

SECTION **FFD**  
FRONT FINAL DRIVE

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FFD

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# PRECAUTIONS

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## PRECAUTIONS

PFP:00001

### Service Notice or Precautions

EDS0034W

- Before starting diagnosis of the vehicle, understand the symptoms well. Perform correct and systematic operations.
- Check for the correct installation status prior to removal or disassembly. When matching marks are required, be certain they do not interfere with the function of the parts they are applied to.
- Overhaul should be done in a clean work area, a dust proof area is recommended.
- Before disassembly, completely remove sand and mud from the exterior of the unit, preventing them from entering into the unit during disassembly or assembly.
- Always use shop paper for cleaning the inside of components.
- Avoid using cotton gloves or a shop cloth to prevent the entering of lint.
- Check appearance of the disassembled parts for damage, deformation, and unusual wear. Replace them with new ones if necessary.
- Gaskets, seals and O-rings should be replaced any time the unit is disassembled.
- Clean and flush the parts sufficiently and blow them dry.
- Be careful not to damage sliding surfaces and mating surfaces.
- When applying sealant, remove the old sealant from the mating surface; then remove any moisture, oil, and foreign materials from the application and mating surfaces.
- In principle, tighten bolts or nuts gradually in several steps working diagonally from inside to outside. If a tightening sequence is specified, observe it.
- During assembly, observe the specified tightening torque.
- Add new differential gear oil, petroleum jelly, or multi-purpose grease, as specified.

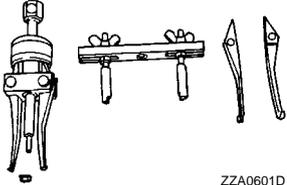
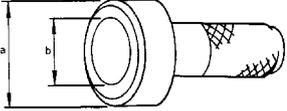
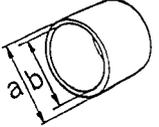
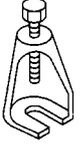
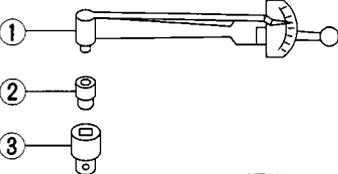
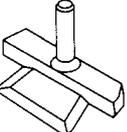
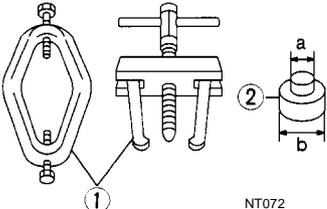
# PREPARATION

## PREPARATION

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### Special Service Tools

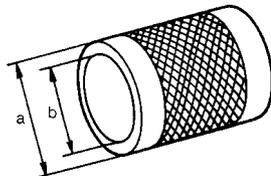
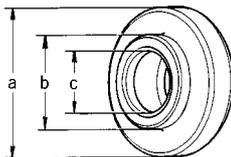
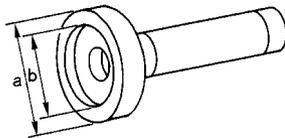
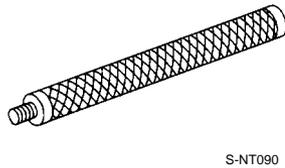
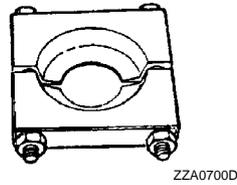
EDS0034X

Tool number Tool name	Description
KV381054S0 Puller <div style="text-align: center;">  <p>ZZA0601D</p> </div>	Removing front oil seal
ST30720000 Drift a: 77 mm (3.03 in) dia. b: 55.5 mm (2.185 in) dia. <div style="text-align: center;">  <p>ZZA0811D</p> </div>	<ul style="list-style-type: none"> <li>● Installing front oil seal</li> <li>● Installing side oil seal</li> </ul>
ST27863000 Drift a: 74.5 mm (2.933 in) dia. b: 62.5 mm (2.461 in) dia. <div style="text-align: center;">  <p>ZZA1003D</p> </div>	<ul style="list-style-type: none"> <li>● Installing front oil seal</li> <li>● Installing side oil seal</li> </ul>
ST29020001 Puller <div style="text-align: center;">  <p>NT143</p> </div>	Separating the upper link ball joint stud
ST3127S000 Preload gauge 1: GG91030000 Torque wrench 2: HT62940000 Socket adapter (1/2") 3: HT62900000 Socket adapter (3/8") <div style="text-align: center;">  <p>NT124</p> </div>	Measuring pinion bearing preload and total preload
KV10111100 Seal cutter <div style="text-align: center;">  <p>S-NT046</p> </div>	Removing rear cover
ST3306S001 Differential side bearing puller set 1: ST33051001 Puller 2: ST33061000 Base a: 28.5 mm (1.122 in) dia. b: 38 mm (1.50 in) dia. <div style="text-align: center;">  <p>NT072</p> </div>	Removing and installing side bearing inner race

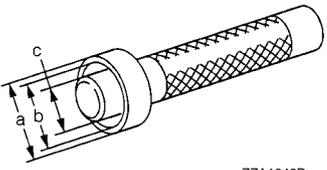
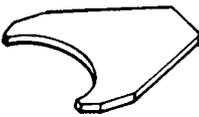
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# PREPARATION

Tool number Tool name	Description
ST30031000 Replacer	Removing pinion rear bearing inner race
ST30611000 Drift bar	Installing pinion rear bearing outer race (Use with ST30613000)
ST30613000 Drift a: 72 mm (2.83 in) dia. b: 48 mm (1.89 in) dia.	Installing pinion rear bearing outer race
KV38100200 Drift a: 65 mm (2.56 in) dia. b: 49 mm (1.93 in) dia.	Installing pinion front bearing outer race
ST30901000 Drift a: 79 mm (3.11 in) dia. b: 45 mm (1.77 in) dia. c: 35.2 mm (1.386 in) dia.	Installing pinion rear bearing inner race
ST33200000 Drift a: 60 mm (2.36 in) dia. b: 44.5 mm (1.752 in) dia.	Installing pinion front bearing inner race

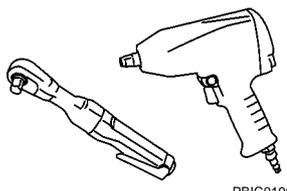
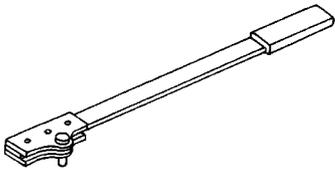


# PREPARATION

Tool number Tool name	Description	
ST33230000 Drift a: 51 mm (2.01 in) dia. b: 41 mm (1.61 in) dia. c: 28 mm (1.10 in) dia.	 ZZA1046D	A B C
KV38100600 Drift	 SDIA0429J	<b>FFD</b> E

## Commercial Service Tools

EDS0034Y

Tool name	Description	
Power tool	 PBIC0190E	F G H I
Flange wrench	 NT771	J K L M



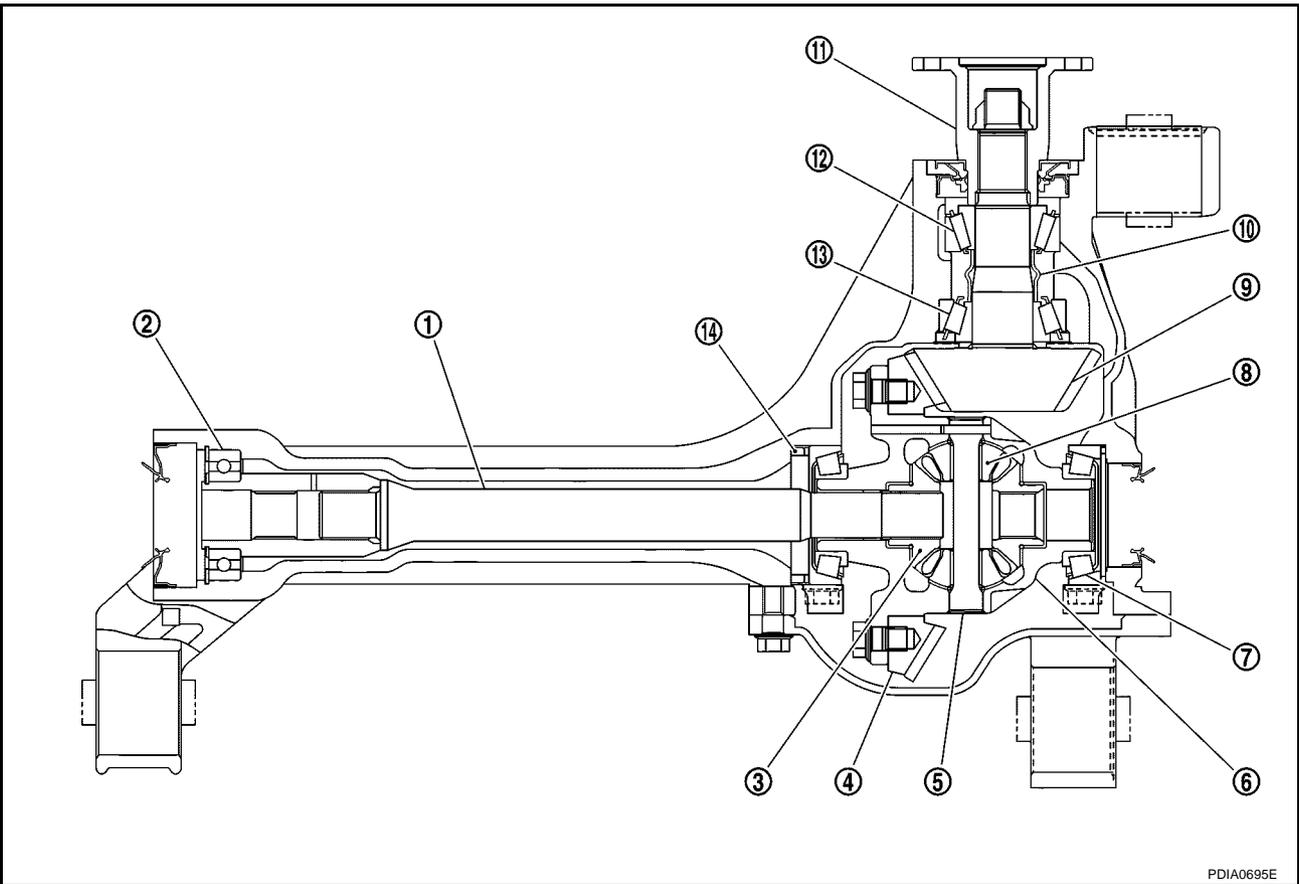
# DESCRIPTION

## DESCRIPTION

PFP:00000

### Cross-Sectional View

EDS00350



- |                         |                       |                          |
|-------------------------|-----------------------|--------------------------|
| 1. Side shaft           | 2. Side shaft bearing | 3. Side bearing          |
| 4. Drive gear           | 5. Pinion mate shaft  | 6. Differential case     |
| 7. Side bearing         | 8. Pinion mate gear   | 9. Drive pinion          |
| 10. Collapsible spacer  | 11. Companion flange  | 12. Pinion front bearing |
| 13. Pinion rear bearing | 14. Housing spacer    |                          |

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## DIFFERENTIAL GEAR OIL

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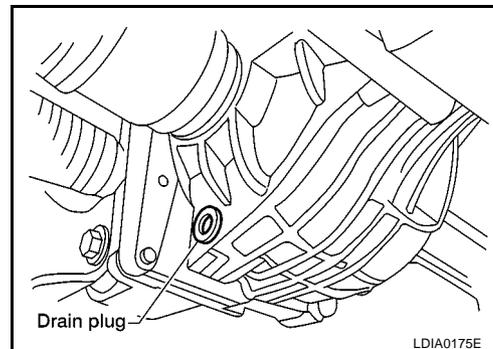
### Changing Differential Gear Oil DRAINING

EDS00351

1. Stop the engine.
2. Remove the drain plug and gasket. Drain the gear oil.
3. Install the drain plug with a new gasket to the final drive assembly. Tighten to the specified torque. Refer to [FFD-17, "COMPONENTS"](#).

**CAUTION:**

**Do not reuse gasket.**



### FILLING

1. Remove the filler plug and gasket. Fill with new gear oil until the oil level reaches the specified level near the filler plug hole.

**Oil grade and Viscosity:**

Refer to [MA-14, "Fluids and Lubricants"](#).

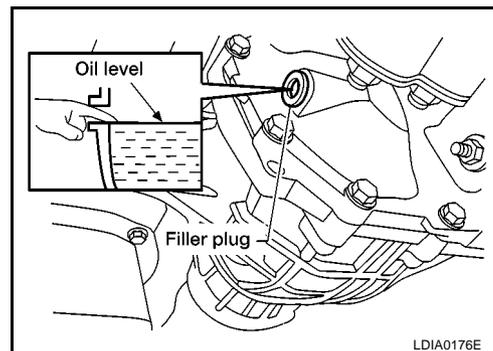
**Oil capacity:**

Approx. 0.85 l (1-1/2 Imp pt)

2. After refilling oil, check the oil level. Install the filler plug with a new gasket on it to the final drive assembly. Tighten to the specified torque. Refer to [FFD-17, "COMPONENTS"](#).

**CAUTION:**

**Do not reuse gasket.**



### Checking Differential Gear Oil OIL LEAKAGE AND OIL LEVEL

EDS00352

- Make sure that oil is not leaking from the final drive assembly or around it.
- Check oil level from the filler plug hole as shown.

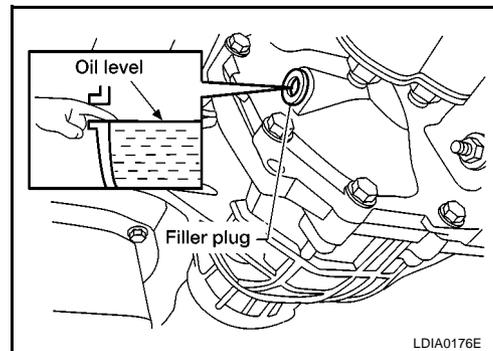
**CAUTION:**

**Do not start engine while checking oil level.**

- Install the filler plug with a new gasket on it to the final drive assembly. Tighten to the specified torque. Refer to [FFD-17, "COMPONENTS"](#).

**CAUTION:**

**Do not reuse gasket.**



# FRONT OIL SEAL

## FRONT OIL SEAL

PPF:38189

### Removal and Installation

EDS00353

#### CAUTION:

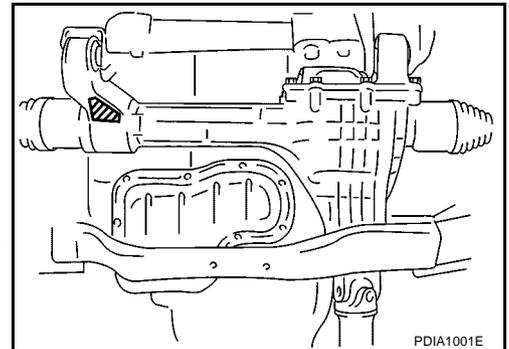
Verify identification stamp of replacement frequency put in the lower part of gear carrier to determine replacement for collapsible spacer when replacing front oil seal. Refer to [FFD-9, "IDENTIFICATION STAMP OF REPLACEMENT FREQUENCY OF FRONT OIL SEAL"](#) . If necessary collapsible spacer replacement, remove final drive assembly and disassemble it to replace front oil seal and collapsible spacer. Refer to [FFD-15, "Removal and Installation"](#) and [FFD-17, "Disassembly and Assembly"](#) .

#### NOTE:

The reuse of collapsible spacer is prohibited in principle. However, it is reusable on a one-time basis only in cases when replacing front oil seal.

### IDENTIFICATION STAMP OF REPLACEMENT FREQUENCY OF FRONT OIL SEAL

- The diagonally shaded area in the figure shows stamping point for replacement frequency of front oil seal.
- The following table shows if collapsible spacer replacement is needed before replacing front oil seal. When collapsible spacer replacement is required, disassemble final drive assembly to replace collapsible spacer and front oil seal. Refer to [FFD-17, "Disassembly and Assembly"](#) .



Stamp	collapsible spacer replacement
No stamp	Not required
"0" or "0" on the far right of stamp	Required
"01" or "1" on the far right of stamp	Not required

#### CAUTION:

Be sure to make a stamping after replacing front oil seal.

- After replacing front oil seal, make a stamping on the stamping point in accordance with the table below in order to identify replacement frequency.

#### CAUTION:

Stamping shall be made from left to right.

Stamp before stamping	Stamping on the far right	Stamping
No stamp	0	0
"0" (Front oil seal was replaced once.)	1	01
"01" (Collapsible spacer and front oil seal were replaced last time.)	0	010
"0" is on the far right. (Only front oil seal was replaced last time.)	1	...01
"1" is on the far right. (Collapsible spacer and front oil seal were replaced last time.)	0	...010

### REMOVAL

- Drain gear oil. Refer to [FFD-8, "DRAINING"](#) .
- Make a judgment if a collapsible spacer replacement is required. Refer to [FFD-9, "IDENTIFICATION STAMP OF REPLACEMENT FREQUENCY OF FRONT OIL SEAL"](#) .
- Remove the front wheels and tires using power tool.
- Without disassembling the hydraulic lines, remove the caliper torque member bolts using power tool. Then reposition the brake caliper aside using suitable wire. Refer to [BR-26, "Removal and Installation of Brake Caliper Assembly"](#) .

#### CAUTION:

Do not press the brake pedal while brake caliper is removed.

- Remove the ABS sensor harness from the mount on the knuckle.

# FRONT OIL SEAL

**CAUTION:**

**Do not pull on the ABS sensor harness.**

- Support the lower link using a suitable jack.
- Separate the upper link ball joint stud from the steering knuckle using Tool.

**Tool number : ST29020001**

**CAUTION:**

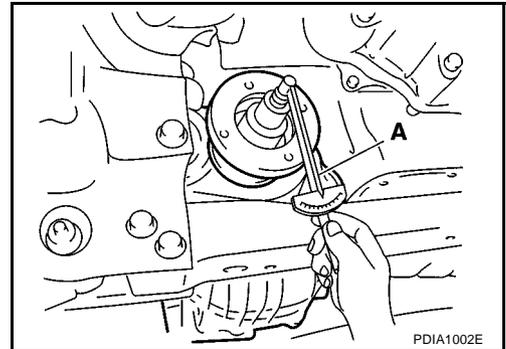
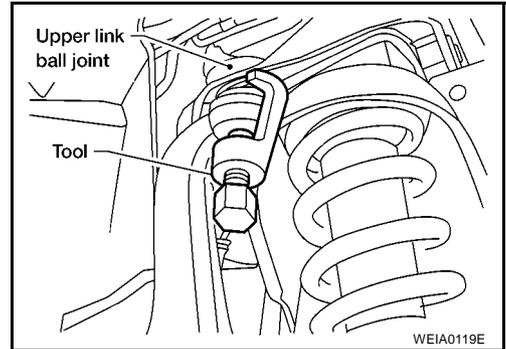
**Support the lower link using a jack.**

- Remove the engine under cover rear using power tool.
- Remove the RH and LH drive shafts from the front final drive using suitable tool.
- Remove the front propeller shaft. Refer to [PR-4, "Removal and Installation"](#).
- Measure the total preload with the preload gauge.

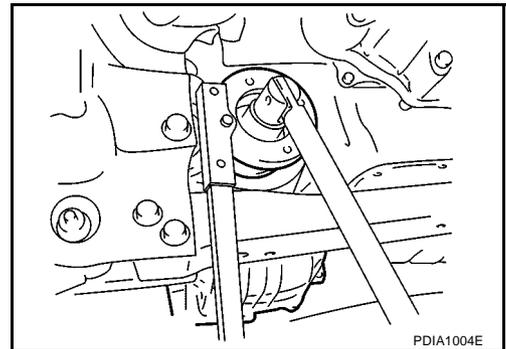
**Tool number A: ST3127S000**

**NOTE:**

**Record the preload measurement.**



- Remove the drive pinion lock nut using flange wrench.



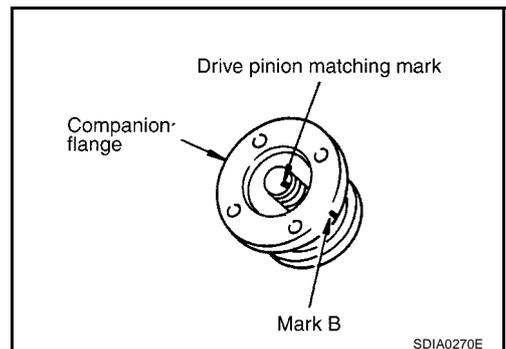
- Put a matching mark on the end of the drive pinion in line with the matching mark B on the companion flange.

**CAUTION:**

**Use paint to make the matching mark on the drive pinion. Do not damage the companion flange or drive pinion.**

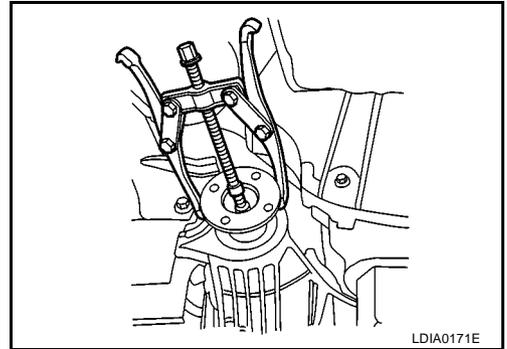
**NOTE:**

The matching mark B on the final drive companion flange indicates the maximum vertical runout position.



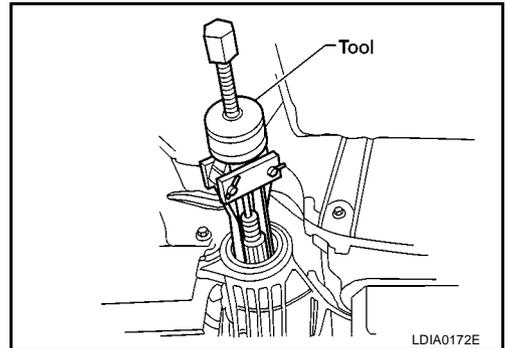
# FRONT OIL SEAL

14. Remove the companion flange using suitable tool.



15. Remove the front oil seal using Tool.

**Tool number : KV381054S0**



## INSTALLATION

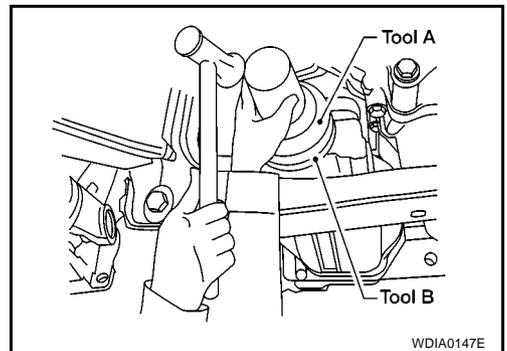
1. Drive the front oil seal in evenly using Tools.

**Tool number A: ST30720000**

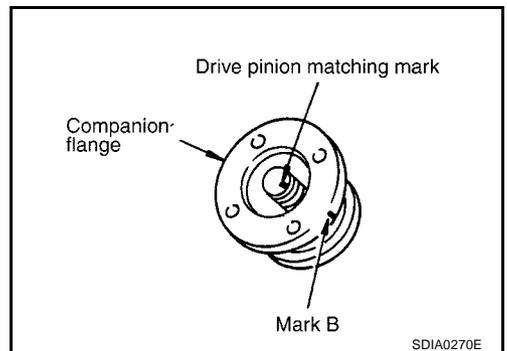
**B: ST27863000**

### CAUTION:

- Do not reuse oil seal.
- Do not incline oil seal when Installing.
- Apply multi-purpose grease onto oil seal lips and gear oil onto the circumference of oil seal.



2. Align the matching mark of the drive pinion with the matching mark B of the companion flange, then install the companion flange.



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## FRONT OIL SEAL

3. Apply anti-corrosion oil to the thread and seat of new drive pinion lock nut, and temporarily tighten drive pinion lock nut to drive pinion.

**CAUTION:**

**Do not reuse drive pinion lock nut.**

4. Tighten to drive pinion lock nut, while adjust total preload torque.

**Tool number A: ST3127S000**

**Drive pinion lock nut tightening torque:**

**186 - 294 N·m (19 - 29 kg·m, 138 - 216 ft·lb)**

**Total preload torque:**

**Total preload torque should equal the measurement taken during removal plus an additional 0.1 - 0.4 N·m (0.01 - 0.04 kg·m, 1 - 3 in·lb).**

**CAUTION:**

- Adjust to the lower limit of the drive pinion lock nut tightening torque first.
- If the preload torque exceeds the specified value, replace collapsible spacer and tighten it again to adjust. Do not loosen drive pinion lock nut to adjust the preload torque.

5. Make a stamping for identification of front oil seal replacement frequency. Refer to [FFD-9, "IDENTIFICATION STAMP OF REPLACEMENT FREQUENCY OF FRONT OIL SEAL"](#).

**CAUTION:**

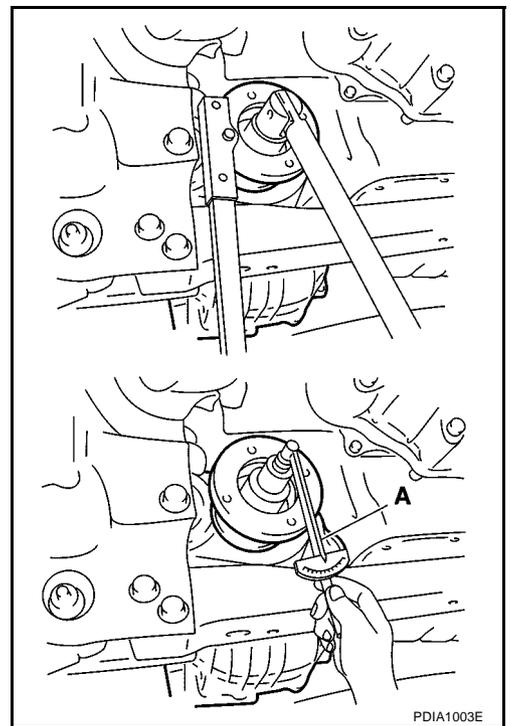
**Be sure to make a stamping after replacing front oil seal.**

6. Install the front propeller shaft. Refer to [PR-5, "INSTALLATION"](#).
7. Install the RH and LH drive shafts. Refer to [FAX-7, "DRIVE SHAFT"](#).

**CAUTION:**

**Do not reuse the front final drive side oil seals.**

8. Install the engine under cover rear. Refer to [FFD-15, "Removal and Installation"](#).
9. Tighten the upper link ball joint stud nut to specifications. Refer to [FSU-6, "Components"](#).
10. Install the ABS sensor harness.
11. Install the brake caliper.
12. Tighten the front wheel nuts to specification. Refer to [WT-5, "Rotation"](#).
13. Refill gear oil to the final drive and check oil level. Refer to [FFD-8, "FILLING"](#).
14. Check the final drive for oil leakage. Refer to [FFD-8, "OIL LEAKAGE AND OIL LEVEL"](#).



## SIDE OIL SEAL

PPF:33142

### Removal and Installation REMOVAL

EDS00354

1. Remove the front wheels and tires using power tool.
2. Without disassembling the hydraulic lines, remove the caliper torque member bolts using power tool. Then reposition the brake caliper aside using suitable wire. Refer to [BR-26, "Removal and Installation of Brake Caliper Assembly"](#).

**CAUTION:**

**Do not press the brake pedal while brake caliper is removed.**

3. Remove the ABS sensor harness from the mount on the knuckle.

**CAUTION:**

**Do not pull on the ABS sensor harness.**

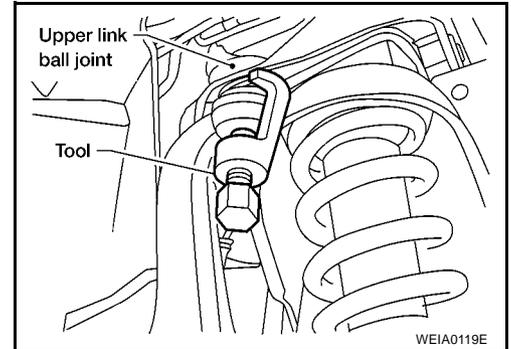
4. Support the lower link using a suitable jack.
5. Separate the upper link ball joint stud from the steering knuckle using Tool.

**Tool number : ST29020001**

**CAUTION:**

**Support the lower link using jack.**

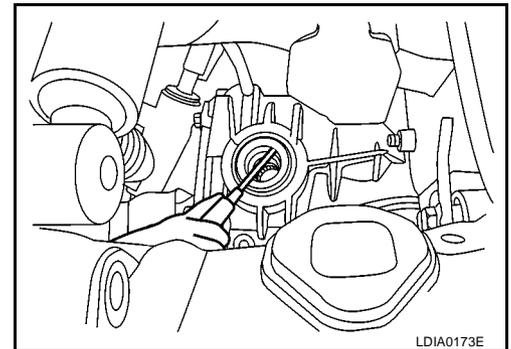
6. Remove the engine under cover rear using power tool.
7. Remove the RH and LH drive shafts from the front final drive using suitable tool.



8. Remove the side oil seal using suitable tool.

**CAUTION:**

**Be careful not to damage gear carrier.**



### INSTALLATION

Installation is the reverse order of removal.

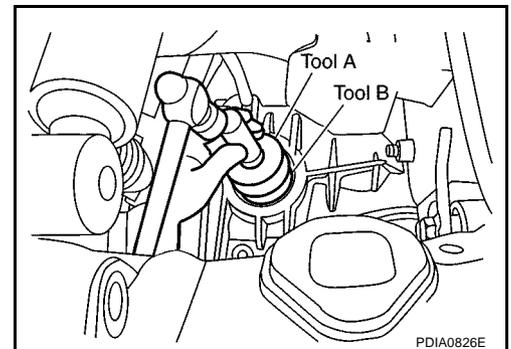
- Drive the side oil seal in evenly until it becomes flush with the case end using Tools.

**Tool number A: ST30720000**

**B: ST27863000**

**CAUTION:**

- Do not reuse oil seal.
- Do not incline oil seal when installing.
- Apply multi-purpose grease onto oil seal lips and gear oil onto the circumference of oil seal.
- When installing the drive shaft assembly into the front final drive assembly, do not damage the side oil seal.
- Check the final drive gear oil level. Refer to [FFD-8, "Checking Differential Gear Oil"](#).
- Tighten the upper link ball joint stud nut to specifications. Refer to [FSU-6, "Components"](#).
- Tighten the wheel nuts to specification. Refer to [WT-5, "Rotation"](#).



# REAR COVER GASKET

PFP:38320

## REAR COVER GASKET

### Removal and Installation

EDS00355

#### REMOVAL

1. Remove front final drive. Refer to [FFD-15, "Removal and Installation"](#) .
2. Remove the rear cover bolts, then remove the rear cover from the gear carrier.

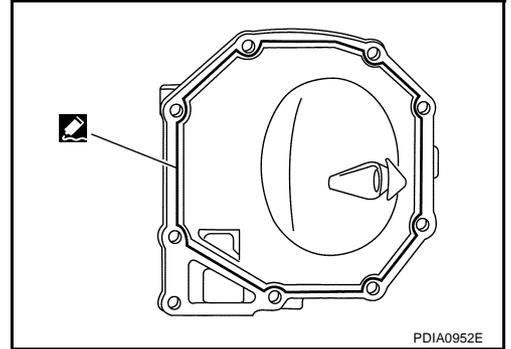
#### INSTALLATION

1. Apply a 3 mm (0.12 in) bead of sealant to the mating surface of the rear cover.

**CAUTION:**

**Remove any old sealant adhering to the mating surfaces. Also remove any moisture, oil, or foreign material adhering to the application and mating surfaces.**

2. Install the rear cover to the gear carrier. Tighten the bolts to the specified torque. Refer to [FFD-17, "COMPONENTS"](#) .
3. Install the front final drive assembly. Refer to [FFD-15, "Removal and Installation"](#) .
4. Fill the final drive with recommended gear oil. Refer to [FFD-8, "Checking Differential Gear Oil"](#) .



# FRONT FINAL DRIVE ASSEMBLY

PFP:38500

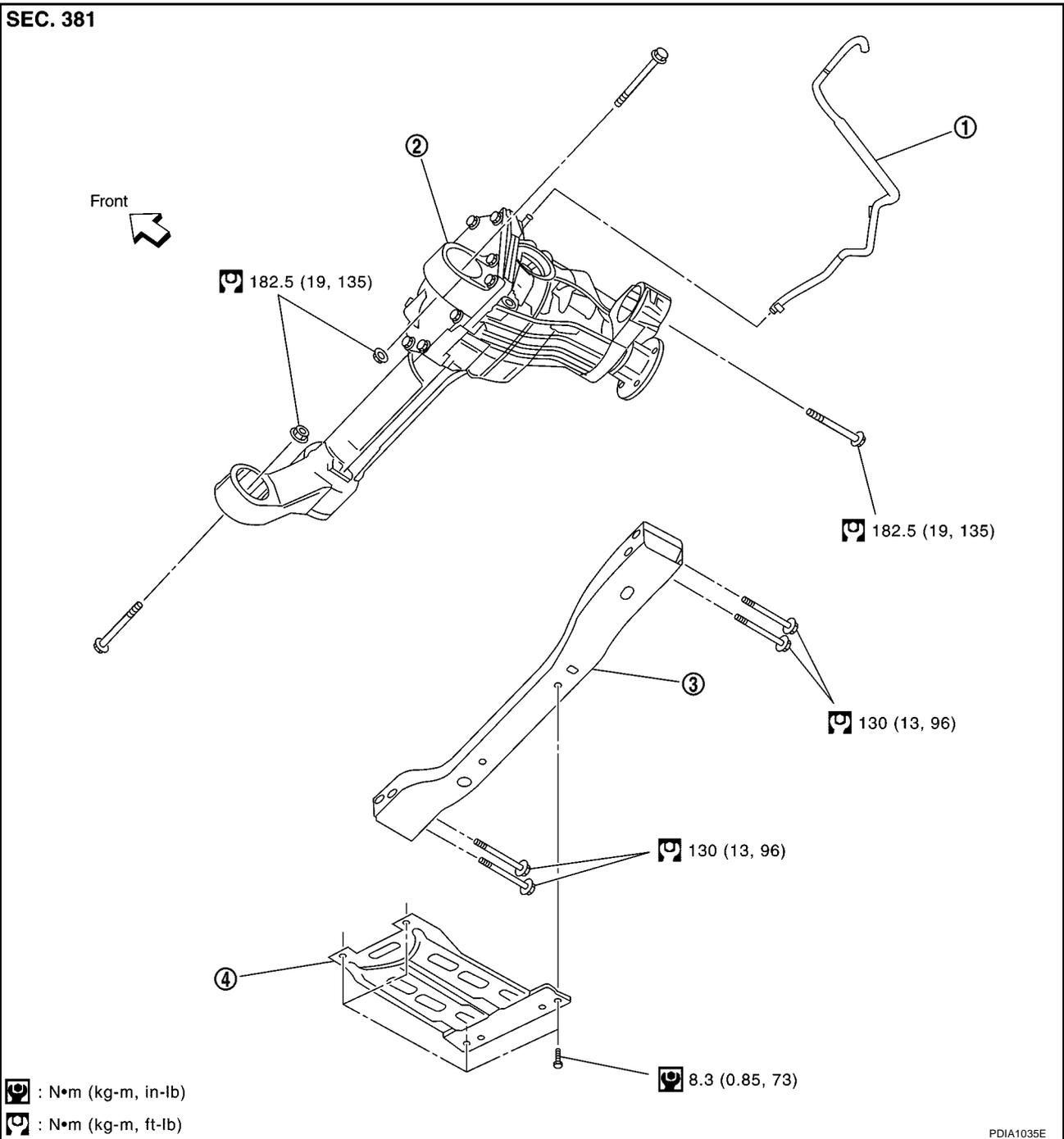
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## FRONT FINAL DRIVE ASSEMBLY

### Removal and Installation

EDS00356

SEC. 381



1. Breather hose
2. Front final drive assembly
3. Front crossmember
4. Engine under cover rear

### REMOVAL

1. Remove the front wheels and tires using power tool.
2. Without disassembling the hydraulic lines, remove the caliper torque member bolts using power tool. Then reposition the brake caliper aside using suitable wire. Refer to [BR-26, "Removal and Installation of Brake Caliper Assembly"](#).

#### CAUTION:

**Do not press the brake pedal while brake caliper is removed.**

3. Remove the ABS sensor harness from the mount on the knuckle.

# FRONT FINAL DRIVE ASSEMBLY

## CAUTION:

**Do not pull on the ABS sensor harness.**

- Support the lower link using a suitable jack.
- Separate the upper link ball joint stud from the steering knuckle using Tool.

**Tool number : ST29020001**

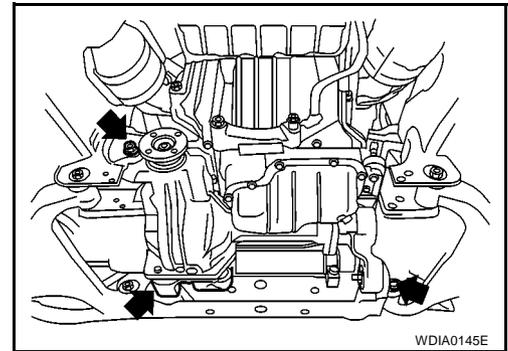
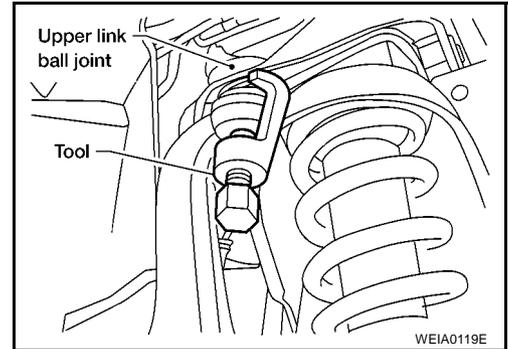
## CAUTION:

**Support the lower link using a jack.**

- Remove the engine under cover rear using power tool.
- Drain the front final drive fluid. Refer to [FFD-8, "Changing Differential Gear Oil"](#).
- Remove the RH and LH drive shafts from the front final drive using suitable tool.
- Remove the front crossmember.
- Disconnect the front propeller shaft from the front final drive. Then reposition the front propeller shaft aside using suitable wire. Refer to [PR-4, "Removal and Installation"](#).
- Disconnect the vent hose from the front final drive.
- Support the front final drive using a suitable jack.
- Remove the front final drive bolts, then remove the front final drive assembly.

## CAUTION:

**Secure rear the front final drive assembly to a suitable jack while removed it.**



## INSTALLATION

Installation is the reverse order of removal.

- Install new side oil seals into the front final drive assembly. Refer to [FFD-13, "Removal and Installation"](#).
- CAUTION:**
  - When installing the drive shaft assembly into the front final drive assembly, do not damage the side oil seal.
  - Make sure there are no pinched or restricted areas on the breather hose caused by bending or winding when installing it.
  - Fill the final drive with recommended gear oil after installation. Refer to [FFD-8, "Changing Differential Gear Oil"](#).
- Tighten the upper link ball joint stud nut to specifications. Refer to [FSU-6, "Components"](#).
- Tighten the wheel nuts to specification. Refer to [WT-5, "Rotation"](#).

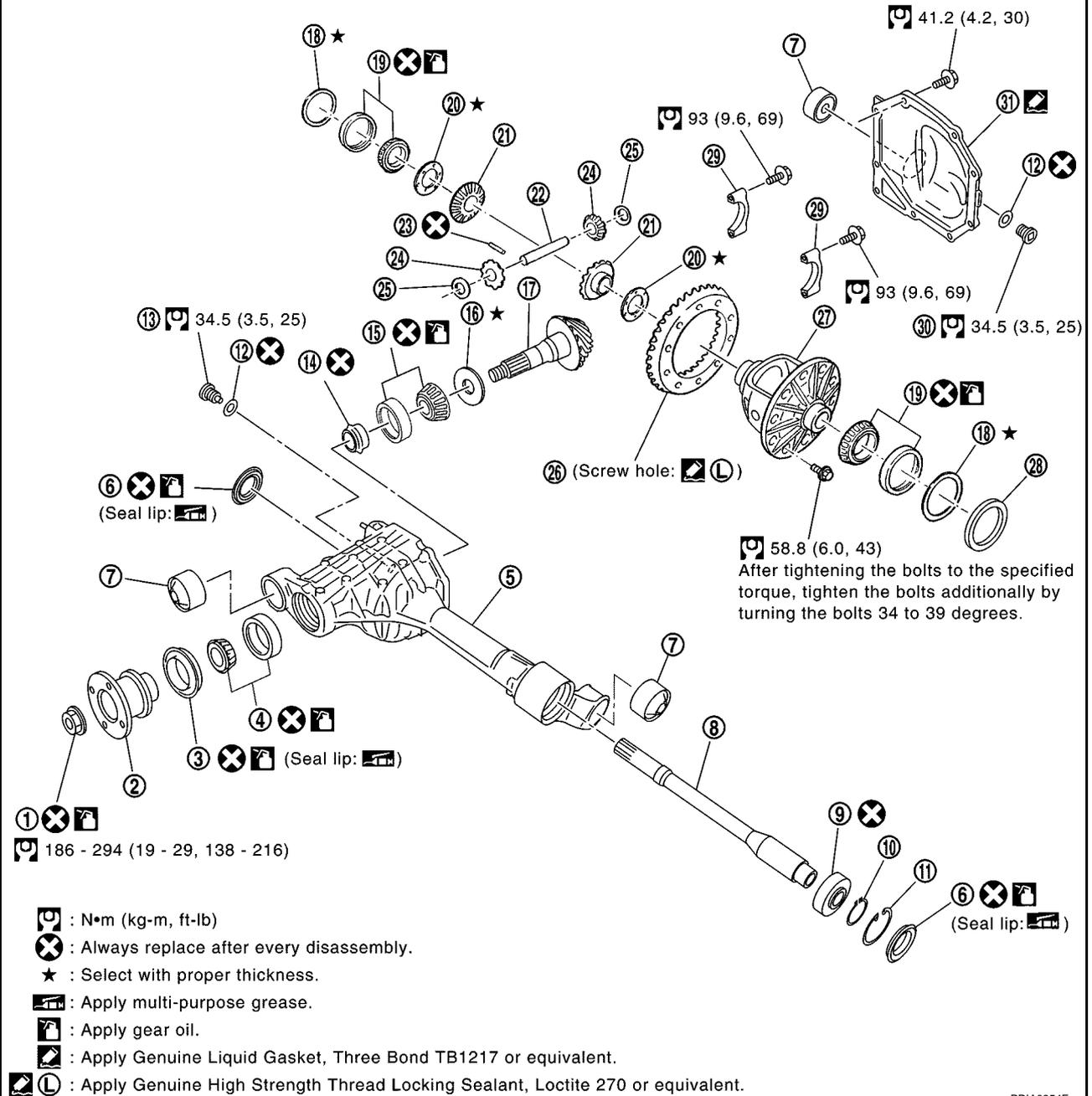
# FRONT FINAL DRIVE ASSEMBLY

EDS00357

## Disassembly and Assembly COMPONENTS

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- |                                    |                             |                                   |
|------------------------------------|-----------------------------|-----------------------------------|
| 1. Drive pinion lock nut           | 2. Companion flange         | 3. Front oil seal                 |
| 4. Pinion front bearing            | 5. Gear carrier             | 6. Side oil seal                  |
| 7. Bushing                         | 8. Side shaft               | 9. Side shaft bearing             |
| 10. Snap ring                      | 11. Snap ring               | 12. Gasket                        |
| 13. Drain plug                     | 14. Collapsible spacer      | 15. Pinion rear bearing           |
| 16. Pinion height adjusting washer | 17. Drive pinion            | 18. Side bearing adjusting washer |
| 19. Side bearing                   | 20. Side gear thrust washer | 21. Side gear                     |
| 22. Pinion mate shaft              | 23. Lock pin                | 24. Pinion mate gear              |
| 25. Pinion mate thrust washer      | 26. Drive gear              | 27. Differential case             |
| 28. Housing spacer                 | 29. Bearing cap             | 30. Filler plug                   |
| 31. Rear cover                     |                             |                                   |

# FRONT FINAL DRIVE ASSEMBLY

## ASSEMBLY INSPECTION AND ADJUSTMENT

- Before inspection and adjustment, drain gear oil.

### Total Preload Torque

1. Rotate drive pinion back and forth 2 to 3 times to check for unusual noise and rotation malfunction.
2. Rotate drive pinion at least 20 times to check for smooth operation of the bearing.
3. Measure total preload using Tool.

**Tool number : ST3127S000**

**Total preload torque:**

**1.67 - 2.74 N·m (0.17 - 0.27 kg·m, 15 - 24 in·lb)**

#### NOTE:

**Total preload torque = Pinion bearing preload torque + Side bearing preload torque**

- If measured value is out of the specification, disassemble it to check and adjust each part. Adjust the pinion bearing preload and side bearing preload. Adjust the pinion bearing preload first, then adjust the side bearing preload.

#### When the preload torque is greater than specification

**On pinion bearings: Replace the collapsible spacer.**

**On side bearings: Use thinner side bearing adjusting washers by the same amount to each side. Refer to [FFD-38, "Side Bearing Adjusting Washer"](#) .**

#### When the preload torque is less than specification

**On pinion bearings: Tighten the drive pinion nut.**

**On side bearings: Use thicker side bearing adjusting washers by the same amount to each side. Refer to [FFD-38, "Side Bearing Adjusting Washer"](#) .**

#### CAUTION:

**Select a side bearing adjusting washer for right and left individually.**

### Drive Gear Runout

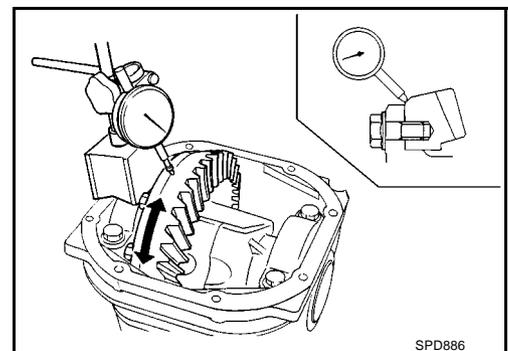
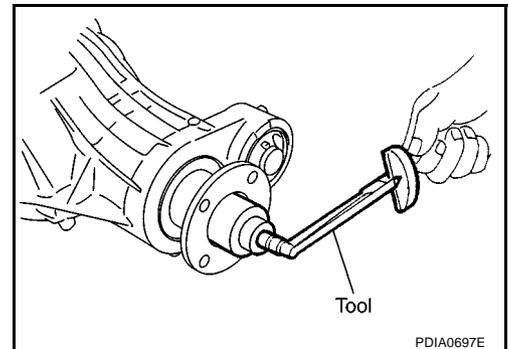
1. Remove rear cover. Refer to [FFD-22, "Differential Assembly"](#) .
2. Fit a dial indicator to the drive gear back face.
3. Rotate the drive gear to measure runout.

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

- If the runout is outside of the repair limit, check drive gear assembly condition; foreign material may be caught between drive gear and differential case, or differential case or drive gear may be deformed.

#### CAUTION:

**Replace drive gear and drive pinion gear as a set.**



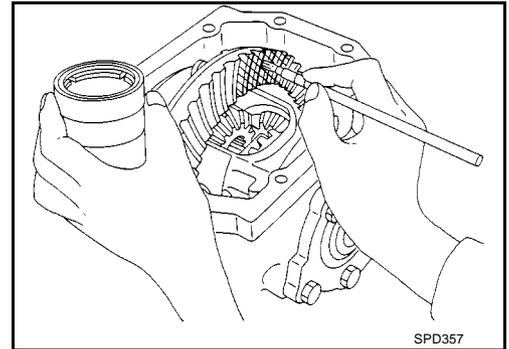
# FRONT FINAL DRIVE ASSEMBLY

## Tooth Contact

1. Remove rear cover. Refer to [FFD-22, "Differential Assembly"](#) .
2. Apply red lead to drive gear.

**CAUTION:**

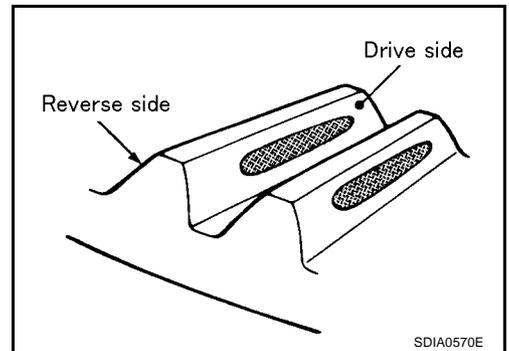
Apply red lead to both the faces of 3 to 4 gears at 4 locations evenly spaced on drive gear.



3. Rotate drive gear back and forth several times, check drive pinion gear to drive gear tooth contact.

**CAUTION:**

Check tooth contact on drive side and reverse side.



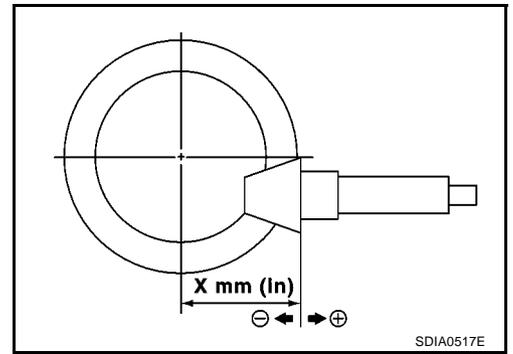
Tooth contact condition		Drive pinion adjusting shim selection value [mm (in)]	Adjustment (Yes/No)	Possible cause
Drive side	Back side			
Heel side      Toe side 	Toe side      Heel side 	↑ Thicker	Yes	Occurrence of noise and scoring sound in all speed ranges.
				+0.09 (+0.0035)
			+0.06 (+0.0024)	No
		+0.03 (+0.0012)		
		0		
		↓ Thinner	Yes	Occurrence of noise at constant speed and decreasing speed.
			-0.06 (-0.0024)	Yes
		-0.09 (-0.0035)		

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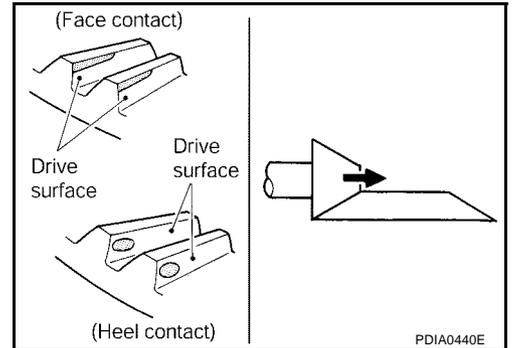
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## FRONT FINAL DRIVE ASSEMBLY

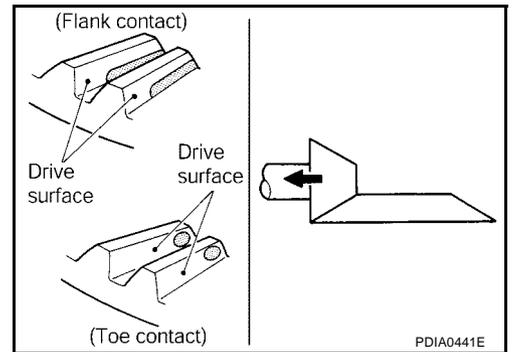
4. If tooth contact is improperly adjusted, follow the procedure below to adjust the pinion height (dimension X).



- If the tooth contact is near the face (face contact), or near the heel (heel contact), thicken pinion height adjusting washers to move drive pinion closer to drive gear. Refer to [FFD-38, "Pinion Height Adjusting Washer"](#) .



- If the tooth contact is near the flank (flank contact), or near the toe (toe contact), thin pinion height adjusting washers to move drive pinion farther from drive gear. Refer to [FFD-38, "Pinion Height Adjusting Washer"](#) .



### Backlash

1. Remove rear cover. Refer to [FFD-22, "Differential Assembly"](#) .
2. Fit a dial indicator to the drive gear face to measure the backlash.

**Backlash: 0.10 - 0.15 mm (0.0039 - 0.0059 in)**

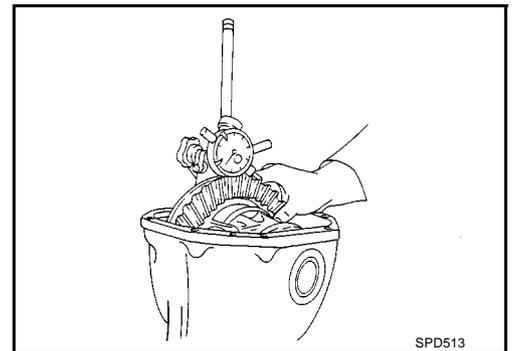
- If the backlash is outside of the specified value, change the thickness of side bearing adjusting washer.

**When the backlash is greater than specification:**

**Make drive gear back side adjusting washer thicker, and drive gear tooth side adjusting washer thinner by the same amount. Refer to [FFD-38, "Side Bearing Adjusting Washer"](#) .**

**When the backlash is less than specification:**

**Make drive gear back side adjusting washer thinner, and drive gear tooth side adjusting washer thicker by the same amount. Refer to [FFD-38, "Side Bearing Adjusting Washer"](#) .**



### CAUTION:

Do not change the total amount of washers as it will change the bearing preload.

# FRONT FINAL DRIVE ASSEMBLY

## Companion Flange Runout

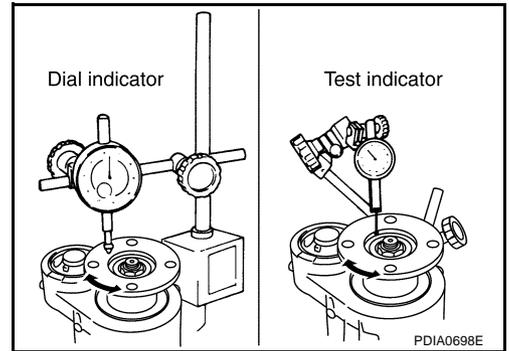
1. Fit a dial indicator onto the companion flange face (inner side of the propeller shaft bolt holes).
2. Rotate companion flange to check for runout.

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

3. Fit a test indicator to the inner side of companion flange (socket diameter).
4. Rotate companion flange to check for runout.

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

5. If the runout value is outside the runout limit, follow the procedure below to adjust.
  - a. Rotate the companion flange on the drive pinion by 90°, 180° and 270°, while checking for the position where the runout is minimum.
  - b. If the runout value is still outside of the limit after the phase has been changed, possible cause will be an assembly malfunction of drive pinion and pinion bearing or a malfunctioning pinion bearing.
  - c. If the runout value is still outside of the limit after repair of the assembly of drive pinion and pinion bearing or pinion bearing, replace the companion flange.



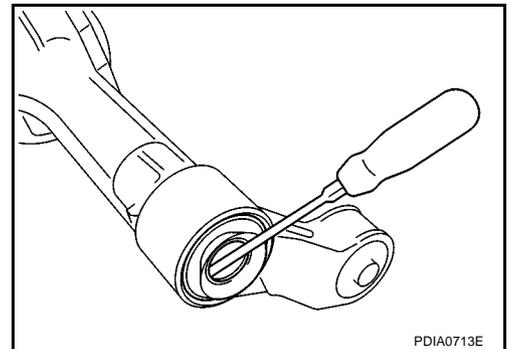
## DISASSEMBLY

### Side Shaft

1. Drain gear oil, if necessary.
2. Remove side oil seal.

**CAUTION:**  
Do not damage gear carrier.

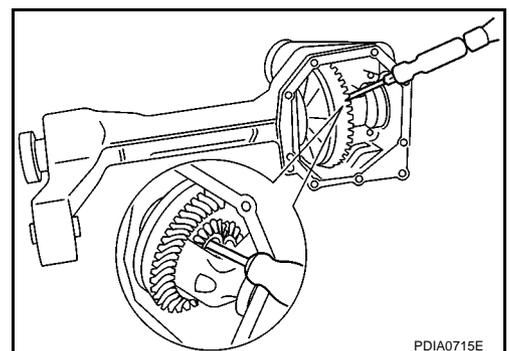
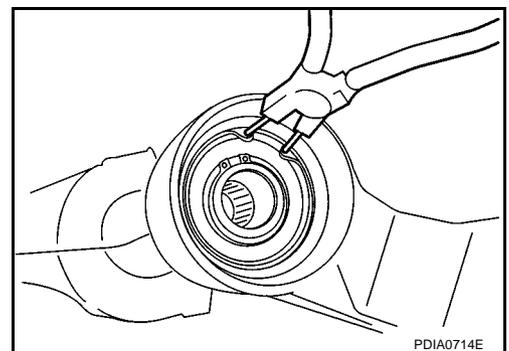
3. Remove snap ring (hole side) using suitable tool.



4. Remove side shaft assembly out of gear carrier using suitable tool.

**NOTE:**  
Tap on side shaft assembly from side gear side.

5. Remove snap ring (shaft side).

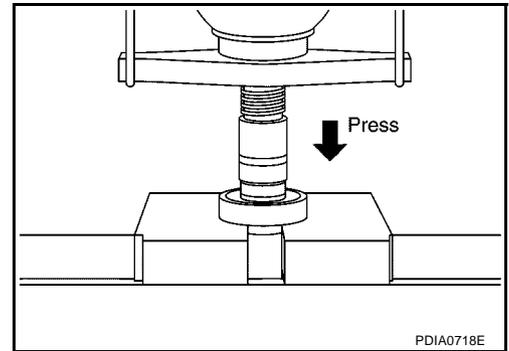


# FRONT FINAL DRIVE ASSEMBLY

6. Press side shaft out of side shaft bearing.

**CAUTION:**

Do not drop side shaft.



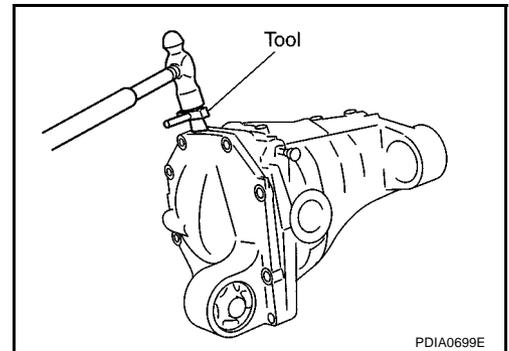
## Differential Assembly

1. Remove side shaft assembly. Refer to [FFD-35, "Side Shaft"](#).
2. Remove rear cover bolts.
3. Separate the rear cover from the gear carrier using Tool.

**Tool number : KV10111100**

**CAUTION:**

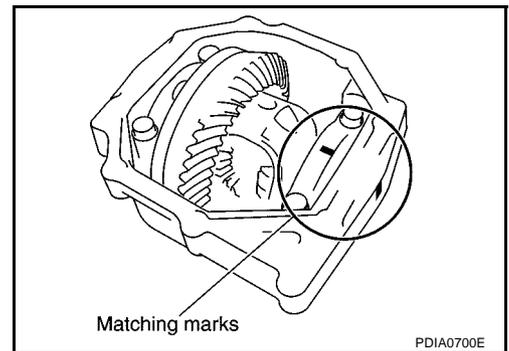
- Do not damage the mating surface.
- Do not insert flat-bladed screwdriver, this will damage the mating surface.



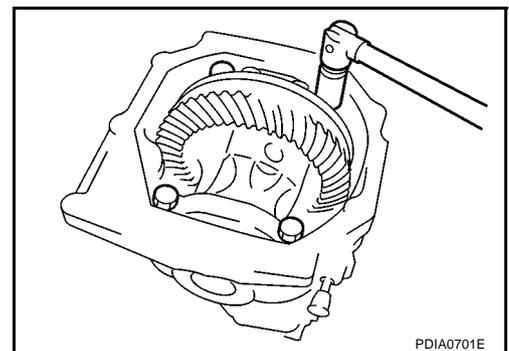
4. For proper reinstallation, paint matching marks on one side of the bearing cap.

**CAUTION:**

- For matching mark, use paint. Do not damage bearing caps and gear carrier.
- Bearing caps are line-board during manufacture. The matching marks are used to reinstall them in their original positions.

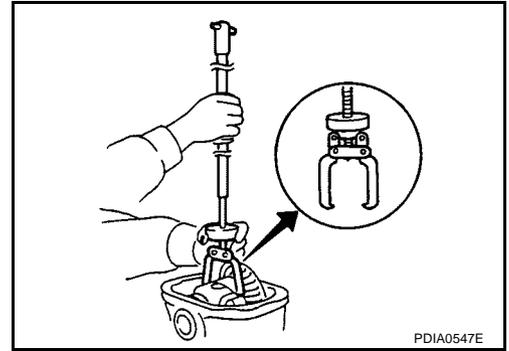


5. Remove bearing caps.



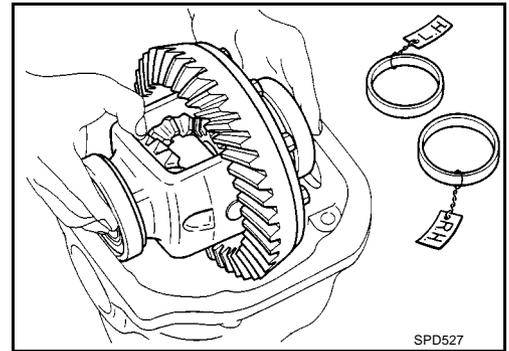
# FRONT FINAL DRIVE ASSEMBLY

6. Lift differential case assembly out using suitable tool.



**CAUTION:**

- Keep side bearing outer races together with inner race. Do not mix them up.
- Keep side bearing adjusting washers together with bearings.

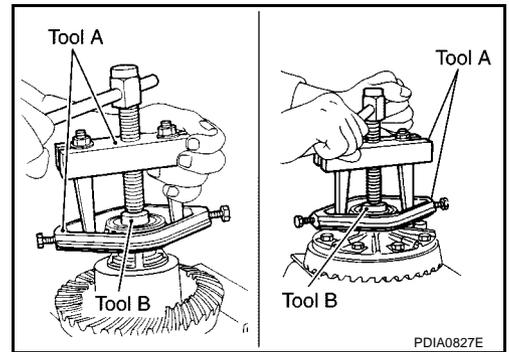


7. Remove housing spacer.  
8. Remove side bearing inner races, using Tools.

**Tool number**     **A: ST33051001**  
                              **B: ST33061000**

**CAUTION:**

- Place copper plates between the side bearing and drive gear and the vise to prevent damage.
- Do not remove side bearing inner race unless it is being replaced.



9. For proper reinstallation, paint matching mark on one side of differential case assembly.

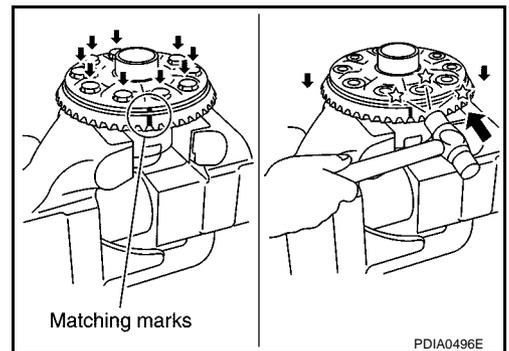
**CAUTION:**

**Use paint for matching mark. Do not damage differential case or drive gear.**

10. Remove drive gear bolts.  
11. Tap drive gear off differential case assembly using suitable tool.

**CAUTION:**

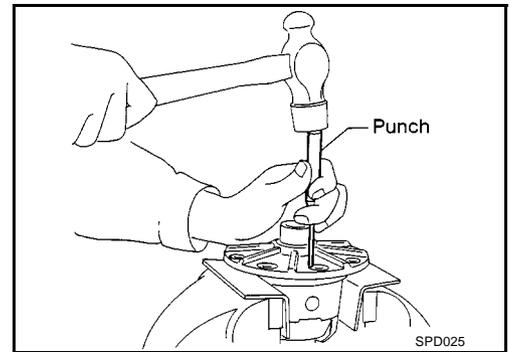
**Tap evenly all around to keep drive gear from bending.**



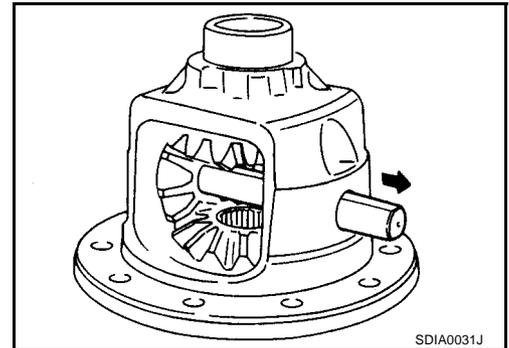
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## FRONT FINAL DRIVE ASSEMBLY

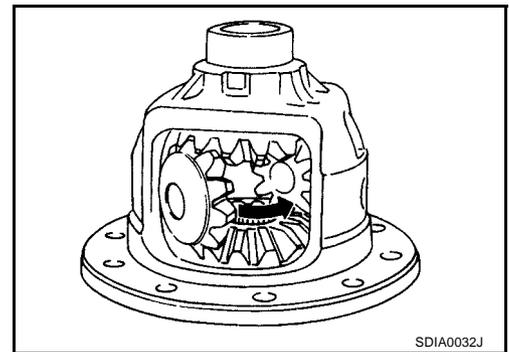
12. Remove lock pin of pinion mate shaft from drive gear side using suitable tool.



13. Remove pinion mate shaft.

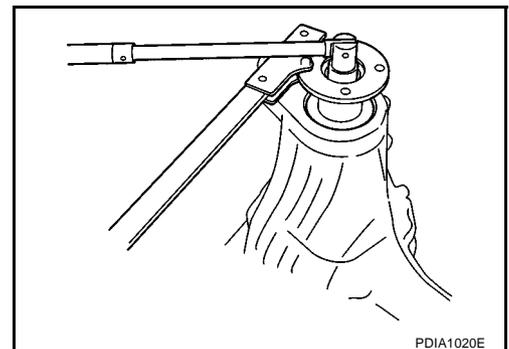


14. Turn pinion mate gear, then remove pinion mate gear, pinion mate thrust washer, side gear and side gear thrust washer from differential case.



### Drive Pinion Assembly

1. Remove side shaft assembly. Refer to [FFD-21. "Side Shaft"](#).
2. Remove differential assembly. Refer to [FFD-22. "Differential Assembly"](#).
3. Remove drive pinion lock nut using flange wrench.



# FRONT FINAL DRIVE ASSEMBLY

4. Put matching mark on the end of drive pinion. The matching mark should be in line with the matching mark A on companion flange.

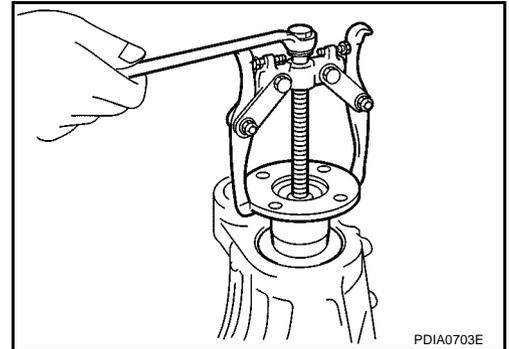
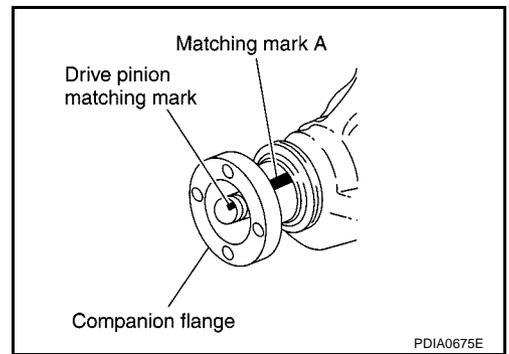
**CAUTION:**

**Use paint for matching mark. Do not damage companion flange or drive pinion.**

**NOTE:**

The matching mark A on the final drive companion flange indicates the maximum vertical runout position. When replacing companion flange, matching mark is not necessary.

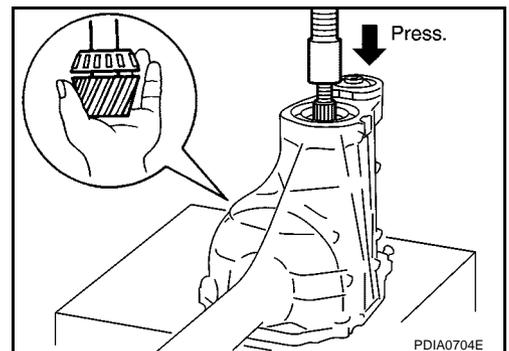
5. Remove companion flange using suitable tool.



6. Press drive pinion assembly out of gear carrier. (Together with collapsible spacer.)

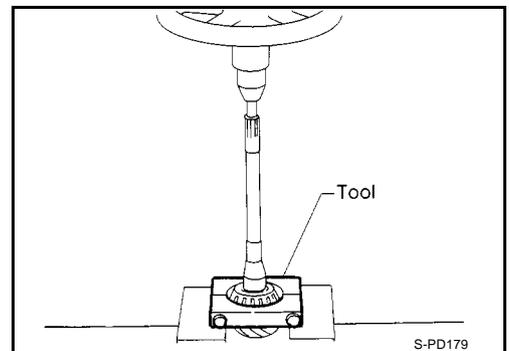
**CAUTION:**

**Do not drop drive pinion assembly.**



7. Remove pinion rear bearing inner race and drive pinion height adjusting washer using Tool.

**Tool number : ST30031000**

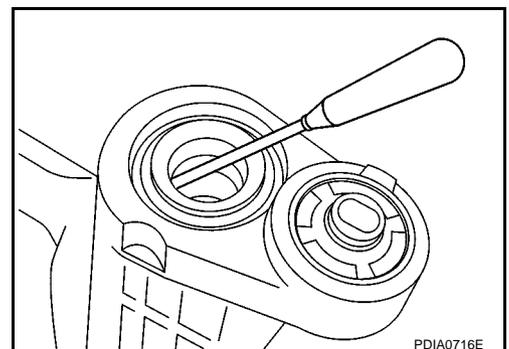


8. Remove front oil seal using suitable tool.

**CAUTION:**

**Do not damage gear carrier.**

9. Remove pinion front bearing inner race.  
10. Remove collapsible spacer.



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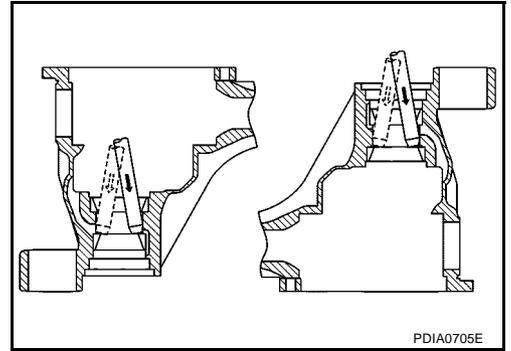
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## FRONT FINAL DRIVE ASSEMBLY

11. Tap pinion front/rear bearing outer races uniformly to remove them, using suitable tool.

**CAUTION:**

**Do not damage gear carrier.**



### INSPECTION AFTER DISASSEMBLY

Clean up the disassembled parts. Then, inspect if the parts are worn or damaged. If parts are worn or damaged, follow the measures below.

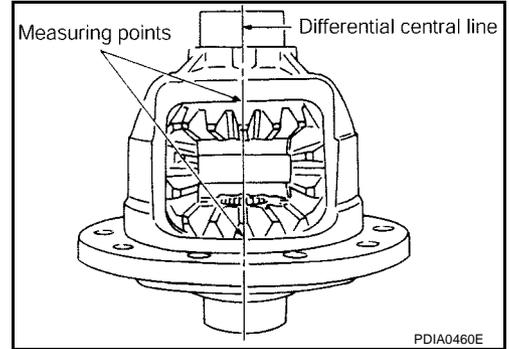
Content	Conditions and Measures
Hypoid gear	<ul style="list-style-type: none"> <li>● If the gear teeth do not mesh or line-up correctly, determine the cause and adjust or replace as necessary.</li> <li>● If the gears are worn, cracked, damaged, pitted or chipped (by friction) noticeably, replace with new drive gear and drive pinion as a set.</li> </ul>
Bearing	<ul style="list-style-type: none"> <li>● If any chipped (by friction), pitted, worn, rusted or scratched mark, or unusual noise from the bearing is observed, replace as a bearing assembly (as a new set).</li> </ul>
Side gear and Pinion mate gear	<ul style="list-style-type: none"> <li>● If any cracks or damage on the surface of the tooth is found, replace.</li> <li>● If any worn or chipped mark on the contact sides of the thrust washer is found, replace.</li> </ul>
Side gear thrust washer and pinion mate thrust washer	<ul style="list-style-type: none"> <li>● If it is chipped (by friction), damaged, or unusually worn, replace.</li> </ul>
Oil seal	<ul style="list-style-type: none"> <li>● Whenever disassembled, replace.</li> <li>● If wear, deterioration of adherence (sealing force lips), or damage is detected on the lips, replace them.</li> </ul>
Differential case	<ul style="list-style-type: none"> <li>● If any wear or crack on the contact sides of the differential case is found, replace.</li> </ul>
Companion flange	<ul style="list-style-type: none"> <li>● If any chipped mark (about 0.1 mm, 0.004 in) or other damage on the contact sides of the lips of the companion flange is found, replace.</li> </ul>

# FRONT FINAL DRIVE ASSEMBLY

## ADJUSTMENT AND SELECTION ADJUSTING WASHERS

### Differential Side Gear Clearance

- Assemble the differential parts if they are disassembled. Refer to [FFD-32, "Differential Assembly"](#).
1. Place differential case straight up so that side gear to be measured comes upward.



2. Using feeler gauge, measure the clearance between side gear back and differential case at 3 different points, while rotating side gear. Average the 3 readings, and then measure the clearance. (Measure the clearance of the other side as well.)

#### Side gear back clearance specification:

**0.1 mm (0.004 in) or less.**

**(Each gear should rotate smoothly without excessive resistance during differential motion.)**

#### CAUTION:

**To prevent side gear from tilting, insert feeler gauges with the same thickness from both sides.**

3. If the back clearance is outside the specification, use a thicker/thinner side gear thrust washer to adjust. Refer to [FFD-37, "Side Gear Thrust Washer"](#).

**When the back clearance is greater than specification:**

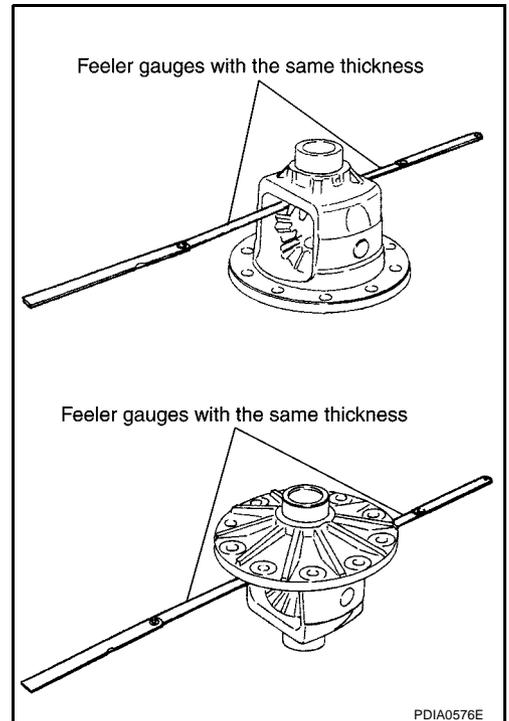
**Use a thicker thrust washer.**

**When the back clearance is less than specification:**

**Use a thinner thrust washer.**

#### CAUTION:

**Select a side gear thrust washer for right and left individually.**



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# FRONT FINAL DRIVE ASSEMBLY

## Pinion Gear Height

If the hypoid gear set has been replaced, select the pinion height adjusting washer.

1. Use the formula below to calculate pinion height adjusting washer thickness.

**Washer selection equation:**

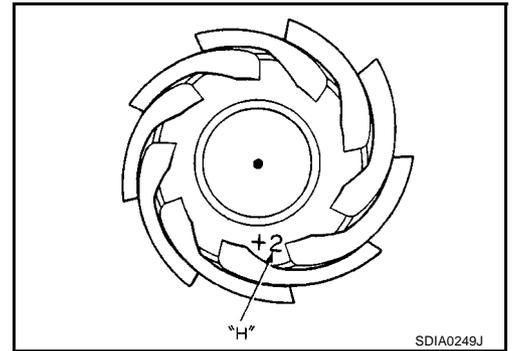
$$T = T_0 + (t_1 - t_2)$$

**T:** Correct washer thickness

**T<sub>0</sub>:** Removed washer thickness

**t<sub>1</sub>:** Old drive pinion head letter "H × 0.01"  
("H": machined tolerance 1/100 mm × 100)

**t<sub>2</sub>:** New drive pinion head letter "H × 0.01"  
("H": machined tolerance 1/100 mm × 100)



**Example:**

$$T = 3.21 + [(2 \times 0.01) - (-1 \times 0.01)] = 3.24$$

**T<sub>0</sub>:** 3.21

**t<sub>1</sub>:** +2

**t<sub>2</sub>:** -1

2. Select the proper pinion height adjusting washer. Refer to [FFD-38, "Pinion Height Adjusting Washer"](#). 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**

## ASSEMBLY

### Drive Pinion Assembly

1. Install front and rear bearing outer races using Tools.

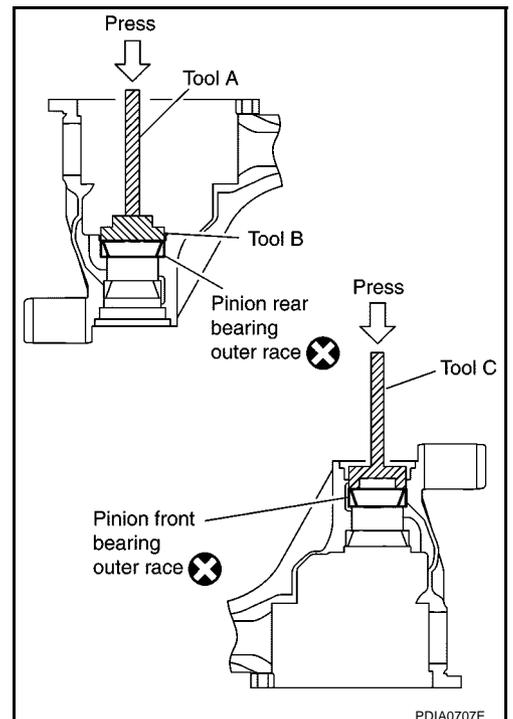
**Tool number**      **A: ST30611000**

**B: ST30613000**

**C: KV38100200**

#### **CAUTION:**

- First tap the bearing outer race until it becomes flat to the gear carrier.
- Do not reuse pinion front and rear bearing outer race.



# FRONT FINAL DRIVE ASSEMBLY

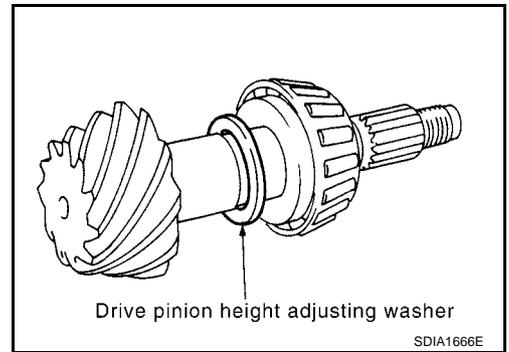
2. Temporarily install pinion height adjusting washer.

**When hypoid gear set has been replaced**

- Select pinion height adjusting washer. Refer to [FFD-28, "Pinion Gear Height"](#).

**When hypoid gear set has been reused**

- Temporarily install the removed pinion height adjusting washer or same thickness washer to drive pinion.



3. Install selected pinion height adjusting washer to drive pinion. Press pinion rear bearing inner race to it using Tool.

**Tool number : ST30901000**

**CAUTION:**

- Pay attention to the direction of pinion height adjusting washer. (Assemble as shown in the figure.)
- Do not reuse pinion rear bearing inner race.

4. After checking and adjusting the tooth contact and backlash of the hypoid gear following the procedure below.

- a. Apply gear oil to the drive pinion rear bearing, and assemble the drive pinion to the gear carrier.

**CAUTION:**

**Do not assemble a collapsible spacer.**

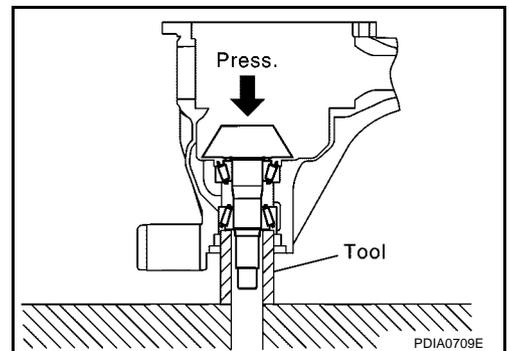
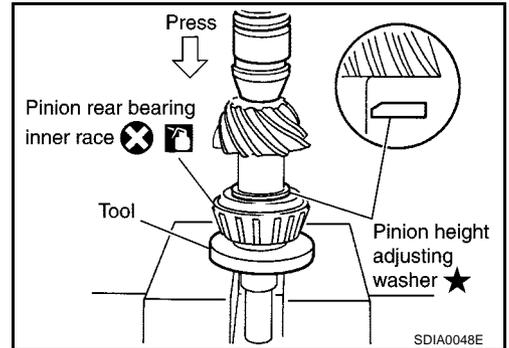
- b. Apply gear oil to drive pinion front bearing, and assemble pinion front bearing inner race to drive pinion.

**CAUTION:**

**Do not reuse pinion front bearing inner race.**

- c. Press the pinion front bearing inner race to drive pinion as far as drive pinion lock nut can be tightened using drift.

**Tool number : ST33200000**



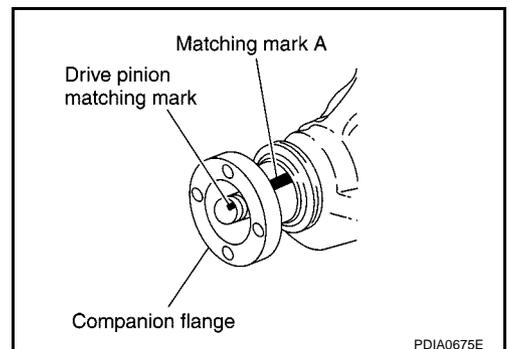
- d. Install companion flange.

**CAUTION:**

**Do not assemble a front oil seal.**

**NOTE:**

When reusing drive pinion, align the matching mark of drive pinion with the matching mark A of companion flange, then install companion flange.



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## FRONT FINAL DRIVE ASSEMBLY

- e. Temporarily tighten removed drive pinon nut to drive pinion.

**NOTE:**

Use removed drive pinon nut only for the preload measurement.

- f. Adjust the drive pinion lock nut tightening torque and pinion bearing preload torque using Tool.

**Tool number A: ST3127S000**

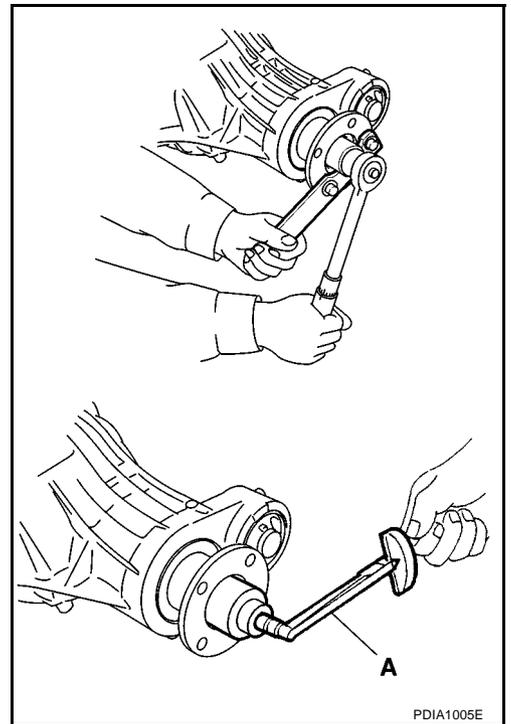
**Drive pinion bearing preload:**

**1.08 - 1.66 N-m (0.11 - 0.16 kg-m, 10 - 14 in-lb)**

**CAUTION:**

**Drive pinon nut is tightened with no collapsible spacer. Be careful not to overtighten it. While measuring the preload, tighten it by 5° to 10°.**

- g. Apply gear oil to side bearings, and install new side bearing adjusting washer with the same thickness or re-install the old ones to the same mounting position they were in prior to disassembly. Install differential case assembly to gear carrier.



- h. Align matching mark on bearing cap with that on gear carrier.  
i. Check and adjust the tooth contact. Refer to [FFD-19, "Tooth Contact"](#) .  
j. Check and adjust the backlash. Refer to [FFD-20, "Backlash"](#) .  
k. Remove bearing caps.  
l. Lift differential case assembly out using suitable tool.

**CAUTION:**

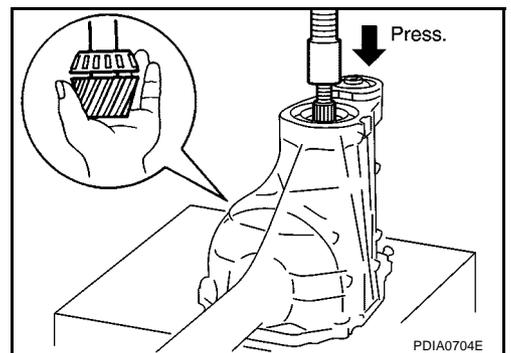
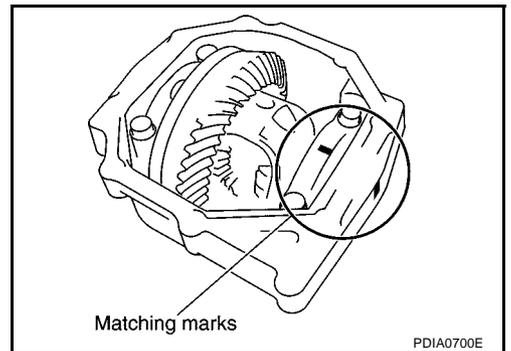
- **Keep side bearing outer races together with inner race. Do not mix them up.**
- **Keep side bearing adjusting washers together with bearings.**

- m. Remove companion flange.  
n. Press drive pinion assembly out of gear carrier. (Together with collapsible spacer.)

**CAUTION:**

**Do not drop drive pinion assembly.**

- o. Remove pinion front bearing inner race.



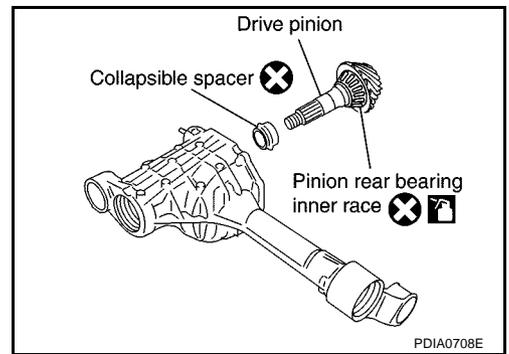
# FRONT FINAL DRIVE ASSEMBLY

5. Assemble collapsible spacer to drive pinion.

**CAUTION:**

**Do not reuse collapsible spacer.**

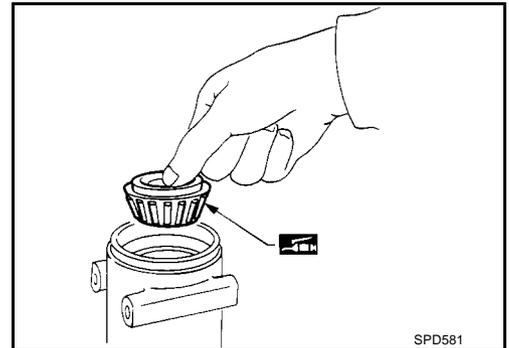
6. Apply gear oil to pinion rear bearing, and assemble drive pinion into gear carrier.



7. Apply gear oil to pinion front bearing, and assemble pinion front bearing inner race to drive pinion assembly.

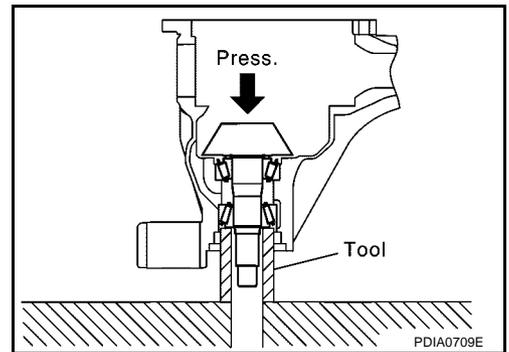
**CAUTION:**

**Do not reuse pinion front bearing inner race.**



8. Press the pinion front bearing inner race to drive pinion as far as drive pinion lock nut can be tightened using Tool.

**Tool number : ST33200000**



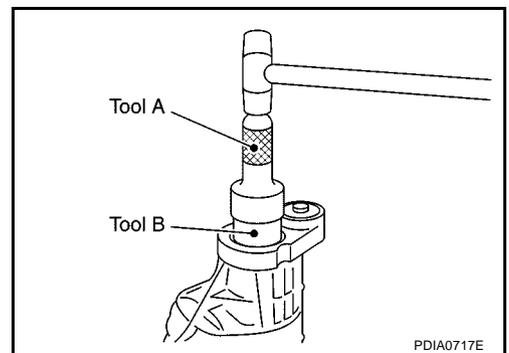
9. Install front oil seal until it becomes flush with the case end using Tools.

**Tool number A: ST30720000**

**B: ST27863000**

**CAUTION:**

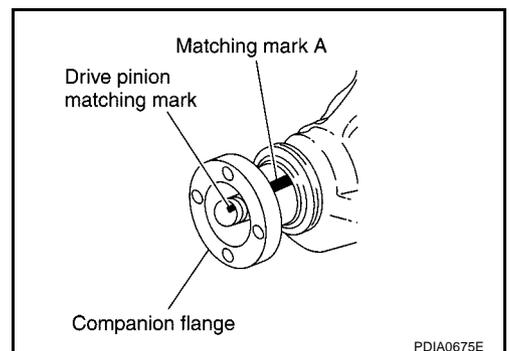
- Do not reuse oil seal.
- Do not incline oil seal when installing.
- Apply multi-purpose grease onto oil seal lips, and gear oil onto the circumference of oil seal.



10. Install companion flange.

**NOTE:**

When reusing drive pinion, align the matching mark of drive pinion with the matching mark A of companion flange, then install companion flange.



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## FRONT FINAL DRIVE ASSEMBLY

11. Apply anti-corrosive oil to the thread and seat of drive pinion lock nut, and temporarily tighten drive pinion lock nut to drive pinion.

**CAUTION:**

**Do not reuse drive pinion lock nut.**

12. Adjust the drive pinion lock nut tightening torque and pinion bearing preload torque using Tool.

**Tool number     A: ST3127S000**

**Drive pinion lock nut tightening torque:**

**186 - 294 N-m (19 - 29 kg-m, 138 - 216 ft-lb)**

**Drive pinion bearing preload:**

**1.08 - 1.66 N-m (0.11 - 0.16 kg-m, 10 - 14 in-lb)**

**CAUTION:**

- Adjust the lower limit of the drive pinion lock nut tightening torque first.
- If the preload torque exceeds the specified value, replace collapsible spacer and tighten it again to adjust. Do not loosen drive pinion lock nut to adjust the preload torque.
- After adjustment, rotate drive pinion back and forth 2 to 3 times to check for unusual noise, rotation malfunction, and other malfunctions.

13. Install differential case assembly. Refer to [FFD-32, "Differential Assembly"](#).

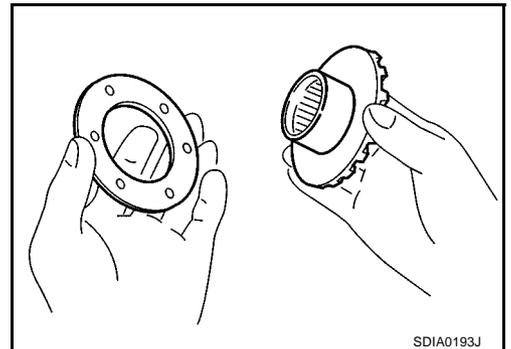
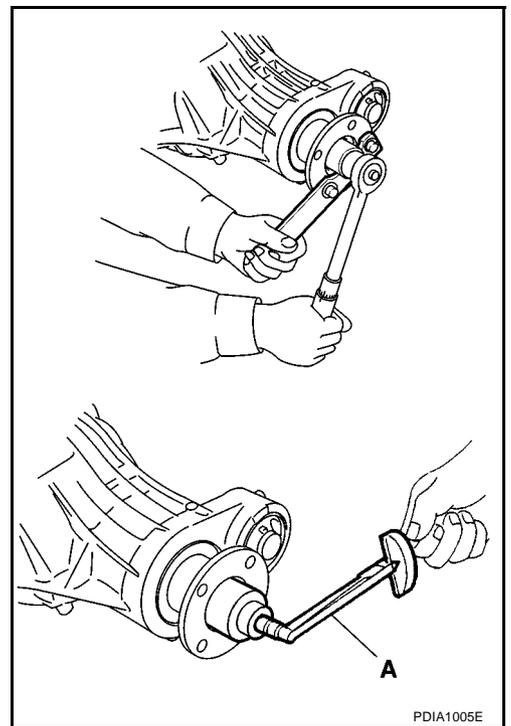
**CAUTION:**

**Do not install rear cover yet.**

14. Check and adjust drive gear runout, tooth contact, drive gear to drive pinion backlash, and companion flange runout. Refer to [FFD-18, "Drive Gear Runout"](#), [FFD-19, "Tooth Contact"](#), [FFD-20, "Backlash"](#), [FFD-21, "Companion Flange Runout"](#).  
Recheck above items. Readjust the above description, if necessary.
15. Check total preload torque. Refer to [FFD-18, "Total Preload Torque"](#).
16. Install rear cover. Refer to [FFD-32, "Differential Assembly"](#).
17. Install side shaft assembly. Refer to [FFD-35, "Side Shaft"](#).

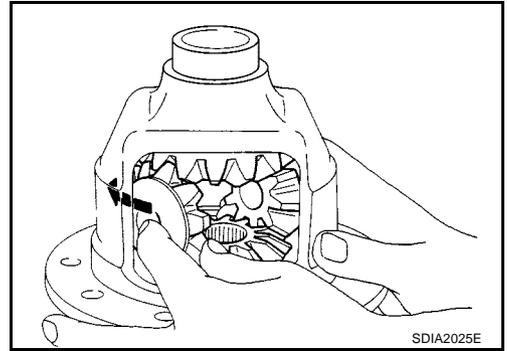
### Differential Assembly

1. Install side gear thrust washers with the same thickness as the ones installed prior to disassembly or reinstall the old ones on the side gears.

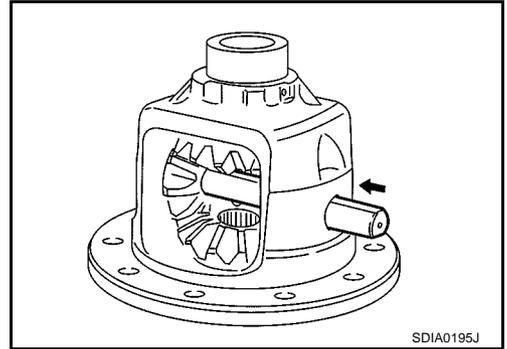


## FRONT FINAL DRIVE ASSEMBLY

2. Install side gears and thrust washers into differential case.
3. Align 2 pinion mate gears in diagonally opposite positions, then rotate and install them into differential case after installing thrust washer to pinion mate gear.

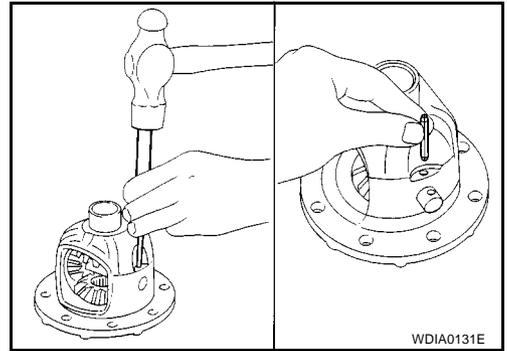


4. Align the lock pin holes on differential case with shaft, and install pinion mate shaft.
5. Measure side gear end play. If necessary, select the appropriate side gear thrust washers. Refer to [FFD-27, "Differential Side Gear Clearance"](#).

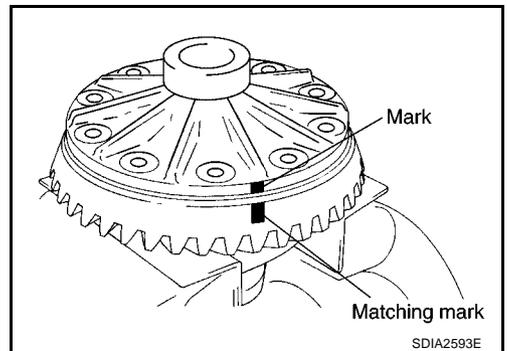


6. Drive a lock pin into pinion mate shaft, using suitable tool. Make sure lock pin is flush with differential case.

**CAUTION:**  
Do not reuse lock pin.

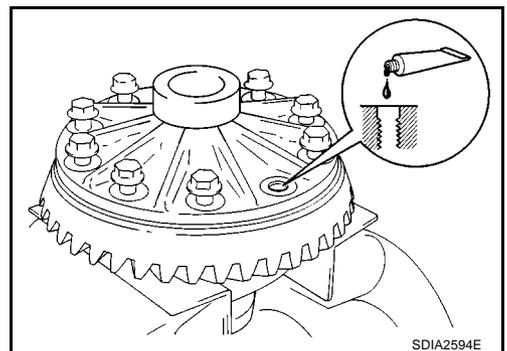


7. Align the matching mark of differential case with the mark of drive gear, then place drive gear.



8. Apply recommended thread locking sealant into the thread hole of drive gear. Refer to [FFD-17, "COMPONENTS"](#).

**CAUTION:**  
Make sure the drive gear back and threaded holes are clean.



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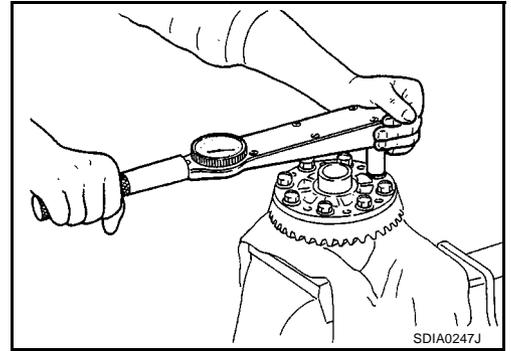
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## FRONT FINAL DRIVE ASSEMBLY

9. Install drive gear on the bolts, and then tighten to the specified torque. Refer to [FFD-17, "COMPONENTS"](#) .

**CAUTION:**

- Tighten bolts in a crisscross pattern.
- After tightening the bolts to the specified torque, tighten the bolts additionally by turning the bolts 34 to 39 degrees.

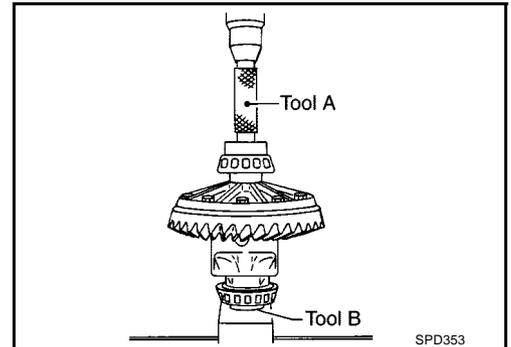


10. Press side bearing inner races to differential case, using Tools.

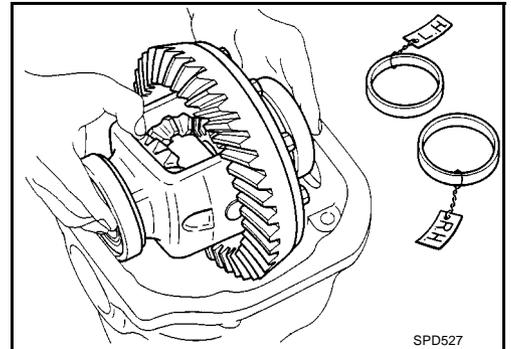
**Tool number**     **A: ST33230000**  
                              **B: ST33061000**

**CAUTION:**

**Do not reuse side bearing inner race.**

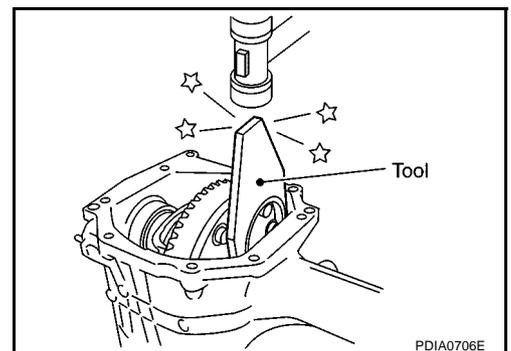


11. Install housing spacer.  
12. Apply gear oil to side bearings, and install differential case assembly with side bearing outer races into gear carrier.



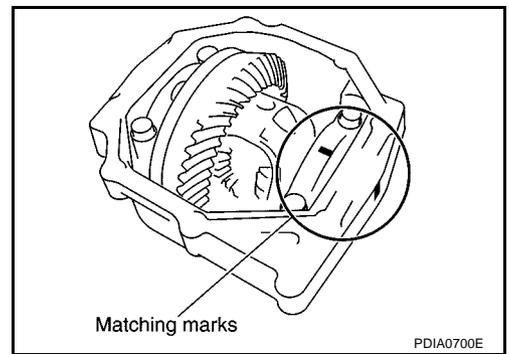
13. Insert left and right original side bearing adjusting washers in place between side bearings and gear carrier, using Tool.

**Tool number**     **: KV38100600**



# FRONT FINAL DRIVE ASSEMBLY

- Align matching mark on bearing cap with that on gear carrier.
- Install bearing caps and tighten bearing cap bolts to the specified torque. Refer to [FFD-17, "COMPONENTS"](#).

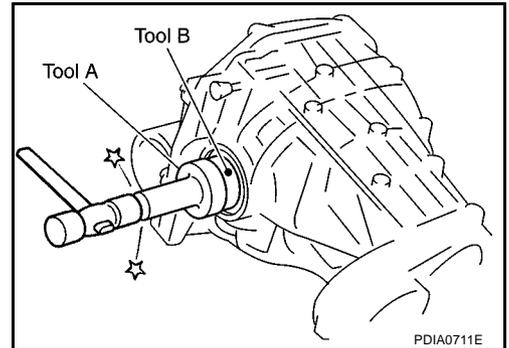


- Drive side oil seal until it becomes flush with the case end using Tools.

**Tool number**     **A: ST30720000**  
                              **B: ST27863000**

**CAUTION:**

- Do not reuse oil seal.
- Do not incline oil seal when installing.
- Apply multi-purpose grease onto oil seal lips, and gear oil onto the circumference of oil seal.



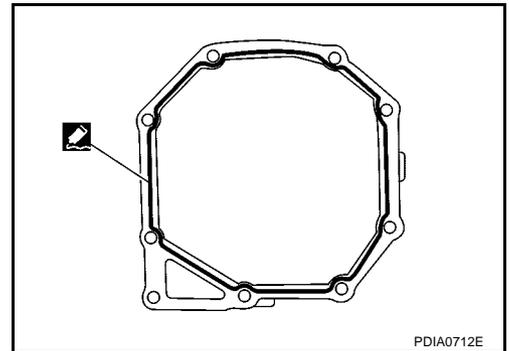
- Check and adjust drive gear runout, tooth contact, drive gear to drive pinion backlash, and total preload torque. Refer to [FFD-18, "Drive Gear Runout"](#), [FFD-19, "Tooth Contact"](#), [FFD-20, "Backlash"](#), [FFD-18, "Total Preload Torque"](#). Recheck above items. Readjust the above description, if necessary.

- Apply recommended sealant to mating surface of rear cover. Refer to [FFD-17, "COMPONENTS"](#).

**CAUTION:**

Remove old sealant adhering to mating surfaces. Also remove any moisture, oil, or foreign material adhering to application and mating surfaces.

- Install rear cover on gear carrier and tighten bolts with the specified torque. Refer to [FFD-17, "COMPONENTS"](#).
- Install side shaft assembly. Refer to [FFD-35, "Side Shaft"](#).



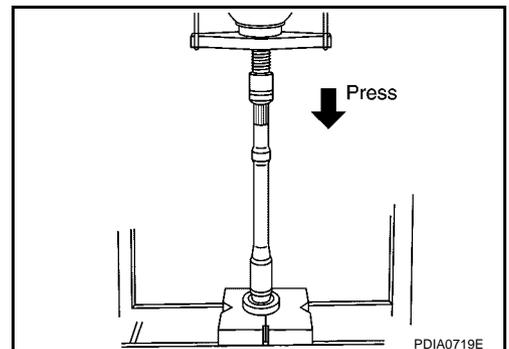
## Side Shaft

- Press side shaft bearing to side shaft.

**CAUTION:**

Do not reuse bearing.

- Install snap ring (shaft side).
- Install side shaft assembly into gear carrier.
- Install snap ring (hole side).



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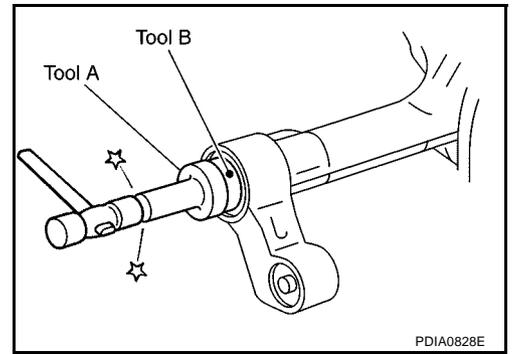
## FRONT FINAL DRIVE ASSEMBLY

5. Drive side oil seal until it becomes flush with the case end using Tools.

**Tool number**    **A: ST30720000**  
                          **B: ST27863000**

**CAUTION:**

- Do not reuse oil seal.
- Do not incline oil seal when installing.
- Apply multi-purpose grease onto oil seal lips, and gear oil onto the circumference of oil seal.



# SERVICE DATA AND SPECIFICATIONS (SDS)

## SERVICE DATA AND SPECIFICATIONS (SDS)

PPF:00030

### General Specifications

EDS00358

Applied model	YD25DDTi		
	6M/T		5A/T
Grade	SE, XE*	XE	SE
Final drive model	R180A		
Gear ratio	3.692	3.538	
Number of teeth (Drive gear/Drive pinion)	48/13	46/13	
Oil capacity (Approx.)	ℓ (Imp pt)	0.85 (1-1/2)	
Number of pinion gears	2		
Drive pinion adjustment spacer type	Collapsible		

\*: Option

### Inspection and Adjustment DRIVE GEAR RUNOUT

EDS00359

Unit: mm (in)

Item	Runout limit
Drive gear back face	0.08 (0.0031) or less

### DIFFERENTIAL SIDE GEAR CLEARANCE

Unit: mm (in)

Item	Specification
Side gear backlash (Clearance between side gear and differential case)	0.1 (0.004) or less (Each gear should rotate smoothly without excessive resistance during differential motion.)

### PRELOAD TORQUE

Unit: N·m (kg·m, in·lb)

Item	Specification
Pinion bearing (P1)	1.08 - 1.66 (0.11 - 0.16, 10 - 14)
Side bearing (P2)	0.59 - 1.08 (0.06 - 0.11, 6 - 9)
Side bearing to pinion bearing (Total preload) (Total preload = P1 + P2)	1.67 - 2.74 (0.17 - 0.27, 15 - 24)

### BACKLASH

Unit: mm (in)

Item	Specification
Drive gear to drive pinion gear	0.10 - 0.15 (0.0039 - 0.0059)

### COMPANION FLANGE RUNOUT

Unit: mm (in)

Item	Runout limit
Companion flange face	0.1 (0.004) or less
Inner side of the companion flange	0.1 (0.004) or less

### SELECTIVE PARTS

#### Side Gear Thrust Washer

Unit: mm (in)

Thickness	Part number*	Thickness	Part number*
0.75 (0.0295)	38424 W2010	0.87 (0.0343)	38424 W2014
0.78 (0.0307)	38424 W2011	0.90 (0.0354)	38424 W2015
0.81 (0.0319)	38424 W2012	0.93 (0.0366)	38424 W2016
0.84 (0.0331)	38424 W2013	0.96 (0.0378)	38424 W2017

\*: Always check with the Parts Department for the latest parts information.

## SERVICE DATA AND SPECIFICATIONS (SDS)

### Pinion Height Adjusting Washer

Unit: mm (in)

Thickness	Part number*	Thickness	Part number*
3.09 (0.1217)	38154 EA000	3.39 (0.1335)	38154 EA010
3.12 (0.1228)	38154 EA001	3.42 (0.1346)	38154 EA011
3.15 (0.1240)	38154 EA002	3.45 (0.1358)	38154 EA012
3.18 (0.1252)	38154 EA003	3.48 (0.1370)	38154 EA013
3.21 (0.1264)	38154 EA004	3.51 (0.1382)	38154 EA014
3.24 (0.1276)	38154 EA005	3.54 (0.1394)	38154 EA015
3.27 (0.1287)	38154 EA006	3.57 (0.1406)	38154 EA016
3.30 (0.1299)	38154 EA007	3.60 (0.1417)	38154 EA017
3.33 (0.1311)	38154 EA008	3.63 (0.1429)	38154 EA018
3.36 (0.1323)	38154 EA009	3.66 (0.1441)	38154 EA019

\*: Always check with the Parts Department for the latest parts information.

### Side Bearing Adjusting Washer

Unit: mm (in)

Thickness	Part number*	Thickness	Part number*
1.95 (0.0768)	38453 EA000	2.35 (0.0925)	38453 EA008
2.00 (0.0787)	38453 EA001	2.40 (0.0945)	38453 EA009
2.05 (0.0807)	38453 EA002	2.45 (0.0965)	38453 EA010
2.10 (0.0827)	38453 EA003	2.50 (0.0984)	38453 EA011
2.15 (0.0846)	38453 EA004	2.55 (0.1004)	38453 EA012
2.20 (0.0866)	38453 EA005	2.60 (0.1024)	38453 EA013
2.25 (0.0886)	38453 EA006	2.65 (0.1043)	38453 EA014
2.30 (0.0906)	38453 EA007		

\*: Always check with the Parts Department for the latest parts information.