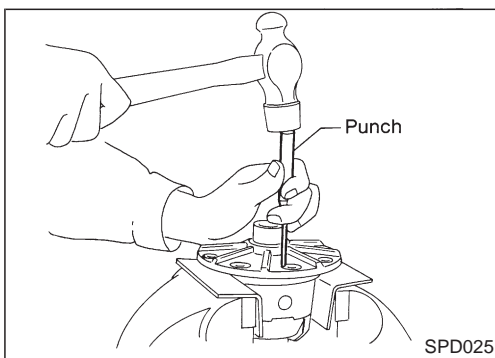
**A ST33051001**

**B ST02371000**

**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 pattern.
3. Tap ring gear off differential case with a soft hammer.  
**Tap evenly all around to keep ring gear from binding.**



4. Drive out pinion mate shaft lock pin, with punch from ring gear side (2-pinon type differential case).

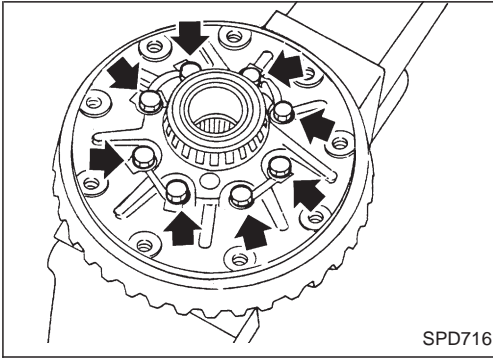
**Lock pin is calked at pin hole mouth on differential case.**

## DISASSEMBLY

### Differential Case (Cont'd)

5. Separate differential case LH and RH (4-pinion type differential case).

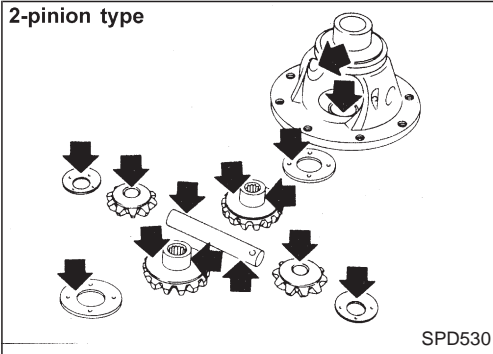
**Put matchmarks on both differential case LH and RH sides prior to separating them.**



# INSPECTION

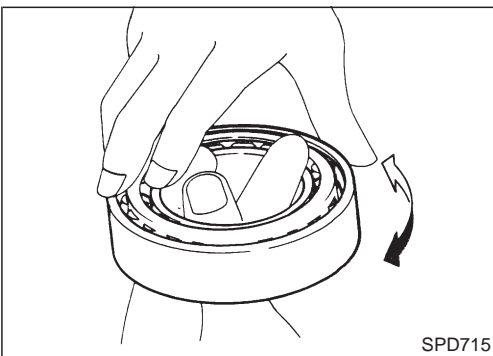
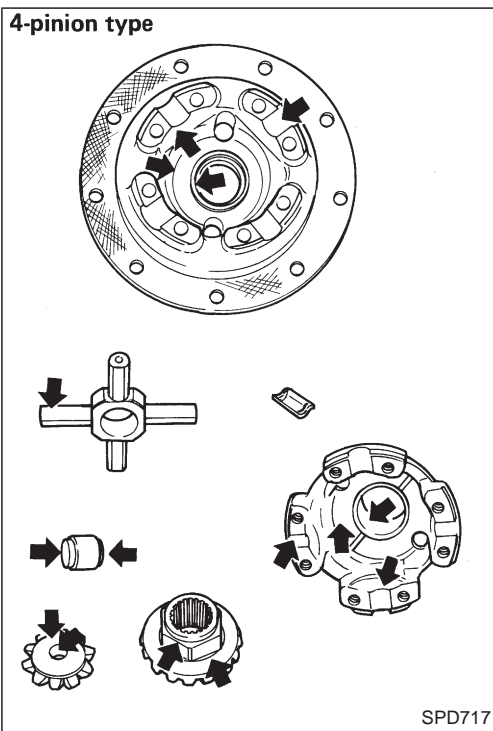
## Ring Gear and Drive Pinion

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



## Differential Case Assembly

Check mating surfaces of differential case, side gears, pinion mate gears, pinion mate shaft, thrust block and thrust washers.



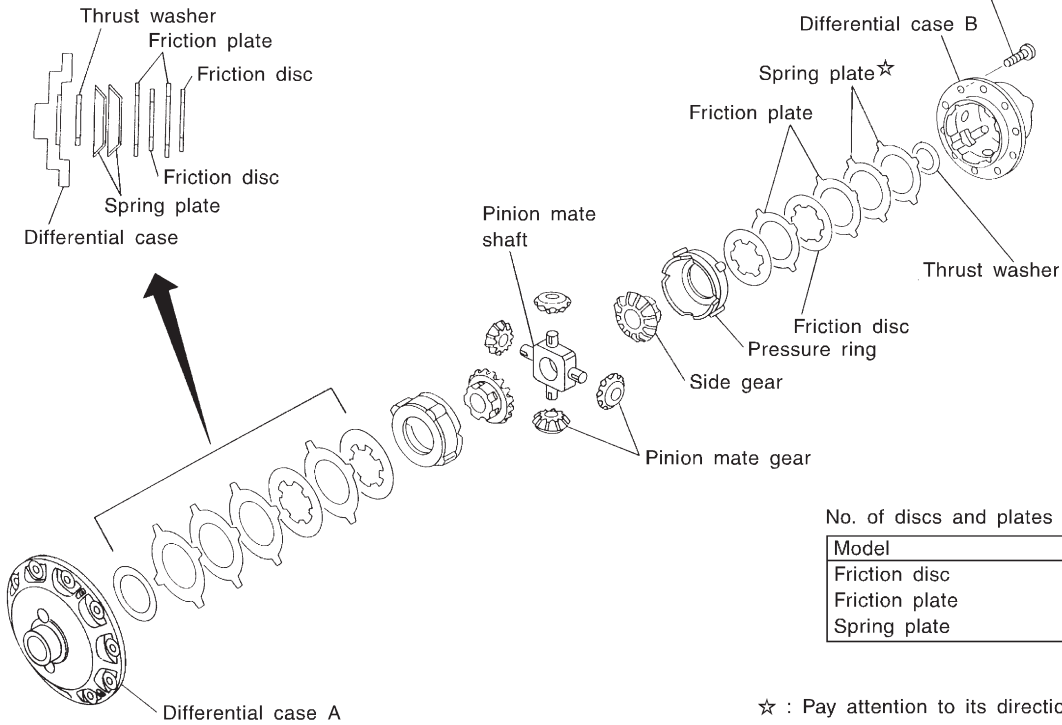
## Bearing

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.

# LIMITED SLIP DIFFERENTIAL

## H233B SEC. 380

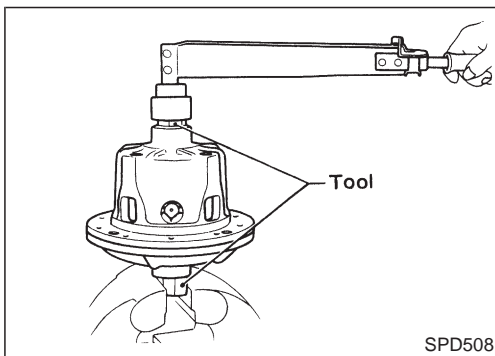
Pay attention to direction of parts and assembly procedures.



SPD439A

### CAUTION:

Do not run engine when one wheel (rear) is off the ground.



## Preparation for Disassembly

### CHECKING DIFFERENTIAL TORQUE

Measure differential torque with Tool.

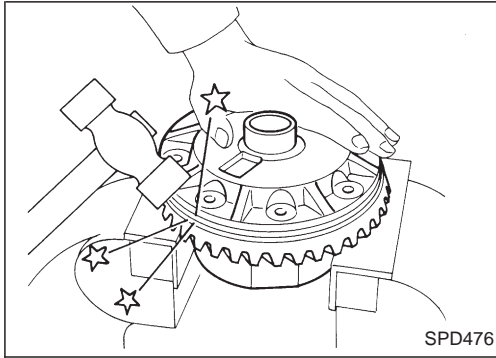
If it is not within the specifications, inspect components of limited slip differential.

Differential torque:

108 - 137 N•m (11 - 14 kg-m, 80 - 101 ft-lb)

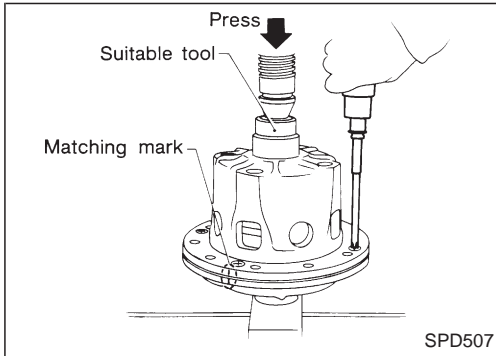
Tool number: KV38106400

# LIMITED SLIP DIFFERENTIAL



## Disassembly

1. Remove side bearing inner cone with Tool.
2. Loosen ring gear bolts in a criss-cross pattern.
3. Tap ring gear off gear case with a soft hammer.  
**Tap evenly all around to keep ring gear from binding.**



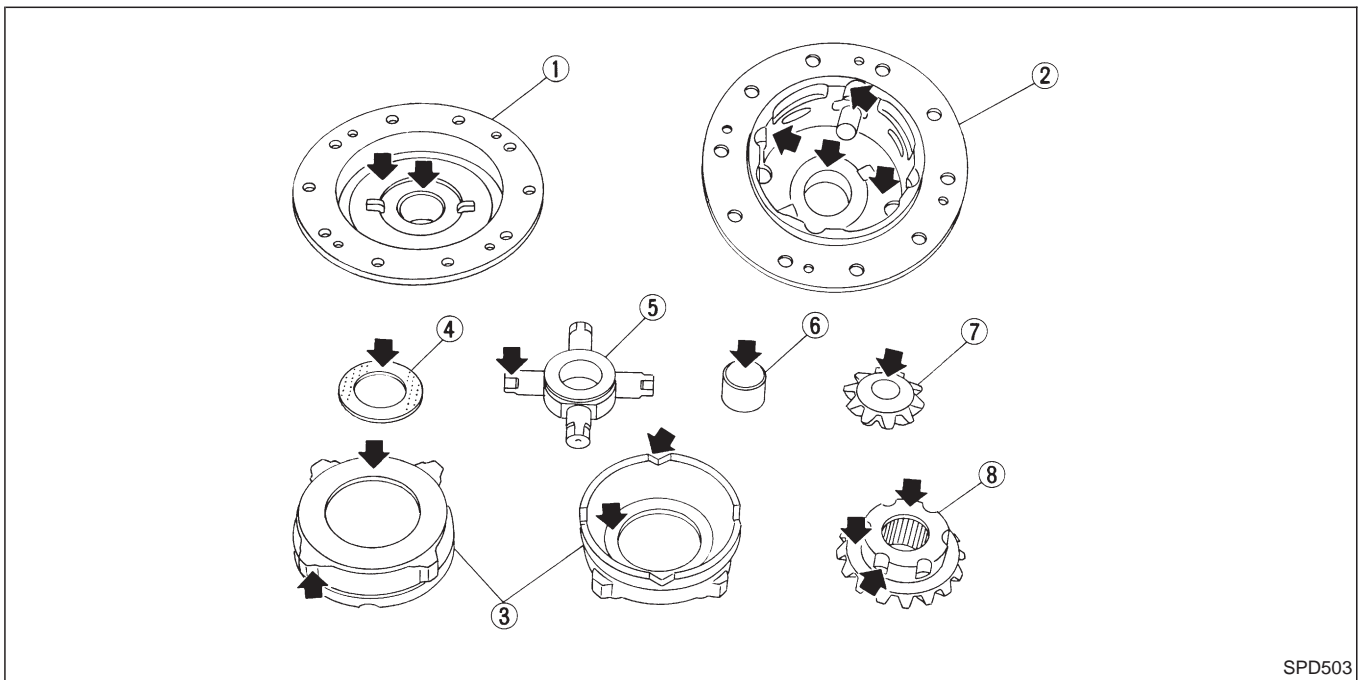
4. Loosen screws on differential cases A and B using a press.
5. Separate differential cases A and B. Draw out component parts (discs and plates, etc.).

**Put marks on gears, discs and plates so that they can be reinstalled in their original positions from which they were removed.**

## Inspection

### CONTACT SURFACES

1. Clean the disassembled parts in suitable solvent and blow dry with compressed air.
2. If following surfaces are found with burrs or scratches, smooth with oil stone.



- ① Differential case A
- ② Differential case B
- ③ Pressure ring

- ④ Thrust washer
- ⑤ Pinion mate shaft
- ⑥ Thrust block

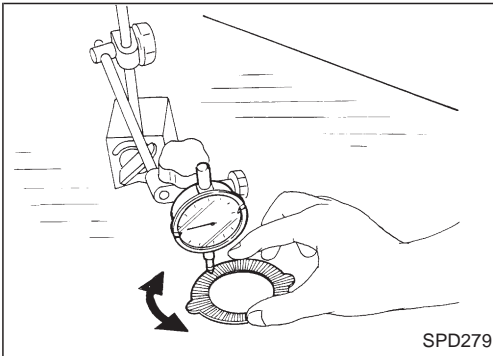
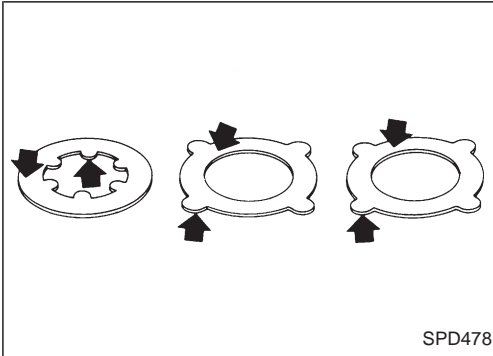
- ⑦ Pinion mate gear
- ⑧ Side gear

## LIMITED SLIP DIFFERENTIAL

### Inspection (Cont'd)

#### DISC AND PLATE

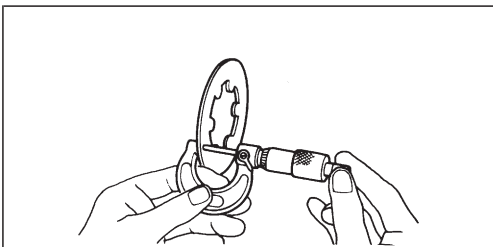
1. Clean the discs and plates in suitable solvent and blow dry with compressed air.
2. Inspect discs and plates for wear, nicks and burrs.



3. To test if friction disc or plate is not distorted, place it on a surface plate and rotate it by hand with indicating finger of dial gauge resting against disc or plate surface.

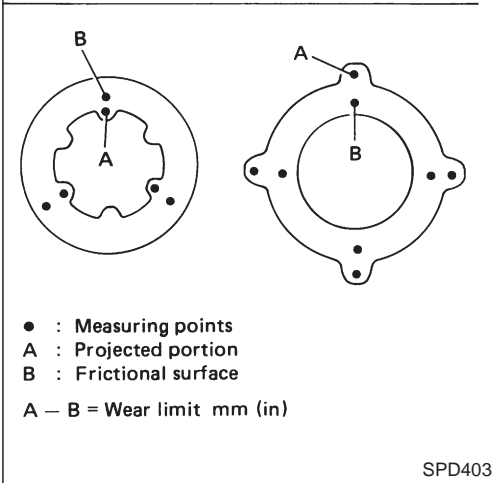
**Allowable warpage:**  
**0.08 mm (0.0031 in)**

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

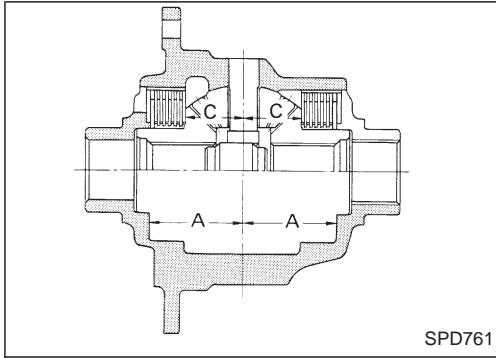


4. Measure frictional surfaces and projected portions of friction disc, friction plate, spring plate, and determine each part's differences to see if the specified wear limit has been exceeded. If any part has worn beyond the wear limit, and deformed or fatigued, replace it with a new one that is the same thickness as the projected portion.

**Wear limit:**  
**0.1 mm (0.004 in) or less**



# LIMITED SLIP DIFFERENTIAL



## Adjustment

### FRICITION DISC AND FRICTION PLATE END PLAY

End play of friction disc and friction plate can be calculated by using following equation and should be adjusted within following range. Adjustment can be made by selecting friction disc having two different thicknesses.

End play E:

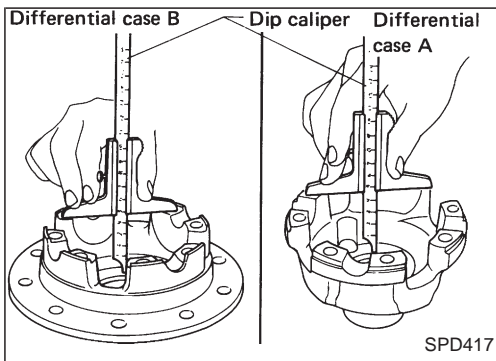
**0.05 - 0.15 mm (0.0020 - 0.0059 in)**

**$E = A - (B + C)$**

A: Length of differential case contact surface to differential case inner bottom.

B: Total thickness of friction discs, friction plates, spring disc and spring plate in differential case on one side.

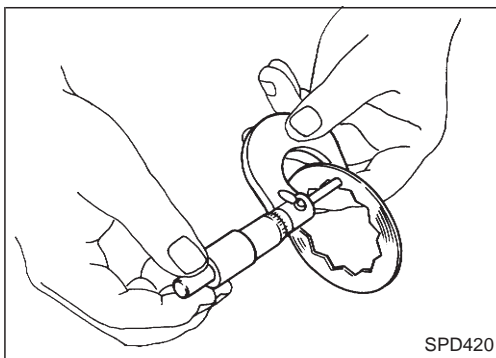
C: Length of differential case contact surface to back side of side gear.



1. Measure values of "A".

**Standard length A:**

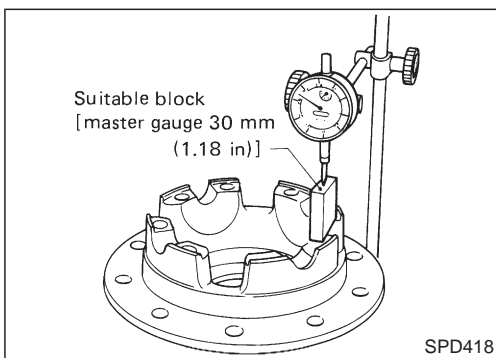
**49.50 - 49.55 mm (1.9488 - 1.9508 in)**



2. Measure thickness of each disc and plate.

**Total thickness "B":**

**19.24 - 20.26 mm (0.7575 - 0.7976 in)**



3. Measure values of "C".

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

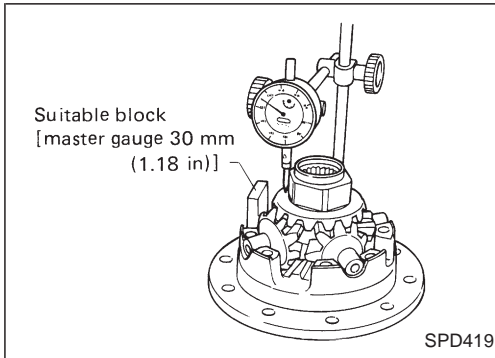
(2) Place differential case B on the base plate, and install a master gauge on case B.

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



## LIMITED SLIP DIFFERENTIAL

### Adjustment (Cont'd)



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

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

$$E = A - D = A - (B + C) = 0.05 \text{ to } 0.15 \text{ mm}$$

$$A = 49.52 \text{ mm}$$

$$B = 19.45 \text{ mm}$$

$$C = 29.7 \text{ mm}$$

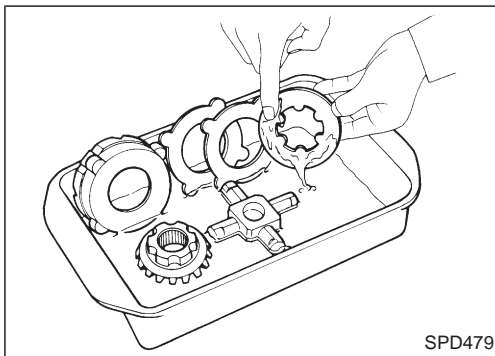
$$D = B + C$$

$$E = A - D$$

B .... 19.45	A ..... 49.52
+C .... 29.7	-D .... 49.15
49.15	0.37

From the above equation, end play of 0.37 mm exceeds the specified range of 0.05 to 0.15 mm.

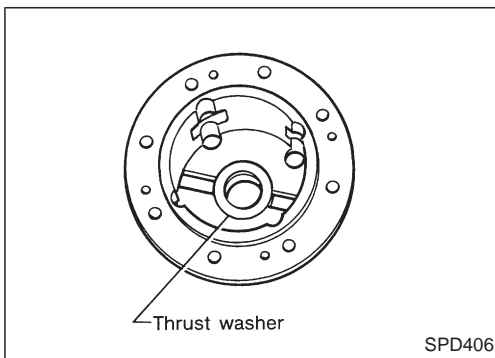
Select suitable discs and plates to adjust correctly.



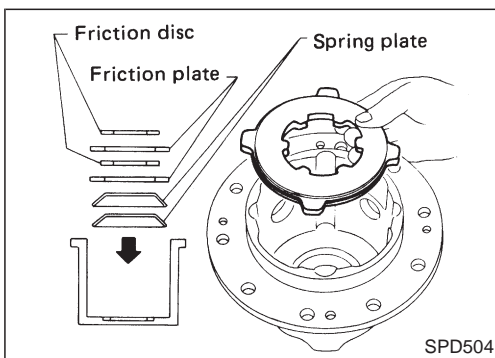
### Assembly

Assemble differential case in the reverse order of disassembly, observing the following.

1. As an aid to installation, apply sufficient amounts of recommended limited slip differential gear oil (refer to MA section) to the faces of pressure rings, discs and plates to be assembled together.



2. Place differential case B on a level surface, then install thrust washer.

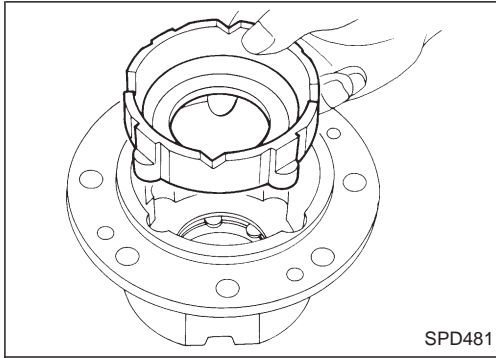


3. Install spring plates, friction plates and friction discs.

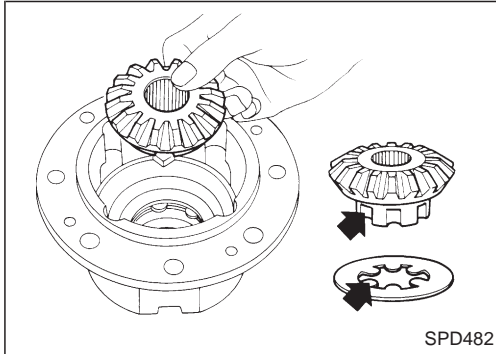
**Pay particular attention to the direction of clutch plates and their assembly sequence.**

# LIMITED SLIP DIFFERENTIAL

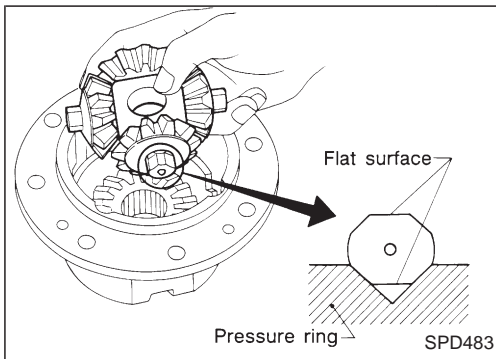
## Assembly (Cont'd)



4. Install pressure ring.

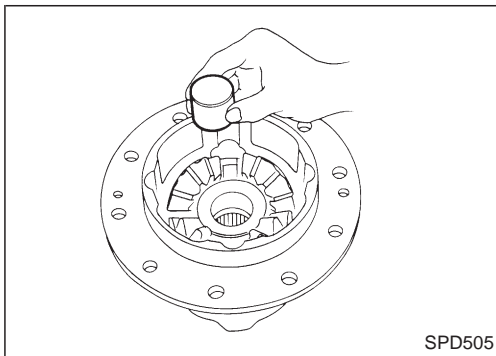


5. Install side gear by inserting projected portion of disc.

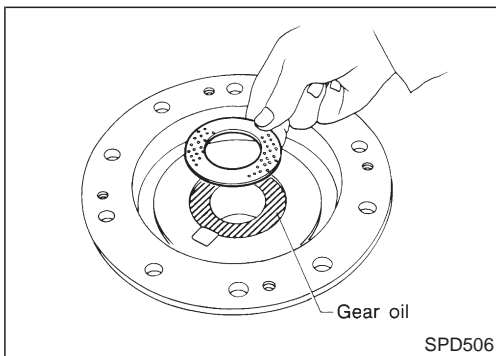


6. Install pinion mate gears and shaft.

**Always attach pinion mate shaft to "V" groove in pressure ring with flat surfaces facing up and down.**



7. Install thrust block.

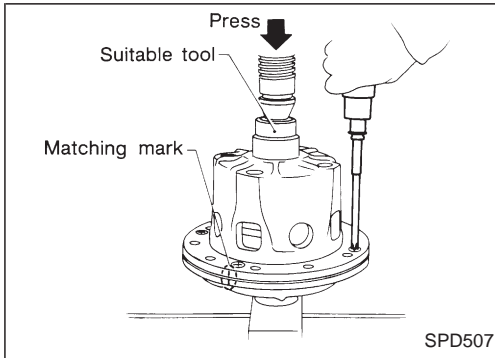


8. Install differential case A side components in the opposite way of differential case B components.

9. Apply gear oil to differential case A, and attach thrust washer to it.

## LIMITED SLIP DIFFERENTIAL

### Assembly (Cont'd)

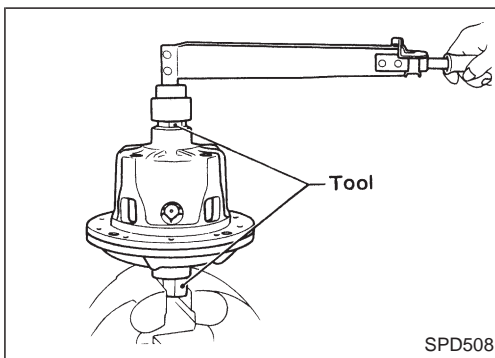


10. Install differential case A on differential case B. Align the matching marks on the cases, then install screws while pushing differential case down using a press.

**Press force:**

**7,846 N (800 kg, 1,764 lb)**

11. After all parts have been assembled, check and adjust the following:



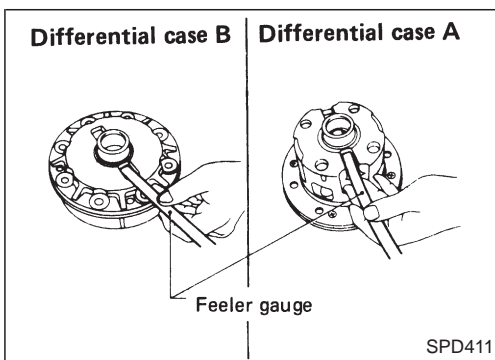
### DIFFERENTIAL TORQUE INSPECTION

- a. Place side gear in a vise with Tool into the gear splines.
- b. Turn side gear several times, then measure the differential torque after side gear begins to rotate in order to determine whether it is within the specified range. If it is not, adjust it by selecting a friction disc. (Refer to SDS for adjustment parts.)

**Differential torque:**

**108 - 137 N·m (11 - 14 kg-m, 80 - 101 ft-lb)**

**Tool number: KV38106400**



### SIDE GEAR BACKLASH INSPECTION

Check backlash of side gear on both sides. Using a feeler gauge, measure clearance between side gear and thrust washer. If it is not within specifications, adjust it by selecting a thrust washer. (Refer to SDS.)

**Side gear backlash:**

**Differential case A side**

**0.05 - 0.20 mm (0.0020 - 0.0079 in)**

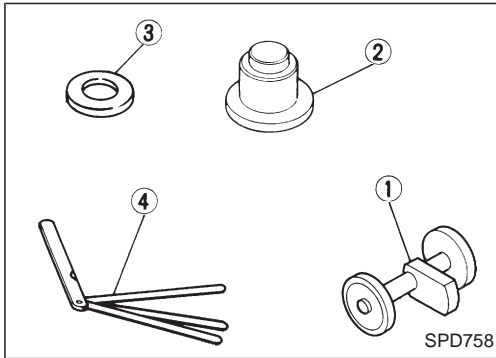
**Differential case B side**

**0.05 - 0.20 mm (0.0020 - 0.0079 in)**

12. After checking and adjusting, tighten ring gear bolts in a criss-cross fashion.
13. Bend up lock straps to lock bolts in place.
14. Install side bearing inner race with Tool.

# ADJUSTMENT

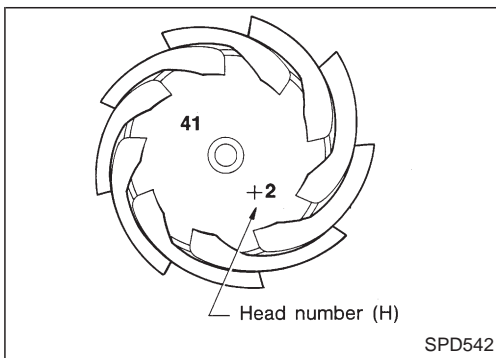
To avoid confusion while calculating bearing shims, it is absolutely necessary to stay with the metric system. If you measure anything in inches, **the results must be converted to the metric system.**



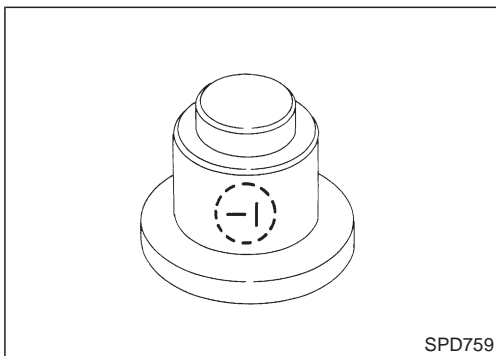
## Drive Pinion Height

- First prepare Tools for pinion height adjustment.
  - : ① Height gauge (ST31251000)
  - ② Dummy shaft (ST31181001)
  - ③ Spacer [thickness: 2.50 mm (0.0984 in)]
  - ④ Feeler gauge
- To simplify the job, make a chart, like the one below, to organize your calculations.

LETTERS	HUNDREDTHS OF A MILLIMETER
H: Head number	
D': Figure marked on dummy shaft	
S: Figure marked on height gauge	
N: Measuring clearance	



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

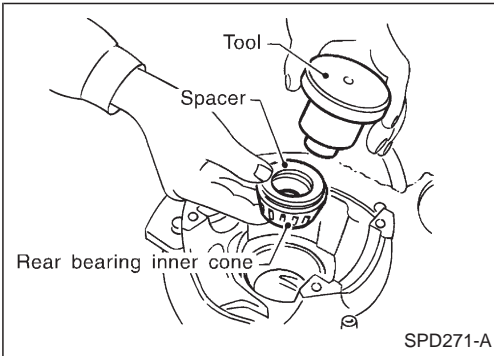
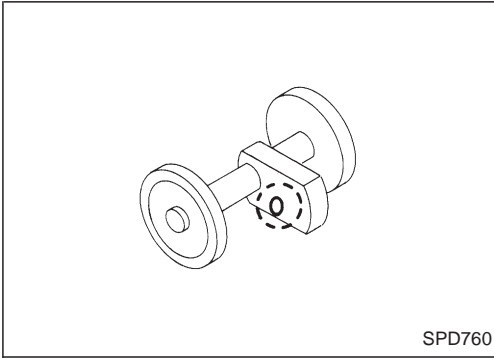


D': Figure marked on dummy shaft.

## ADJUSTMENT

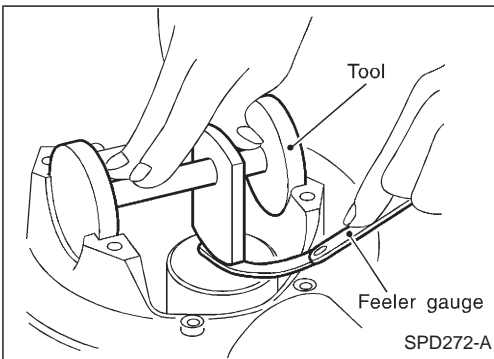
### Drive Pinion Height (Cont'd)

S: Figure marked on height gauge.



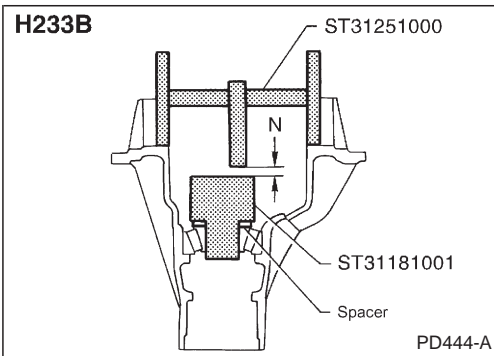
4. Place pinion rear bearing inner cone and Tools on gear carrier.

**Tool number:  
ST31181001**



5. Attach Tool (Height gauge) to gear carrier, and measure the clearance between the height gauge tip and the dummy shaft face.

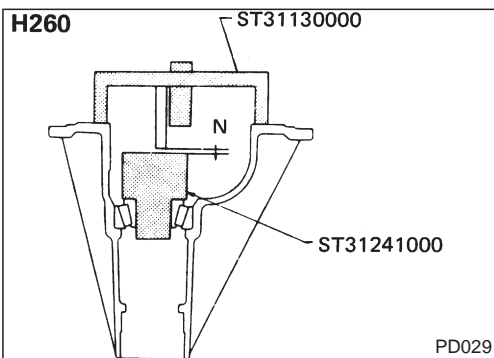
**Tool number:  
ST31251000**



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

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

$$T \text{ (Thickness of washer)} = N - [(H - D' - S) \times 0.01] + 3.05$$



## ADJUSTMENT

### Drive Pinion Height (Cont'd)

Example (H233B):

$$N = 0.30$$

$$H = 2$$

$$D' = -1$$

$$S = 0$$

$$T = N - [(H - D' - S) \times 0.01] + 3.05$$

$$= 0.30 - [(2 - (-1) - 0) \times 0.01] + 3.05$$

(1)	H .....	2	
	-D' .....	-(-1)	
		3	
	-S .....	-0	
		3	
(2)		3	
		x 0.01	
		0.03	
(3)	N .....	0.30	
		-0.03	
		0.27	
(4)		0.27	
		+3.05	
		3.32	

$$\therefore T = 3.32$$

7. Select the proper pinion height washer.

**Drive pinion height adjusting washer:  
Refer to SDS (PD-0, 53).**

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

Example (H233B):

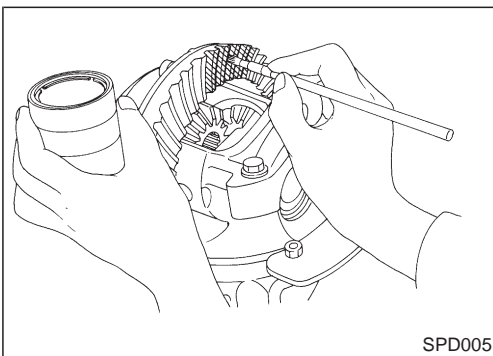
Calculated value ... T = 3.32 mm

Used washer ... T = 3.33 mm

### Tooth Contact

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

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

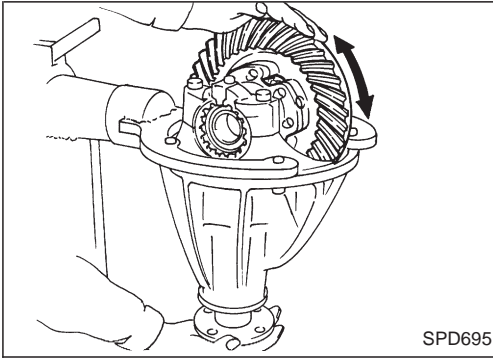


SPD005

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.

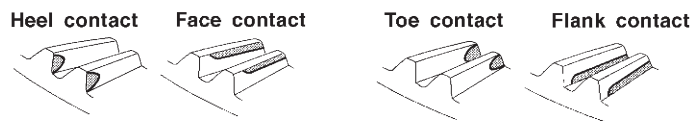
## ADJUSTMENT

### Tooth Contact (Cont'd)



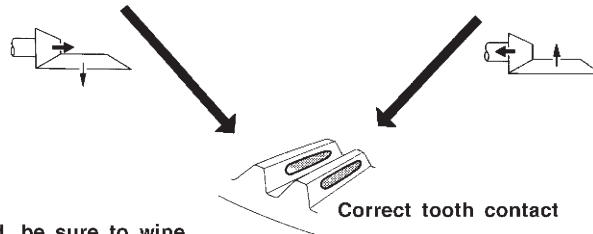
3. Hold companion flange steady by hand and rotate the ring gear in both directions.

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.



To correct, increase thickness of pinion height adjusting washer in order to bring drive pinion close to ring gear.

To correct, reduce thickness of pinion height adjusting washer in order to make drive pinion go away from ring gear.



When adjustment is completed, be sure to wipe off completely the ferric oxide and oil or their equivalent.

SPD007-B

## ASSEMBLY

### Differential Case — 4-pinion type —

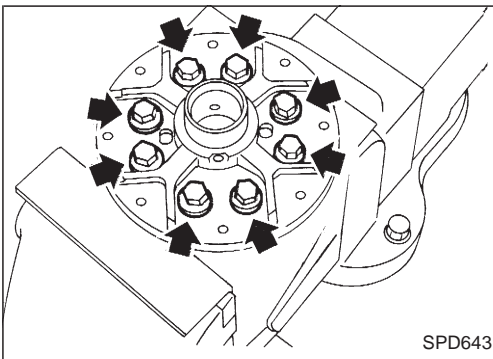
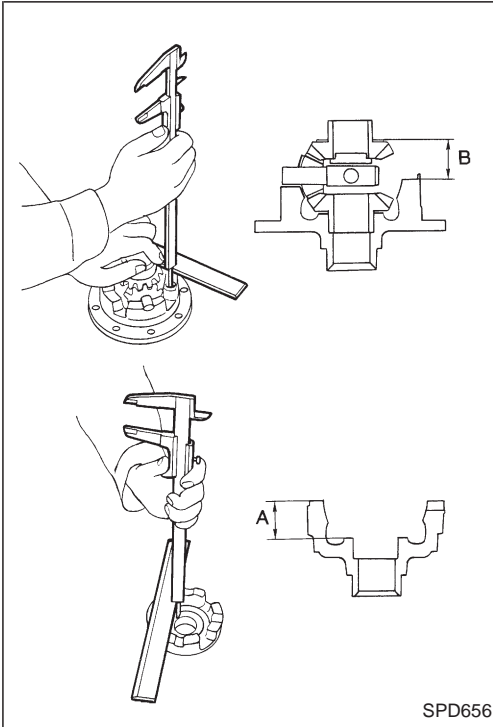
1. Measure clearance between side gear thrust washer and differential case.

**Clearance between side gear thrust washer and differential case (A — B):**

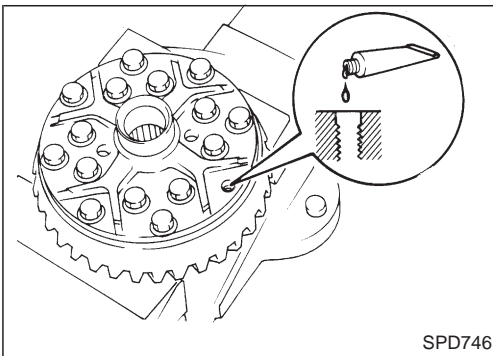
**0.15 - 0.20 mm (0.0059 - 0.0079 in)**

The clearance can be adjusted with side gear thrust washer. Refer to SDS.

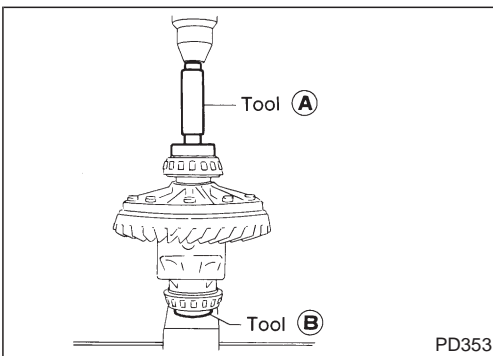
2. Apply oil to gear tooth surfaces and thrust surfaces and check that they turn properly.



3. Install differential case LH and RH.



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



6. Press-fit side bearing inner races on differential case with Tool.

**Tool number:**

(A) **ST33190000**

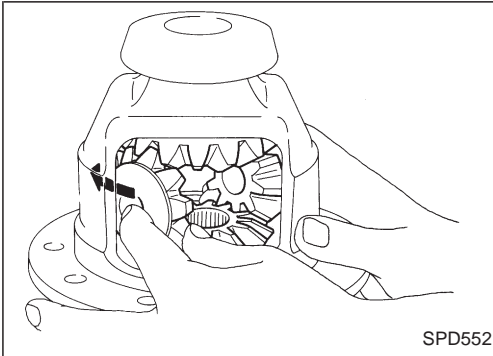
(B) **ST02371000**



## ASSEMBLY

### Differential Case — 2-pinion type —

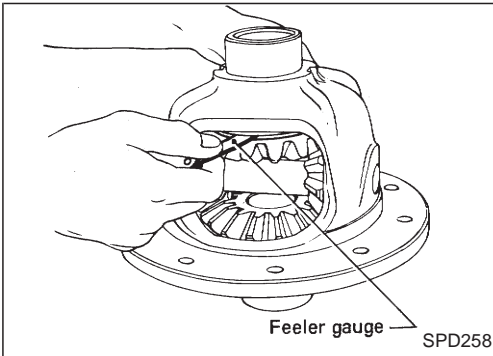
1. Install side gears, pinion mate gears and thrust washers into differential case.



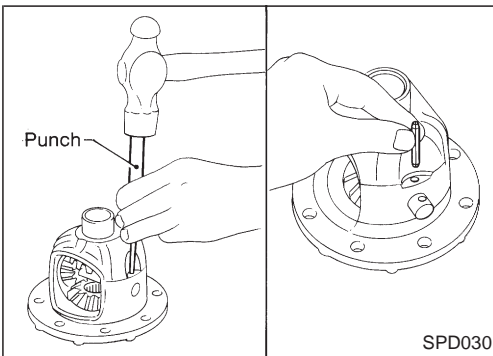
2. Fit pinion mate shaft to differential case so that it meets lock pin holes.
3. Adjust backlash between side gear and pinion mate gear by selecting side gear thrust washer. Refer to SDS.

**Backlash between side gear and pinion mate gear  
(Clearance between side gear thrust washer and dif-  
ferential case):**

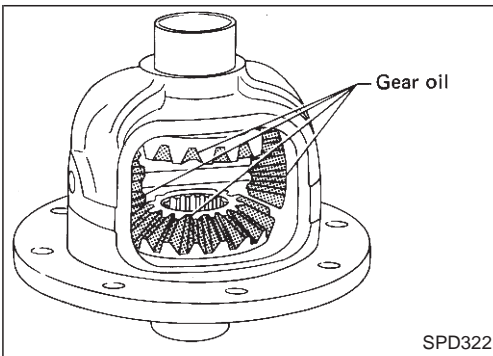
**0.15 - 0.20 mm (0.0059 - 0.0079 in)**



4. Install pinion mate shaft lock pin with a punch.  
**Make sure lock pin is flush with case.**



5. Apply gear oil to gear tooth surfaces and thrust surfaces and make sure they turn properly.
6. Install differential case assembly on ring gear.  
**Tighten bolts in a criss-cross pattern, lightly tapping bolt head with a hammer.**

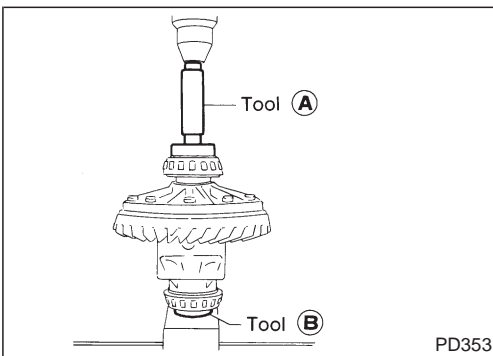


7. Press-fit side bearing inner cones on differential case with Tool.

**Tool number:**

**(A) ST33190000**

**(B) ST02371000**



# ASSEMBLY

## Differential Carrier

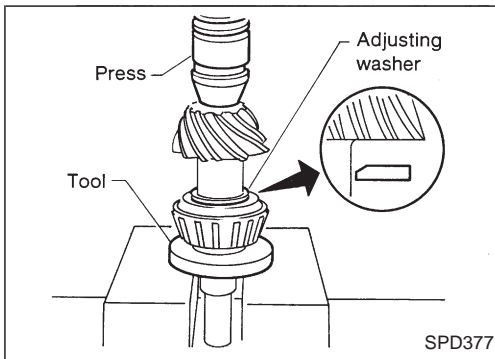
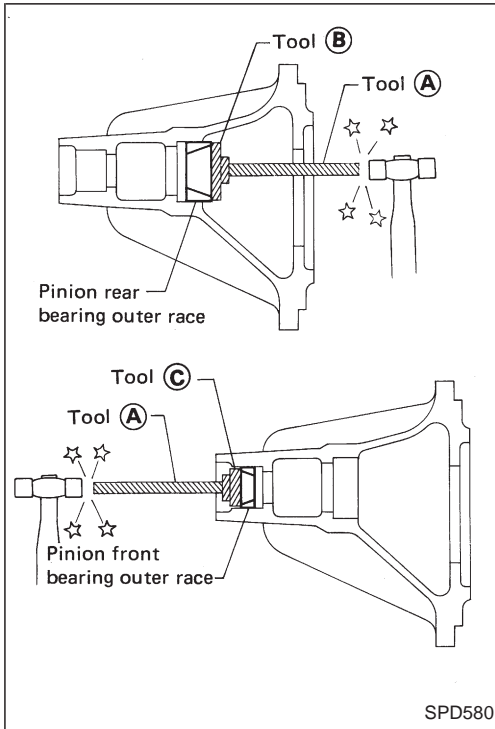
1. Press-fit front and rear bearing outer races with Tools.

**Tool number:**

- Ⓐ ST30611000
- Ⓑ ST30621000 (front differential)  
or suitable pipe
- Ⓒ ST30701000

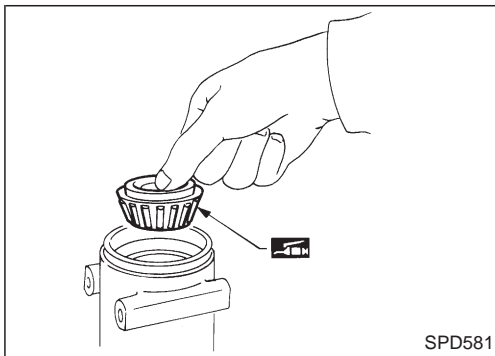
**CAUTION:**

**Do not damage roller side face.**

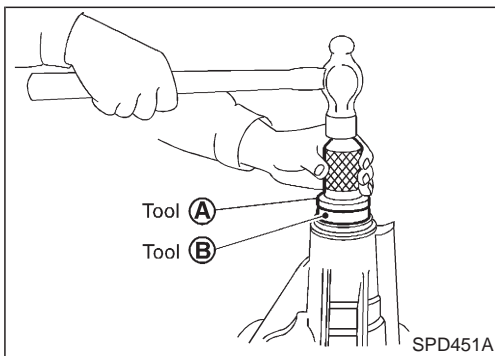


2. Select drive pinion height adjusting washer. Refer to ADJUSTMENT (PD-27).
3. Install drive pinion height adjusting washer in drive pinion, and press-fit pinion rear bearing inner cone in it, with press and Tool.

**Tool number: ST30911000**



4. Place pinion front bearing inner cone in gear carrier.



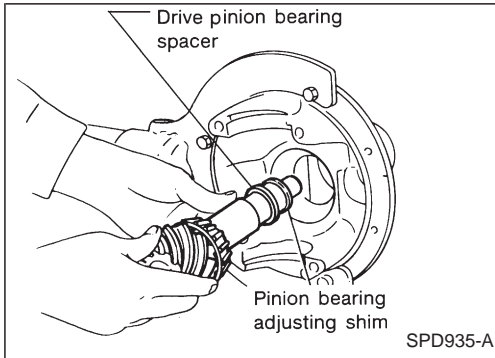
5. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install front oil seal.

**Tool number:**

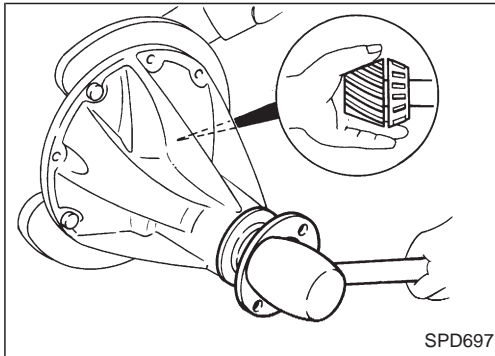
- Ⓐ ST30720000
- Ⓑ KV38102510

## ASSEMBLY

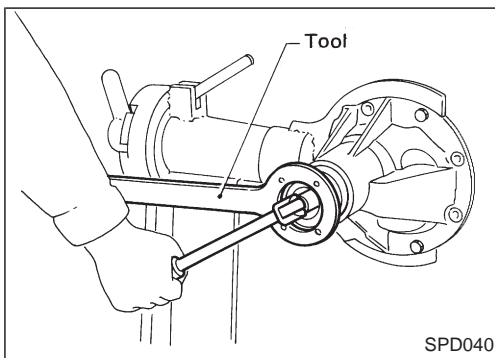
### Differential Carrier (Cont'd)



6. Install drive pinion bearing spacer, pinion bearing adjusting shim and drive pinion in gear carrier.

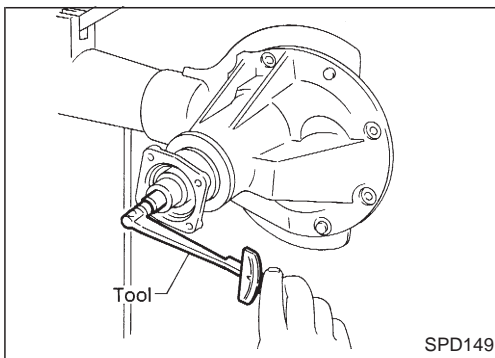


7. Insert companion flange into drive pinion by tapping the companion flange with a soft hammer.



8. Tighten pinion nut to the specified torque.  
**The threaded portion of drive pinion and pinion nut should be free from oil or grease.**

**Tool number: KV38104700**



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

**Tool number: ST3127S000**

**Pinion bearing preload (with front oil seal):**

**1.4 - 1.7 N·m (14 - 17 kg-cm, 12 - 15 in-lb)**

If preload is out of specification, adjust the thickness of spacer and shim combination by replacing shim and spacer with thinner one.

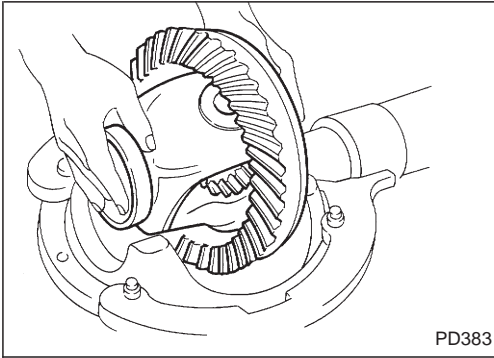
- Start from the combination of thickest spacer and shim.
- Combine each spacer and shim thickness one by one until the correct specification are achieved.

**Drive pinion bearing preload adjusting spacer and shim:**

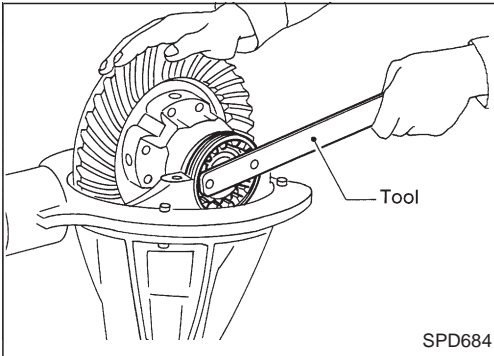
**Refer to SDS (PD-51).**

## ASSEMBLY

### Differential Carrier (Cont'd)

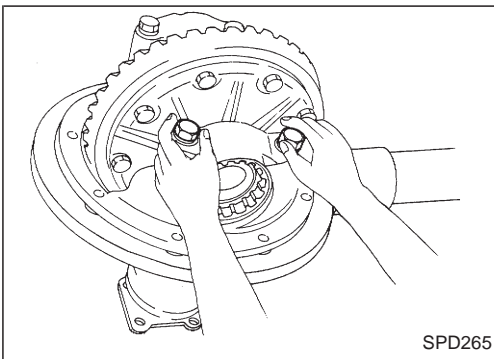


10. Install differential case assembly with side bearing outer races into gear carrier.



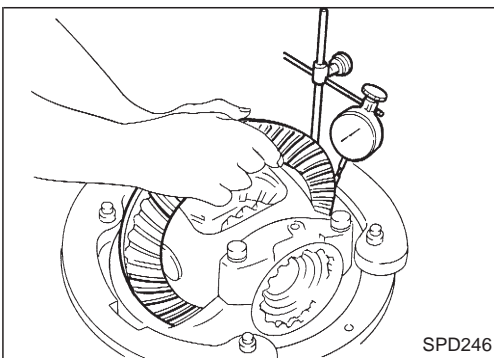
11. Position side bearing adjusters on gear carrier with threads properly engaged; screw in adjusters lightly at this stage of assembly.

**Tool number:**  
**ST32580000**



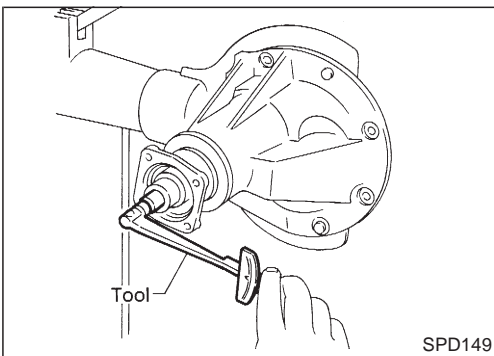
12. Align mark on bearing cap with that on gear carrier and install bearing cap on gear carrier.

- Do not tighten at this point to allow further tightening of side bearing adjusters.



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

**Ring gear-to-drive pinion backlash:**  
**0.15 - 0.20 mm (0.0059 - 0.0079 in)**



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

**Tool number: ST3127S000**

**Total preload (with front oil seal):**

**Drive pinion bearing**

**New parts**

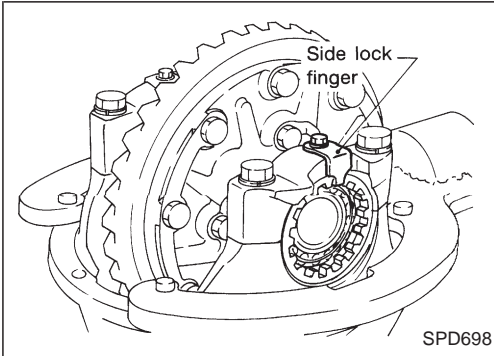
**1.7 - 2.5 N·m (17 - 25 kg-cm, 15 - 22 in-lb)**

**Used parts**

**1.5 - 1.7 N·m (15 - 17 kg-cm, 13 - 15 in-lb)**

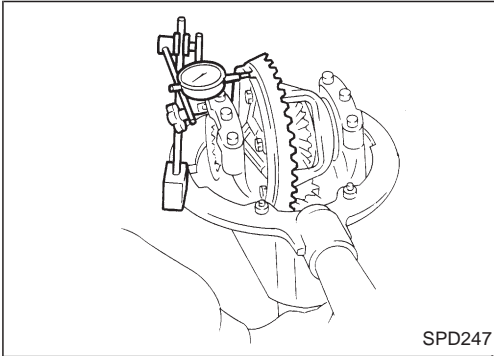
## ASSEMBLY

### Differential Carrier (Cont'd)



14. Tighten side bearing cap bolts.

15. Install side lock finger in place to prevent rotation during operation.



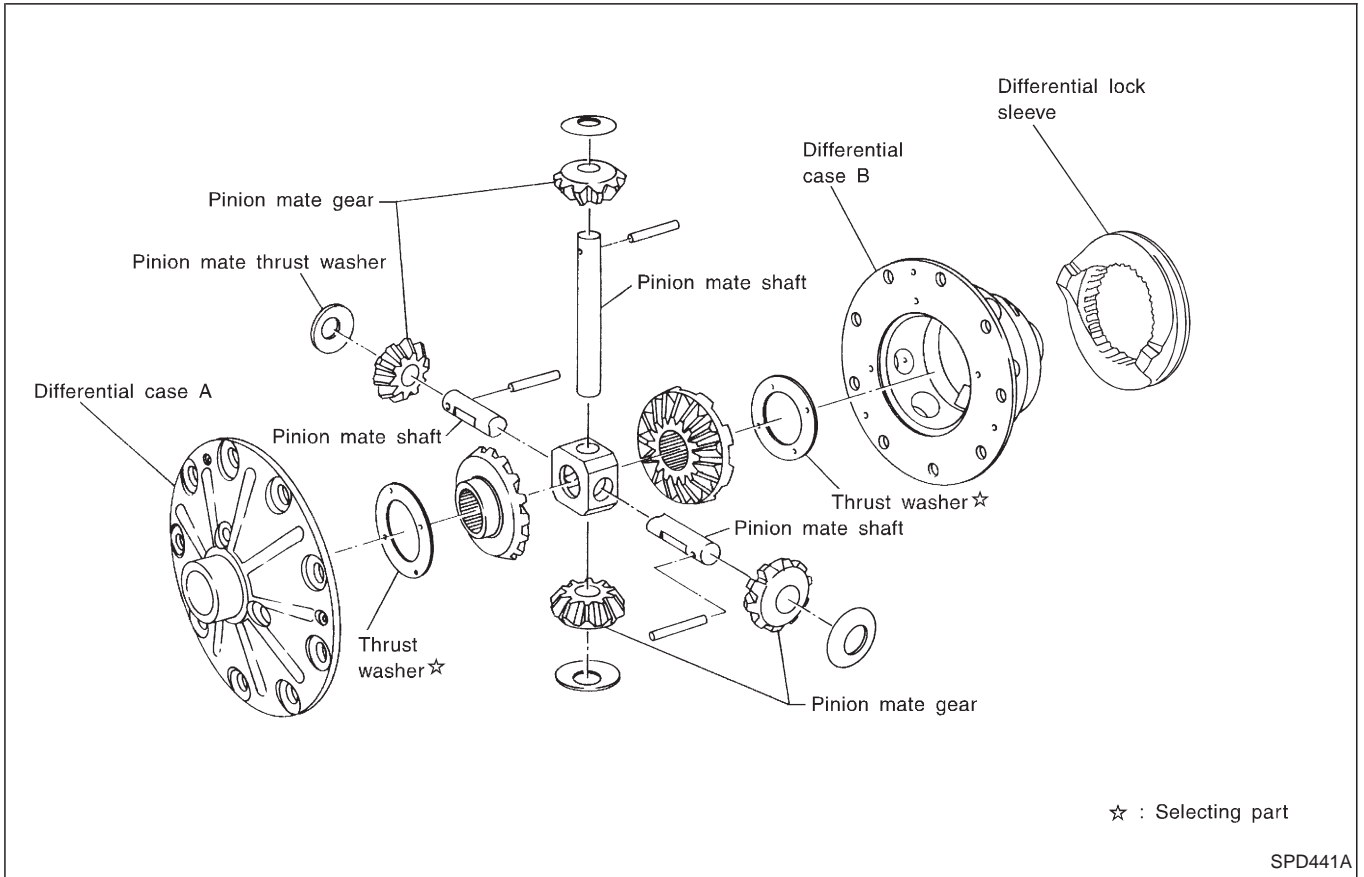
16. Check runout of ring gear with a dial indicator.

**Runout limit: 0.08 mm (0.0031 in)**

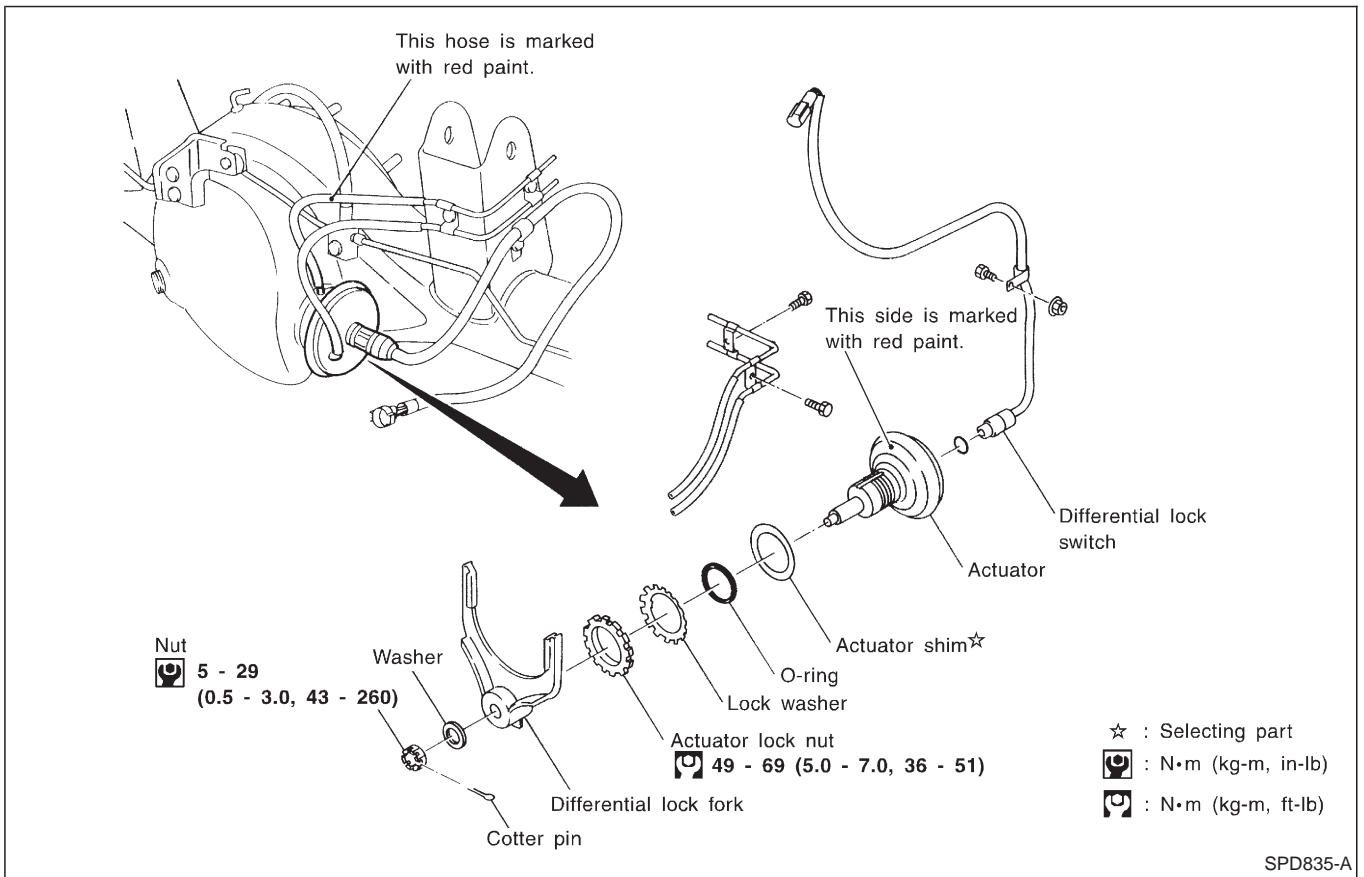
- If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.
- If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

17. Check tooth contact. Refer to ADJUSTMENT (PD-27).

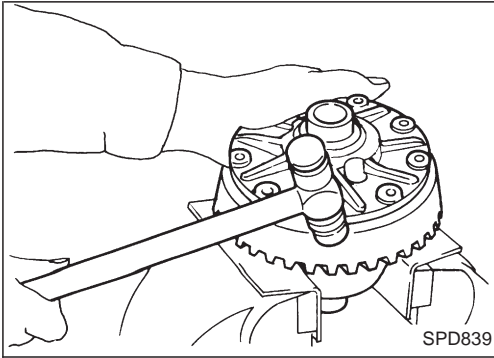
# DIFFERENTIAL LOCK



# Actuator and Fork

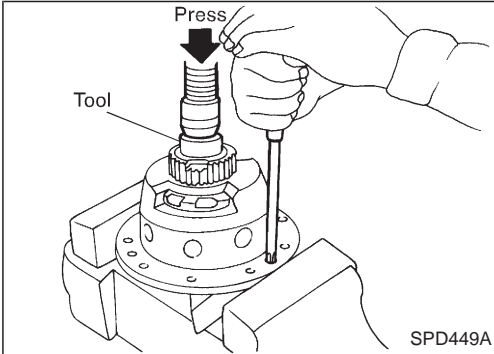


# DIFFERENTIAL LOCK

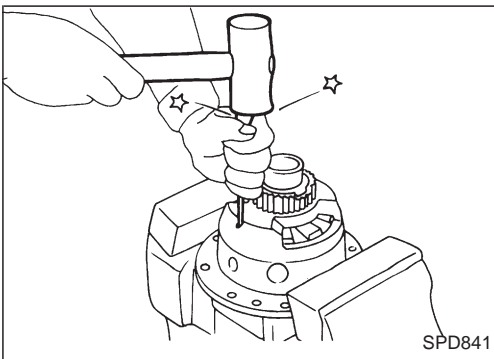


## Disassembly

1. Remove side bearing inner cone with Tool. For removal procedure, refer to ordinary differential case.
2. Loosen gear bolts in a criss-cross pattern.
3. Tap ring gear off the gear with a soft hammer.



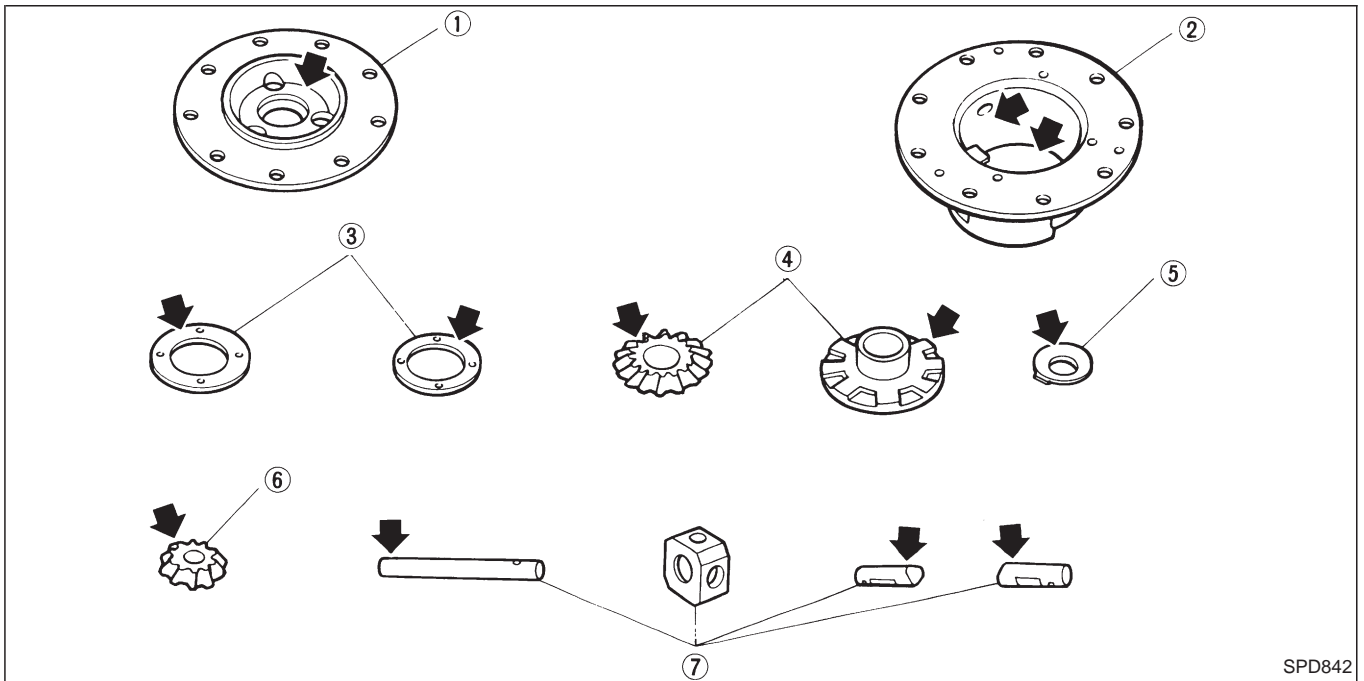
4. Put marks on both differential cases.
5. Loosen screws on differential cases A and B using a press.  
**Tool number: ST33081000**
6. Separate differential cases A and B.



7. Drive out pinion mate shaft lock pin with Tool.  
Draw out component parts.

# DIFFERENTIAL LOCK

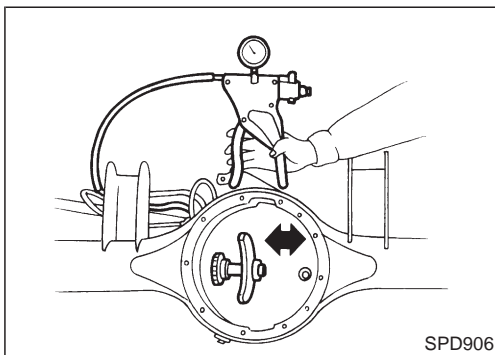
## Inspection



SPD842

### CONTACT SURFACES

1. Clean the disassembled parts in suitable solvent and blow dry with compressed air.
2. If following surfaces are found with burrs or scratches, smooth with oil stone.
  - ① Differential case A
  - ② Differential case B
  - ③ Side gear thrust washer
  - ④ Side gear
  - ⑤ Pinion mate thrust washer
  - ⑥ Pinion mate gear
  - ⑦ Pinion mate shaft



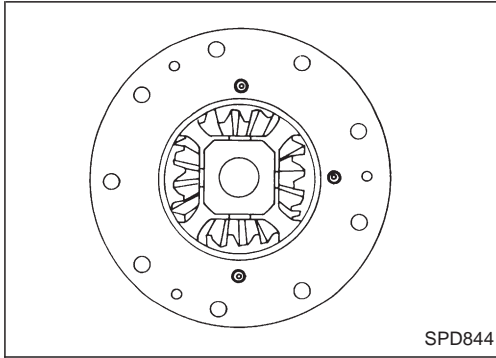
SPD906

### ACTUATOR OPERATION

Apply a vacuum pressure of 66.7 kPa (667 mbar, 500 mmHg, 19.69 inHg) and check its operation and leakage within 10 seconds.



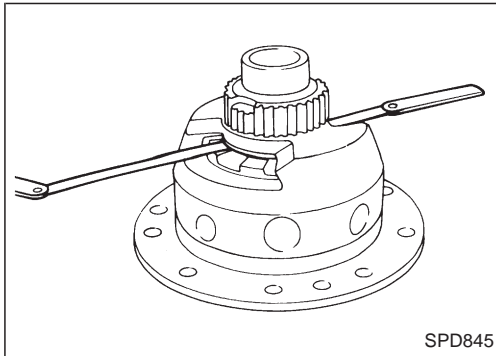
# DIFFERENTIAL LOCK



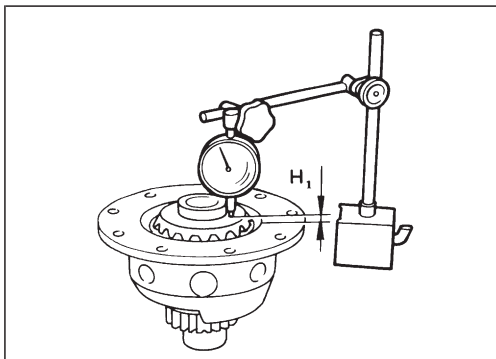
## Assembly

### DIFFERENTIAL CASE

1. Install side gears, pinion mate gears and thrust washers into differential case B.
2. Fit pinion mate shaft to differential case so that it meets lock pin holes.



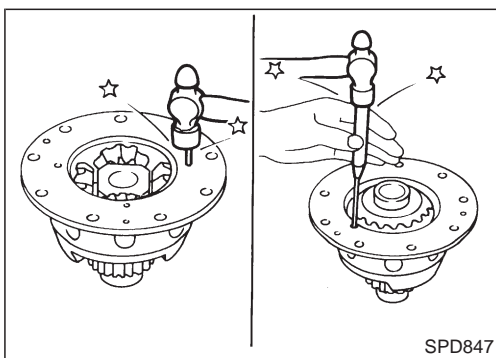
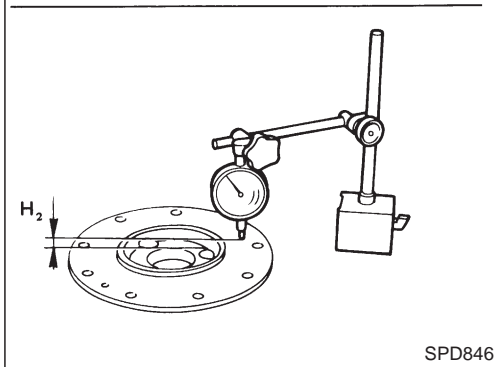
3. Adjust backlash between side gear and pinion mate gear.
  - **Opposite side of ring gear:**  
Select side gear thrust washer by measuring gap with feeler gauge. Refer to SDS.



- **Ring gear side:**  
Measure height  $H_1$ .  
Measure height  $H_2$ .  
 $H_2 - H_1 =$  Clearance between the side gear end face and differential case B  
Select side gear thrust washer. Refer to SDS.

**Backlash between side gear and pinion mate gear  
(Clearance between side gear thrust washer and differential case):**

**0.10 - 0.20 mm (0.0039 - 0.0079 in)**



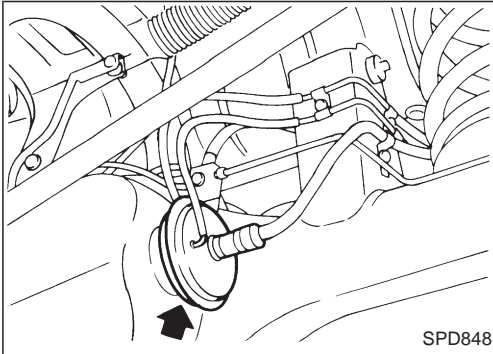
4. Install pinion mate shaft lock pin with a punch. Make sure lock pin is flush with case.
5. Install differential case A.
6. Place ring gear on differential case and install it by tightening bolt. Use locking sealant.
7. Install side bearing inner cone.

# DIFFERENTIAL LOCK

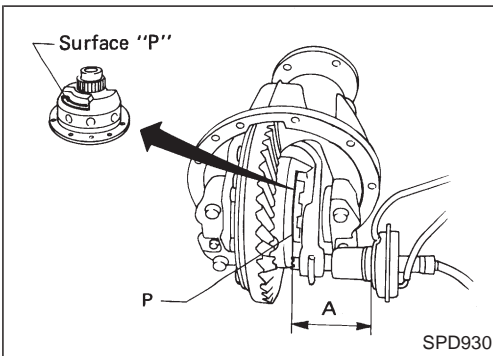
## Assembly (Cont'd)

### ACTUATOR

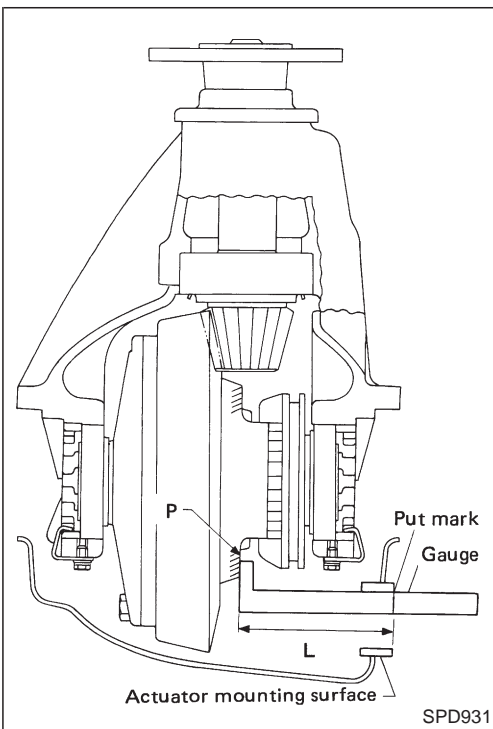
- If same differential carrier is used again, reuse actuator shim or use a shim of the same thickness when used shim is damaged.



- When differential carrier is replaced with a new one, select actuator shim to keep differential lock mechanism functioning.
- When installing the differential lock fork, make sure it is facing the correct direction.



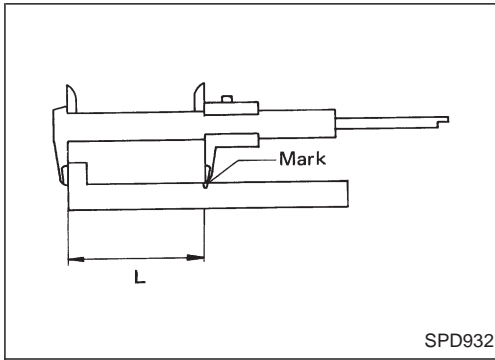
1. Standard length "A" is between specified mounting surface of actuator and differential case B surface "P". Refer to SDS.



2. Install differential carrier on axle case.
  3. Rotate ring gear until surface "P" is seen through actuator mounting hole in axle case.  
Measure dimension "L" between actual mounting surface of actuator on axle case and surface "P", using suitable gauge tool.
- Put gauge as shown on drawing.
  - Put mark on gauge at actuator mounting surface.
  - Measure dimension "L".

## DIFFERENTIAL LOCK

### Assembly (Cont'd)



4. If shim thickness determined by equation is assumed as "T", "T" will be expressed by equation "A" - "L". Select a combination of shims from those shown in SDS so that shim thickness is within "T" range. Install actuator using selected shims.

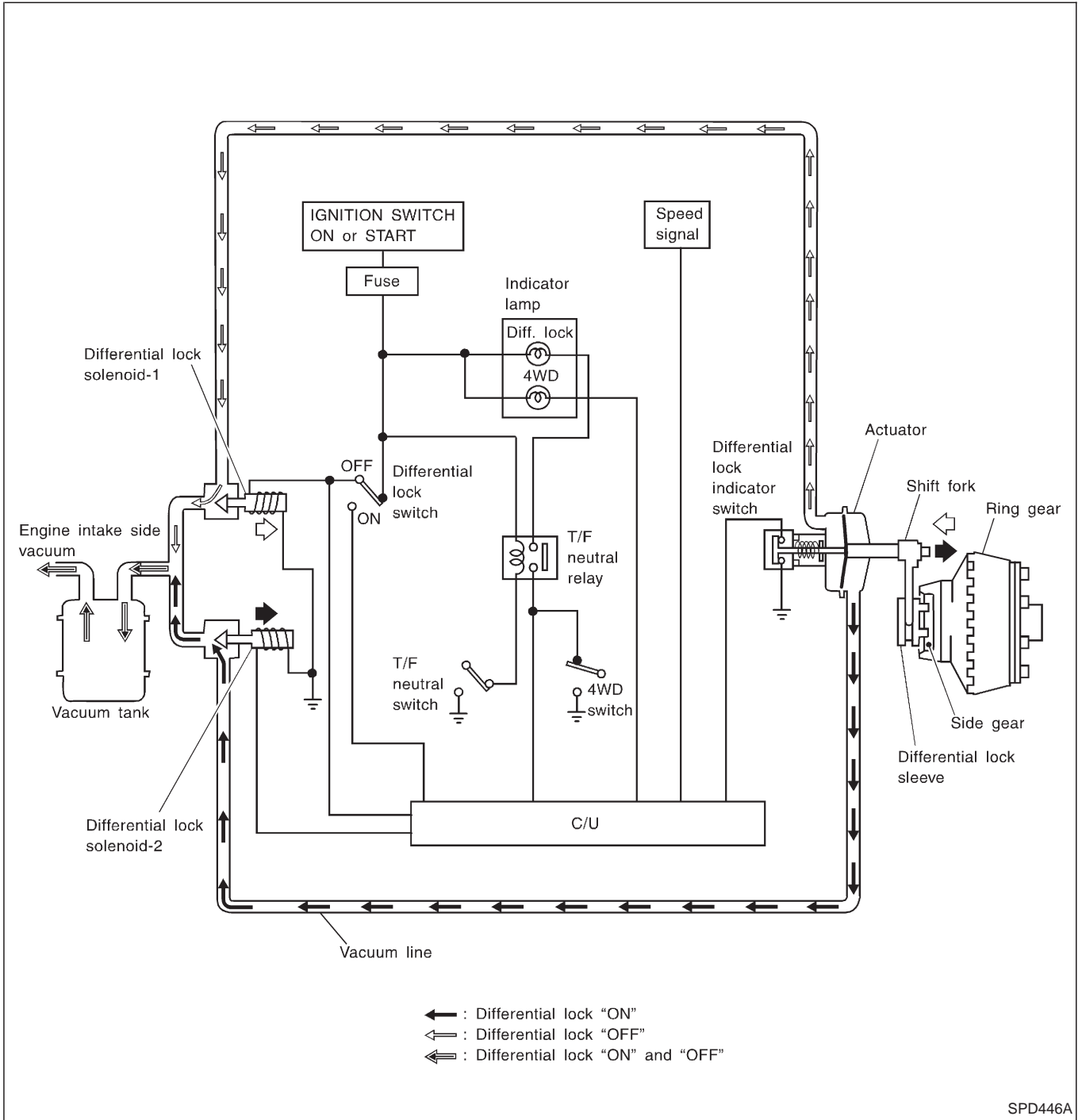
# DIFFERENTIAL LOCK

## System Description

The differential lock operates only in 4WD.

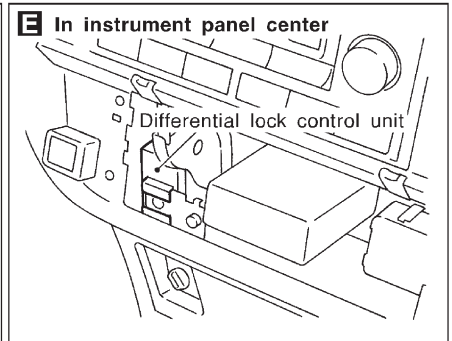
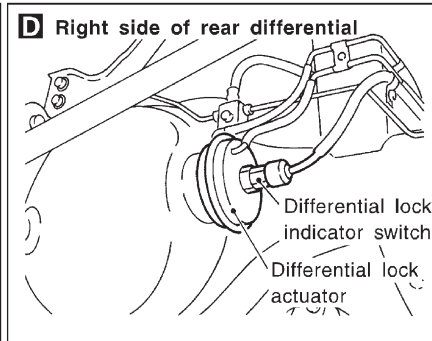
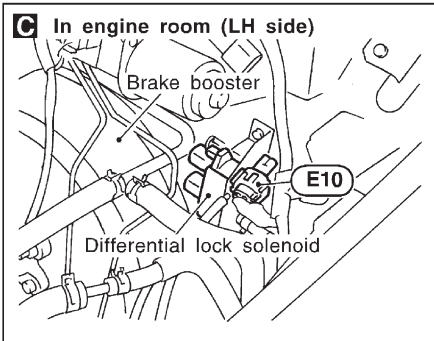
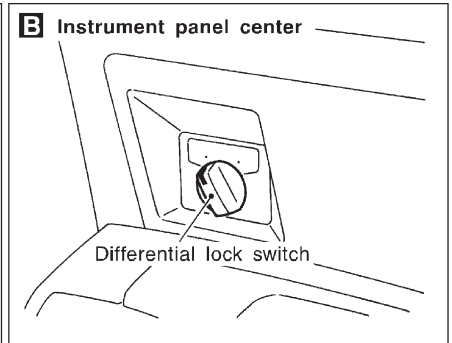
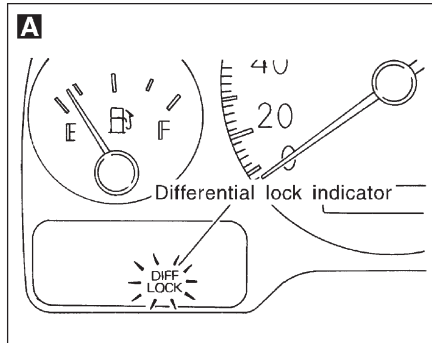
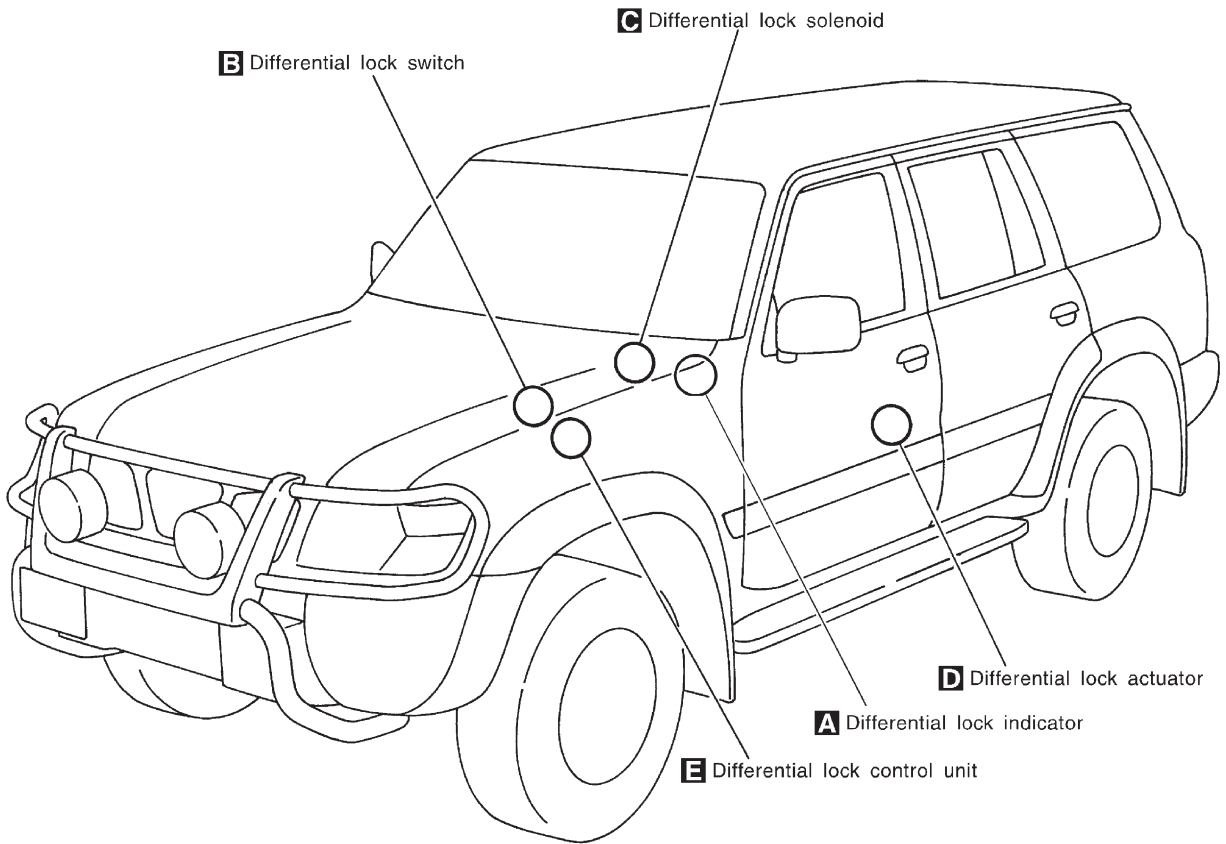
The differential lock control unit interrupts current flowing through differential lock solenoid-2 when vehicle speed exceeds 7 km/h (4 MPH). If the differential lock switch is accidentally turned on when vehicle speed is greater than 7 km/h (4 MPH), the control unit will prevent the differential lock from sustaining impact damage.

A warning buzzer will sound when the vehicle is driven over 20 km/h (12 MPH) with the differential lock engaged.



# DIFFERENTIAL LOCK

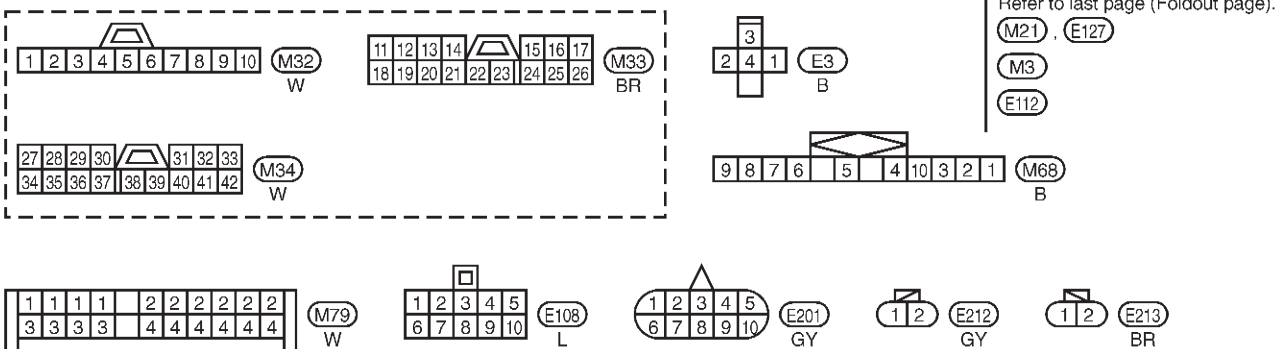
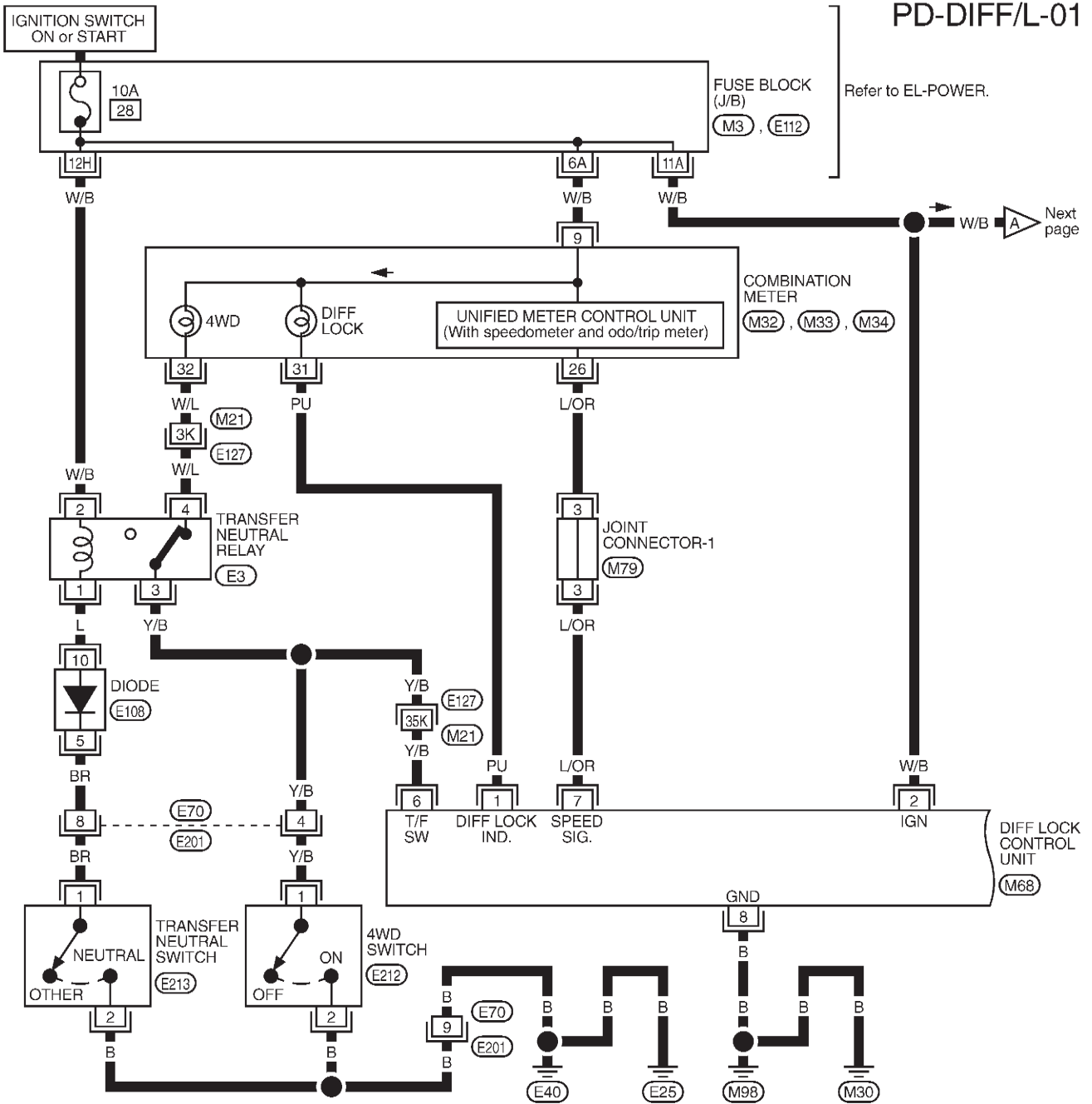
## Component Parts Location



# DIFFERENTIAL LOCK

## Wiring Diagram — DIFF/L —/LHD Models

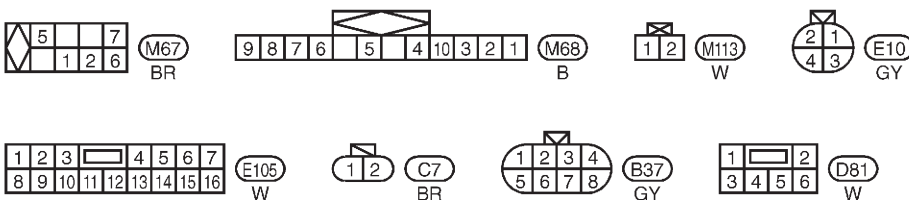
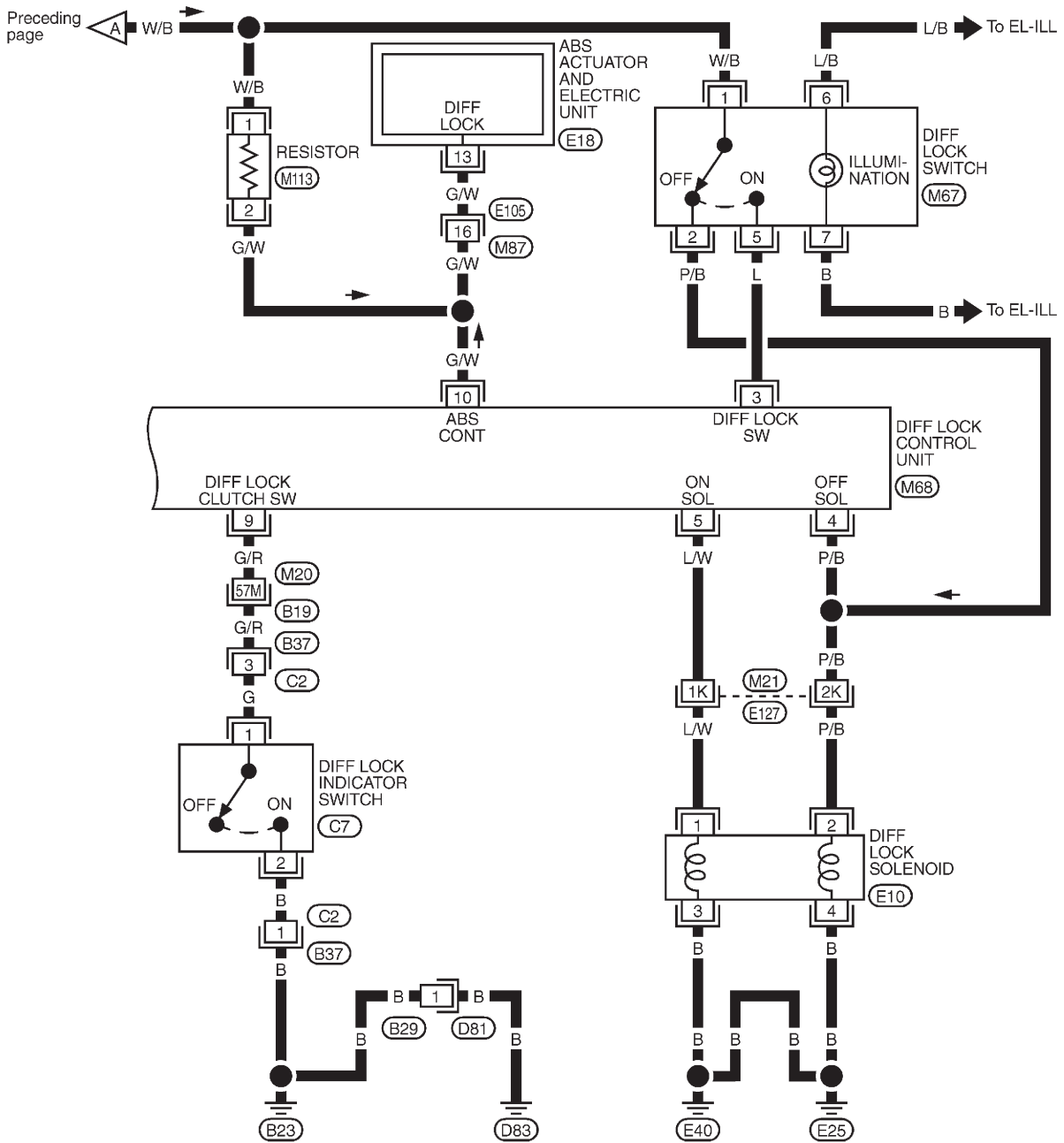
PD-DIFF/L-01



# DIFFERENTIAL LOCK

## Wiring Diagram — DIFF/L —/LHD Models (Cont'd)

PD-DIFF/L-02



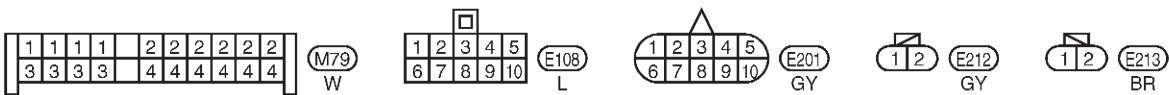
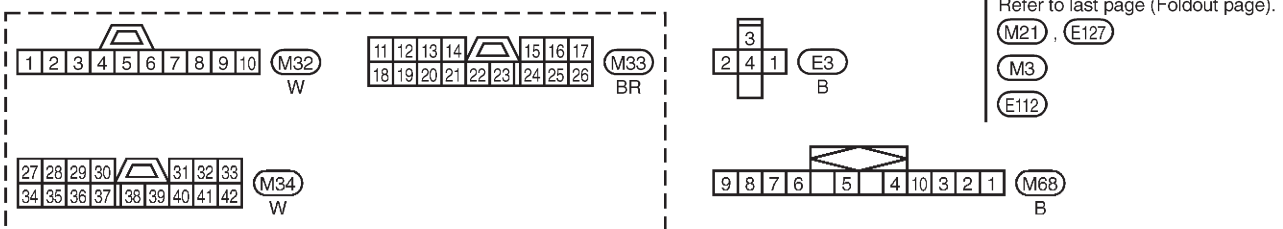
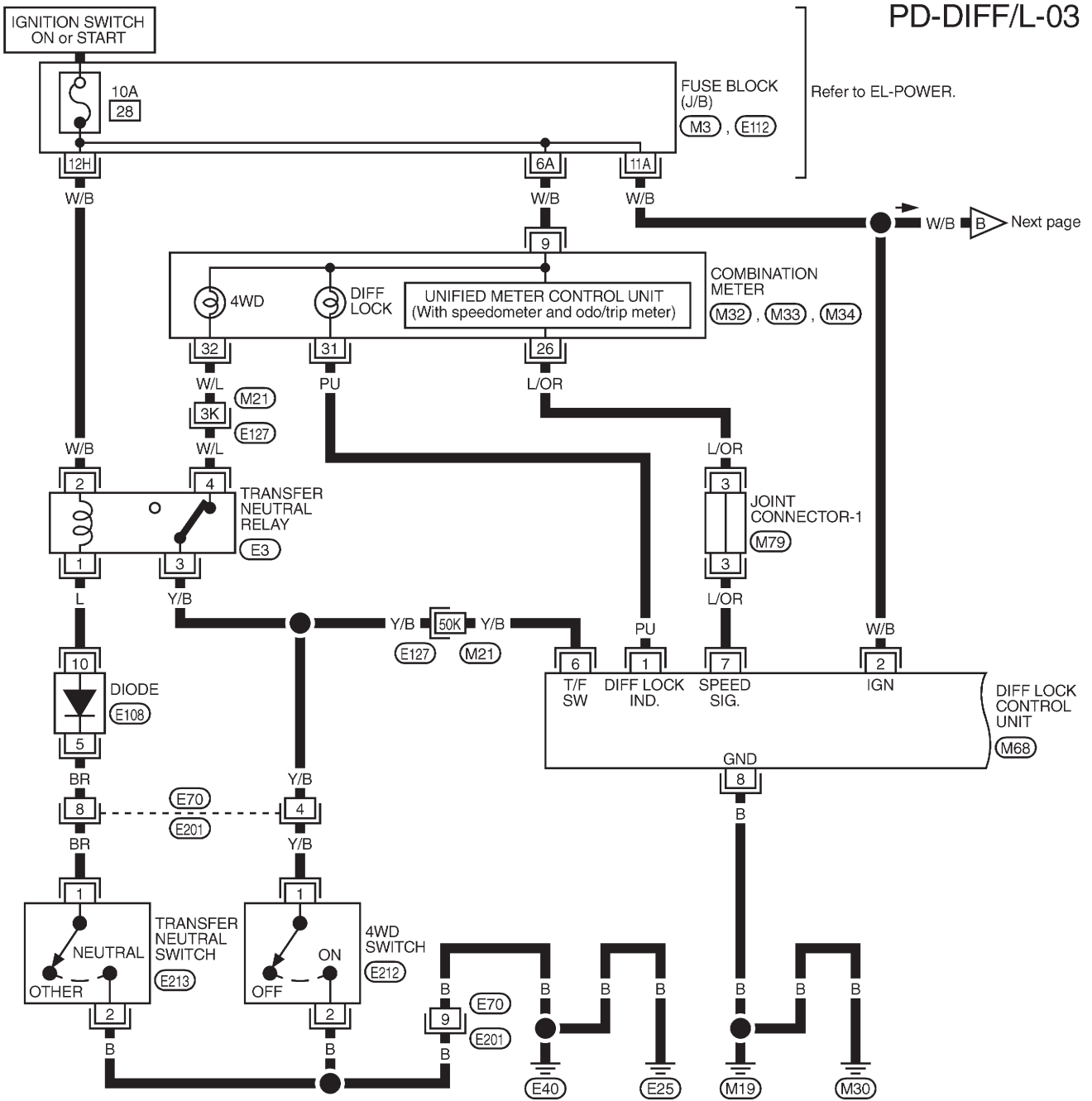
Refer to last page (Foldout page).

(M20), (B19)  
(M21), (E127)  
(E18)

# DIFFERENTIAL LOCK

## Wiring Diagram — DIFF/L —/RHD Models

PD-DIFF/L-03

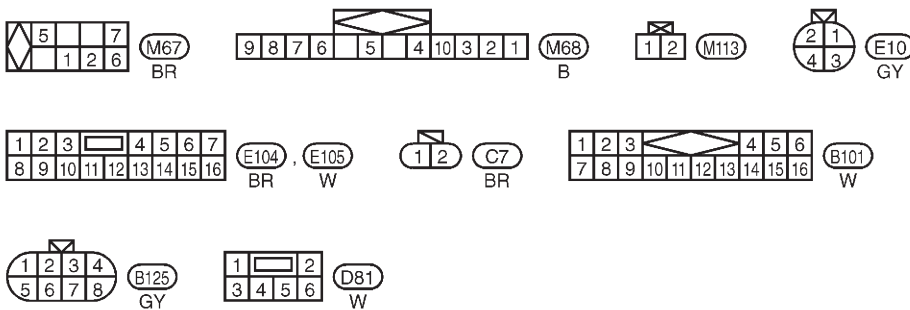
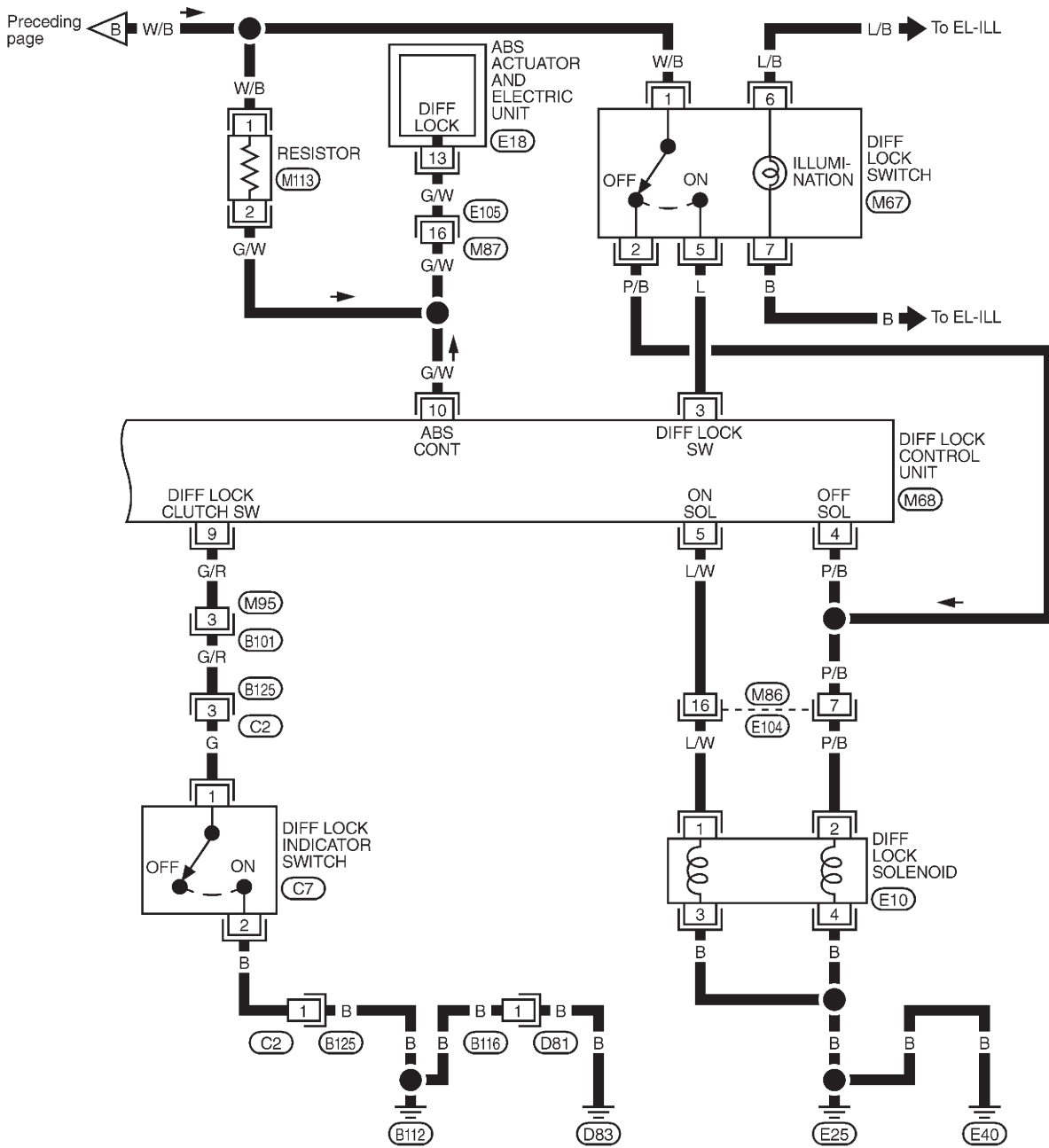




# DIFFERENTIAL LOCK

## Wiring Diagram — DIFF/L —/RHD Models (Cont'd)

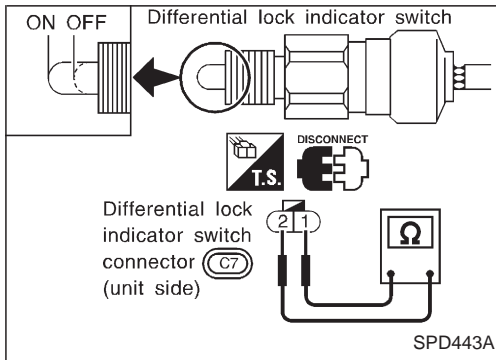
PD-DIFF/L-04



Refer to last page (Foldout page).

E18

# DIFFERENTIAL LOCK



## Electrical Components Inspection

### DIFFERENTIAL LOCK INDICATOR SWITCH CHECK

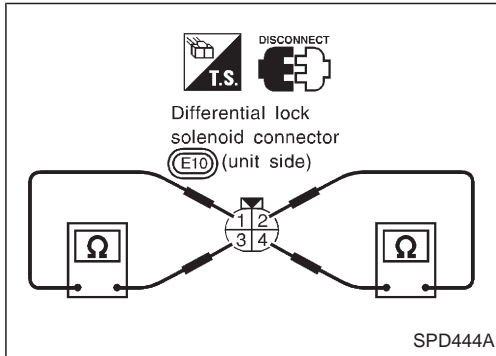
- Check switch function by checking continuity.

#### Continuity:

**ON** Continuity should exist.

**OFF** Continuity should not exist.

If NG, replace differential lock indicator switch.



### DIFFERENTIAL LOCK SOLENOID CHECK

1. Disconnect differential lock solenoid 4-pin connector.
2. Check continuity between terminals ① and ③, ② and ④.

**Continuity should exist.**

If NG, replace differential lock solenoid.

### SPEED SENSOR CHECK

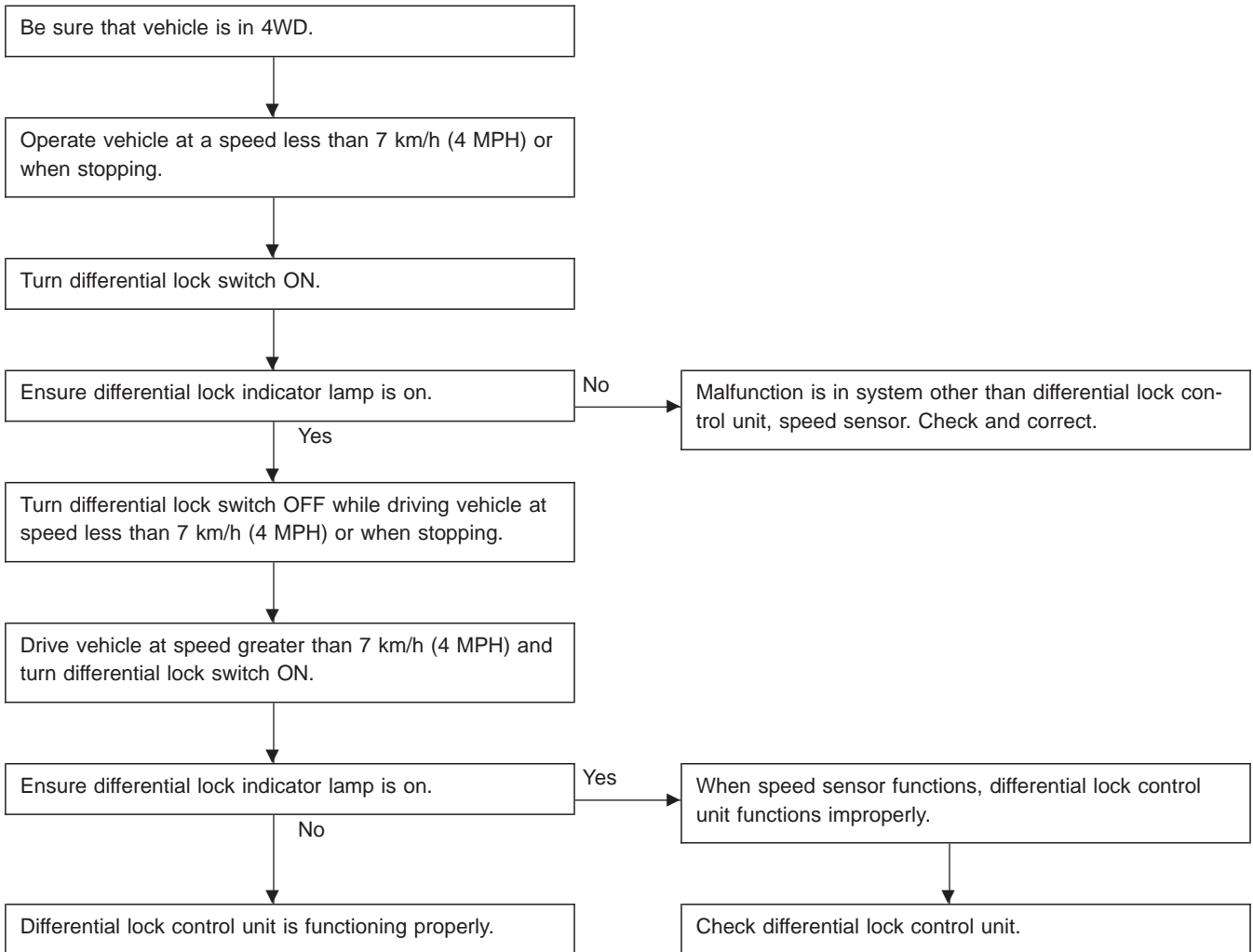
Refer to EL section.

# DIFFERENTIAL LOCK

## Electrical Components Inspection (Cont'd)

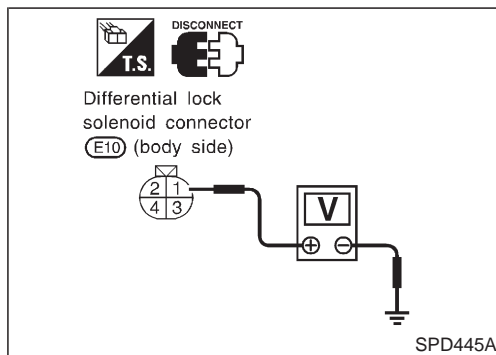
### DIFFERENTIAL LOCK CONTROL UNIT CHECK

#### On-vehicle check



#### Unit check

1. Ensure that wiring to differential lock control unit is correct and that the unit is properly connected to power supply.
2. Place vehicle on a safety stand properly. Ensure that the front and rear wheels rotate freely.



3. Check output voltage of differential lock at solenoid-2 connector.
  - Vehicle speed less than 7 km/h (4 MPH) on speedometer  
**Power supply: Approximately 12V**
  - Vehicle speed greater than 7 km/h (4 MPH) on speedometer  
**Output voltage: Approximately 0V**

# SERVICE DATA AND SPECIFICATIONS (SDS)

## Propeller Shaft

### GENERAL SPECIFICATIONS

#### Front propeller shaft

Applied model	RD28 Engine MT models
Propeller shaft model	2F80B
Number of joints	2
Type of journal bearing	Solid (Disassembly type)
Coupling type with transmission	Flange type
Distance between yokes mm (in)	73 (2.87)
Shaft length (Spider-to-spider) mm (in)	832 (32.76)
Shaft outer diameter mm (in)	50.8 (2.000)

#### Rear propeller shaft

Applied model	RD28	
Engine	RD28	
Transmission	M/T	
Body	Hardtop	Wagon
Propeller shaft model	2F100H	2F80B
Number of joints	2	
Type of journal bearing	Solid (Disassembly type)	
Coupling type with transmission	Flange type	
Distance between yokes mm (in)	94 (3.70)	73 (2.87)
Shaft length (Spider-to-spider) mm (in)	440 (17.32)	1,033 (40.67)
Shaft outer diameter mm (in)	57 (2.24)	89.6 (3.528)

### INSPECTION AND ADJUSTMENT

#### Service data

Propeller shaft model	2F80B, 2F100H
Propeller shaft runout limit mm (in)	0.6 (0.024)
Journal axial play mm (in)	0.02 (0.0008)

#### Available snap rings

##### 2F80B

Thickness mm (in)	Color	Part number
1.99 (0.0783)	White	37146-C9400
2.02 (0.0795)	Yellow	37147-C9400
2.05 (0.0807)	Red	37148-C9400
2.08 (0.0819)	Green	37149-C9400
2.11 (0.0831)	Blue	37150-C9400
2.14 (0.0843)	Light brown	37151-C9400
2.17 (0.0854)	Black	37152-C9400
2.20 (0.0866)	Black	37153-C9400

# SERVICE DATA AND SPECIFICATIONS (SDS)

## Propeller Shaft (Cont'd)

### 2F100H

Thickness mm (in)	Color	Part number
1.95 (0.0768)	White	37146-61502
1.98 (0.0780)	Yellow	37147-61502
2.01 (0.0791)	Red	37148-61502
2.04 (0.0803)	Green	37149-61502
2.07 (0.0815)	Blue	37150-61502
2.10 (0.0827)	Light Brown	37151-61502
2.13 (0.0839)	Pink	37146-61503
2.16 (0.0850)	Gold	37147-61503
2.19 (0.0862)	Black	37148-61503
2.22 (0.0874)	Color less	37149-61503

## Final Drive

### GENERAL SPECIFICATIONS

Body type	Wagon		Hardtop	
Engine	RD28ETi			
Transmission	M/T			
Front final drive [All]	Standard			
	H233B			
	2-pinion			
Gear ratio	4.625		4.625	
Number of teeth (Ring gear/drive pinion)	37/8		37/8	
Oil capacity (Approx.) ℓ (Imp pt)	5.4 (9-1/2)			
Rear final drive [Grade]	Optional	Standard	Standard	Optional
	H233B		H233B	
	Diff. lock	4 pinion	4 pinion	Diff. lock
Gear ratio	4.625		4.625	
Number of teeth (Ring gear/drive pinion)	37/8		37/8	
Oil capacity (Approx.) ℓ (Imp pt)	Without diff. lock	2.4 (4-1/4)		2.4 (4-1/4)
	With diff. lock	3.0 (5-1/4)		3.0 (5-1/4)

### With LSD model

Body type	Wagon	Hardtop
Engine	RD28ETi	
Transmission	All	M/T
Rear final drive [Grade]	H233B	
	LSD	
Gear ratio	4,625	
Number of teeth (ring gear/drive pinion)	37/8	
Oil capacity (Approx.) ℓ (Imp pt)	2.1 (3-3/4)	

### INSPECTION AND ADJUSTMENT

#### Ring gear runout

Ring gear runout limit	mm (in)	0.08 (0.0031)
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#### Side gear adjustment (without LSD)

Side gear backlash (Clearance between side gear to differential case)	mm (in)	0.15 - 0.20 (0.0059 - 0.0079)
Available side gear thrust washers		
Thickness	mm (in)	Part number
1.75 (0.0689)		38424-T5000
1.80 (0.0709)		38424-T5001
1.85 (0.0728)		38424-T5002

# SERVICE DATA AND SPECIFICATIONS (SDS)

## Final Drive (Cont'd)

### — Additional service for LSD model —

#### Differential torque adjustment

Differential torque N-m (kg-m, ft-lb)	108 - 137 (11 - 14, 80 - 101)	
Number of discs and plates		
Friction disc	4	
Friction plate	4	
Spring plate	4	
Wear limit of plate and disc mm (in)	0.1 (0.004)	
Allowable warpage of friction disc and plate mm (in)	0.08 (0.0031)	
Available discs and plates		
Part name	Thickness mm (in)	Part number
Friction disc	1.48 - 1.52 (0.0583 - 0.0598)	38433-C6000 (Standard type)
	1.58 - 1.62 (0.0622 - 0.0638)	38433-C6001 (Adjusting type)
Friction plate	1.48 - 1.52 (0.0583 - 0.0598)	38432-C6000
Spring disc	1.48 - 1.52 (0.0583 - 0.0598)	38436-C6000
Spring plate	1.48 - 1.52 (0.0583 - 0.0598)	38435-C6010

#### Drive pinion height adjustment

Available pinion height adjusting washers

Thickness	mm (in)	Part number
2.58 (0.1016)		38151-01J00
2.61 (0.1028)		38151-01J01
2.64 (0.1039)		38151-01J02
2.67 (0.1051)		38151-01J03
2.70 (0.1063)		38151-01J04
2.73 (0.1075)		38151-01J05
2.76 (0.1087)		38151-01J06
2.79 (0.1098)		38151-01J07
2.82 (0.1110)		38151-01J08
2.85 (0.1122)		38151-01J09
2.88 (0.1134)		38151-01J10
2.91 (0.1146)		38151-01J11
2.94 (0.1157)		38151-01J12
2.97 (0.1169)		38151-01J13
3.00 (0.1181)		38151-01J14
3.03 (0.1193)		38151-01J15
3.06 (0.1205)		38151-01J16
3.09 (0.1217)		38151-01J17
3.12 (0.1228)		38151-01J18
3.15 (0.1240)		38151-01J19
3.18 (0.1252)		38151-01J60
3.21 (0.1264)		38151-01J61
3.24 (0.1276)		38151-01J62
3.27 (0.1287)		38151-01J63
3.30 (0.1299)		38151-01J64
3.33 (0.1311)		38151-01J65
3.36 (0.1323)		38151-01J66
3.39 (0.1335)		38151-01J67
3.42 (0.1346)		38151-01J68
3.45 (0.1358)		38151-01J69
3.48 (0.1370)		38151-01J70
3.51 (0.1382)		38151-01J71
3.54 (0.1394)		38151-01J72
3.57 (0.1406)		38151-01J73
3.60 (0.1417)		38151-01J74
3.63 (0.1429)		38151-01J75
3.66 (0.1441)		38151-01J76

#### Drive pinion preload adjustment

Drive pinion bearing preload adjusting method	Adjusting shim and spacer
Drive pinion preload N-m (kg-cm, in-lb)	
With front oil seal	1.4 - 1.7 (14 - 17, 12 - 15)
Without front oil seal	1.2 - 1.5 (12 - 15, 10 - 13)

Available drive pinion preload adjusting shims

Thickness	mm (in)	Part number
2.31 (0.0909)		38125-82100
2.33 (0.0917)		38126-82100
2.35 (0.0925)		38127-82100
2.37 (0.0933)		38128-82100
2.39 (0.0941)		38129-82100
2.41 (0.0949)		38130-82100
2.43 (0.0957)		38131-82100
2.45 (0.0965)		38132-82100
2.47 (0.0972)		38133-82100
2.49 (0.0980)		38134-82100
2.51 (0.0988)		38135-82100
2.53 (0.0996)		38136-82100
2.55 (0.1004)		38137-82100
2.57 (0.1012)		38138-82100
2.59 (0.1020)		38139-82100

Available drive pinion preload adjusting spacers

Length	mm (in)	Part number
4.50 (0.1772)		38165-76000
4.75 (0.1870)		38166-76000
5.00 (0.1969)		38167-76000
5.25 (0.2067)		38166-01J00
5.50 (0.2165)		38166-01J10

#### Total preload adjustment

Total preload N-m (kg-cm, in-lb) With front oil seal	Drive pinion bearing	New	1.7 - 2.5 (17 - 25, 15 - 22)
		Old	1.5 - 1.7 (15 - 17, 13 - 15)
Ring gear backlash	mm (in)		0.15 - 0.20 (0.0059 - 0.0079)
Side bearing adjusting method	Side adjuster		