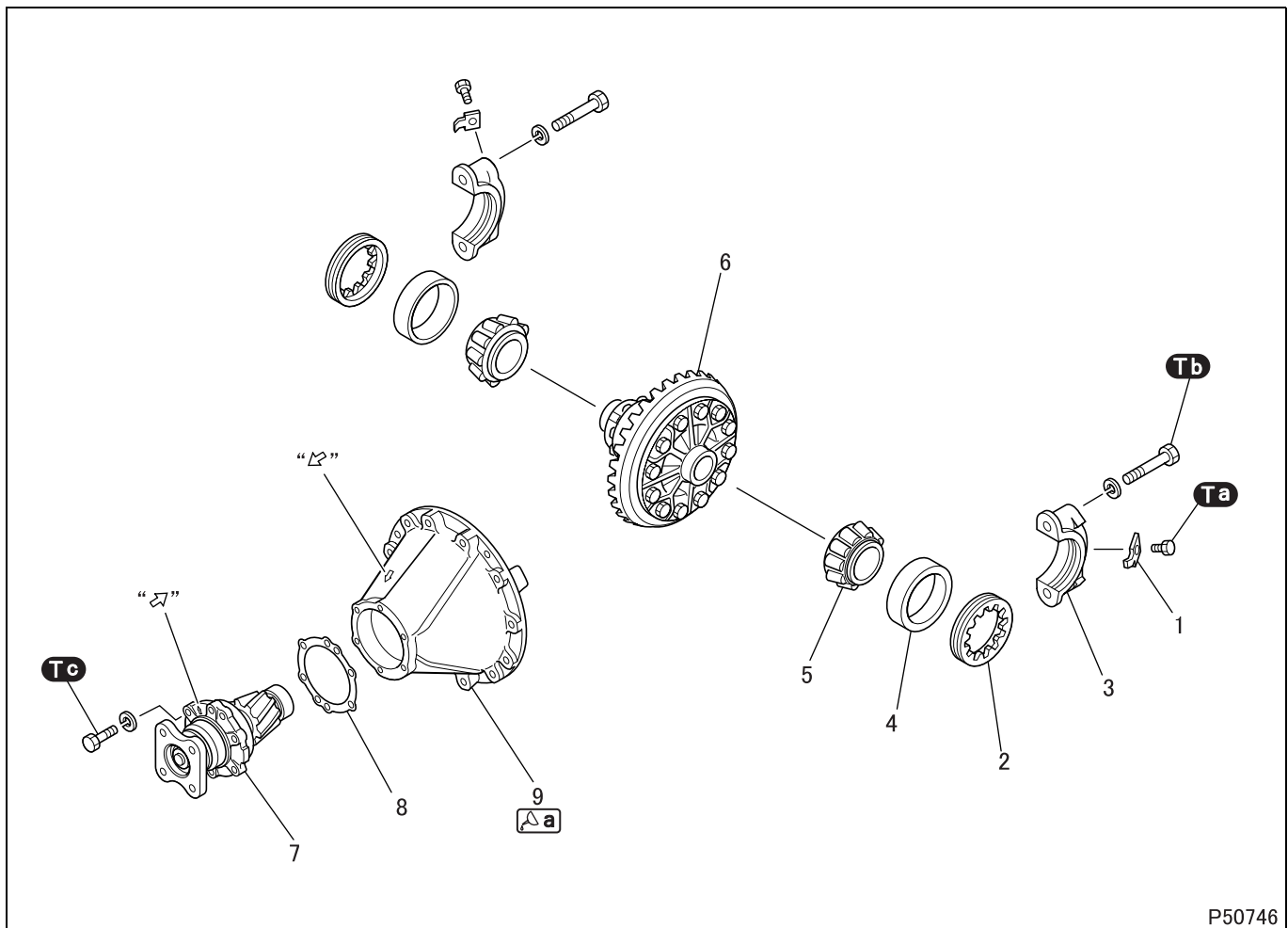


# REDUCTION AND DIFFERENTIAL



## ● Disassembly sequence

- |                           |   |
|---------------------------|---|
| 1 Lock plate              | 6 Differential (see later sections)     |
| 2 Side bearing nut        | 7 Reduction pinion (see later sections) |
| 3 Bearing cap             | 8 Shim                                  |
| 4 Side bearing outer race | 9 Differential carrier                  |
| 5 Side bearing inner race |   |

## CAUTION

- Keep side bearings that have been removed separated from each other and ensure that during installation each one is correctly placed.
- Be sure to replace the bearing cap, differential carrier and bolts as a differential carrier set.
- Be sure to replace the reduction pinion and the reduction gear of the differential as a reduction gear set.

## NOTE

- Record the number and thickness of shims to use them as reference at assembly.

## ● Assembly sequence

Follow the disassembly sequence in reverse.


**Service standards: mm {in}**

Location	Maintenance item	Standard value	Limit	Remedy
7, 8	Starting torque of side bearing	2.0 to 2.9 N·m {1.4 to 2.2 ft.lbs}	–	Adjust
9	Wobble at back face of reduction gear	0.1 {0.0039} or less	–	Replace
9, 11	Backlash between reduction gear and reduction pinion	0.20 to 0.28 {0.0079 to 0.011}	0.5 {0.020}	Adjust or replace

**Torque value: N·m (lbf-ft)**

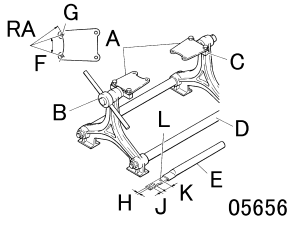
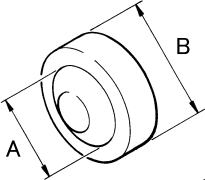
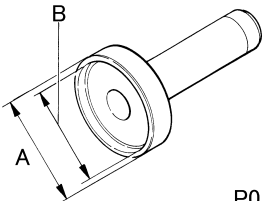
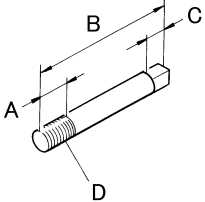
Mark	Fastener	Torque value	Remarks
<b>Ta</b>	Bolt (lock plate mounting)	20 to 26 (15 to 19)	–
<b>Tb</b>	Bolt (bearing cap mounting)	200.9 (150)	–
<b>Tc</b>	Bolt (pinion mounting)	67 to 90 (49 to 67)	–

**Lubricant and/or sealant**

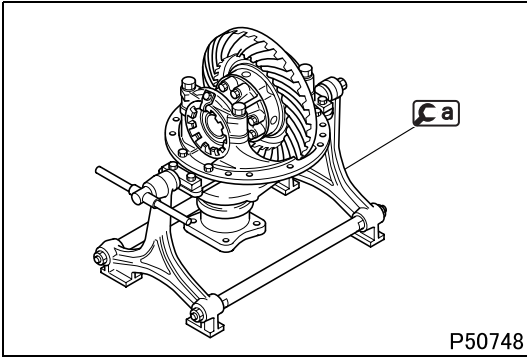
Mark	Points of application	Specified lubricant and/or sealant	Quantity
 <b>a</b>	Pinion pilot bearing mounting surface of differential carrier	Loctite 601	As required

# REDUCTION AND DIFFERENTIAL


## Special tools (Unit: mm {in})

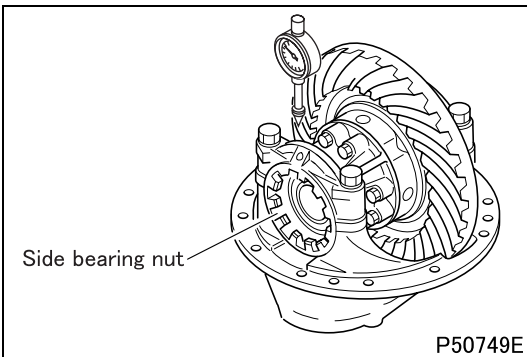
Mark	Tool name and shape	Part No.	Application																												
Ca	Differential working base 	MB999034	Workbench for reduction and differential  (flange stopper is unused)																												
				<table border="1"> <thead> <tr> <th colspan="2">Component</th> <th>Part No.</th> </tr> </thead> <tbody> <tr> <td rowspan="3">A</td> <td colspan="2">Attachment</td> <td>–</td> </tr> <tr> <td>RA</td> <td>F</td> <td>G</td> <td>–</td> </tr> <tr> <td>R158 {6.22}</td> <td>30°</td> <td>φ13 {0.51}</td> <td>MB999040</td> </tr> <tr> <td>B</td> <td>Holder</td> <td>MB999036</td> </tr> <tr> <td>C</td> <td>Holder</td> <td>MB999037</td> </tr> <tr> <td>D</td> <td>Working base</td> <td>MB999035</td> </tr> <tr> <td>E</td> <td>Flange stopper</td> <td>MB999096</td> </tr> </tbody> </table>	Component		Part No.	A	Attachment		–	RA	F	G	–	R158 {6.22}	30°	φ13 {0.51}	MB999040	B	Holder	MB999036	C	Holder	MB999037	D	Working base	MB999035	E	Flange stopper	MB999096
				Component		Part No.																									
				A	Attachment		–																								
RA	F	G	–																												
R158 {6.22}	30°	φ13 {0.51}	MB999040																												
B	Holder	MB999036																													
C	Holder	MB999037																													
D	Working base	MB999035																													
E	Flange stopper	MB999096																													
<table border="1"> <thead> <tr> <th>H</th> <th>J</th> <th>K</th> <th>L</th> </tr> </thead> <tbody> <tr> <td>11 {0.43}</td> <td>20 {0.79}</td> <td>40 {1.57}</td> <td>φ11 {0.43}</td> </tr> </tbody> </table>	H	J	K	L	11 {0.43}	20 {0.79}	40 {1.57}	φ11 {0.43}																							
H	J	K	L																												
11 {0.43}	20 {0.79}	40 {1.57}	φ11 {0.43}																												
Cb	Adapter 	MB999076	Removal of side bearing inner race (to be used in combination with commercial bearing puller)																												
				<table border="1"> <thead> <tr> <th>A</th> <th>B</th> </tr> </thead> <tbody> <tr> <td>φ45 {1.77}</td> <td>φ59 {2.32}</td> </tr> </tbody> </table>	A	B	φ45 {1.77}	φ59 {2.32}																							
A	B																														
φ45 {1.77}	φ59 {2.32}																														
Cc	Bearing installer 	MH061748	Installation of side bearing inner race																												
				<table border="1"> <thead> <tr> <th>A</th> <th>B</th> </tr> </thead> <tbody> <tr> <td>φ80 {3.15}</td> <td>φ70 {2.76}</td> </tr> </tbody> </table>	A	B	φ80 {3.15}	φ70 {2.76}																							
A	B																														
φ80 {3.15}	φ70 {2.76}																														
Cd	Bearing retainer guide pin 	MH061745	Installation of reduction pinion (two pieces are used)																												
				<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>18 {0.71}</td> <td>85 {3.35}</td> <td>12 {0.47}</td> <td>M12 × 1.25</td> </tr> </tbody> </table>	A	B	C	D	18 {0.71}	85 {3.35}	12 {0.47}	M12 × 1.25																			
A	B	C	D																												
18 {0.71}	85 {3.35}	12 {0.47}	M12 × 1.25																												

### ◆ Work before removal ◆



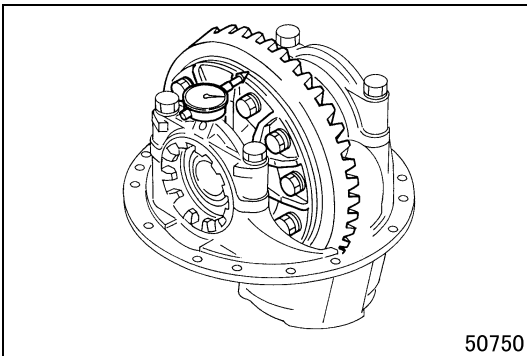
#### ■ Preparatory work: Installation of differential working base assembly

- Install the reduction and differential on the differential working base .



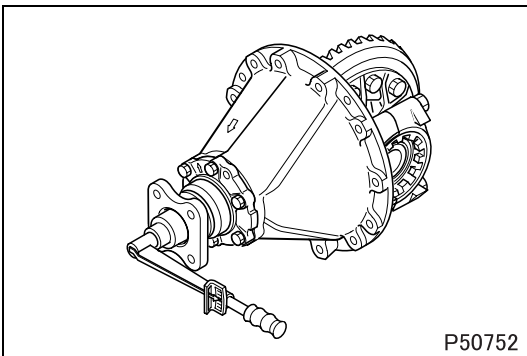
#### ■ Inspection: Backlash between reduction gear and reduction pinion

- If backlash is found faulty, the tightening amount of the side bearing nut is probably inappropriate.



#### ■ Inspection: Wobble at back face of reduction gear

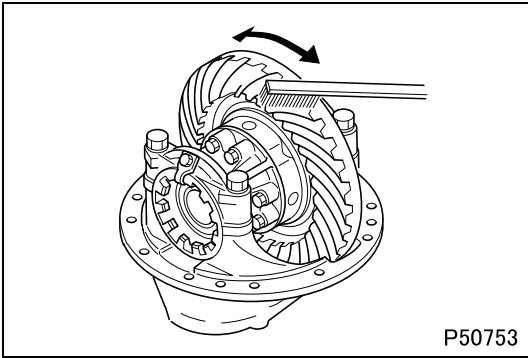
- Measure wobble at the illustrated position of the reduction gear.



#### ■ Inspection: Starting torque of side bearing

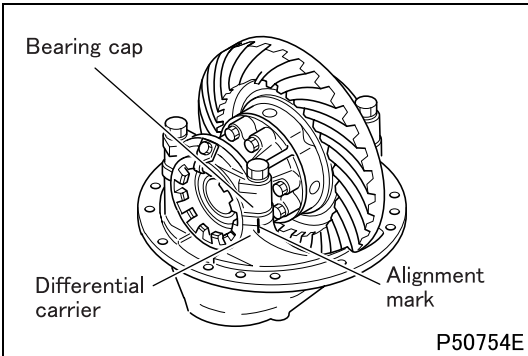
- Measure starting torque of the pinion assembly using a torque wrench and calculate the starting torque of the side bearing using the following formula.  
(Total starting torque – Pinion bearing starting torque (See later section.)) × Final ratio = Side bearing starting torque

# REDUCTION AND DIFFERENTIAL



## ■ Inspection: Tooth contact of reduction gear

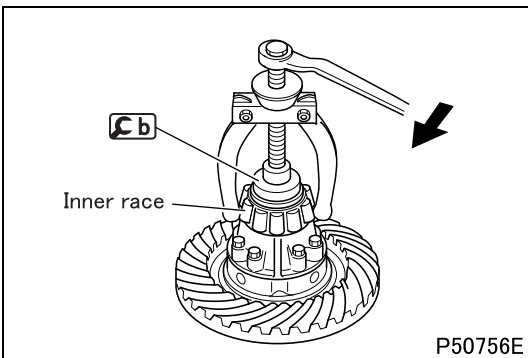
- Apply red lead to three to four teeth at three equally spaced points of the reduction gear.
- Turn the reduction gear several times to check for tooth contact.



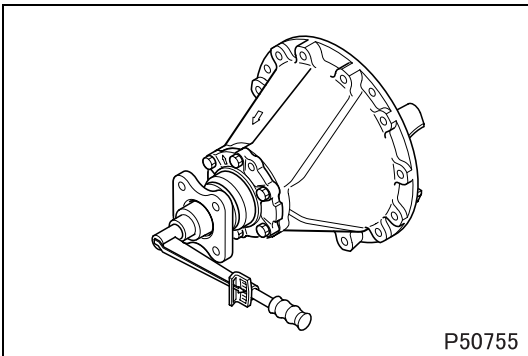
## ■ Alignment marks: Bearing cap and differential carrier

- Put alignment marks on the bearing cap and differential carrier for correct identification of right and left parts.

## ◆ Removal procedure ◆

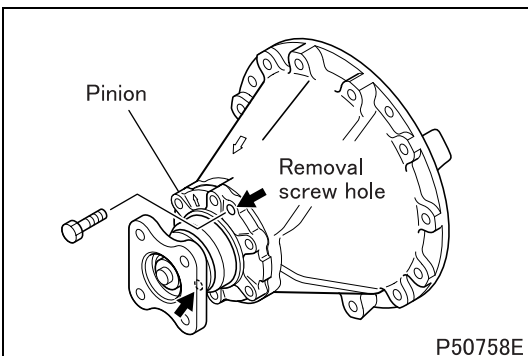


## ■ Removal: Side bearing inner race



## ■ Inspection: Starting torque of pinion bearing

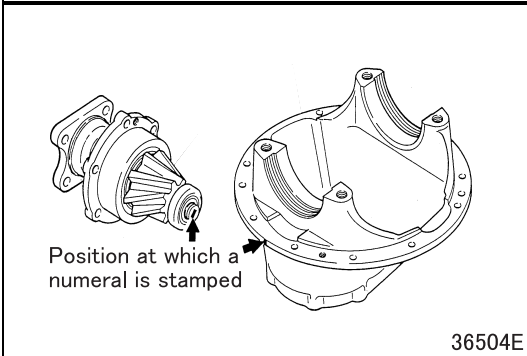
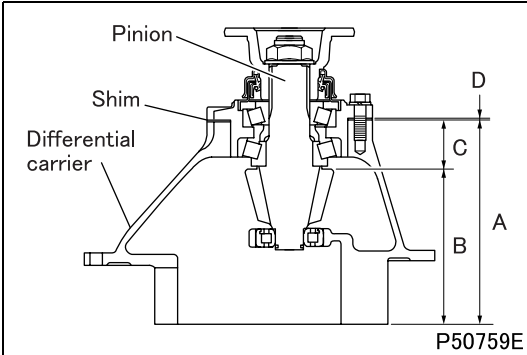
- After removing the differential, measure the starting torque of the pinion bearing.



## ■ Removal: Pinion

- Screw two bolts evenly into the pinion removal screw holes to remove the pinion.

◆ Adjustment procedure ◆



■ Adjustment: Reduction pinion

- Perform the following steps to adjust dimensions **A**, **B** and **C**.
- Calculate shim thickness (dimension **D**) by using the following formula based on the machining error data stamped on pinion assembly and differential carrier.

• Formula:

$$D = 0.5 \text{ mm } \{0.020 \text{ in}\} - a + b + c$$

**a** = Deviation from standard dimension **A**

**b** = Deviation from standard dimension **B**

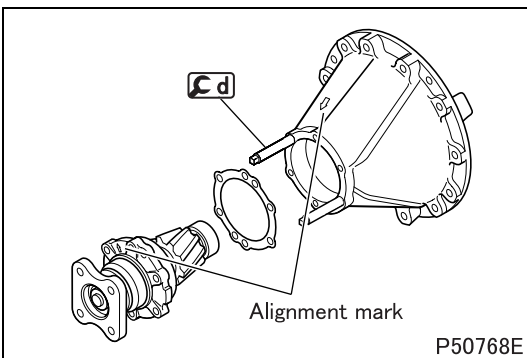
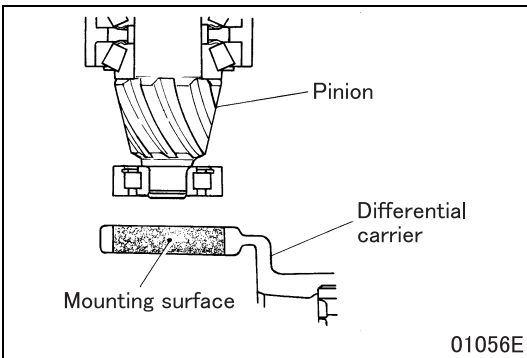
**c** = Deviation from standard dimension **C**

Unit: mm {in}

Location	Standard dimension	How to calculate deviation
Shim thickness	0.5 {0.020}	-
<b>A</b>	203 {7.99}	A numeral, multiplied by 100, is stamped on the outer periphery of the flange of the differential carrier.
<b>B</b>	157 {0.18}	A numeral is stamped on the top of the pinion assembly.
<b>C</b>	46.5 {1.8}	Measure deviation from dimension <b>C</b> using a dial gauge. Taking measurement is usually not feasible and assume a value from 0 to 0.2 mm.

- Select a shim based on shim thickness **D**.  
Thickness of shims available  
0.1 mm {0.0039 in}, 0.2 mm {0.0079 in} (two thickness)

◆ Installation procedure ◆



■ Installation: Reduction pinion

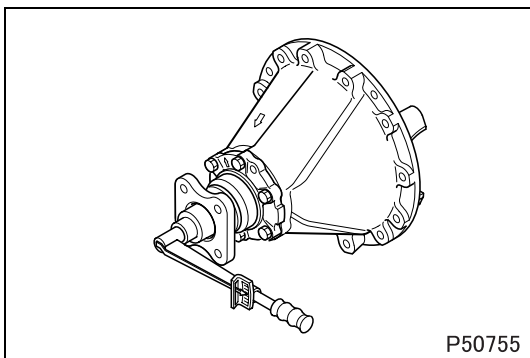
- Apply sealant to the pilot bearing mounting surface of the differential carrier.

- Aligning the embossed alignment mark on the bearing retainer of the pinion assembly with that on the differential carrier, mount the pinion assembly.

**CAUTION** ⚠

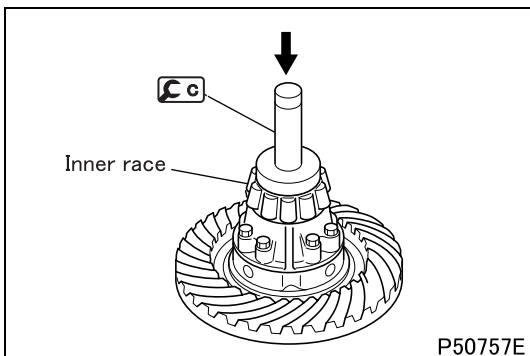
- Leave for 30 minutes to 2 hours after installation to let the sealant harden.
- Wait at least three hours or, if feasible 24 hours, before running the vehicle to let the sealant harden.

# REDUCTION AND DIFFERENTIAL



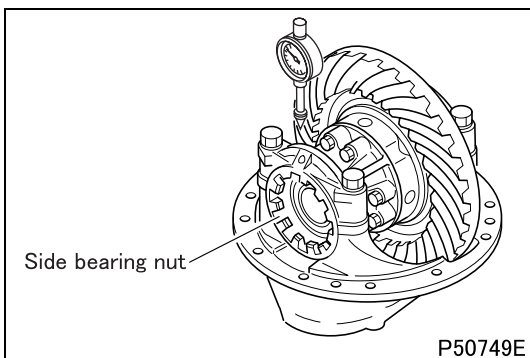
## ■ Inspection: Starting torque of pinion bearing

- After installing the pinion, measure the starting torque of the pinion bearing.
- If the measured value deviates from the standard value, adjust.



## ■ Installation: Side bearing inner race

## ◆ Work after installation ◆

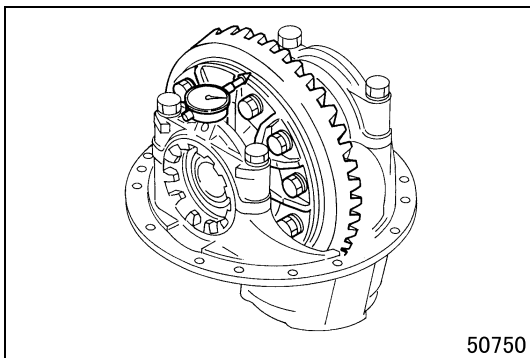


## ■ Adjustment: Backlash between reduction gear and reduction pinion

- Adjust backlash with the side bearing nut, using care not to allow the side bearing starting torque to change.

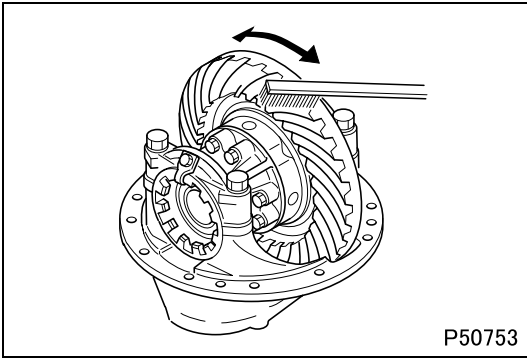
## CAUTION ⚠

- When one side bearing nut is loosened, be sure to tighten the other one the same amount to prevent the side bearing starting torque from changing.



## ■ Inspection: Wobble at back face of reduction gear

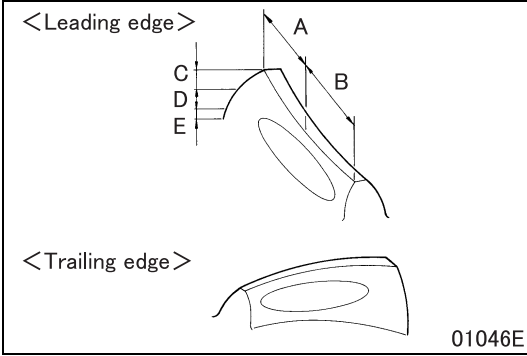
- Measure wobble at the illustrated position of the reduction gear.
- If the measured value deviates from the standard value, replace the reduction gear and reduction pinion of the differential as a set.



■ **Inspection: Tooth contact of reduction gear**

[Inspection]

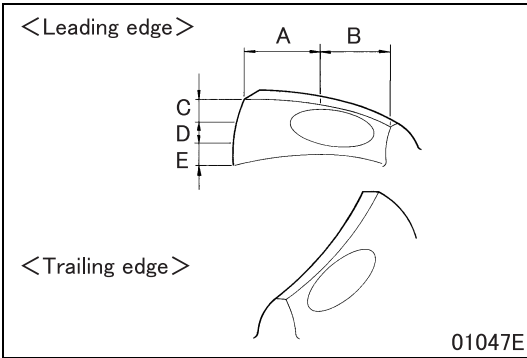
- Apply red lead to three to four teeth at three equally spaced points of the reduction gear.
- Turn the reduction gear several times to check for tooth contact.
- Adjust tooth contact if it is remarkably offset.



● **Correct tooth contact at no load**

<Reduction gear>

- A: Heel
- B: Toe
- C: Face
- D: Flank
- E: Clearance



<Reduction pinion>

- A: Heel
- B: Toe
- C: Face
- D: Flank
- E: Clearance

Maintenance item		Assembly standards	
At no load	Tooth contact position	Lengthwise direction of tooth	From center towards toe
		Vertical direction	From center towards top of tooth for reduction gear and center for reduction pinion
	Tooth contact shape	Length	Approximately 50 to 70% of tooth width
		Width	Approximately 50 to 70% of tooth depth
	Degree of tooth contact		It becomes weaker as it nears tooth root and tooth tip



# REDUCTION AND DIFFERENTIAL

## NOTE

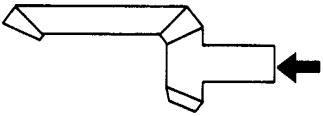
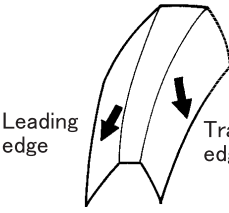
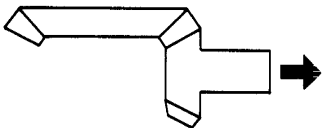
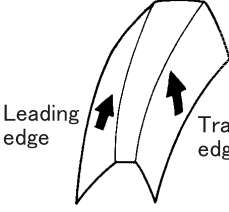
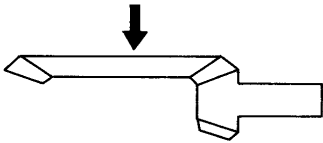
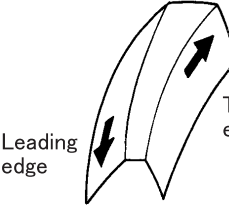
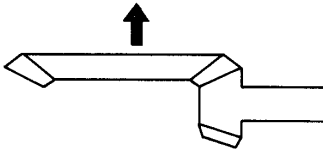
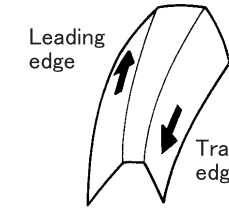
- When tooth contact is near the toe at no load, it becomes middle area contact at load.

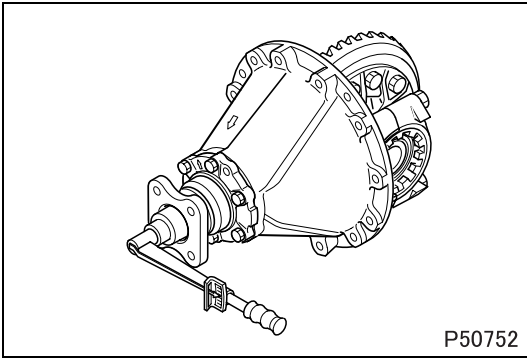
## [Adjustment]

- Adjust by backlash between reduction gear and reduction pinion (to be adjusted with the side bearing nut) and addition or reduction of rear bearing shims.

## CAUTION

- Make sure you replace as a reduction gear set (reduction gear and reduction pinion), when you replace the gear because of excessive teeth wear.

	Method of adjustment	Moving direction	
Tooth contact by addition or reduction of shims	Advance reduction pinion to reduction gear (shims are reduced)  55497	 55501E	Tooth contact moves towards tooth root
	Retard reduction pinion from reduction gear (shims are added)  55498	 55502E	Tooth contact moves towards tooth tip
Tooth contact by adjustment with side bearing nut	Advance reduction gear to reduction pinion center (less backlash)  55499	 55503E	Tooth contact moves in lengthwise direction of tooth Leading edge: Nearer to toe and slightly nearer to root of tooth Trailing edge: Nearer to heel and slightly nearer to top of tooth
	Retard reduction gear from reduction pinion center (more backlash)  55500	 55504E	Tooth contact moves in lengthwise direction of tooth Leading edge: Nearer to heel and slightly nearer to top of tooth Trailing edge: Nearer to toe and slightly nearer to root of tooth



### ■ Inspection: Starting torque of side bearing

#### [Inspection]

- Measure starting torque of the pinion assembly using a torque wrench and calculate the starting torque of the side bearing using the following formula.

(Total starting torque – Pinion bearing starting torque (See later section.)) × Final ratio = Side bearing starting torque

#### [Adjustment]

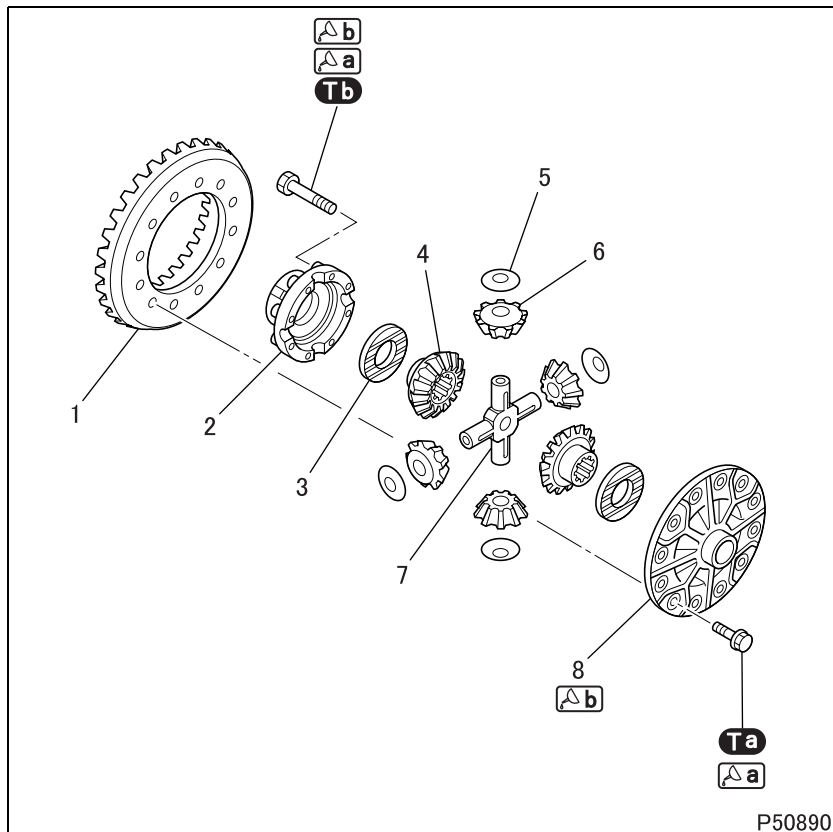
- Adjust by means of the right- and left-hand adjusting screws.

### CAUTION

- Always adjust both adjusting screws by the same amount.
- The starting torque must be adjusted without causing the backlash between the reduction gear and reduction pinion out of the standard value.

# REDUCTION AND DIFFERENTIAL

## Differential



### ● Disassembly sequence

- 1 Reduction gear
- 2 Differential case, R/H
- 3 Side gear washer
- 4 Side gear
- 5 Pinion washer
- 6 Differential pinion
- 7 Pinion spider
- 8 Differential case, L/H

### CAUTION

- Be sure to replace the R/H differential case and the L/H differential case as a differential case set.
- Be sure to replace the side gear and the differential pinion as a side gear set.

### ● Assembly sequence

Follow the disassembly sequence in reverse.

### Service standards: mm {in}

Location	Maintenance item	Standard value	Limit	Remedy
4	Backlash between side gear and spline of axle shaft	0.05 to 0.15 {0.0020 to 0.0059}	0.5 {0.020}	Replace
4, 6	Backlash between side gear and differential pinion	0.15 to 0.20 {0.0059 to 0.0079}	0.5 {0.020}	Replace
6, 7	Clearance between differential pinion and pinion spider	0.17 to 0.27 {0.0067 to 0.011}	0.5 {0.020}	Replace

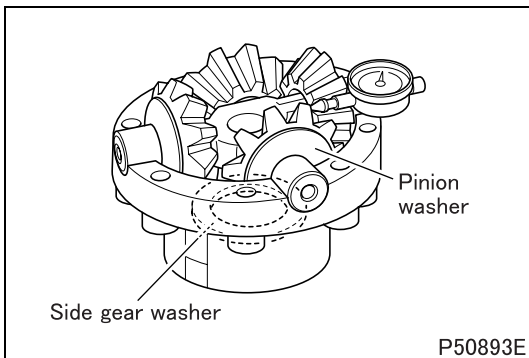
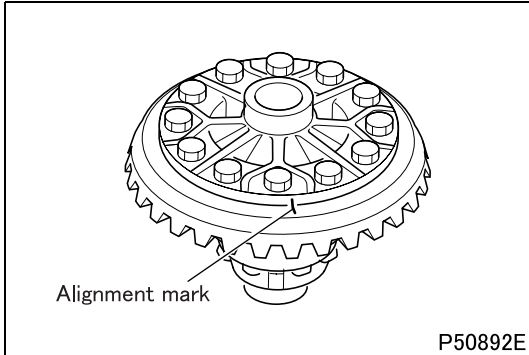
### Torque value: N·m (lbf·ft)

Mark	Fastener	Torque value	Remarks
	Bolt (reduction gear mounting)	166.6 to 225.4 (120 to 165)	–
	Bolt (R/H and L/H differential case mounting)	83.3 to 112.7 (61 to 83)	–

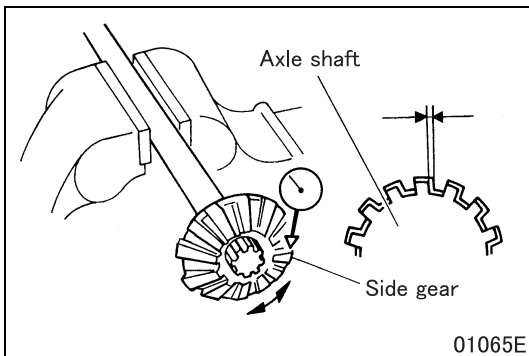
### Lubricant and/or sealant

Mark	Points of application	Specified lubricant and/or sealant	Quantity
	Entire bolt	Rust preventive	As required
	Thread area of bolt	Loctite 271	As required
	Bolt tip of L/H differential case		

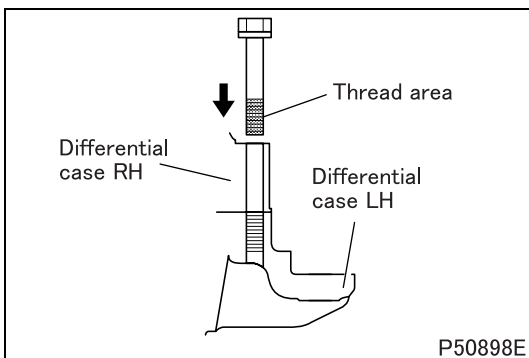
### ◆ Work before removal ◆



### ◆ Inspection procedure ◆



### ◆ Installation procedure ◆



#### ■ Alignment marks: Reduction gear and L/H differential case

- Put alignment marks on the reduction gear and L/H differential case.

#### ■ Inspection: Backlash between side gear and differential pinion

- If backlash is found faulty, thickness of the side gear washer and pinion washer is probably inappropriate.

#### ■ Inspection: Backlash between side gear and axle shaft

- If the measured value exceeds the limit, replace defective parts.

#### ■ Installation: Differential case, R/H and L/H

- Apply rust preventive to the entire surface of the bolt. After applying it, blow off the excess rust preventive on the bolt by compressed air.
- Apply thread lock cement to the bolt threads.
- Tighten the bolt to the specified torque.

#### CAUTION ⚠

- Make sure to apply rust preventive when tightening the bolt to the specified torque.
- Wait at least one hour after installation before actually running the vehicle to let the thread lock cement harden.
- Wait at least four hours after installation before operating the vehicle at full torque to let the thread lock cement harden.