

SECTION **FFD**
FRONT FINAL DRIVE

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PRECAUTIONS

PRECAUTIONS

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Service Notice or Precautions

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

PREPARATION

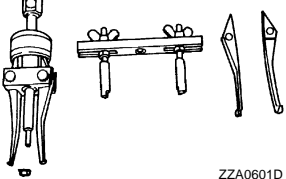
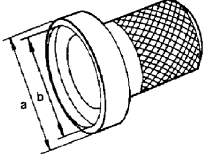
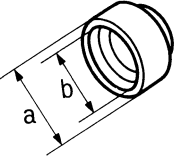
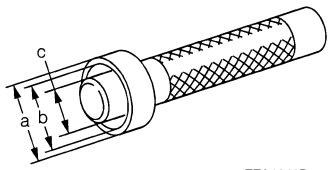
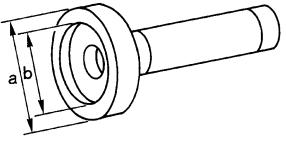
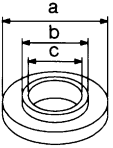
PREPARATION

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Special Service Tools

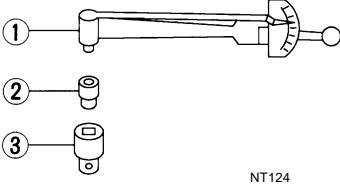
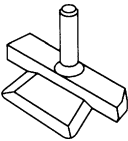
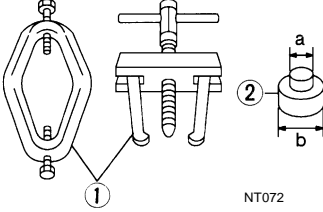
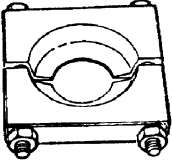
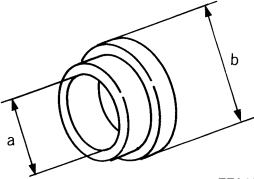
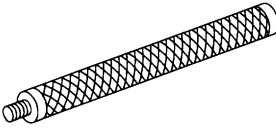
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The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

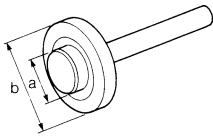
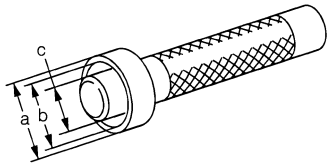
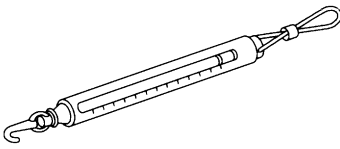
Tool number (Kent-Moore No.) Tool name	Description
KV381054S0 (J-34286) Puller  <p style="text-align: right;">ZZA0601D</p>	<ul style="list-style-type: none"> ● Removing front oil seal ● Removing side bearing outer race ● Removing side oil seal
ST33400001 (J-26082) Drift a: 60 mm (2.36 in) dia. b: 47 mm (1.85 in) dia.  <p style="text-align: right;">ZZA0702D</p>	<ul style="list-style-type: none"> ● Installing front oil seal ● Installing side oil seal (right side)
KV38102510 (—) Drift a: 71 mm (2.80 in) dia. b: 65 mm (2.56 in) dia.  <p style="text-align: right;">ZZA0838D</p>	Installing front oil seal
KV38102100 (J-25803-01) Drift a: 44 mm (1.73 in) dia. b: 36 mm (1.42 in) dia. c: 24.5 mm (0.965 in) dia.  <p style="text-align: right;">ZZA1046D</p>	Installing side oil seal (left side)
KV38100200 (—) Drift a: 65 mm (2.56 in) dia. b: 49 mm (1.93 in) dia.  <p style="text-align: right;">ZZA1143D</p>	Installing side shaft oil seal
ST30032000 (J-26010-01) Drift a: 80 mm (3.15 in) dia. b: 38 mm (1.50 in) dia. c: 31 mm (1.22 in) dia.  <p style="text-align: right;">S-NT107</p>	<ul style="list-style-type: none"> ● Installing drive pinion rear bearing inner race ● Installing side shaft

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PREPARATION

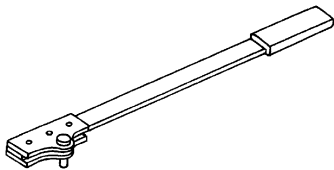
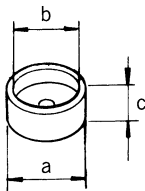
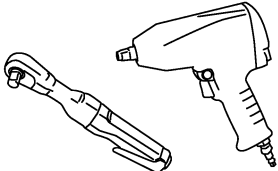
Tool number (Kent-Moore No.) Tool name	Description
ST3127S000 (J-25765-A) Preload gauge 1: GG91030000 (J-25765) Torque wrench 2: HT62940000 (—) Socket adapter (1/2") 3: HT62900000 (—) Socket adapter (3/8")	Measuring pinion bearing preload and total preload 
KV10111100 (J-37228) Seal cutter	Removing carrier cover 
ST3306S001 (J-22888-D) Differential side bearing puller set 1: ST33051001 (J-22888-20) Puller 2: ST33061000 (J-8107-2) Base a: 28.5 mm (1.122 in) dia. b: 38 mm (1.50 in) dia.	Removing and installing side bearing inner race 
ST30031000 (J-22912-01) Replacer	Removing pinion rear bearing inner race 
KV31103000 (J-38982) Drift a: 49 mm (1.93 in) dia. b: 70 mm (2.76 in) dia.	Installing side bearing outer race 
ST30611000 (J-25742-1) Drift bar	Installing side bearing outer race (Use with KV31103000) 

PREPARATION

Tool number (Kent-Moore No.) Tool name	Description
ST37820000 (—) Drift a: 39 mm (1.54 in) dia. b: 72 mm (2.83 in) dia.  ZZA0836D	Installing drive pinion front and rear bearing outer race
ST33230000 (J-25805-01) Drift a: 51 mm (2.01 in) dia. b: 41 mm (1.61 in) dia. c: 28.5 mm (1.122 in) dia.  ZZA1046D	Installing side bearing inner race
(J-8129) Spring gauge  NT127	Measuring turning torque

Commercial Service Tools

NDS0004L

Tool name	Description
Flange wrench  NT771	Removing and installing drive pinion lock nut
Spacer a: 60 mm (2.36 in) dia. b: 36 mm (1.42 in) dia. c: 30 mm (1.18 in)  ZZA1133D	Installing pinion front bearing inner race
Power tool  PBIC0190E	Loosening bolts and nuts

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

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NVH Troubleshooting Chart

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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															
Noise																	
		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Reference page																	

×: Applicable

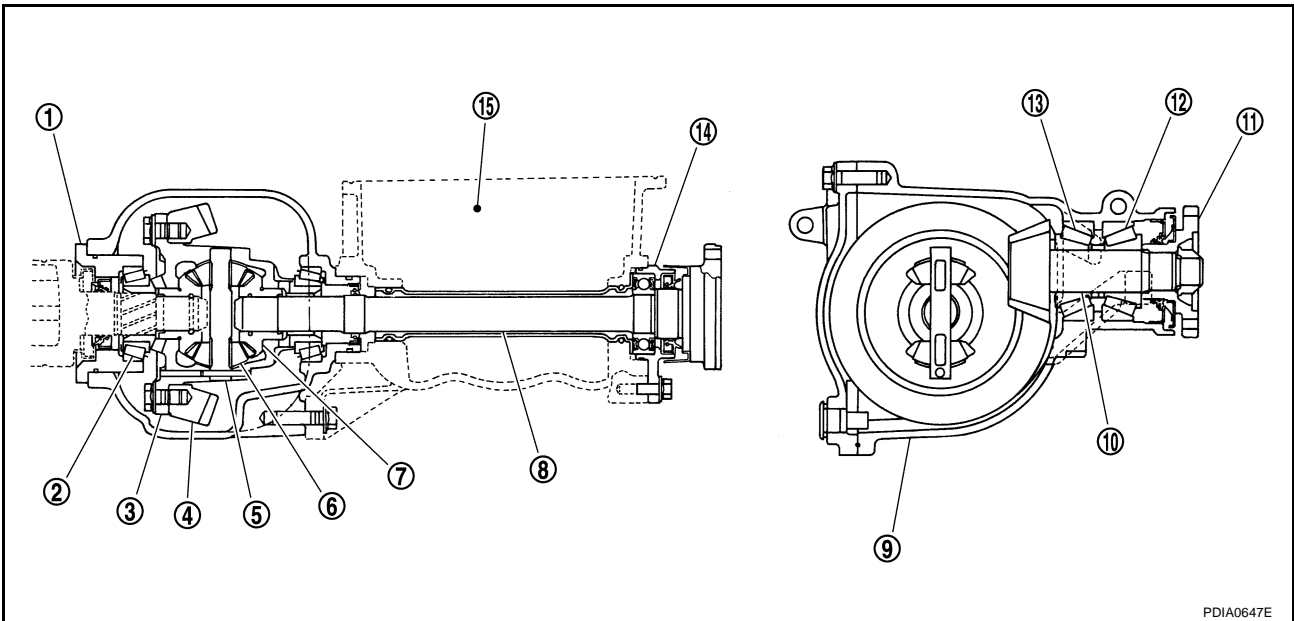
DESCRIPTION

DESCRIPTION

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Cross-Sectional View

NDS0004N



- | | | |
|-------------------------|-----------------------------|--------------------------|
| 1. Side retainer | 2. Side bearing | 3. Differential case |
| 4. Drive gear | 5. Pinion mate shaft | 6. Pinion mate gear |
| 7. Side gear | 8. Side shaft | 9. Gear carrier |
| 10. Drive pinion | 11. Companion flange | 12. Pinion front bearing |
| 13. Pinion rear bearing | 14. Extension tube retainer | 15. Engine assembly |

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DIFFERENTIAL GEAR OIL

DIFFERENTIAL GEAR OIL

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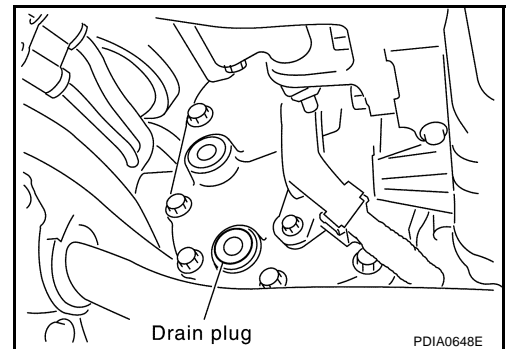
Changing Differential Gear Oil DRAINING

NDS00040

1. Stop engine.
2. Remove drain plug and drain gear oil.
3. Set a gasket on drain plug and install it to final drive assembly and tighten to the specified torque. Refer to [FFD-14, "COMPONENTS"](#).

CAUTION:

Do not reuse gasket.



FILLING

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

Oil grade and Viscosity:

Refer to [MA-10, "Fluids and Lubricants"](#).

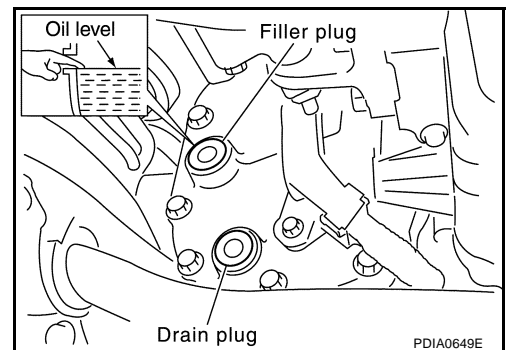
Oil capacity:

Approx. 0.65 l (1-3/8 US pt, 1-1/8 Imp pt)

2. After refilling oil, check oil level. Set a gasket to filler plug, then install it to final drive assembly. Refer to [FFD-14, "COMPONENTS"](#).

CAUTION:

Do not reuse gasket.



Checking Differential Gear Oil OIL LEAKAGE AND OIL LEVEL

NDS0004P

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

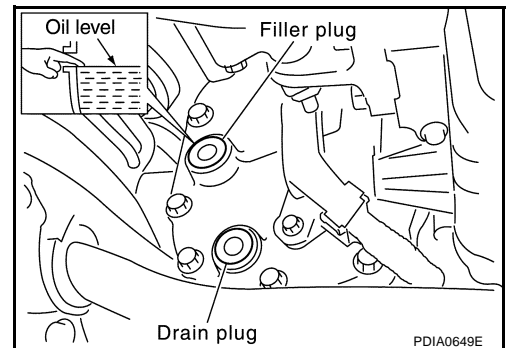
CAUTION:

Do not start engine while checking oil level.

- Set a gasket on filler plug and install it on final drive assembly. Refer to [FFD-14, "COMPONENTS"](#).

CAUTION:

Do not reuse gasket.



FRONT OIL SEAL

FRONT OIL SEAL

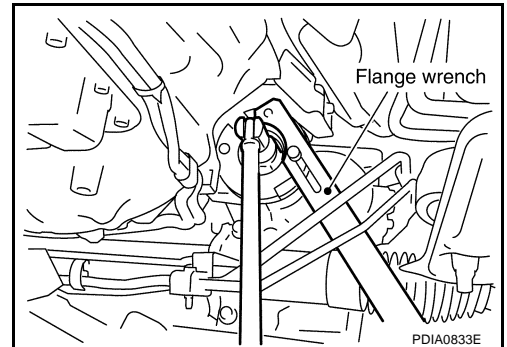
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Removal and Installation

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REMOVAL

1. Remove front propeller shaft. Refer to [PR-13, "FRONT PROPELLER SHAFT"](#).
2. Remove drive pinion lock nut using a flange wrench.



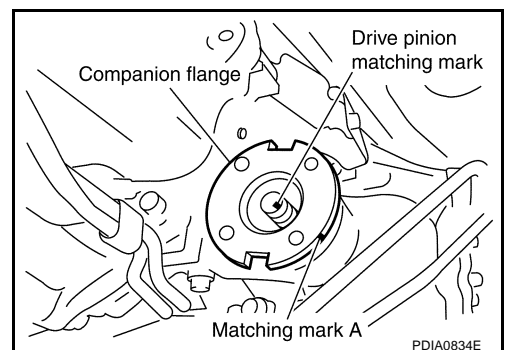
3. Put matching mark on the end of the drive pinion. The matching mark should be in line with the matching mark A on companion flange.

CAUTION:

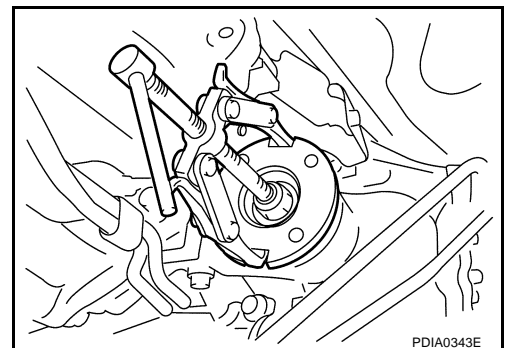
For matching mark, use paint. Do not damage drive pinion.

NOTE:

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

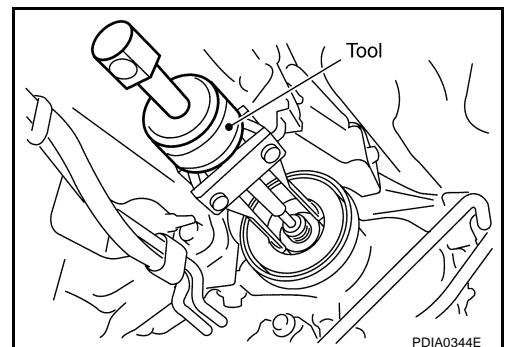


4. Remove companion flange using a puller.



5. Remove front oil seal using the puller.

Tool number : KV381054S0 (J-34286)



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FRONT OIL SEAL

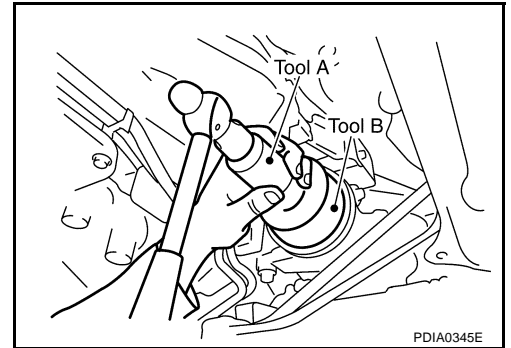
INSTALLATION

1. Apply multi-purpose grease to front oil seal lips.
2. Using the drift, install front oil seal as shown in figure.

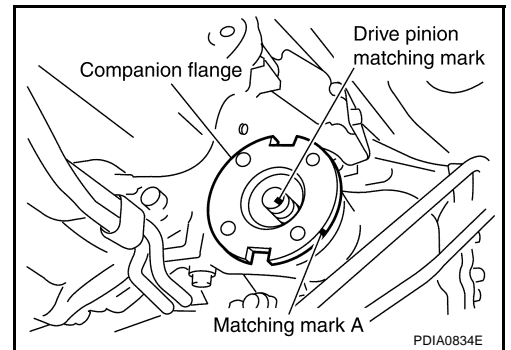
Tool number **A: ST33400001 (J-26082)**
 B: KV38102510 (—)

CAUTION:

- Do not reuse oil seal.
- When installing, do not incline oil seal.



3. Align the matching mark of drive pinion with the matching mark A of companion flange, then install the companion flange.

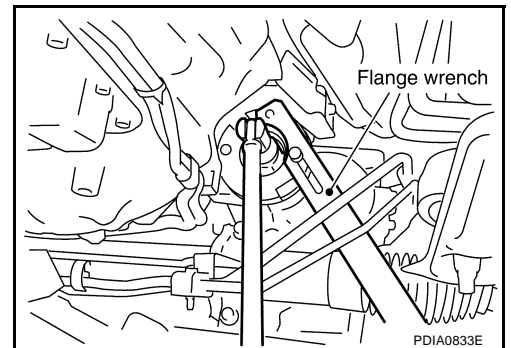


4. Apply gear oil on the screw part of drive pinion and the seating surface of drive pinion lock nut.
5. Install drive pinion lock nut with a flange wrench, tighten to the specified torque. Refer to [FFD-14, "COMPONENTS"](#).

CAUTION:

Do not reuse drive pinion lock nut.

6. Install front propeller shaft. Refer to [PR-13, "FRONT PROPELLER SHAFT"](#).



SIDE OIL SEAL

SIDE OIL SEAL

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Removal and Installation

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NOTE:

Left side oil seal is attached to engine assembly. Replace it when front final drive assembly is removed from vehicle.

REMOVAL

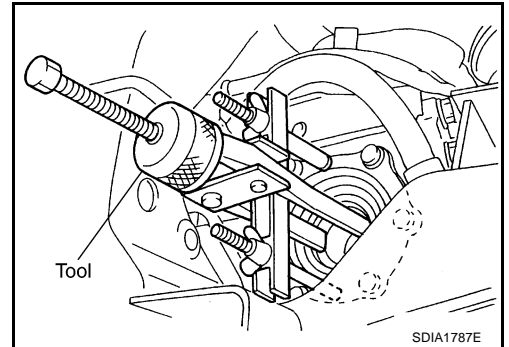
Right Side:

1. Remove the front drive shaft. Refer to [FAX-20, "Right Side"](#).
2. Remove the side oil seal using tool.

Tool number : KV381054S0(J-34286)

CAUTION:

Be careful not to damage gear carrier.



Left Side:

1. Remove the front final drive assembly from vehicle. Refer to [FFD-12, "Removal and Installation"](#).
2. Remove the side oil seal using tool.

Tool number : KV381054S0(J-34286)

CAUTION:

Be careful not to damage gear carrier.

INSTALLATION

Right Side:

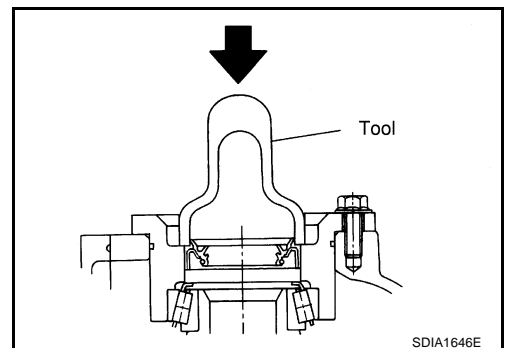
1. Apply multi-purpose grease to sealing lips of side oil seal.
2. Using the drift, press-fit side oil seal so that its surface comes face to face with the end surface of the side retainer.

Tool number : ST33400001 (J-26082)

CAUTION:

- Do not reuse oil seal.
- When installing, do not incline oil seal.

3. Install the front drive shaft. Refer to [FAX-20, "INSTALLATION"](#).



Left Side:

1. Apply multi-purpose grease to sealing lips of side oil seal.
2. Using the drift, press-fit side oil seal so that its surface comes face to face with the end surface of the gear carrier.

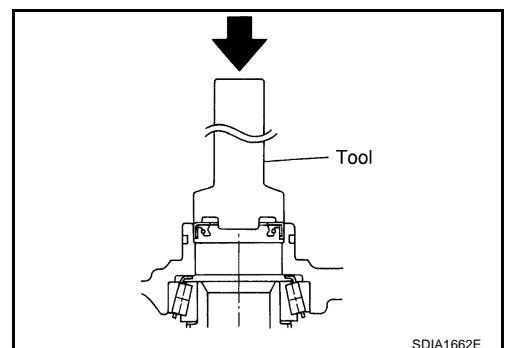
Tool number : KV38102100 (J-25803-01)

CAUTION:

- Do not reuse oil seal.
- When installing, do not incline oil seal.

3. Install the front final drive assembly on vehicle. Refer to [FFD-12, "Removal and Installation"](#).

4. Install the front drive shaft. Refer to [FAX-20, "INSTALLATION"](#).



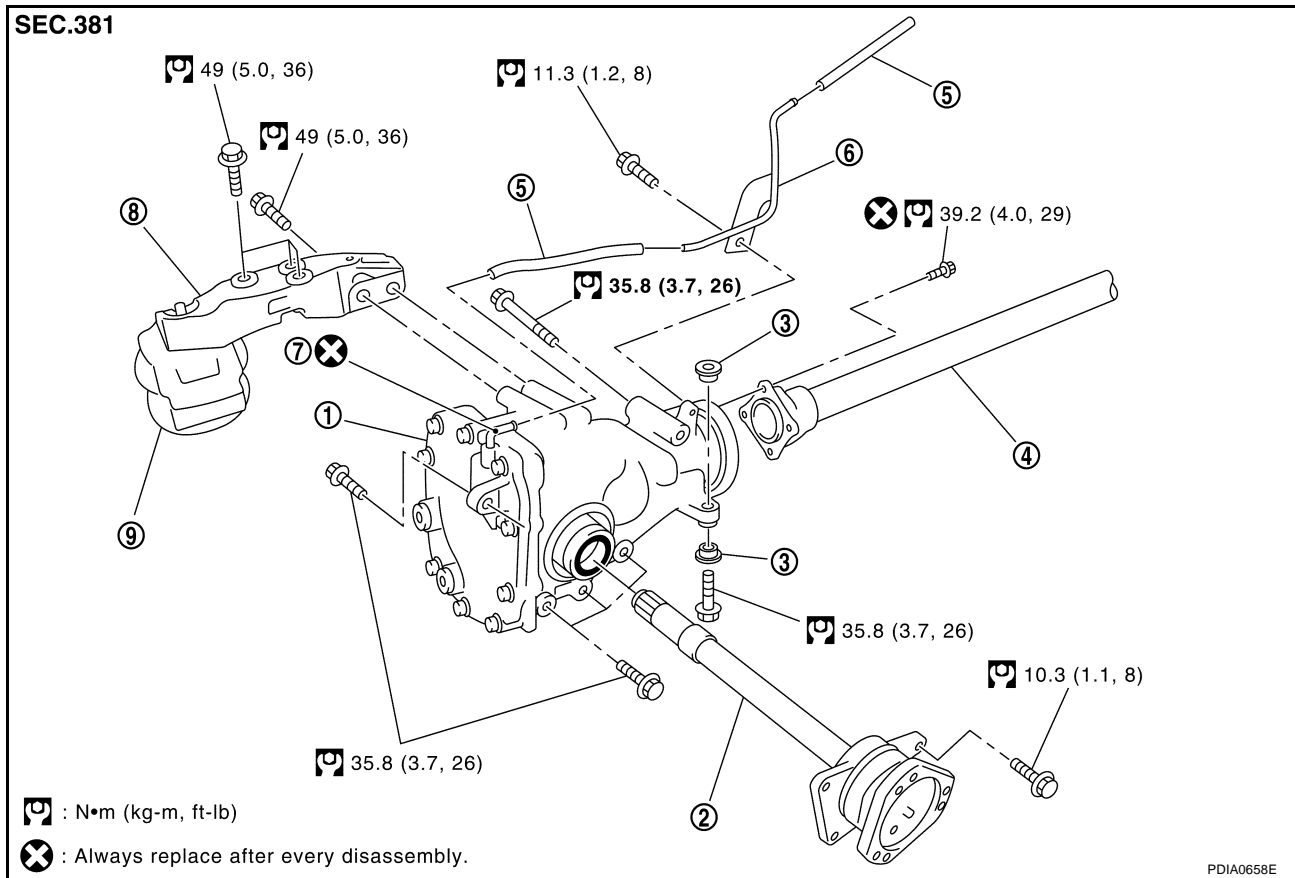
FRONT FINAL DRIVE ASSEMBLY

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FRONT FINAL DRIVE ASSEMBLY

Removal and Installation COMPONENTS



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| 1. Front final drive assembly | 2. Side shaft | 3. Bushing |
| 4. Front propeller shaft | 5. Breather hose | 6. Breather tube |
| 7. Breather connector | 8. Engine mounting bracket | 9. Insulator |

REMOVAL

1. Remove three engine mounting bracket upper bolts. Refer to [EM-146, "Removal and Installation \(AWD Models\)"](#) .
2. Remove three way catalyst (right bank). Refer to [EM-27, "Removal and Installation"](#) .
3. Remove stabilizer assembly. Refer to [FSU-34, "STABILIZER BAR"](#) .
4. Remove steering gearbox mounting bolts with a power tool. Refer to [PS-20, "POWER STEERING GEAR AND LINKAGE"](#) .
5. Remove front drive shaft both. Refer to [FAX-16, "FRONT DRIVE SHAFT"](#) .
6. Remove side shaft assembly.
7. Remove front propeller shaft. Refer to [PR-13, "FRONT PROPELLER SHAFT"](#) .
8. Remove front suspension member with a power tool. Refer to [FSU-35, "FRONT SUSPENSION MEMBER"](#) .
9. Remove breather hose and tube.
10. Remove mounting bolts and remove front final drive assembly from the vehicle.

INSTALLATION

Note the following, and installation is in the reverse order of removal.

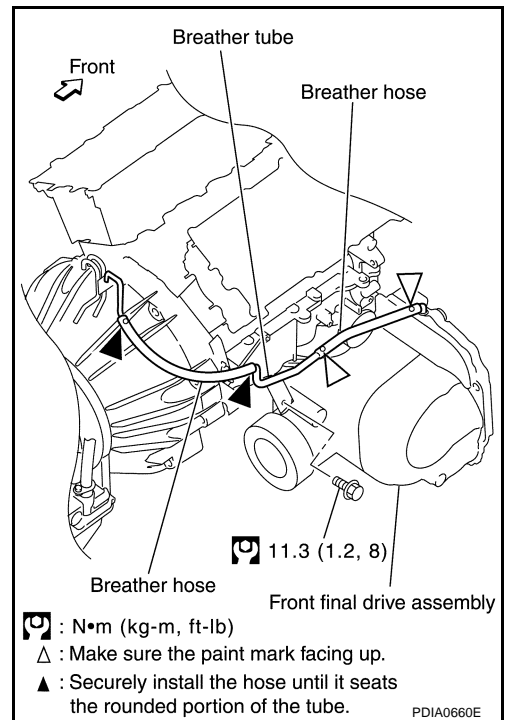
- Refer to [FFD-12, "COMPONENTS"](#) about each tightening torque.
- When installing the side shaft, apply multi-purpose grease to contact surface of side shaft and side shaft oil seal.

FRONT FINAL DRIVE ASSEMBLY

- When installing breather hoses, refer to the figure.

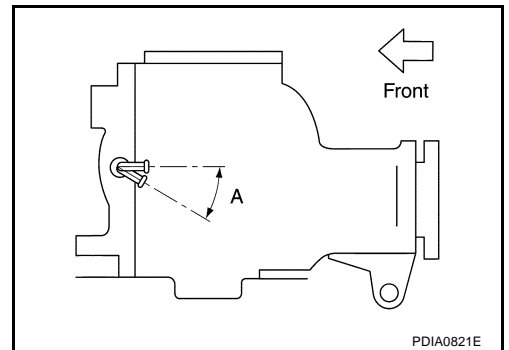
CAUTION:

Make sure there are no pinched or restricted areas on the breather hose caused by bending or winding when installing it.

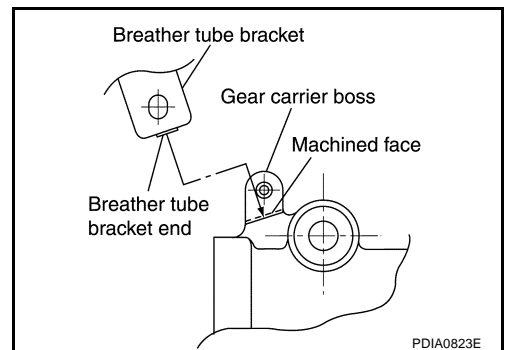


- Install breather connector as shown in the figure.

Angle "A": 0 - 30°



- Seat the breather tube bracket end to the machined of gear carrier boss.
- When oil leaks while removing final drive assembly, check oil level after the installation. Refer to [FFD-8, "Checking Differential Gear Oil"](#) .



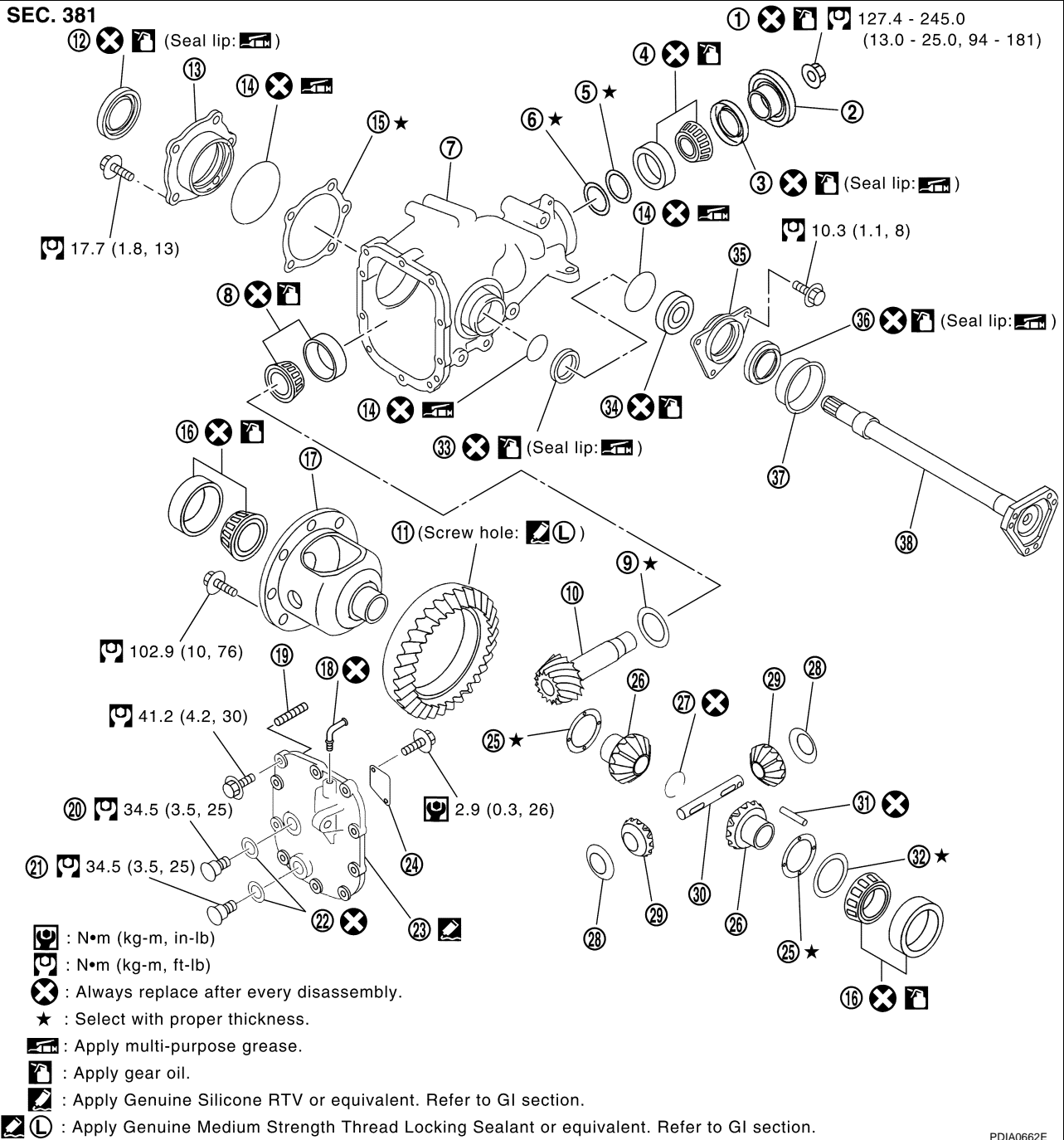
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FRONT FINAL DRIVE ASSEMBLY

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Disassembly and Assembly COMPONENTS

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PDIA0662E

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|-------------------------------|--|-----------------------------------|
| 1. Drive pinion lock nut | 2. Companion flange | 3. Front oil seal |
| 4. Pinion front bearing | 5. Drive pinion bearing adjusting washer | 6. Drive pinion adjusting washer |
| 7. Gear carrier | 8. Pinion rear bearing | 9. Pinion height adjusting washer |
| 10. Drive pinion | 11. Drive gear | 12. Side oil seal (right side) |
| 13. Side retainer | 14. O-ring | 15. Side bearing adjusting shim |
| 16. Side bearing | 17. Differential case | 18. Breather connector |
| 19. Dowel pin | 20. Filler plug | 21. Drain plug |
| 22. Gasket | 23. Carrier cover | 24. Gear oil defence |
| 25. Side gear thrust washer | 26. Side gear | 27. Circular clip |
| 28. Pinion mate thrust washer | 29. Pinion mate gear | 30. Pinion mate shaft |
| 31. Lock pin | 32. Side bearing adjusting washer | 33. Side oil seal (left side) |

FRONT FINAL DRIVE ASSEMBLY

34. Side shaft bearing
37. Dust sealed

35. Extension tube retainer
38. Side shaft

36. Side shaft oil seal

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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 with preload gauge.

Tool number : ST3127S000 (J-25765-A)

Total preload torque (With oil seal):

1.56 - 2.65 N·m (0.16 - 0.27 kg·m, 14 - 23 in·lb)

NOTE:

Total preload torque = Pinion bearing torque + Side bearing 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 large

On pinion bearings: Decrease the drive pinion bearing adjusting washer and drive pinion adjusting washer thickness. Refer to [FFD-36, "Drive Pinion Bearing Adjusting Washer"](#) and [FFD-36, "Drive Pinion Adjusting Washer"](#).

On side bearings: Increase the side bearing adjusting shim thickness. Refer to [FFD-36, "Side Bearing Adjusting Shim"](#).

When the preload torque is small

On pinion bearings: Increase the drive pinion bearing adjusting washer and drive pinion adjusting washer thickness. Refer to [FFD-36, "Drive Pinion Bearing Adjusting Washer"](#) and [FFD-36, "Drive Pinion Adjusting Washer"](#).

On side bearings: Decrease the side bearing adjusting shim thickness. Refer to [FFD-36, "Side Bearing Adjusting Shim"](#).

Drive Gear Runout

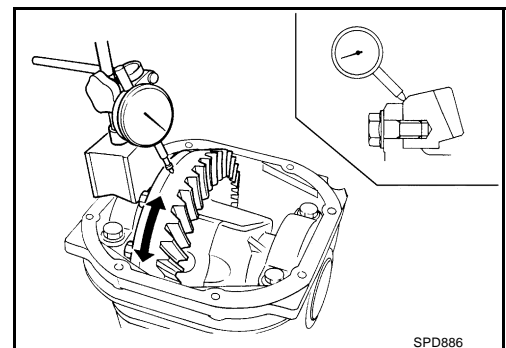
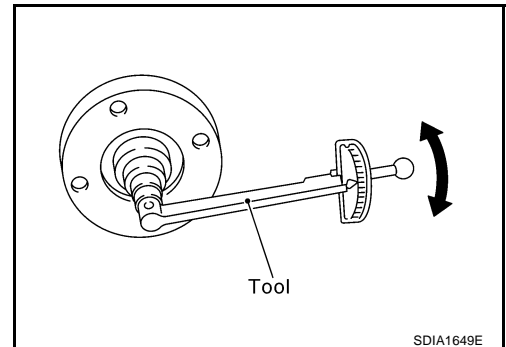
1. Remove carrier cover. Refer to [FFD-20, "Differential Assembly"](#).
2. Fit a dial indicator to the drive gear back face.
3. Rotate the drive gear to measure runout.

Runout limit: 0.05 mm (0.0020 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, etc.

CAUTION:

Replace drive gear and drive pinion gear as a set.



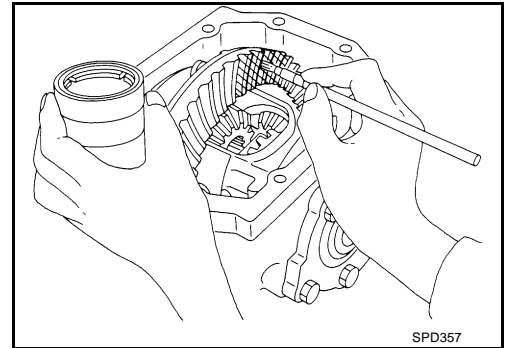
FRONT FINAL DRIVE ASSEMBLY

Tooth Contact

1. Remove carrier cover. Refer to [FFD-20, "Differential Assembly"](#).
2. Apply red lead to drive gear.

CAUTION:

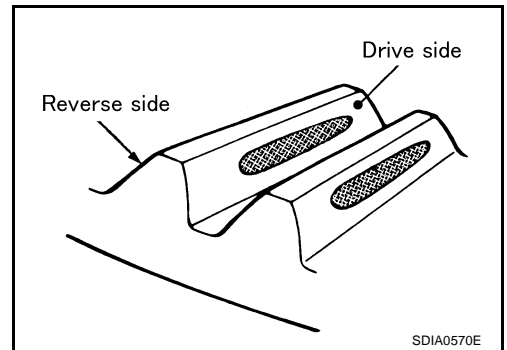
Apply red lead to both the faces of 3 to 4 gears at 4 locations evenly spaced on drive gear.



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.



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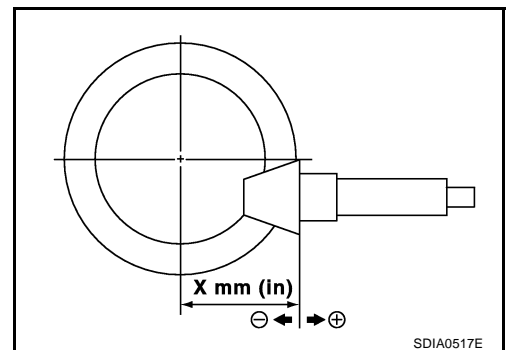
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FRONT FINAL DRIVE ASSEMBLY

Tooth contact pattern				Pinion height adjusting washer selection value [mm (in)]	Adjustment requirement (Yes/No)
Back side		Drive side			
Heel side	Toe side	Toe side	Heel side		
				+0.15 (+0.0059)	Yes
				+0.12 (+0.0047)	
				+0.09 (+0.0035)	
				+0.06 (+0.0024)	No
				+0.03 (+0.0012)	
				0	
				-0.03 (-0.0012)	
				-0.06 (-0.0024)	
				-0.09 (-0.0035)	Yes
				-0.12 (-0.0047)	
				-0.15 (-0.0059)	

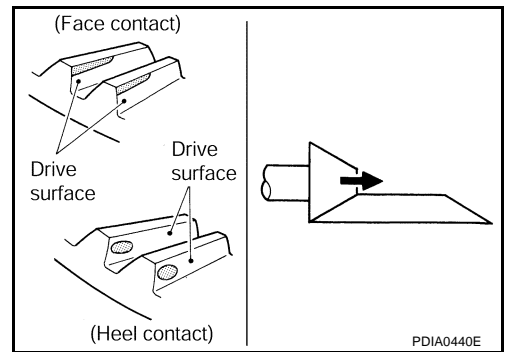
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4. If tooth contact is improperly adjusted, follow the procedure below to adjust the pinion height (dimension X).

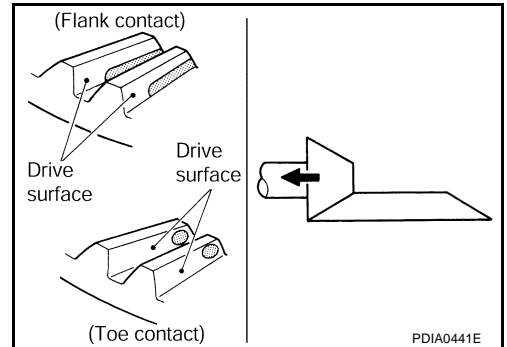


FRONT FINAL DRIVE ASSEMBLY

- 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-36, "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-36, "Pinion Height Adjusting Washer"](#) .



Backlash

1. Remove carrier cover. Refer to [FFD-20, "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)

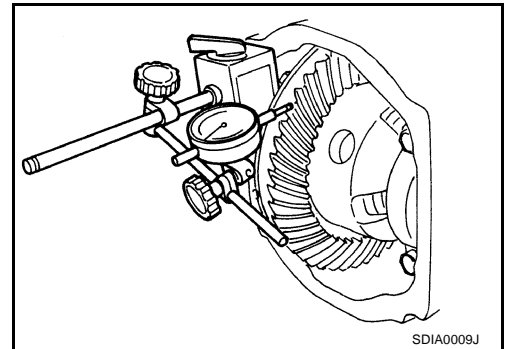
- If the backlash is outside of the specified value, change the thickness of side bearing adjusting washer.

When the backlash is large:

**Decrease side bearing adjusting washer thickness.
Refer to [FFD-36, "Side Bearing Adjusting Washer"](#) .**

When the backlash is small:

**Increase side bearing adjusting washer thickness.
Refer to [FFD-36, "Side Bearing Adjusting Washer"](#) .**



Companion Flange Runout

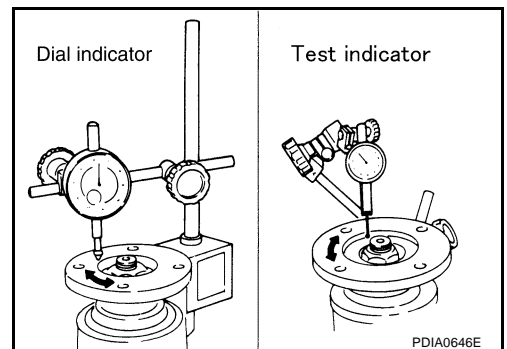
1. Fit a dial indicator onto the companion flange face (inner side of the propeller shaft mounting bolt holes).
2. Rotate companion flange to check for runout.

Runout limit: 0.18 mm (0.0070 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: 0.13 mm (0.0051 in) or less

5. If the runout value is outside the runout limit, follow the procedure below to adjust.
 - a. Check for runout while changing the phase between companion flange and drive pinion by 90° step, and search for the position where the runout is the 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 and malfunction of pinion bearing. Check for these items and repair if necessary.



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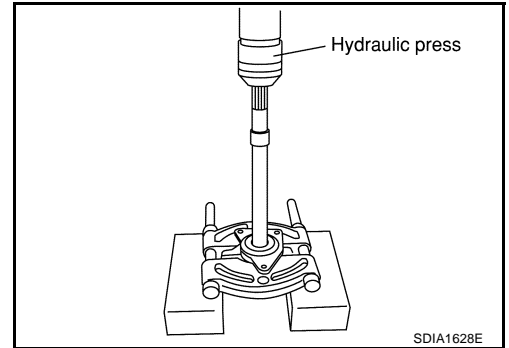
FRONT FINAL DRIVE ASSEMBLY

- c. If the runout value is still outside of the limit after the check and repair, replace companion flange.

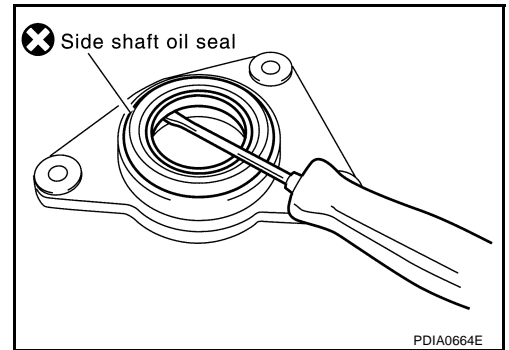
DISASSEMBLY

Side Shaft Assembly

1. Hold extension tube retainer with puller, then press out side shaft using a press.



2. Remove side shaft oil seal from extension tube retainer with a flat-blade screwdriver.
3. Remove side shaft bearing from extension tube retainer.
4. Remove O-ring from extension tube retainer.
5. Remove dust sealed from side shaft.



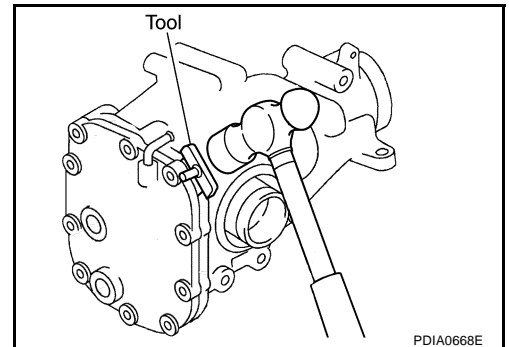
Differential Assembly

1. Drain gear oil, if necessary.
2. Remove carrier cover mounting bolts.
3. Remove carrier cover to insert the seal cutter between gear carrier and carrier cover.

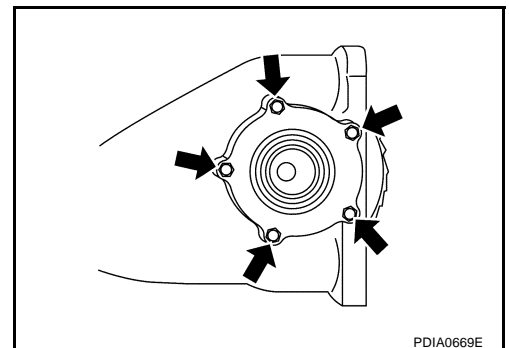
Tool number : KV10111100 (J-37228)

CAUTION:

- Be careful not to damage the mating surface.
- Do not insert flat-bladed screwdriver, this way damage the mating surface.

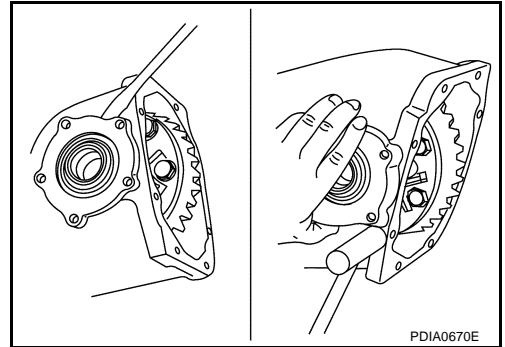


4. Remove side retainer mounting bolts.



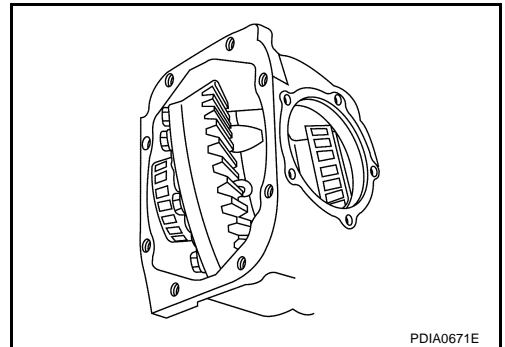
FRONT FINAL DRIVE ASSEMBLY

5. Remove side retainer.
6. Remove side bearing adjusting shim.
7. Remove O-ring from side retainer.



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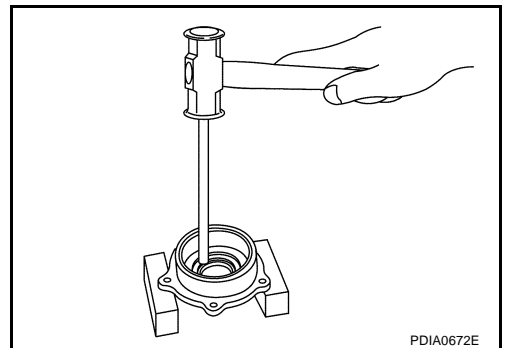
8. Remove differential case assembly from gear carrier.



FFD

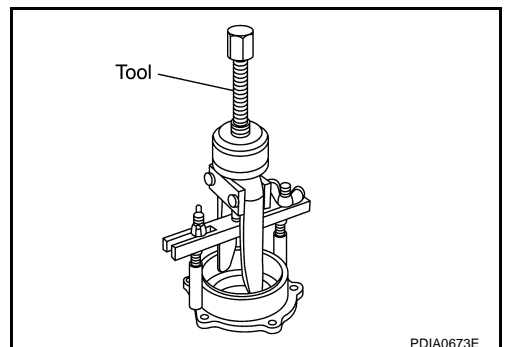
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9. Remove side oil seal (right side) from side retainer.



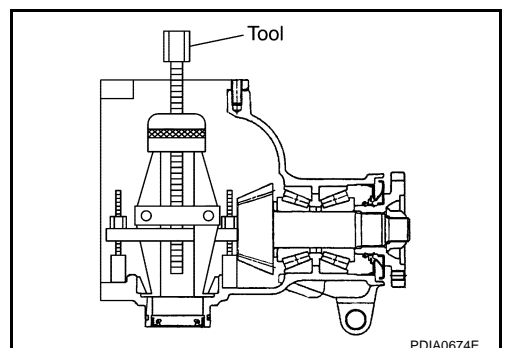
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10. Remove side bearing outer race with puller.
Tool number : KV381054S0 (J-34286)
11. Remove O-ring from gear carrier.
12. Remove side oil seal (left side) from gear carrier.



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13. Remove side bearing outer race with puller.
Tool number : KV381054S0 (J-34286)



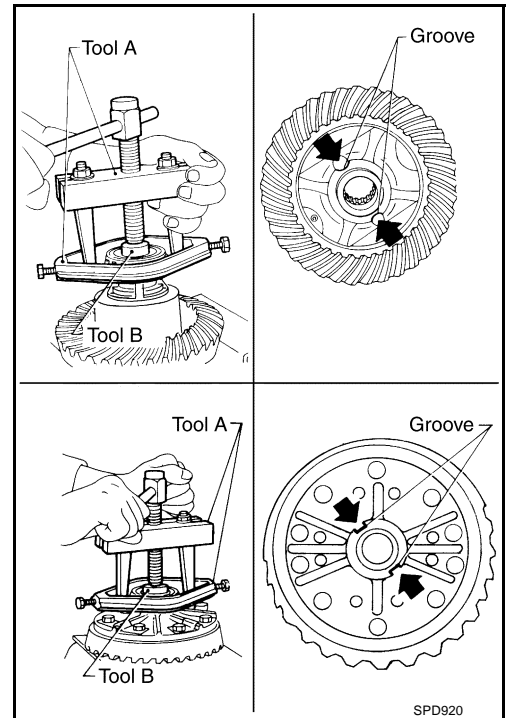
FRONT FINAL DRIVE ASSEMBLY

14. Remove side bearing inner race.
To prevent damage to bearing, engage puller jaws in groove.

Tool number **A: ST33051001 (J-22888-20)**
 B: ST33061000 (J-8107-2)

CAUTION:

- To prevent damage to the side bearing and drive gear, place copper plates between these parts and vise.
- It is not necessary to remove side bearing inner race except it is replaced.



15. For proper reinstallation, paint matching mark on one differential case assembly.

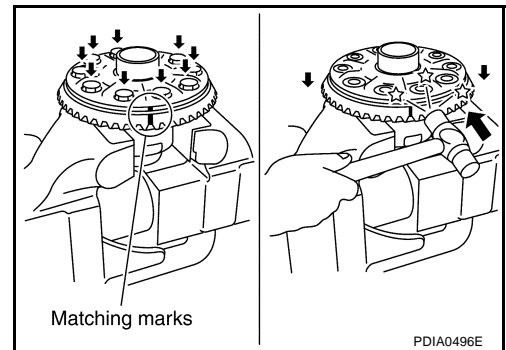
CAUTION:

For matching mark, use paint. Do not damage differential case and drive gear.

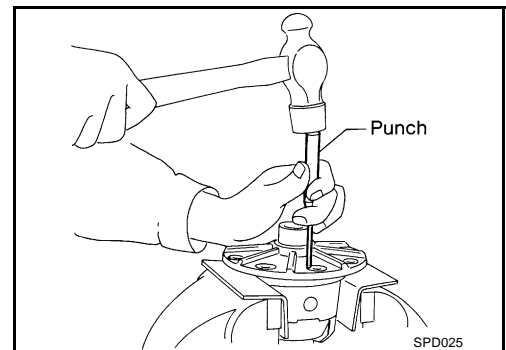
16. Remove drive gear mounting bolts.
17. Tap drive gear off differential case assembly with a soft hammer.

CAUTION:

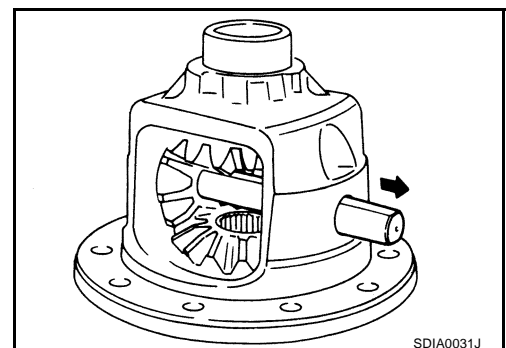
Tap evenly all around to keep drive gear from bending.



18. Remove lock pin of pinion mate shaft with a punch from drive gear side.

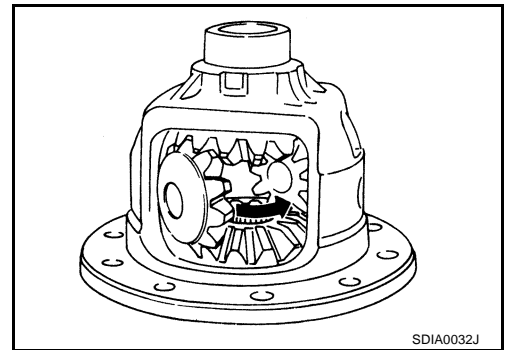


19. Remove pinion mate shaft.



FRONT FINAL DRIVE ASSEMBLY

20. Turn pinion mate gear, then remove pinion mate gears, pinion mate thrust washers, side gears and side gear thrust washers from differential case.

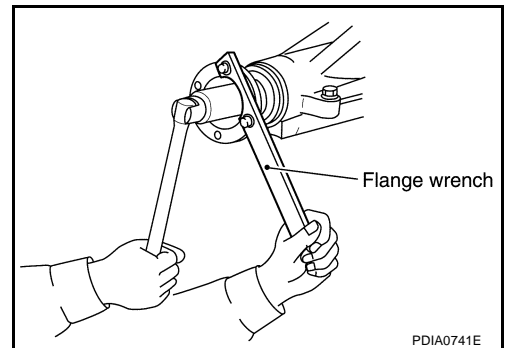


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Drive Pinion Assembly

1. Remove differential assembly. Refer to [FFD-20, "Differential Assembly"](#).
2. Remove drive pinion lock nut with a flange wrench.



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

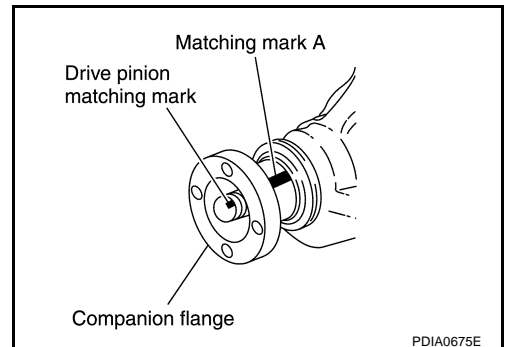
CAUTION:

For matching mark, use paint. Do not damage companion flange and drive pinion.

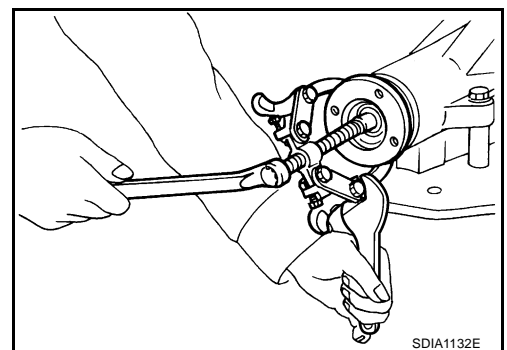
NOTE:

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.

4. Remove companion flange using the suitable puller.



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FRONT FINAL DRIVE ASSEMBLY

5. Press drive pinion assembly out of gear carrier.

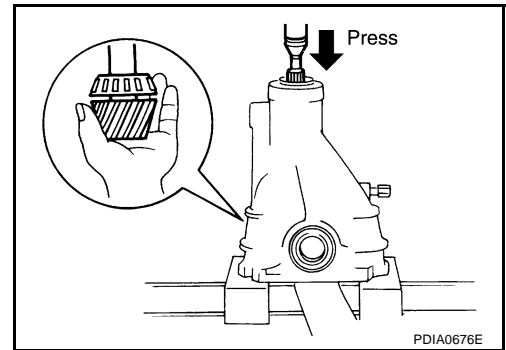
CAUTION:

Do not drop drive pinion assembly.

6. Remove front oil seal.

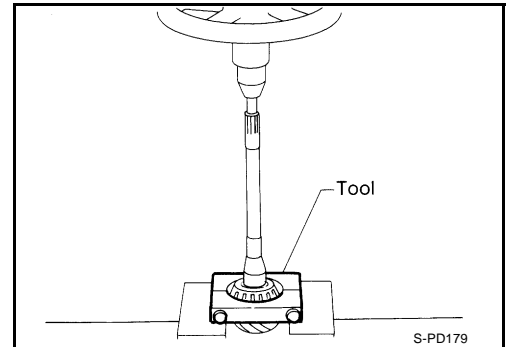
7. Remove pinion front bearing inner race.

8. Remove drive pinion bearing adjusting washer and drive pinion adjusting washer.



9. Remove pinion rear bearing inner race and drive pinion height adjusting washer with replacer.

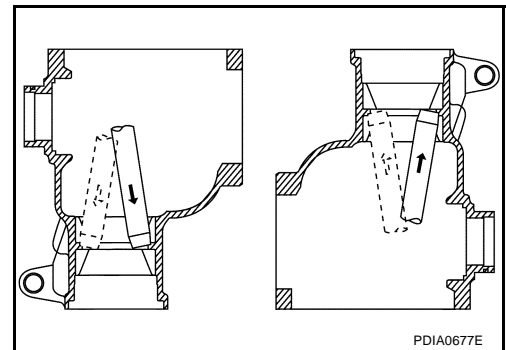
Tool number : ST30031000 (J-22912-01)



10. Tap pinion front/rear bearing outer races uniformly a brass rod or equivalent to removed.

CAUTION:

Be careful not to damage gear carrier.



INSPECTION AFTER DISASSEMBLY

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

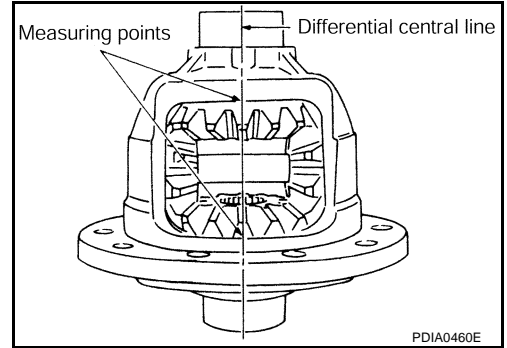
Content	Conditions and Measures
Hypoid gear	<ul style="list-style-type: none"> ● If the gear teeth do not mesh or line-up correctly, determine the cause and adjust or replace as necessary. ● If the gears are worn, cracked, damaged, pitted or chipped (by friction) noticeably, replace with new drive gear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

FRONT FINAL DRIVE ASSEMBLY

ADJUSTMENT AND SELECTION OF ADJUSTING WASHERS (SHIMS)

Differential Side Gear Clearance

- Assemble the differential parts if they are disassembled. Refer to [FFD-30, "Differential Assembly"](#).
- Place differential case straight up so that side gear to be measured comes upward.



- 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 of the other side as well.

Side gear back clearance specification:

0.2 mm (0.008 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.

- If the back clearance is outside the specification, use a thicker/thinner side gear thrust washer to adjust. Refer to [FFD-35, "Side Gear Thrust Washer"](#).

When the back clearance is large:

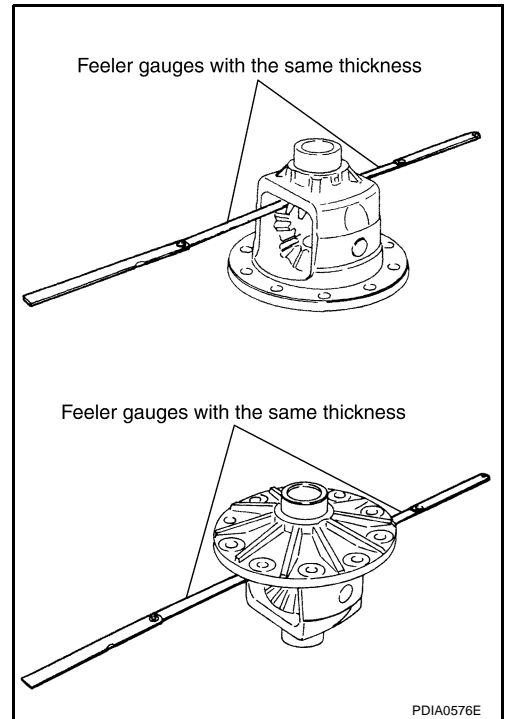
Use a thicker thrust washer.

When the back clearance is small:

Use a thinner thrust washer.

CAUTION:

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



Side Bearing Preload

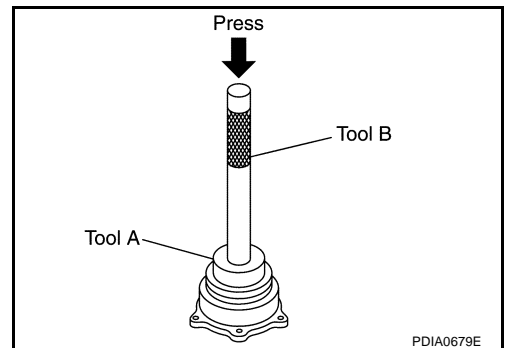
- Make sure all parts are clean. Also, make sure the bearings are well lubricated with gear oil.
- Press-fit side bearing outer race into side retainer with tool.

Tool number A: KV31103000 (J-38982)

B: ST30611000 (J-25742-1)

CAUTION:

- At first, using a hammer, tap bearing outer race until it becomes flat to side retainer.**
- Do not reuse side bearing outer race.**



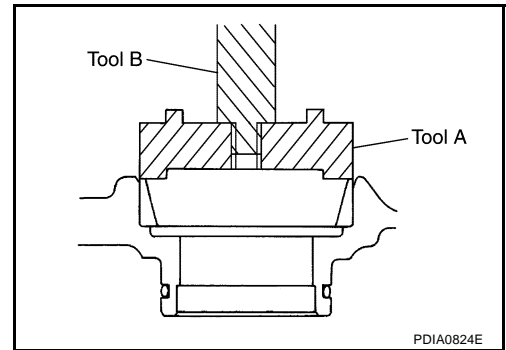
FRONT FINAL DRIVE ASSEMBLY

3. Press-fit side bearing outer race into gear carrier with tool.

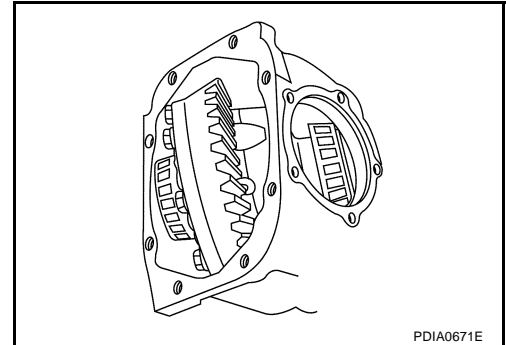
Tool number **A: KV31103000 (J-38982)**
 B: ST30611000 (J-25742-1)

CAUTION:

- At first, using a hammer, tap bearing outer race until it becomes flat to gear carrier.
- Do not reuse side bearing outer race.



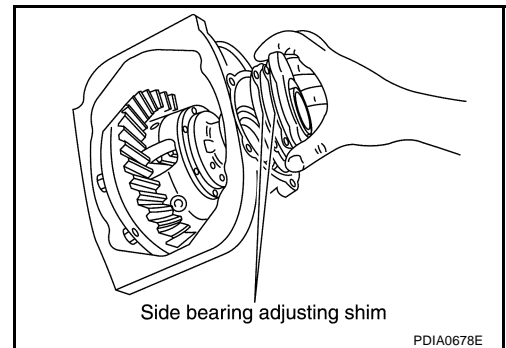
4. Place the differential case assembly into gear carrier.



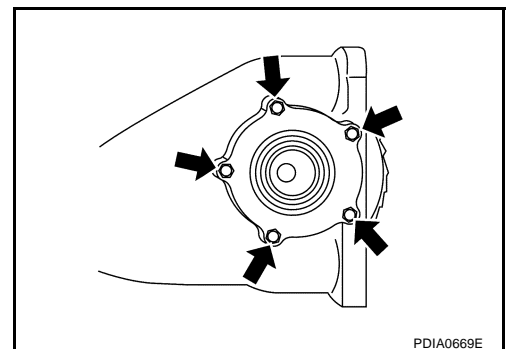
5. Install side bearing adjusting shim before disassembling or shim which thickness is the same as the one before disassembling.
6. Install side retainer assembly to gear carrier.

CAUTION:

Do not install O-ring.



7. Install side retainer mounting bolts to the specified torque. Refer to [FFD-14, "COMPONENTS"](#).

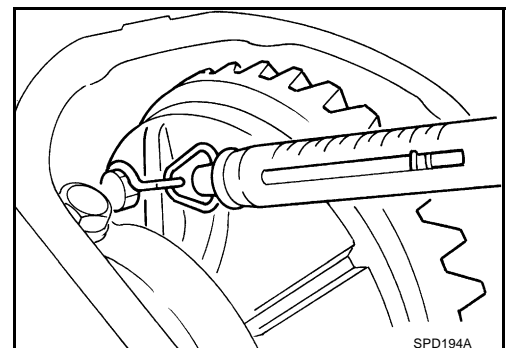


8. Measure the turning torque of the gear carrier at the drive gear mounting bolts with a spring gauge.

Tool number : — **(J-8129)**

Specification:

0.78 - 1.08 N (0.08 - 0.11 kg, 0.57 - 0.80 lb) of pulling force at the drive gear bolt



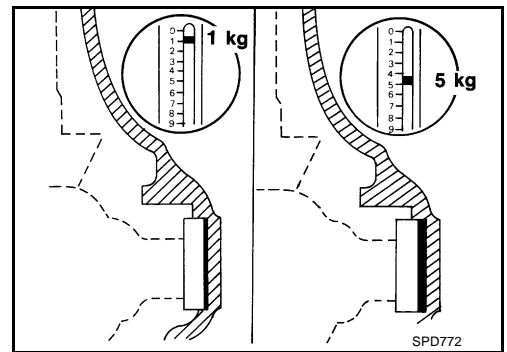
FRONT FINAL DRIVE ASSEMBLY

9. If the turning torque is outside the specification, use a thicker/thinner side bearing adjusting shim to adjust. Refer to [FFD-36, "Side Bearing Adjusting Shim"](#).

**If the turning torque is less than the specified range:
Decrease the side bearing adjusting shim thickness.**

**If the turning torque is greater than the specification:
Increase the side bearing adjusting shim thickness.**

10. Record the total amount of shim thickness required for the correct carrier side bearing preload.



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FFD

Pinion Gear Height

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

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

Washer selection equation:

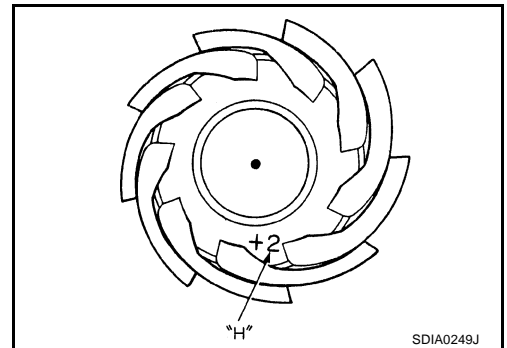
$$T = T_0 + (t_1 - t_2)$$

T: Correct washer thickness

T₀: Removed washer thickness

t₁: Old drive pinion head letter "H × 0.01"
("H": machined tolerance 1/100 mm × 100)

t₂: New drive pinion head letter "H × 0.01"
("H": machined tolerance 1/100 mm × 100)



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H

Example:

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

T₀: 3.21

t₁: +2

t₂: -1

2. Select the proper pinion height adjusting washer. Refer to [FFD-36, "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

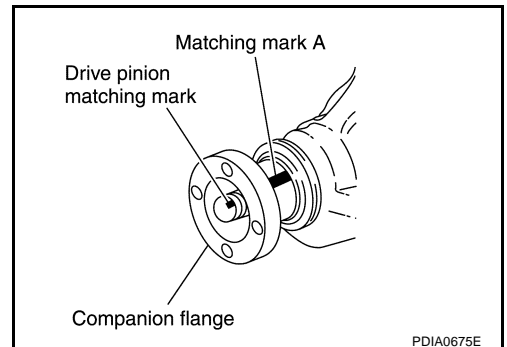
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Pinion Bearing Preload

- Assemble the drive pinion parts if they are disassembled. Refer to [FFD-28, "Drive Pinion Assembly"](#).
- Make sure all parts are clean. Also, make sure the bearings are well lubricated with gear oil.
 - 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.



FRONT FINAL DRIVE ASSEMBLY

- Temporarily tighten removed drive pinion lock nut to drive pinion.

NOTE:

Use removed drive pinion lock nut only for the preload measurement.

- Rotate drive pinion at least 20 times to check for smooth operation of the bearing.
- Tighten to drive pinion lock nut, while adjust pinion bearing preload torque.

Tool number : ST3127S000 (J-25765-A)

Drive pinion lock nut tightening torque:

127.4 - 245.0 N·m (13 - 25 kg·m, 94 - 181 ft·lb)

Pinion bearing preload:

0.78 - 1.57 N·m (0.08 - 0.16 kg·m, 7 - 13 in·lb)

CAUTION:

- Adjust to the lower limit of the drive pinion lock nut tightening torque first.
- After adjustment, rotate drive pinion back and forth 2 to 3 times to check for unusual noise, rotation malfunction, and other malfunctions.

- If the pinion bearing preload torque is outside the specification, use a thicker/thinner drive pinion bearing adjusting washer and drive pinion adjusting washer to adjust. Refer to [FFD-36, "Drive Pinion Bearing Adjusting Washer"](#) and [FFD-36, "Drive Pinion Adjusting Washer"](#).

When the preload torque is large:

Decrease the drive pinion bearing adjusting washer and drive pinion adjusting washer thickness.

When the preload is small:

Increase the drive pinion bearing adjusting washer and drive pinion adjusting washer thickness.

- Remove companion flange, after adjustment.

ASSEMBLY

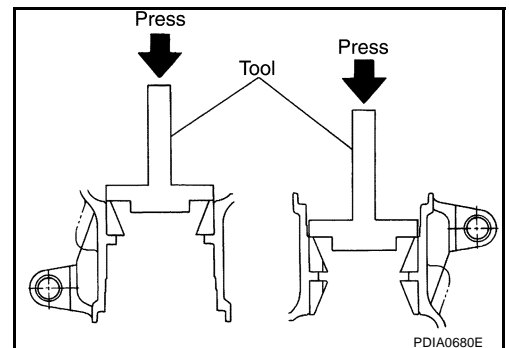
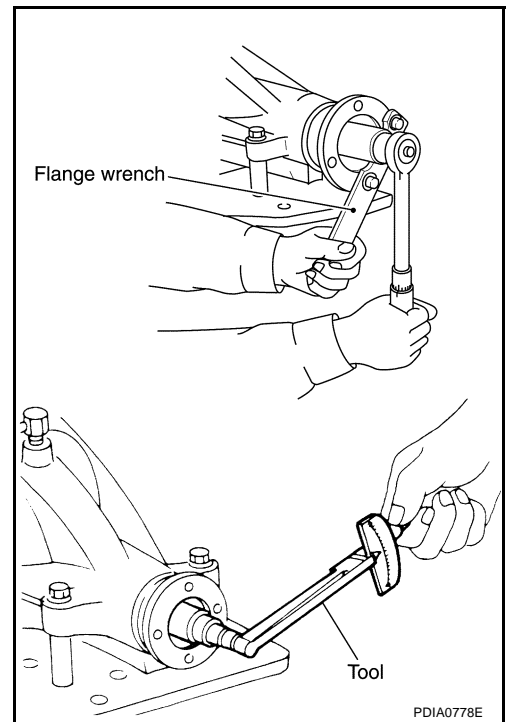
Drive Pinion Assembly

- Install front and rear bearing outer races using drifts.

Tool number : ST37820000 (—)

CAUTION:

- At first, using a hammer, tap bearing outer race until it becomes flat to gear carrier.
- Do not reuse pinion front and rear bearing outer race.



FRONT FINAL DRIVE ASSEMBLY

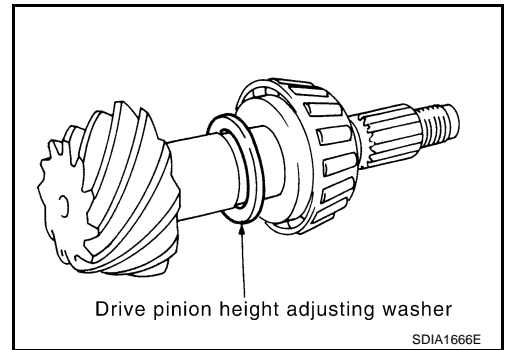
2. Temporarily install pinion height adjusting washer.

When hypoid gear set has been replaced

- Select pinion height adjusting washer. Refer to [FFD-27, "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.

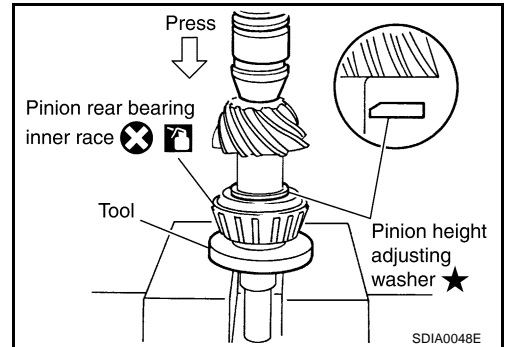


3. Install selected drive pinion height adjusting washer to drive pinion. Press pinion rear bearing inner race to it, using drift.

Tool number : ST30032000 (J-26010-01)

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.



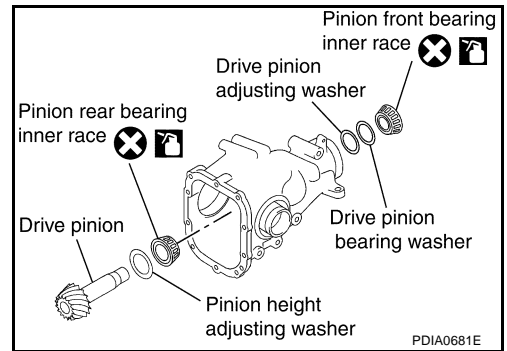
4. Temporarily assemble removed drive pinion adjusting washer and drive pinion bearing adjusting washer or same thickness them to drive pinion.

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

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

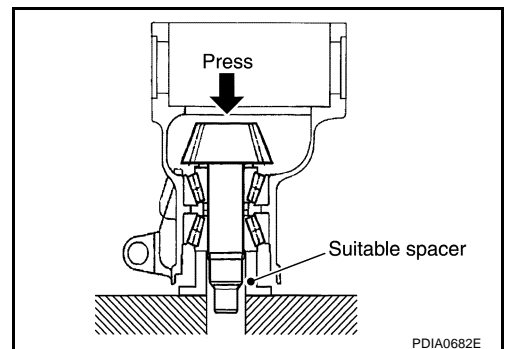
CAUTION:

Do not reuse pinion front bearing inner race.



7. Using suitable spacer, press the pinion front bearing inner race to drive pinion as far as drive pinion nut can be tightened.

8. Adjust pinion bearing preload. If necessary, select the appropriate drive pinion adjusting washer and drive pinion bearing adjusting washer. Refer to [FFD-27, "Pinion Bearing Preload"](#) .



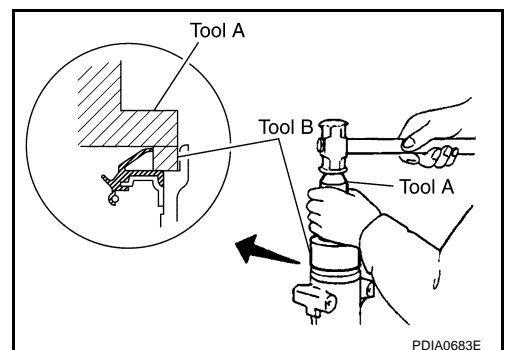
9. Using the drift, install front oil seal as shown in figure.

Tool number A: ST33400001 (J-26082)

B: KV38102510 (—)

CAUTION:

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

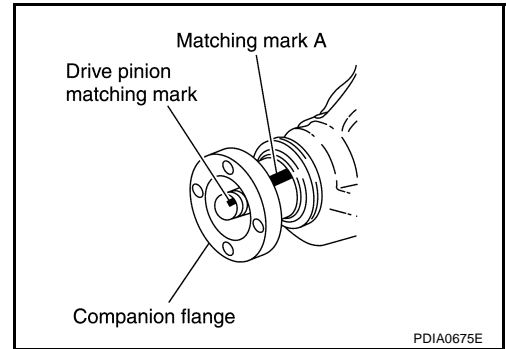


FRONT FINAL DRIVE ASSEMBLY

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.



11. Apply gear 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.

12. Tighten to drive pinion lock nut, while adjust pinion bearing preload torque.

Tool number : ST3127S000 (J-25765-A)

Drive pinion lock nut tightening torque:

127.4 - 245.0 N-m (13 - 25 kg-m, 94 - 181 ft-lb)

Pinion bearing preload:

0.78 - 1.57 N-m (0.08 - 0.16 kg-m, 7 - 13 in-lb)

CAUTION:

- Adjust to the lower limit of the drive pinion lock nut tightening torque first.
- 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-30, "Differential Assembly"](#).

CAUTION:

Do not install carrier cover yet.

14. Check and adjust drive gear runout, tooth contact, drive gear to drive pinion backlash, and companion flange runout. Refer to [FFD-16, "Drive Gear Runout"](#), [FFD-17, "Tooth Contact"](#), [FFD-19, "Backlash"](#), [FFD-19, "Companion Flange Runout"](#).

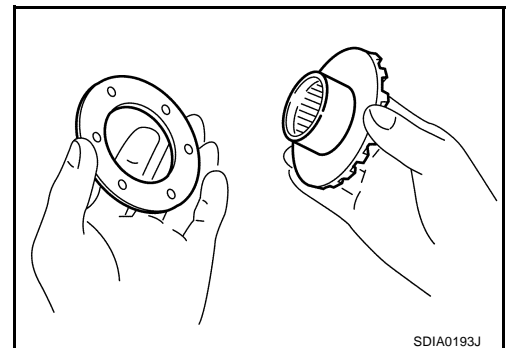
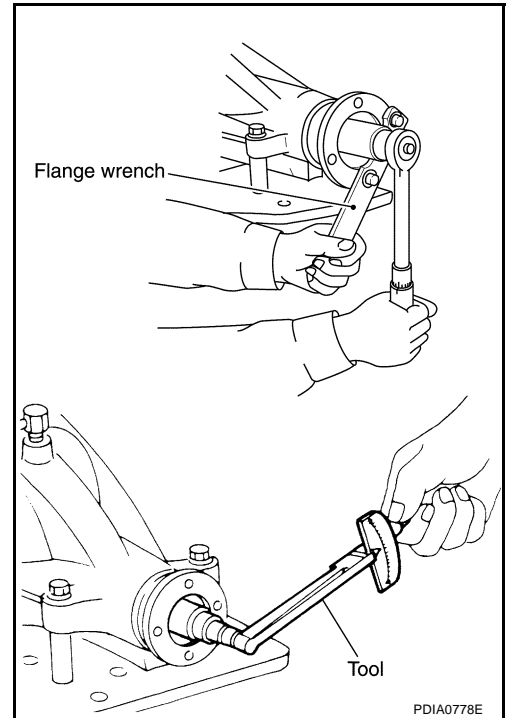
Recheck above items. Readjust the above description, if necessary.

15. Check total preload torque. Refer to [FFD-16, "Total Preload Torque"](#).

16. Install carrier cover. Refer to [FFD-30, "Differential Assembly"](#).

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.



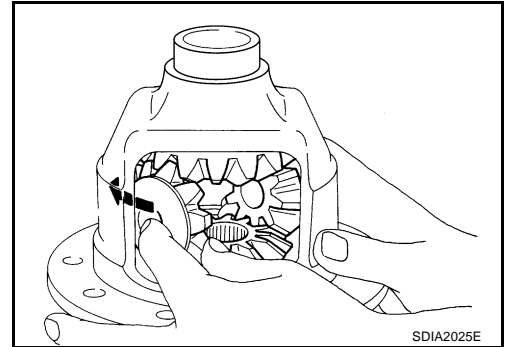
FRONT FINAL DRIVE ASSEMBLY

2. Install side gears and thrust washers into differential case.

CAUTION:

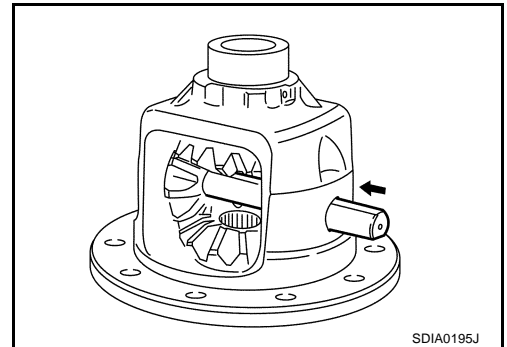
- Do not reuse circular clip.
- Make sure that the circular clip is installed to side gear (side retainer side).

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.

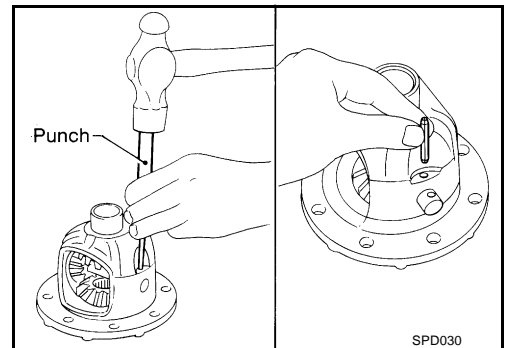
5. Measure side gear end play. If necessary, select the appropriate side gear thrust washers. Refer to [FFD-25, "Differential Side Gear Clearance"](#).



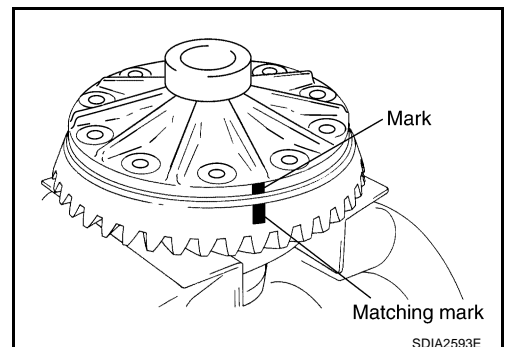
6. Drive a lock pin into pinion mate shaft, using a punch. Make sure lock pin is flush with differential case.

CAUTION:

- Do not reuse lock pin.



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

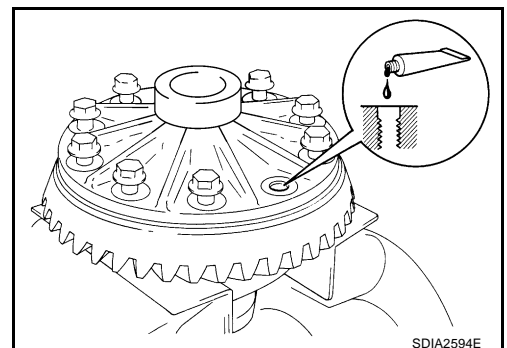


8. Apply thread locking sealant into the thread hole of drive gear.

- Use Genuine Medium Strength Thread Locking Sealant or equivalent. Refer to [GI-47, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).

CAUTION:

- Drive gear back and threaded holes shall be cleaned and degreased sufficiently.



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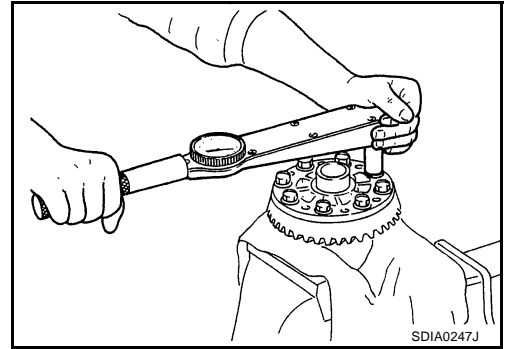
M

FRONT FINAL DRIVE ASSEMBLY

9. Install drive gear on the mounting bolts, and then tighten to the specified torque. Refer to [FFD-14, "COMPONENTS"](#) .

CAUTION:

Tighten bolts in a crisscross fashion.



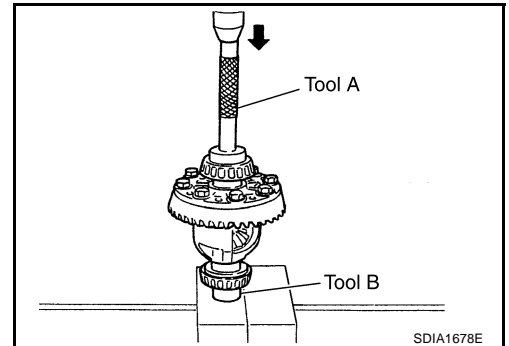
10. Press side bearing inner races to differential case, using the drift and the base.

Tool number **A: ST33230000 (J-25805-01)**

B: ST33061000 (J-8107-2)

CAUTION:

Do not reuse side bearing inner race.



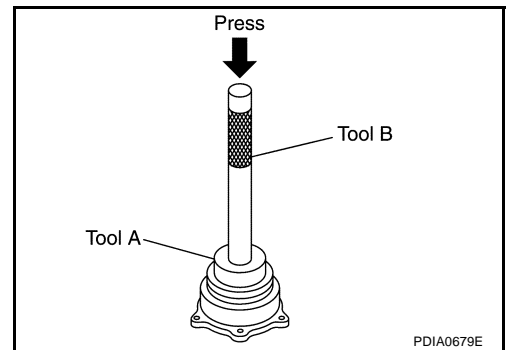
11. Press-fit side bearing outer race into side retainer with the drift and the drift bar.

Tool number **A: KV31103000 (J-38982)**

B: ST30611000 (J-25742-1)

CAUTION:

- At first, using a hammer, tap bearing outer race until it becomes flat to side retainer.
- Do not reuse side bearing outer race.



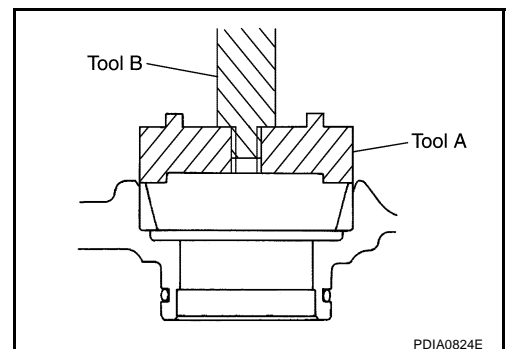
12. Press-fit side bearing outer race into gear carrier with the drift and the drift bar.

Tool number **A: KV31103000 (J-38982)**

B: ST30611000 (J-25742-1)

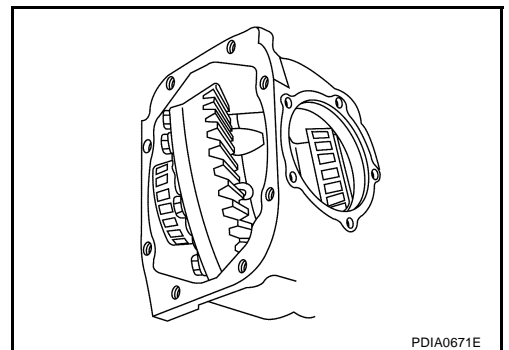
CAUTION:

- At first, using a hammer, tap bearing outer race until it becomes flat to gear carrier.
- Do not reuse side bearing outer race.



13. Place the differential case assembly into gear carrier.

14. Measure side bearing preload. If necessary, select the appropriate side bearing adjusting shim. Refer to [FFD-25, "Side Bearing Preload"](#) .

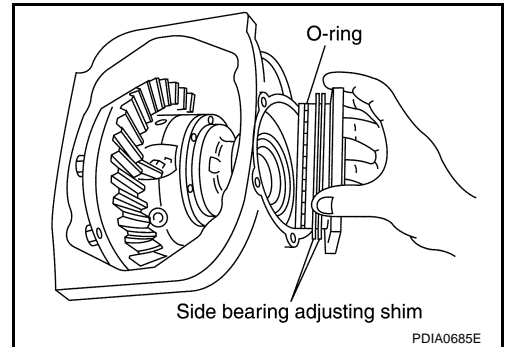


FRONT FINAL DRIVE ASSEMBLY

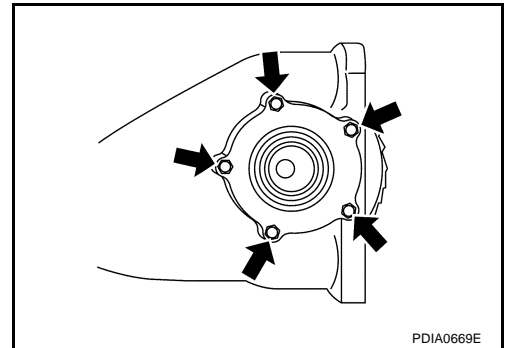
15. Install selected side bearing adjusting shim.
16. Apply multi-purpose grease to O-ring, and install it to side retainer.

CAUTION:
Do not reuse O-ring.

17. Install side retainer assembly to gear carrier.



18. Install side retainer mounting bolts to the specified torque. Refer to [FFD-14, "COMPONENTS"](#).

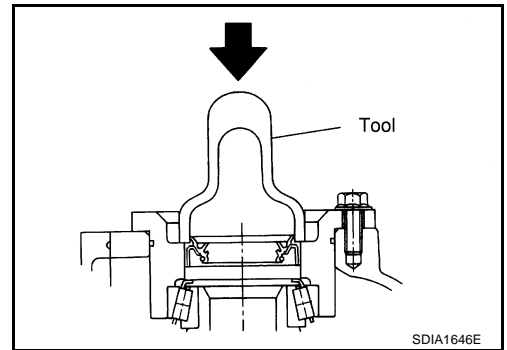


19. Using the drift, press-fit side oil seal so that its surface comes face to face with the end surface of the side retainer.

Tool number : ST33400001 (J-26082)

CAUTION:

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

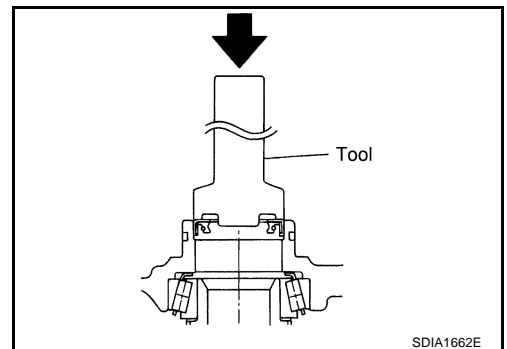


20. Using the drift, press-fit side oil seal so that its surface comes face to face with the end surface of gear carrier.

Tool number : KV38102100 (J-25803-01)

CAUTION:

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



21. Apply multi-purpose grease to O-ring, and install it to gear carrier.

CAUTION:
Do not reuse O-ring.

22. Check and adjust drive gear runout, tooth contact, drive gear to drive pinion backlash, and total preload torque. Refer to [FFD-16, "Drive Gear Runout"](#), [FFD-17, "Tooth Contact"](#), [FFD-19, "Backlash"](#), [FFD-16, "Total Preload Torque"](#).
Recheck above items. Readjust the above description, if necessary.

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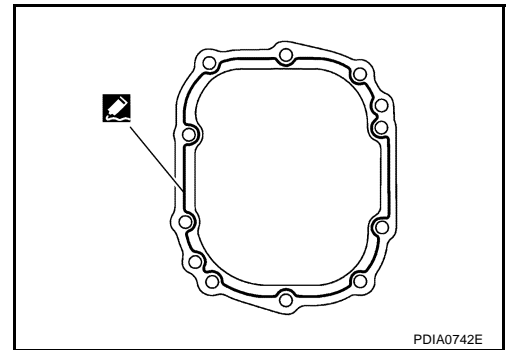
FRONT FINAL DRIVE ASSEMBLY

23. Apply sealant to mating surface of carrier cover.

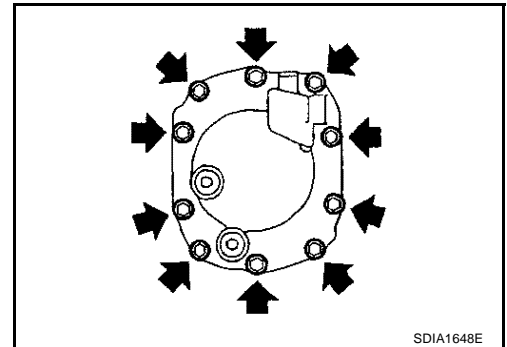
- Use Genuine Silicone RTV or equivalent. Refer to [GI-47, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).

CAUTION:

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



24. Install carrier cover on gear carrier and tighten mounting bolts with the specified torque. Refer to [FFD-14, "COMPONENTS"](#).



Side Shaft Assembly

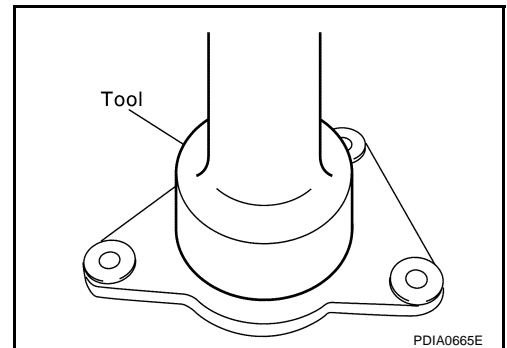
1. Using the drift, install side shaft oil seal.

Tool number :KV38100200 (—)

CAUTION:

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

2. Install dust sealed.



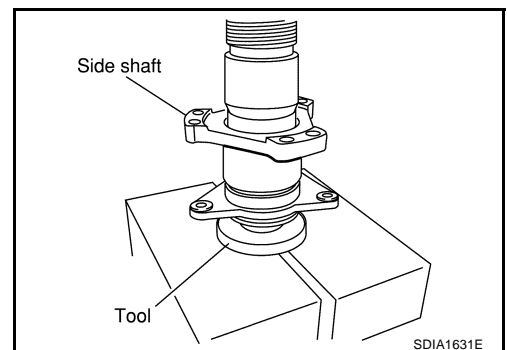
3. Support side shaft bearing with the drift, then press side shaft into the side shaft bearing using a press.

Tool number : ST30032000 (J-26010-01)

4. Apply multi-purpose grease to O-ring, and install it to extension tube retainer.

CAUTION:

Do not reuse O-ring.



SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

PPF:00030

General Specifications

NDS0004U

Applied model	VQ35DE
Final drive model	F160A
Gear ratio	3.538
Number of teeth (Drive gear/Drive pinion)	46/13
Oil capacity (Approx.)	ℓ (US pt, Imp pt)
Number of pinion gears	2
Drive pinion adjustment spacer type	Solid

Inspection and Adjustment DRIVE GEAR RUNOUT

NDS0004V

Unit: mm (in)

Item	Runout limit
Drive gear back face	0.05 (0.0020) or less

DIFFERENTIAL SIDE GEAR CLEARANCE

Unit: mm (in)

Item	Specification
Side gear backlash (Clearance between side gear and differential case)	0.2 (0.008) 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)	0.78 - 1.57 (0.08 - 0.16, 7 - 13)
Side bearing (P2)	0.78 - 1.08 (0.08 - 0.11, 7 - 9)
Side bearing to pinion bearing (Total preload) (Total preload = P1 + P2)	1.56 - 2.65 (0.16 - 0.27, 14 - 23)

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	0.18 (0.0070) or less
Inner side of the companion flange	0.13 (0.0051) or less

SELECTIVE PARTS

Side Gear Thrust Washer

Unit: mm (in)

Thickness	Part number*	Thickness	Part number*
0.68 (0.0268)	38424 W1010	0.86 (0.0339)	38424 W1016
0.71 (0.0280)	38424 W1011	0.89 (0.0350)	38424 W1017
0.74 (0.0291)	38424 W1012	0.92 (0.0362)	38424 W1018
0.77 (0.0303)	38424 W1013	0.95 (0.0374)	38424 W1019
0.80 (0.0315)	38424 W1014	0.98 (0.0386)	38424 W1020
0.83 (0.0327)	38424 W1015	1.01 (0.0398)	38424 W1021

*: 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 U1500	3.39 (0.1335)	38154 U1510
3.12 (0.1228)	38154 U1501	3.42 (0.1346)	38154 U1511
3.15 (0.1240)	38154 U1502	3.45 (0.1358)	38154U1512
3.18 (0.1252)	38154 U1503	3.48 (0.1370)	38154 U1513
3.21 (0.1264)	38154 U1504	3.51 (0.1382)	38154 U1514
3.24 (0.1276)	38154 U1505	3.54 (0.1394)	38154 U1515
3.27 (0.1287)	38154 U1506	3.57 (0.1406)	38154 U1516
3.30 (0.1299)	38154 U1507	3.60 (0.1429)	38154 U1517
3.33 (0.1323)	38154 U1508	3.63 (0.1429)	38154 U1518
3.36 (0.1323)	38154 U1509	3.66 (0.1441)	38154 U1519

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

Drive Pinion Bearing Adjusting Washer

Unit: mm (in)

Thickness	Part number*	Thickness	Part number*
3.81 (0.1500)	38125 61001	3.97 (0.1563)	38133 61001
3.83 (0.1508)	38126 61001	3.99 (0.1571)	38134 61001
3.85 (0.1516)	38127 61001	4.01 (0.1579)	38135 61001
3.87 (0.1524)	38128 61001	4.03 (0.1587)	38136 61001
3.89 (0.1531)	39129 61001	4.05 (0.1594)	38137 61001
3.91 (0.1539)	38130 61001	4.07 (0.1602)	38138 61001
3.93 (0.1547)	38131 61001	4.09 (0.1610)	38139 61001
3.95 (0.1555)	38132 61001		

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

Drive Pinion Adjusting Washer

Unit: mm (in)

Thickness	Part number*	Thickness	Part number*
5.19 (0.2043)	38151 AR000	6.09 (0.2398)	38151 AR003
5.49 (0.2161)	38151 AR001	6.39 (0.2516)	38151 AR004
5.79 (0.2280)	38151 AR002		

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

Side Bearing Adjusting Shim

Unit: mm (in)

Thickness	Part number*	Thickness	Part number*
0.20 (0.0079)	38453 AR000	0.40 (0.0157)	38453 AR003
0.25 (0.0098)	38453 AR001	0.50 (0.0197)	38453 AR004
0.30 (0.0118)	38453 AR002		

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

Side Bearing Adjusting Washer

Unit: mm (in)

Thickness	Part number*	Thickness	Part number*
0.10 (0.0040)	38453 AR010	0.25 (0.0098)	38453 AR015
0.12 (0.0047)	38453 AR011	0.30 (0.0118)	38453 AR016
0.15 (0.0059)	38453 AR012	0.40 (0.0157)	38453 AR017
0.17 (0.0067)	38453 AR013	0.50 (0.0197)	38453 AR018
0.20 (0.0079)	38453 AR014		

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