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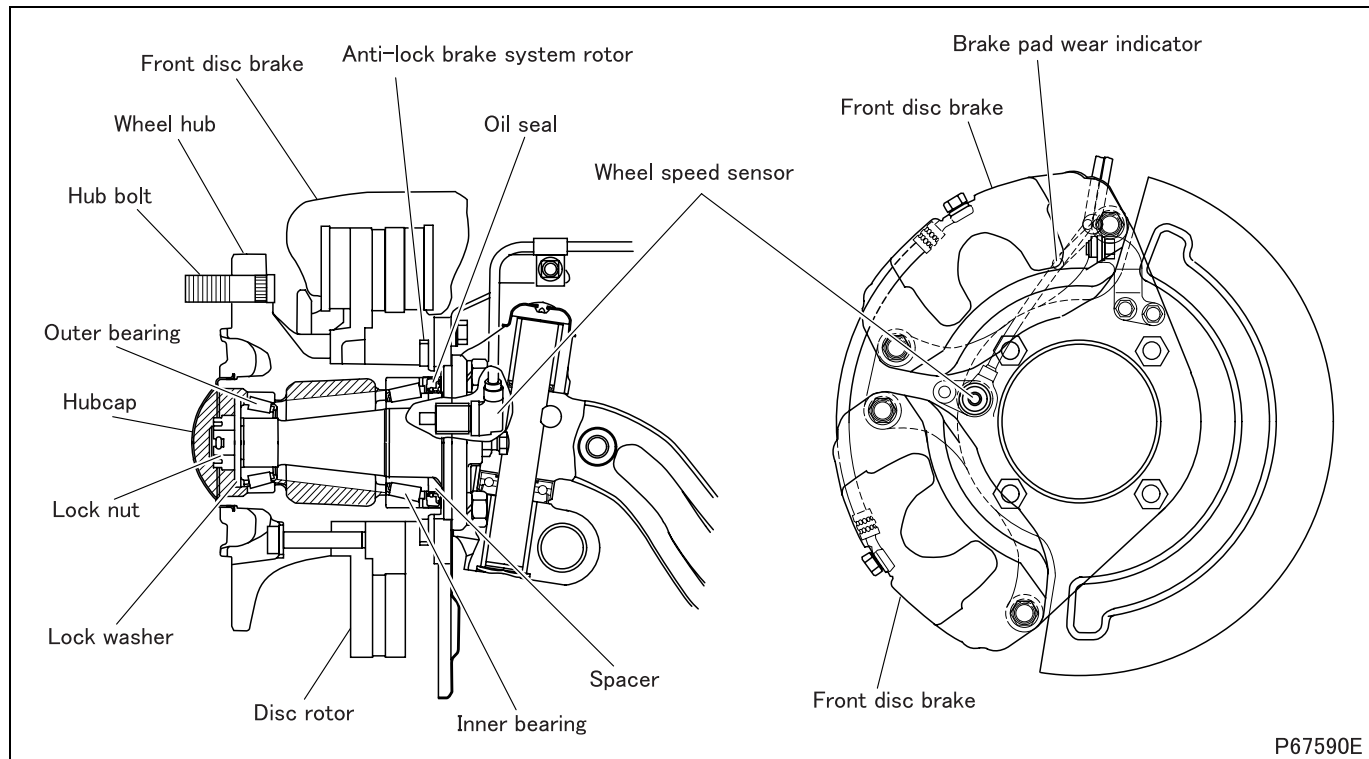
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# SPECIFICATIONS

Item		Specifications		
		COE 40	COE 45	COE 50
Front axle	Model	F200T	F300T	F350T
	Type	Reverse Elliot, "I" beam		
King pin Outer diameter × Length	mm (in.)	28 × 180 (1.10 × 7.09)		
Tread (dimension notified to the authorities)	mm (in.)	1665 (65.6)		
Mass (with disc brakes)	kg (lb)	Approx. 150 (331)	Approx. 155 (342)	Approx. 165 (365)

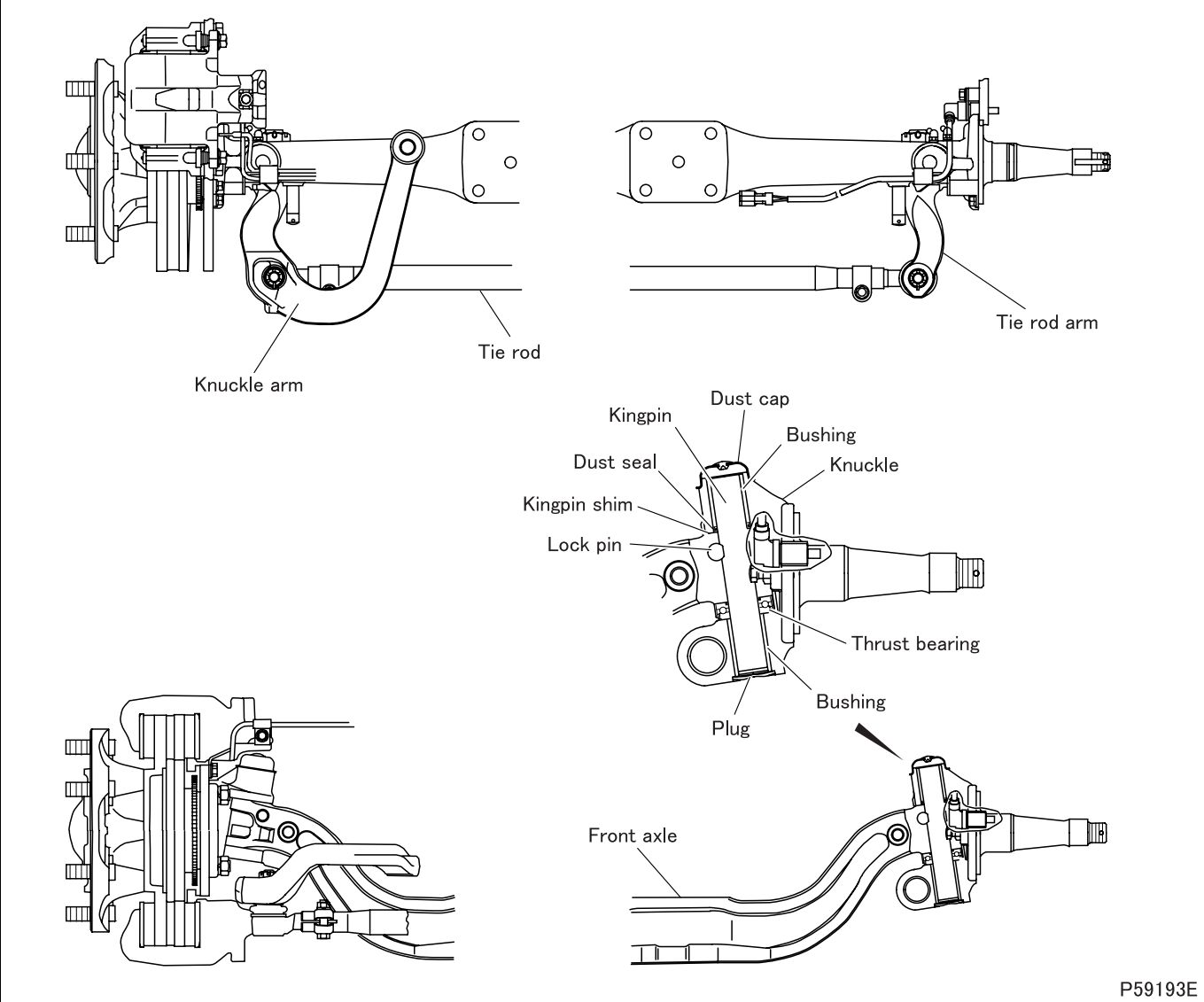
## 1. Wheel Hub and Rotor



- The brake pad wear indicator is installed on the right wheels or on both the right and left wheels.

# STRUCTURE AND OPERATION

## 2. Knuckle and King Pin, Front Axle



Symptoms		Continuous noise while cruising	Intermittent noise while cruising	Steering wheel shakes	Steering feels stiff	Steering wheel return poor	Unable to steer the steering wheel	Steering pulls to one side	Uneven wear or early wear of front tires	Reference Gr
Possible causes										
Wheel hub, knuckle and king pin, front axle	Wheel alignment misaligned			○	○	○			○	
	Steering angle adjustment faulty						○			
	Wheel hub bearing seized, worn or rotation faulty	○		○						
	Wheel hub bearing broken		○							
	King pin worn			○						
	Clearance between king pin and king pin bushing excessive			○	○					
	Greasing to king pin insufficient				○					
	King pin thrust bearing seized, worn or rotation faulty				○					
	Vertical clearance between knuckle and front axle excessive			○						
	Knuckle arm and tie rod arm tightening nuts loose			○						
	Ball stud tightening nut of tie rod end loose			○						
	Tie rod end ball stud worn			○						
	Tie rod bent						○			
	Knuckle bent							○		
	Front axle bent							○		
Various parts of front axle tightened excessively					○					
Front suspension	U-bolt nut of front suspension loose			○						Gr33
	One of front springs worn-out or broken						○			
Tire	Tire inflation pressure uneven			○					○	Gr31
	Tire inflation pressure too little				○					
	Inflation pressure uneven for right and left tires						○			
	Size and type of right and left tires different						○	○		
	Outer diameters of right and left tires remarkably different							○		
Handling of tires inadequate								○		

# ON-VEHICLE INSPECTION AND ADJUSTMENT

## 1. Wheel Alignment

Before performing a wheel alignment, do the following:

- Park the vehicle unloaded on a level place.
- Make sure that the tires are the proper size and inflated to the proper pressure.
- If tire wear is noticeably different on one side of the vehicle, replace the tires.
- Check the vehicle body for tilt to either side, and correct if necessary.
- Service all parts of the front axle and correct any problems, including the following.
  - King pin play or loose king pin
  - Loose front wheel hub
  - Loose bolts used for tightening various parts of tie rod arm, knuckle arm and tie rod
  - Bend of knuckle and front axle
- Make sure steering wheel free play is correct.
- Both wheel alignment and side slip must conform to the standard values.

### Service standards: mm (in.)


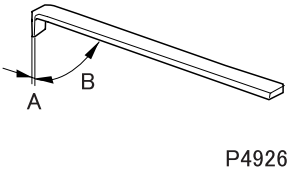

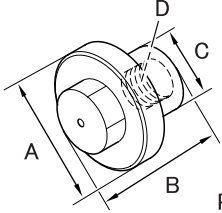
Location	Maintenance item	Standard value	Limit	Remedy
-	Toe-in	0 to 6 (3 ± 3) (0 to 0.24)	-	Adjust
	Camber	1°00' ± 1°00'	-	*
	Caster	1°15' ± '45	-	Replace
	King pin inclination angle	8° ± 30	-	Replace

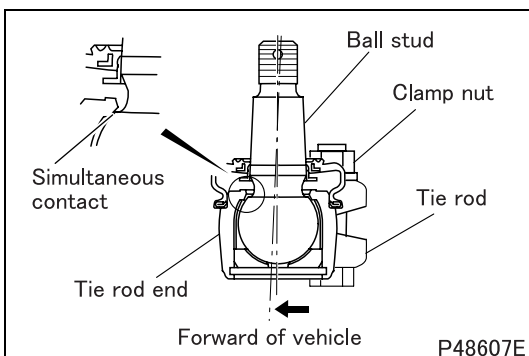
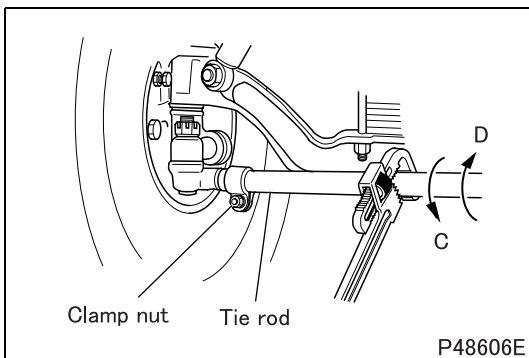
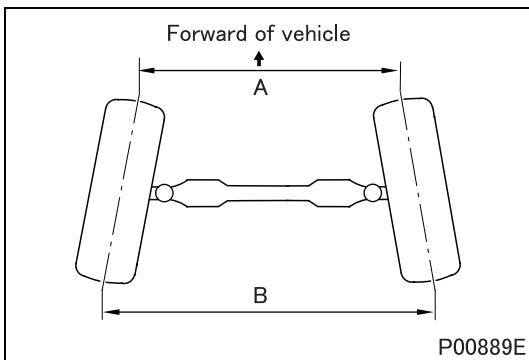
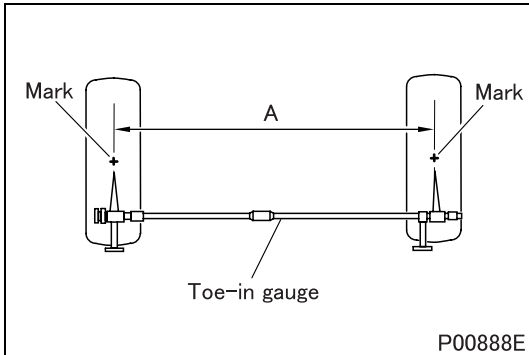
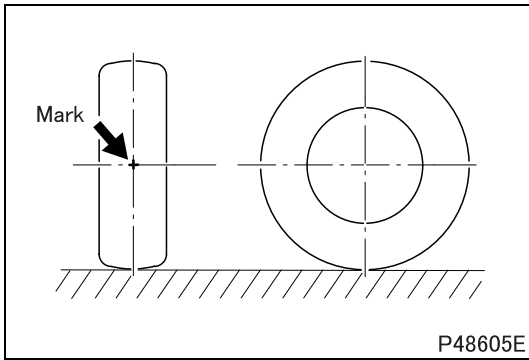
\*: If the measured value deviates from the standard value, abnormalities such as wear of king pin and king pin bushing, loose hub bearing, and bend of knuckle and front axle are suspected. Inspect each part and replace defective parts.

### Torque Value: N·m (lbf·ft)

Mark	Component	Torque value	Remarks
-	Clamp nut (tie rod end clamp fastening)	25 ± 5 (18 ± 3.6)	-
-	Alignment gauge adapter	113 ± 15 (83 ± 11)	-

### Special tools: mm (in)

Mark	Tool name and shape	Part No.	Application
	Hubcap wrench 	MB999108	Removal of hubcap
	Alignment gauge adapter 	MH063428	Measurement of camber, caster and king pin inclination angle



## 1.1 Inspection and adjustment of toe-in

### [Inspection]

- Put the front wheels exactly in forward running position.
- Put a mark on each tire, right and left, at the height of front wheel axis and in the middle of tire width.

- Align the two points of the toe-in gauge with respective marks and measure distance **A** between the marks.

- Push the vehicle to roll the tires 180 degrees.
- Measure distance **B** between the marks that have moved to the rear of the vehicle.
- If toe-in (difference between **A** and **B**) deviates from the standard value, adjust.

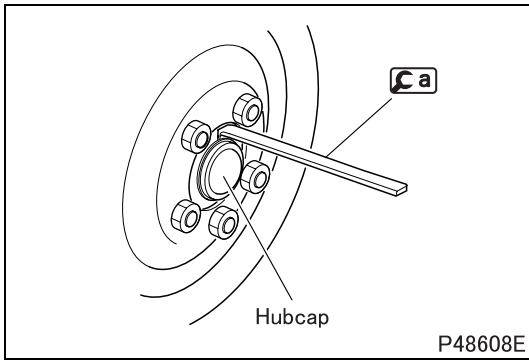
### [Adjustment]

- Loosen the clamp nuts on the right and left.
- Turn the tie rod with a pipe wrench to adjust the toe-in.  
**C**: When adjusting to the toe-out direction  
**D**: When adjusting to the toe-in direction
- After adjustment, tighten the clamp nut to the specified torque.

### CAUTION

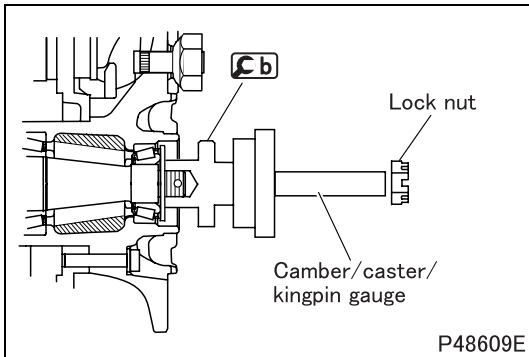
- Hold down the tie rod end toward the front of the vehicle with the front wheels directed to forward running position so that the right and left tie rod ends are in contact with the ball studs at the same time. In this state adjust so that the specified toe-in is achieved and tighten the clamp nut to secure the tie rod.

# ON-VEHICLE INSPECTION AND ADJUSTMENT



## 1.2 Inspection of camber

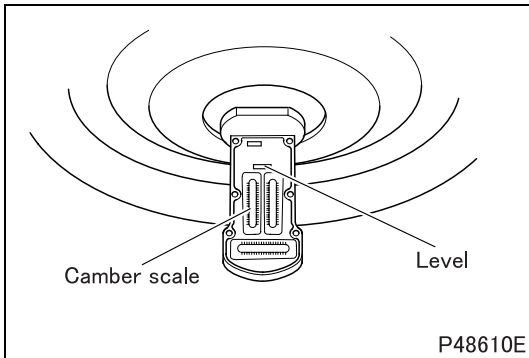
- Direct the front wheels exactly to forward running position.
- Remove the hubcap using the hubcap wrench **C a**.



- Remove the lock nut.

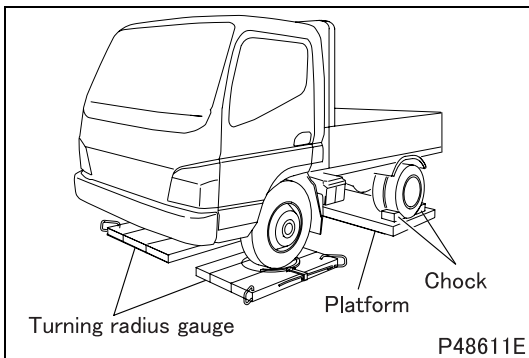
### CAUTION

- **Do not apply a vehicle weight to the hub bearing with the lock nut loosened.**



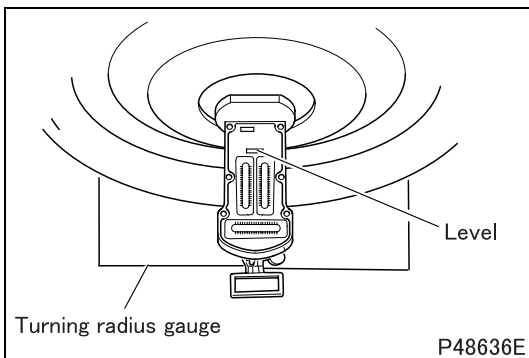
- Wipe off grease from the knuckle end, attach the alignment gauge adapter **C b** and tighten it to the specified torque.
- Attach the camber/caster/king pin gauge.

- Adjust the level until the bubble stays in the middle of the scale.
- On the camber scale, read the degree of camber. Do the same procedure for both front tires.
- If the measured value deviates from the standard value, disassemble the front axle for service.



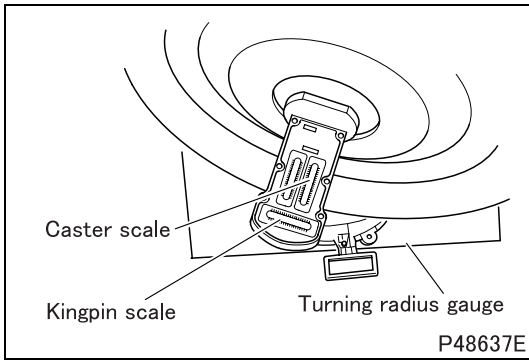
## 1.3 Inspection of caster and king pin inclination angle

- Prepare a platform with the same height as the turning radius gauge and place it under the rear wheels so that the vehicle will be level.
- Chocks the rear tires.
- Keep the turning radius gauge locked.
- Raise the vehicle, and set the right and left front wheels so that respective ground contact area centers of two wheels and turn table centers may meet.



- Unlock the turning radius gauge, and set the scale to 0 degrees.
- In a way similar to the camber measurement in Section 1.2, attach the camber/caster/king pin gauge, and set the level so that the bubble is centered.





- Apply brake, and with brake applied to the front wheels, turn steering wheel slowly from the point of 0 degrees on the turning radius gauge, until the direction is changed by 20 degrees each to the right side in case of the right front wheel and to the left in case of the left front wheel.

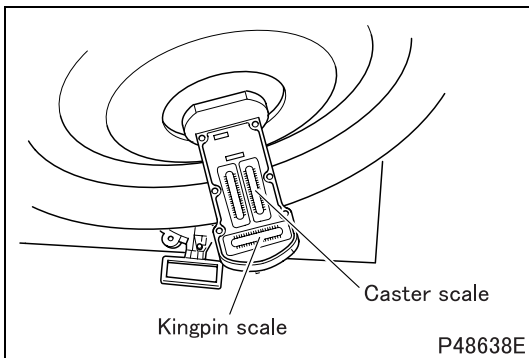
#### NOTE

- **It is not possible to make exact measurements unless the brake is continuously applied. Otherwise, the wheels will turn slightly.**

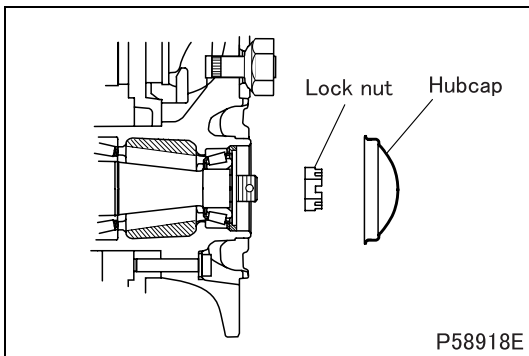
- At the point where the steering wheel has been turned 20 degrees, set the caster scale and the center of the bubble of the king pin scale to 0 degrees by turning the adjuster.

#### NOTE

- **Pay attention to the king pin scale because it has scales for right and left: align the right king pin scale for the right front wheel, and left king pin scale for the left front wheel.**



- Now reverse this position. Turn the steering wheel slowly until the direction of the front wheels changes by 20 degrees in the opposite direction.
- Read the caster scale and king pin scale to find the caster and king pin inclination angles.
- If the measured value deviates from the standard value, disassemble the front axle for service.



- After inspection, install the lock nut and measure the starting torque of the wheel hub bearing. If the starting torque deviates from the standard value, check the wheel bearings and perform expedient adjustment.
- Fill the specified amount of grease into wheel hub by using nozzle so that the outer bearing is covered with the grease and then install a new hubcap.

# ON-VEHICLE INSPECTION AND ADJUSTMENT

## 2. Inspection and Adjustment of Steering Angle

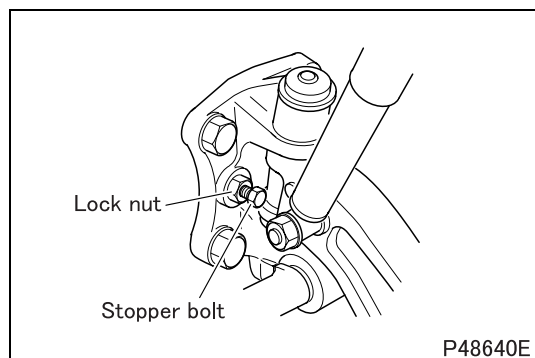
- Perform steering angle inspection and adjustment only after wheel alignment inspection and adjustment has been completed.

### Service standards

Location	Maintenance item		Standard value	Limit	Remedy
–	Steering angle	Inside (outside steering angle is for reference only)	$45^{\circ} \begin{smallmatrix} +0^{\circ} \\ -2^{\circ} \end{smallmatrix}$ (34°)	–	Adjust

### Torque Value: N·m (lbf·ft)

Mark	Fastener	Torque value	Remarks
–	Lock nut (knuckle stopper bolt mounting)	$46.5 \pm 7$ (34 ± 5.4)	–



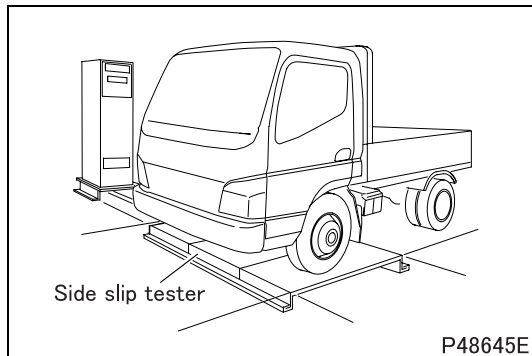
- Set the turning radius gauge and a platform on the vehicle in the same manner as in case of caster and king pin inclination angle measurement performed in Section 1.3.
- Turn the steering wheel right or left completely from the position where the turning radius gauge is set to 0 degrees, and read the scale of the turning radius gauge to measure the steering angle.
- If the measured value deviates from the standard value, adjust with the knuckle stopper bolt and tighten the lock nut to the specified torque.

### 3. Inspection of Side Slip

- Perform side slip inspection only after wheel alignment inspection and adjustment has been completed.
- For the side slip amount, which is related to wheel alignment, both the side slip amount and wheel alignment must conform to the standard values.

#### Service standards: mm (in)

Location	Maintenance item	Standard value	Limit	Remedy
–	Side slip amount	$0 \pm 3$ ( $0 \pm 0.12$ )	–	Adjust



- Set the front wheels exactly to forward running position.
- Move the vehicle forward past the side slip tester as slowly as possible to inspect side slip.

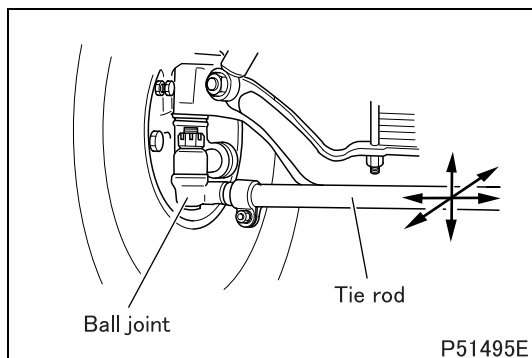
#### NOTE

- Pay attention to the following when moving over the side slip tester.
  - Be sure to hold steering exactly at the forward running position, and make no turn.
  - Do not apply brake.
  - Keep the speed constant.
- If the measured value deviates from the standard value, inspect and adjust wheel alignment.

### 4. Inspection of Tie Rod End Ball Joint

#### Service standards: mm (in)

Location	Maintenance item	Standard value	Limit	Remedy
–	Play of tie rod end ball joint	0	–	Replace



#### (1) Play of tie rod end ball joint

- Hold the tie rod section of the tie rod with the vehicle kept stationary, and move it in the back-and-forth, up-and-down and right-and-left directions to check for play at ball joints of the tie rod end.

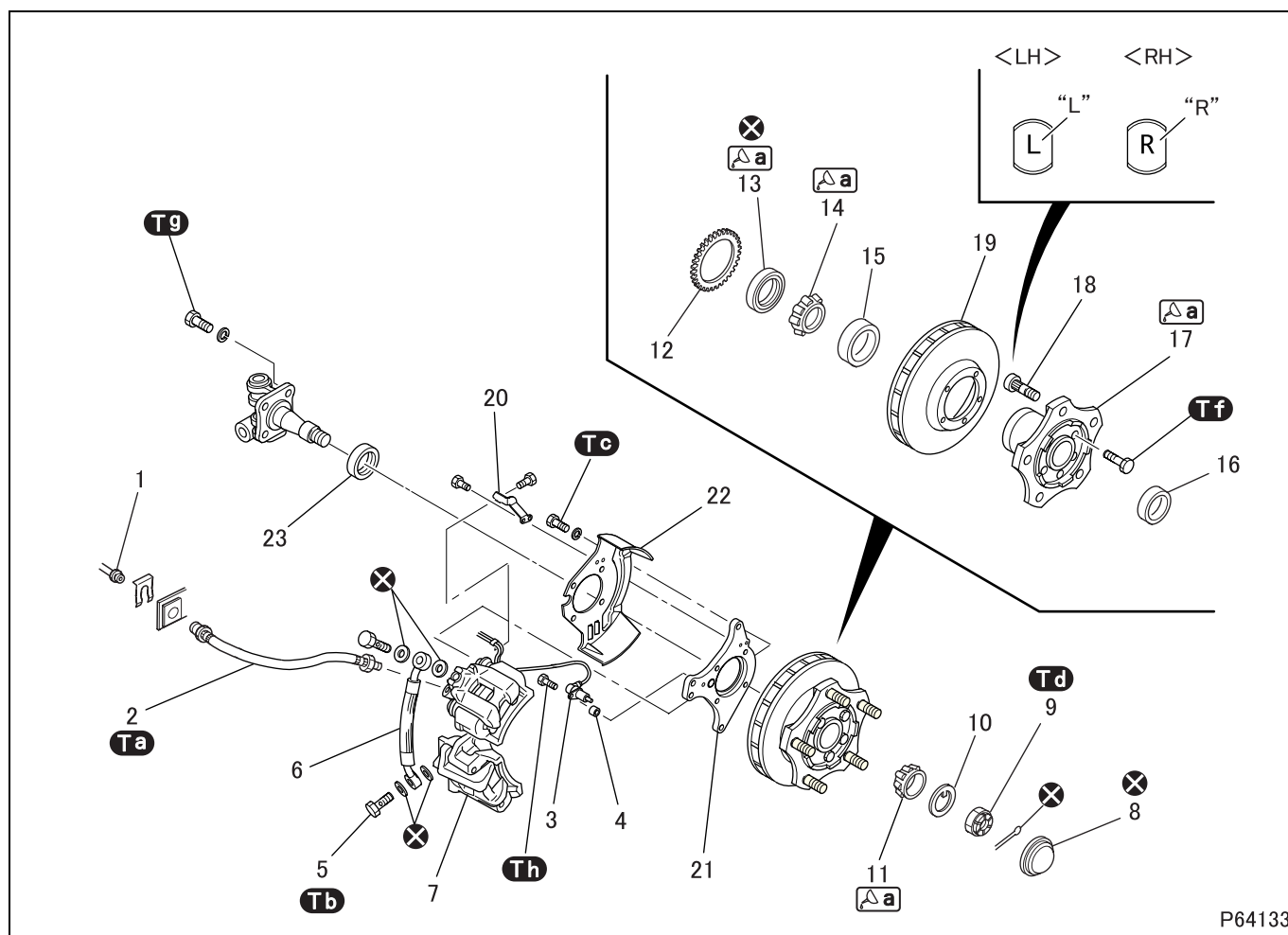
#### NOTE

- Be sure to check for play at ball joints of both right and left sides of the tie rod.
- If there is play, replace the tie rod end of the tie rod.

#### (2) Dust cover

- Check the dust cover for wear, cracks and other damage.
- If there is any abnormality, replace the tie rod end.

# WHEEL HUB AND ROTOR



## ● Disassembly sequence

- |                                 |                             |
|---------------------------------|-----------------------------|
| 1 Brake pipe                    | 14 Inner bearing inner race |
| 2 Brake hose                    | 15 Inner bearing outer race |
| 3 Wheel speed sensor            | 16 Outer bearing outer race |
| 4 Spacer                        | 17 Wheel hub                |
| 5 Eyebolt                       | 18 Hub bolt                 |
| 6 Brake hose                    | 19 Disc rotor               |
| 7 Front disc brake (See Gr35A.) | 20 Bracket                  |
| 8 Hubcap                        | 21 Adapter                  |
| 9 Lock nut                      | 22 Dust shield              |
| 10 Lock washer                  | 23 Spacer                   |
| 11 Outer bearing inner race     |                             |
| 12 Antilock brake system rotor  |                             |
| 13 Oil seal                     |                             |
- ⊗: Non-reusable parts

## CAUTION

- Plug the brake hose to prevent entry of dust and dirt after it has been removed.
- Be careful not to damage the tip of the wheel speed sensor after removing it.

## NOTE

- Do not remove the antilock brake system rotor unless replacing it.
- Do not disassemble the wheel hub and disc rotor unless replacing them.

## ● Assembly sequence

Follow the disassembly sequence in reverse.

## CAUTION

- Make sure that the disc rotor surface and disc brake pad surface are free from grease to avoid malfunction of brakes.
- Make sure that the brake hose is not twisted when installing it.
- Inspect the drag torque of disc brakes after assembly. (See Gr35A.)


## Service standards: mm (in)

Location	Maintenance item	Standard value	Limit	Remedy	
-	Starting torque of wheel hub bearing (tangential force at hub bolt position with oil seal assembled)	1 to 3.5 N·m (0.7 to 2.6 ft.lbs) (tangential force: 8.8 to 28.4 N (2.0 to 6.4 lb))	-	Adjust or replace	
17	Wear at the outer periphery of wheel hub	-	0.8	Replace	
19	Disc rotor	Runout (measure, assembling it into front axle)	0.07 (0.0028) or less	0.10 (0.0039)	Replace
		Thickness	40 (1.57)	38 (1.50)	Replace

## Torque Value: N·m (lbf·ft)

Mark	Component	Torque value	Remarks
<b>Ta</b>	Brake hose	25.5 to 34.3 (18.8 to 25.3)	-
<b>Tb</b>	Eyebolt	22 ± 2 (16 ± 1.5)	-
<b>Tc</b>	Bolt (front disc brake mounting)	152 ± 25 (112 ± 18)	-
<b>Td</b>	Lock nut	Primary tightening	113 ± 15 (83 ± 11)
		Secondary tightening after complete tightening	59 (44)
<b>Tf</b>	Bolt (wheel hub and disc rotor mounting)	85.8 ± 12 (63 ± 8.9)	-
<b>Tg</b>	Bolt (adapter mounting)	118 ± 20 (87 ± 1.5)	-
<b>Th</b>	Bolt (speed sensor mounting)	12.3 ± 2.5 (9.1 ± 1.8)	-

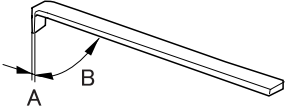
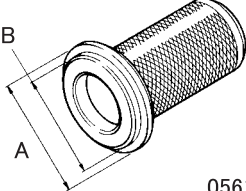
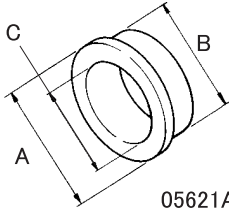
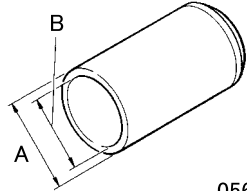
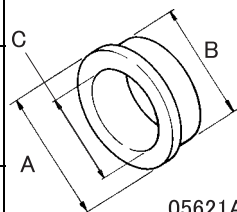
## Lubricant and/or sealant

Mark	Points of application	Specified lubricant and/or sealant	Quantity	
	Pack outside of wheel hub	Wheel bearing grease [NLGI No. 2 (Li soap)]	5 studs	※ 65 ± 10 g (2.29 ± 0.35 oz)
			6 studs	※ 90 ± 10 g (3.17 ± 0.35 oz)
	Pack inside of wheel hub		5 studs	※ 210 ± 20 g (7.41 ± 0.71 oz)
			6 studs	COE 40/45
	COE 50			※ 155 ± 10 g (5.47 ± 0.35 oz)
	Pack space between rollers of outer bearing inner race and inner bearing inner race			As required
Lip area of oil seal				

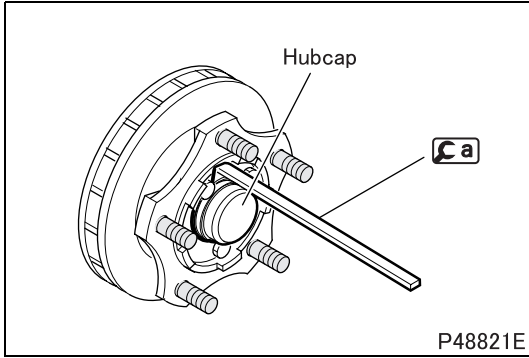
※ : For a wheel hub

# WHEEL HUB AND ROTOR

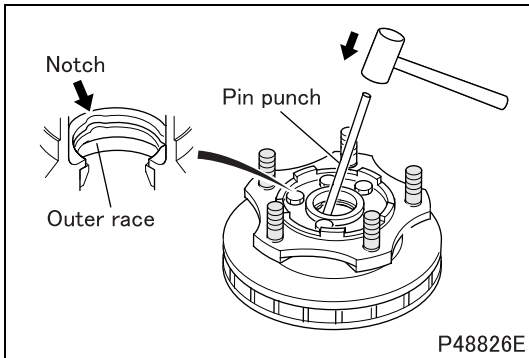
## Special tools: mm (in)

Mark	Tool name and shape	Part No.	Application															
<b>ca</b>	<p>Hubcap wrench</p> <table border="1"> <tr> <td>A</td> <td>B</td> </tr> <tr> <td>0.5 (0.020)</td> <td>78°</td> </tr> </table>  <p>P49261</p>	A	B	0.5 (0.020)	78°	MB999108	Removal of hubcap											
A	B																	
0.5 (0.020)	78°																	
<b>cb</b>	<p>Oil seal installer</p> <table border="1"> <tr> <td>A</td> <td>B</td> </tr> <tr> <td>φ84 (3.31)</td> <td>φ70 (2.76)</td> </tr> </table>  <p>05619</p>	A	B	φ84 (3.31)	φ70 (2.76)	MB999097	Installation of oil seal (to be used in combination)											
A	B																	
φ84 (3.31)	φ70 (2.76)																	
<b>cc</b>	<p>Bearing installer</p> <table border="1"> <thead> <tr> <th>Part No.</th> <th>A</th> <th>B</th> <th>C</th> <th>Vehicle model</th> </tr> </thead> <tbody> <tr> <td>MB999099</td> <td>φ88.5 (3.48)</td> <td>φ71 (2.80)</td> <td>φ51 (2.01)</td> <td>Five studs</td> </tr> <tr> <td>MB999069</td> <td>φ94.5 (3.72)</td> <td>φ92.5 (3.64)</td> <td>φ60 (2.36)</td> <td>Six studs</td> </tr> </tbody> </table>  <p>05621A</p>	Part No.	A	B	C	Vehicle model	MB999099	φ88.5 (3.48)	φ71 (2.80)	φ51 (2.01)	Five studs	MB999069	φ94.5 (3.72)	φ92.5 (3.64)	φ60 (2.36)	Six studs	MB999099 MB999069	
Part No.	A	B	C	Vehicle model														
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<b>cd</b>	<p>Bearing installer</p> <table border="1"> <tr> <td>A</td> <td>B</td> </tr> <tr> <td>φ70 (2.76)</td> <td>φ57 (2.24)</td> </tr> </table>  <p>05668</p>	A	B	φ70 (2.76)	φ57 (2.24)	MB999100												
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<b>ce</b>	<p>Bearing installer</p> <table border="1"> <thead> <tr> <th>Part No.</th> <th>A</th> <th>B</th> <th>C</th> <th>Vehicle model</th> </tr> </thead> <tbody> <tr> <td>MB999099</td> <td>φ88.5 (3.48)</td> <td>φ71 (2.80)</td> <td>φ51 (2.01)</td> <td>Inner side of five-stud models and outer side of all models</td> </tr> <tr> <td>MB999069</td> <td>φ94.5 (3.72)</td> <td>φ92.5 (3.64)</td> <td>φ60 (2.36)</td> <td>Inner side of six-stud models</td> </tr> </tbody> </table>  <p>05621A</p>	Part No.	A	B	C	Vehicle model	MB999099	φ88.5 (3.48)	φ71 (2.80)	φ51 (2.01)	Inner side of five-stud models and outer side of all models	MB999069	φ94.5 (3.72)	φ92.5 (3.64)	φ60 (2.36)	Inner side of six-stud models	MB999099 MB999069	Installation of inner bearing outer race and outer bearing outer race (to be used in combination)
Part No.	A	B	C	Vehicle model														
MB999099	φ88.5 (3.48)	φ71 (2.80)	φ51 (2.01)	Inner side of five-stud models and outer side of all models														
MB999069	φ94.5 (3.72)	φ92.5 (3.64)	φ60 (2.36)	Inner side of six-stud models														

## ◆ Removal procedure ◆

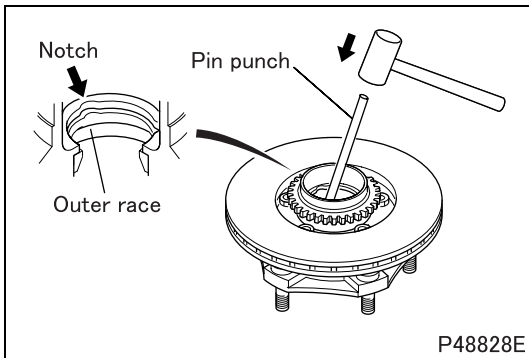


### ■ Removal: Hubcap



### ■ Removal: Inner bearing outer race

- Drive out the inner bearing outer race by tapping evenly at three indented parts in the wheel hub.

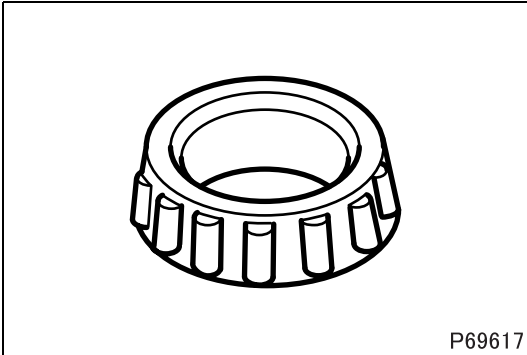


### ■ Removal: Outer bearing outer race

- Drive out the outer bearing outer race by tapping evenly at three indented parts in the wheel hub.

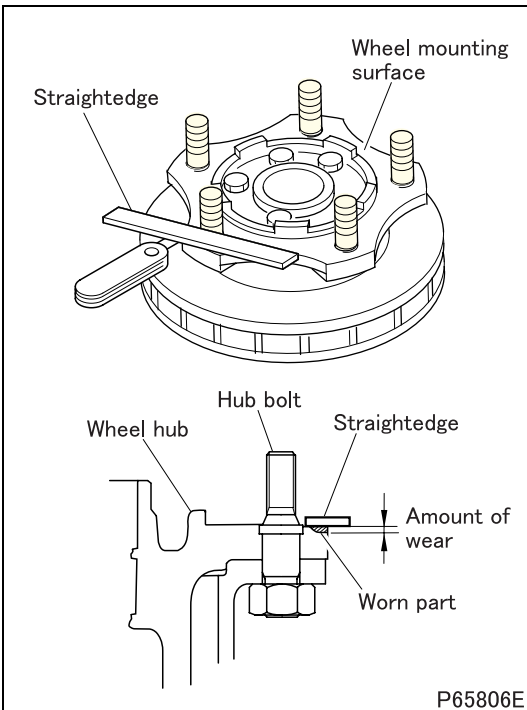
# WHEEL HUB AND ROTOR

## ◆ Inspection inspection procedure ◆



### ■ Inspection: Outer bearing inner race

- Inspect the outer bearing inner race after cleaning the bearing to remove grease completely.
- If any damage, wear, or poor rotating condition is evident in the inner race, replace it with a new one.
- The inner race and outer race should be replaced as a set.



### ■ Inspection: Wear at the outer periphery of wheel hub

Measurement of the amount of the wear at the outer periphery of wheel hub.

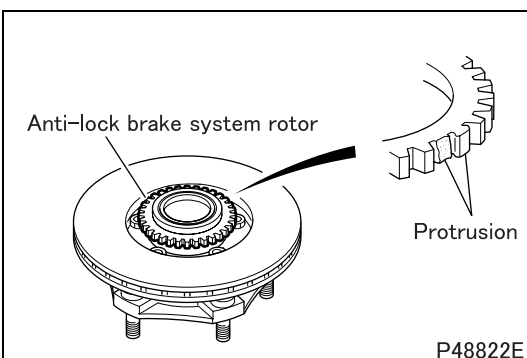
#### CAUTION ⚠

- Clean the wheel mounting surface of the wheel hub before inspection.
- The straightedge should be placed on the hub so as not to contact to the hub bolt.

- Place the straightedge on the wheel mounting surface as shown in the drawing.
- Using the straightedge and feeler gauges, measure the amount of wear at the outer periphery of the wheel hub at five positions.
- If the amount of wear at any point exceeds the limit, replace the wheel hub.
- If the wheel has cracks or has a stepped wear at the wheel hub mounting surface, replace the wheel.

#### CAUTION ⚠

- Never paint the wheel mounting surface of the wheel hub as it may be a cause of loose bolt.

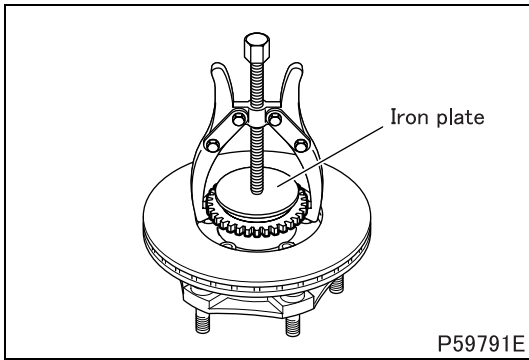


### ■ Inspection: Antilock brake system rotor

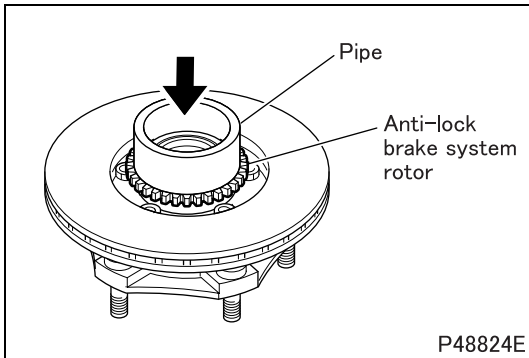
#### [Inspection]

- Check protrusions of the antilock brake system rotor for chipping and flattening.
- If any abnormality is found, replace the antilock brake system rotor.





### [Removal]



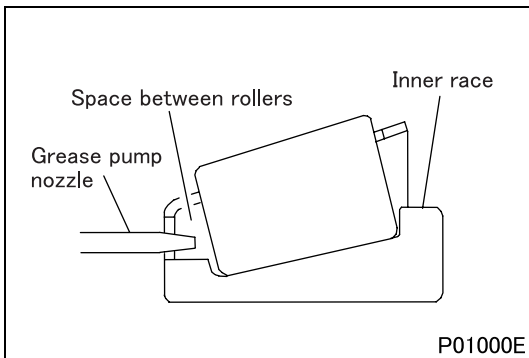
### [Installation]

- Warm the antilock brake system rotor to approximately 150°C.
- Install the antilock brake system rotor and wheel hub evenly using a pipe so as not to allow them to tilt.

### WARNING

- Handling the warmed rotor by bare hands may burn.

### ◆ Installation procedure ◆

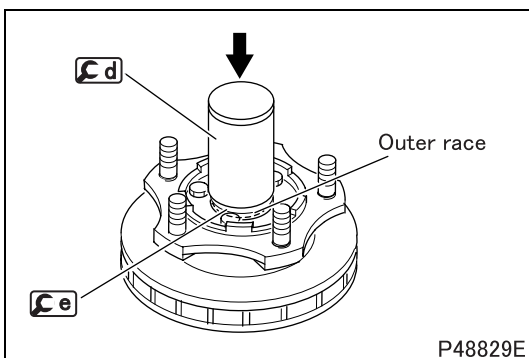


### ■ Inspection: Inner bearing inner race

- Inspect the inner bearing inner race in the same manner as for the outer bearing inner race.  
(See “■ Inspection: Outer bearing inner race”.)

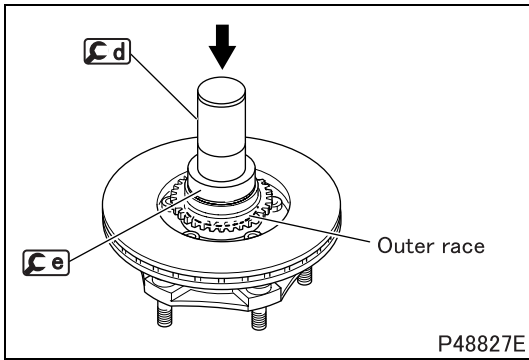
### ■ Installation: Packing grease in inner bearing inner race

- Insert the grease pump nozzle into the space between rollers of the inner bearing inner race to pack grease sufficiently.

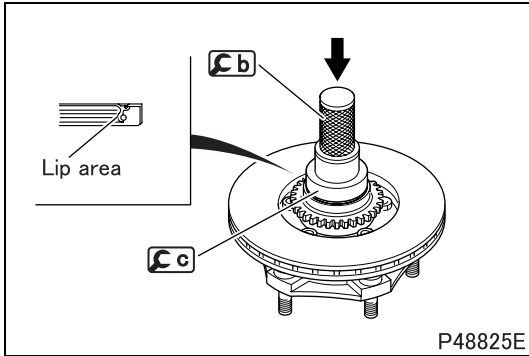


### ■ Installation: Outer bearing outer race

# WHEEL HUB AND ROTOR

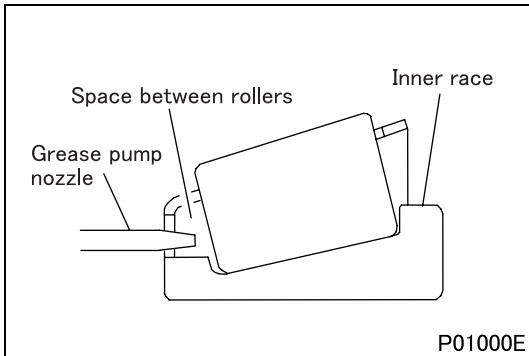


## ■ Installation: Inner bearing outer race



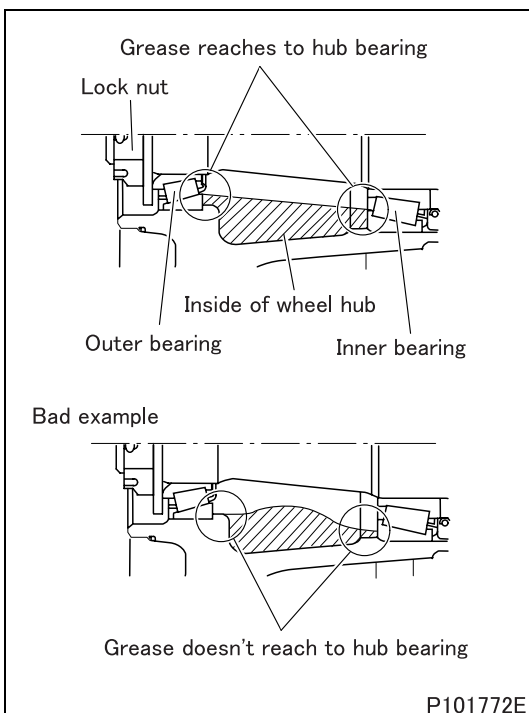
## ■ Installation: Oil seal

- Apply grease to the lip area of the oil seal and install it on the wheel hub in the illustrated direction.



## ■ Installation: Packing grease in outer bearing inner race

Insert the grease pump nozzle into the space between rollers of the inner bearing inner race to pack grease sufficiently.

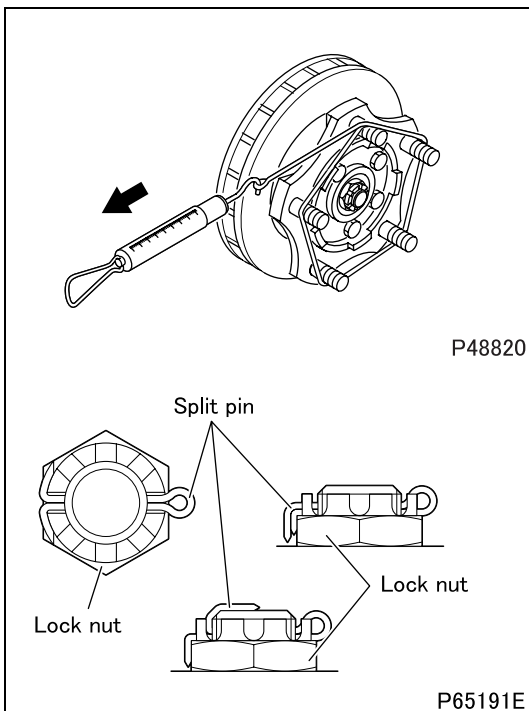
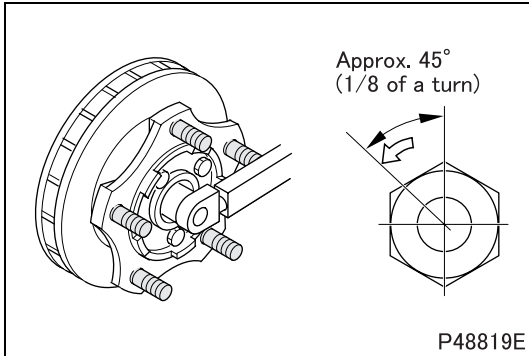
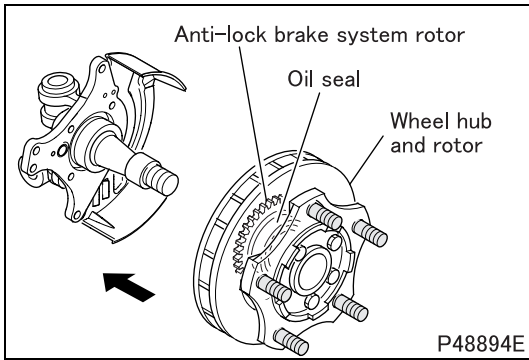


## ■ Installation: Packing grease inside of wheel hub

- Apply specified amount of grease to inside A of wheel hub so that the grease reaches inner bearing and outer bearing as illustrated.
- After installing lock nut, insert grease pump nozzle into outside B of wheel hub and fill specified amount of grease so as to make a grease wall outside of the outer bearing.

## CAUTION ⚠

- Applying grease as illustrated in the “bad example” causes the wheel hub bearing to seize.



### ■ Installation: Wheel hub and rotor

- Slowly install the wheel hub and rotor assembly so as not to cause damage to the oil seal and antilock brake system rotor.

### CAUTION ⚠

- If the antilock brake system rotor is damaged, wheel speed sensor signals become abnormal, causing the antilock brake system to malfunction.

### ■ Adjustment: Starting torque of wheel hub bearing

### CAUTION ⚠

- Unless this adjustment procedure is performed, seizure of the wheel hub bearing can be caused.

### [Adjustment]

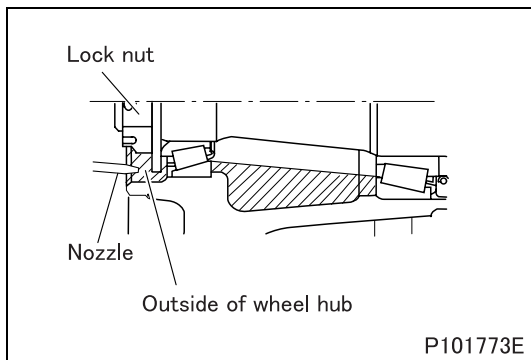
- Tighten the lock nut to the specified torque (primary tightening) while turning the wheel hub and rotor, and then loosen it completely.
- Smooth operation of the outer bearing and inner bearing by turning the wheel hub and rotor several times, and then tighten the lock nut to the specified torque (secondary tightening).
- Return the lock nut by approximately 45 degrees (1/8 of a turn) and secure it with a split pin. If pin holes do not align, align them in the course of loosening. Make sure that there is no play in the axial direction.
- Perform measurement again after adjustment. If any fault is found, replace the outer and inner bearings.

### ■ Inspection: Starting torque of wheel hub bearing

### [Inspection]

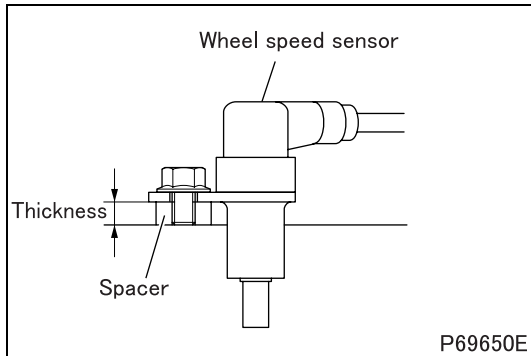
- After installing the lock nut, perform the following inspection.
- Measure the tangential force at the hub bolt position using a spring balance.
- If the tangential force is within the specified value, the starting torque conforms to the standard value. When the measured value is the specified value, install the split pin following either of method in the illustration.
- If the measured value deviates from the specified value, repeat adjustment because the adjustment of the lock nut may be insufficient.
- If the result is found to be abnormal, replace the outer and inner bearings.

# WHEEL HUB AND ROTOR



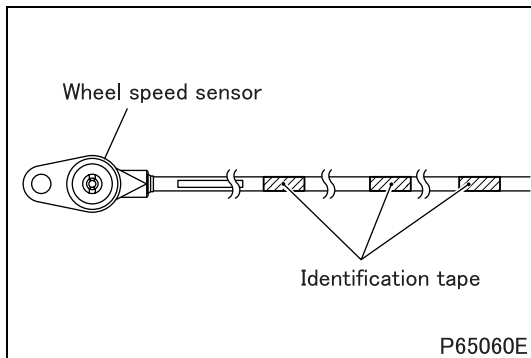
## ■ Installation: Packing grease outside of wheel hub

- After installing lock nut, insert grease pump nozzle into outside of wheel hub and fill specified amount of grease so as to make a grease wall outside of the outer bearing.



## ■ Installation: Spacer

- Install a spacer and wheel speed sensor in the position shown in the illustration.  
Thickness of spacer: 16.0 mm <FE (Except COE 50)>  
14.5 mm <COE 50>



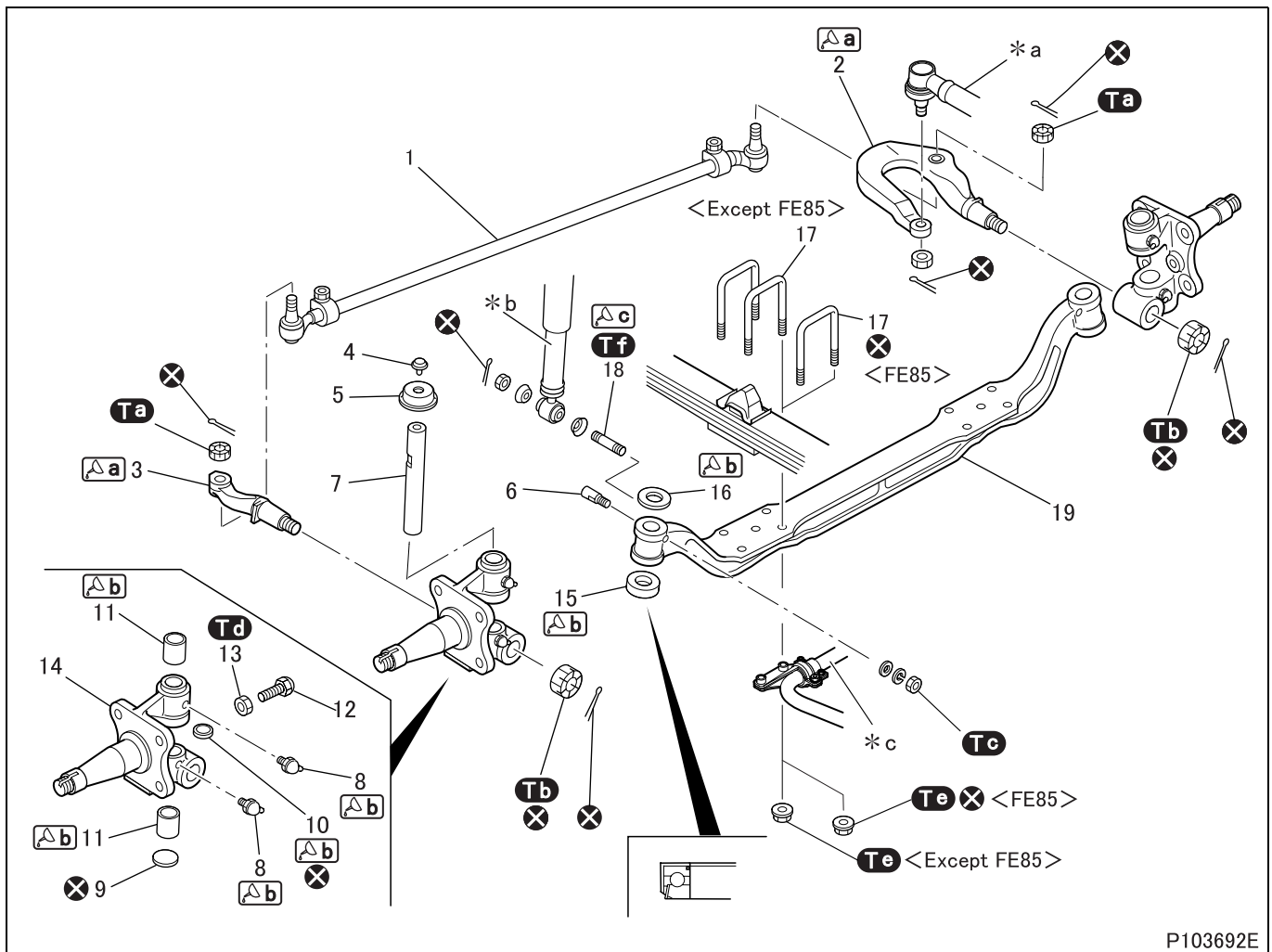
## ■ Installation: Wheel speed sensor

- Using clips, secure in place the wheel speed sensor harness at the identification tape portions, ensuring that the harness is free of kinks, slack and/or interference with other parts.

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M E M O

# KNUCKLE AND KING PIN, FRONT AXLE



## ● Disassembly sequence

- |                                |                   |
|--------------------------------|-------------------|
| 1 Tie rod (See later section.) | 13 Lock nut       |
| 2 Knuckle arm                  | 14 Knuckle        |
| 3 Tie rod arm                  | 15 Thrust bearing |
| 4 Dust plug                    | 16 King pin shim  |
| 5 Dust cap                     | 17 U-bolt         |
| 6 Lock pin                     | 18 Stud bolt      |
| 7 King pin                     | 19 Front axle     |
| 8 Grease nipple                |                   |
| 9 Plug                         |                   |
| 10 Dust seal                   |                   |
| 11 Bushing                     |                   |
| 12 Knuckle stopper bolt        |                   |

- |                       |
|-----------------------|
| *a: Drag link         |
| *b: Shock absorber    |
| *c: Stabilizer        |
| ⊗: Non-reusable parts |

## CAUTION

- When removing the tie rod, take care not to deform or damage the dust cover.

## ● Assembly sequence

Follow the disassembly sequence in reverse.

Repair kit: King pin kit

**Service standards: mm (in)**

Location	Maintenance item	Standard value	Limit	Remedy	
7	Outer diameter of king pin	27.947 to 27.980 (1.100 to 1.102)	27.9 (1.098)	Replace	
7, 11	Clearance between king pin and bushing	0.020 to 0.086 (0.00079 to 0.0034)	0.15 (0.0059)	Replace	
7, 19	Clearance between king pin and front axle	0.020 to 0.074 (0.00079 to 0.0029)	0.1 (0.0039)	Replace	
11	Inner diameter of bushing (after having been pressed into knuckle)	28.000 to 28.033 (1.102 to 1.103)	–	Replace	
14, 19	Vertical clearance between knuckle and front axle	0.02 to 0.10 (0.00079 to 0.0039)	0.20 (0.0079)	Adjust	
19	Front axle	Horizontal bend	–	2 (0.079)	Replace
		Vertical bend	–	2 (0.079)	
		King pin inclination angle	8° ± 10'	–	

**Torque Value: N·m (lbf·ft)**

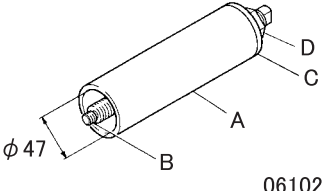
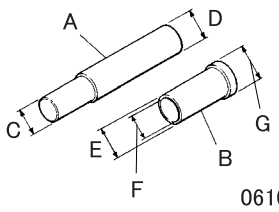
Mark	Component	Torque value	Remarks	
<b>Ta</b>	Nut (tie rod mounting)	93 ± 25 (69 ± 18)	–	
<b>Tb</b>	Nut (knuckle arm mounting)	345 ± 49 (254 ± 36)	–	
	Nut (tie rod arm mounting)			
<b>Tc</b>	Nut (lock pin mounting)	33 ± 5 (25 ± 3.6)	–	
<b>Td</b>	Lock nut (knuckle stopper bolt tightening)	46.5 ± 7 (34 ± 5.4)	–	
<b>Te</b>	Nut (U-bolt mounting)	Except COE 50	162 ± 15 (120 ± 11)	–
		COE 50	175 ± 5 (129 ± 3.7)	–
<b>Tf</b>	Stud bolt	Stud	88 (65) or more	–
		Nut (return)	137 (101) or more	–

**Lubricant and/or sealant**

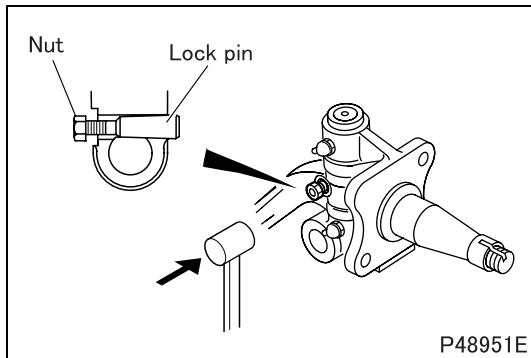
Mark	Points of application	Specified lubricant and/or sealant	Quantity
<b>△a</b>	Knuckle arm and tie rod arm threads	Wheel bearing grease [NLGI No. 2 (Li soap)]	As required when parts are reused
<b>△b</b>	Lip area of dust seal		As required
	Inside surface of bushing		
	Top face of thrust bearing		
	Both sides of king pin shim		
	Fill from grease nipple	Until grease starts overflowing from dust plug	
<b>△c</b>	Stud threads of stud bolt	Loctite 271	As required

# KNUCKLE AND KING PIN, FRONT AXLE

## Special tools: mm (in)

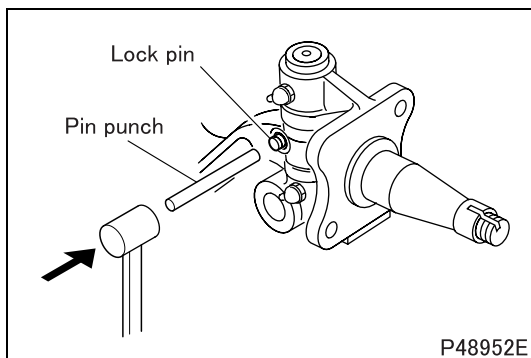
Mark	Tool name and shape	Part No.	Application										
ca	<p>King pin puller</p> <p>A: Pipe B: Bolt C: Cap D: Nut</p>  <p>06102</p>	<p>MB999013 A: MB999014 B: MB999015 C: MB999016 D: MB999017</p>	Removal of king pin										
cb	<p>Bushing installer</p> <p>A: Bushing installer A B: Bushing installer B</p>  <p>06103</p> <table border="1"> <thead> <tr> <th>C</th> <th>D</th> <th>E</th> <th>F</th> <th>G</th> </tr> </thead> <tbody> <tr> <td>φ25 (0.98)</td> <td>φ30 (1.18)</td> <td>φ28 (1.10)</td> <td>φ25 (0.98)</td> <td>φ32.8 (1.29)</td> </tr> </tbody> </table>	C	D	E	F	G	φ25 (0.98)	φ30 (1.18)	φ28 (1.10)	φ25 (0.98)	φ32.8 (1.29)	<p>MB999066 A: MB999067 B: MB999068</p>	Removal and installation of king pin bushing
C	D	E	F	G									
φ25 (0.98)	φ30 (1.18)	φ28 (1.10)	φ25 (0.98)	φ32.8 (1.29)									

### ◆ Removal procedure ◆



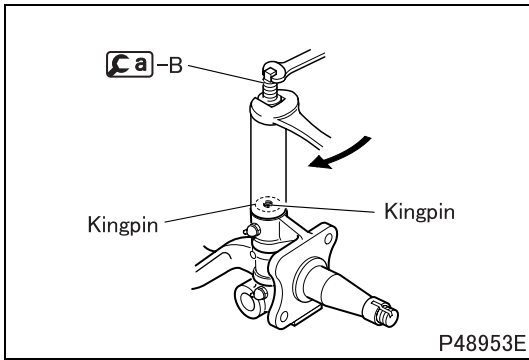
#### ■ Removal: Lock pin

- Remove the nut, spring washer and washer.
- Screw in the nut again until just before it is flush with the lock pin, and lightly tap the nut to loosen the lock pin.



- Remove the nut, apply a pin punch to the lock pin and lightly tap it to remove.

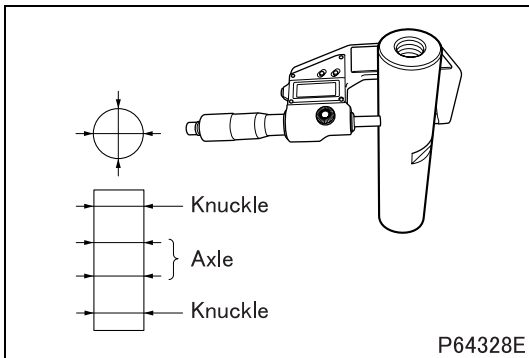




### ■ Removal: King pin

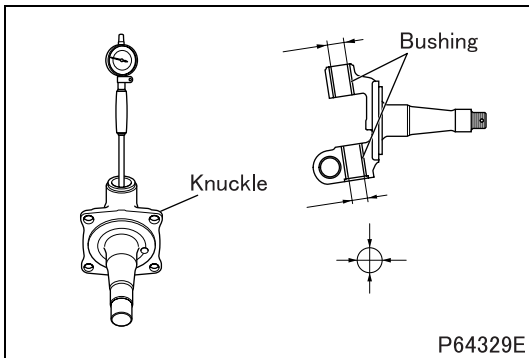
- Screw the bolt of the kin pin puller **Ca**-B into the king pin threads to remove the king pin.

### ◆ Inspection procedure ◆



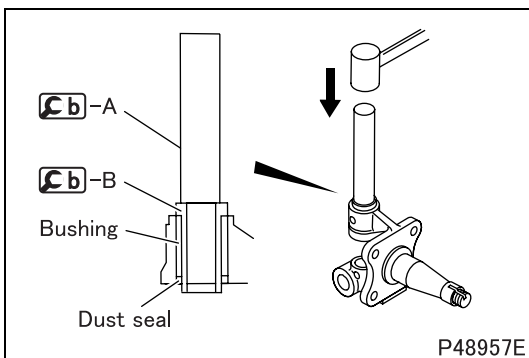
### ■ Inspection: Outer diameter of king pin

- Take measurement at a total of four levels on the king pin: two levels for the axle fitting portion and one level each for the upper and lower knuckle fitting portions.
- If the measured value is under the limit, replace the king pin with a new one.



### ■ Inspection: Clearance between king pin and bushing

- Measure the inner diameter of the upper and lower bushings using a cylinder gauge and calculate the clearance deducting the outer diameter of the king pin from the inner diameter of the bushing.  
If the clearance exceeds the limit, replace the bushings with new ones.

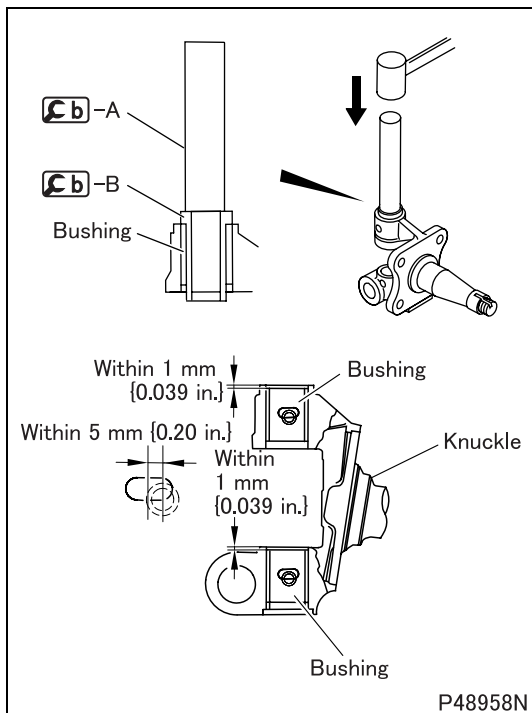


### Replacement of bushing

#### [Removal]

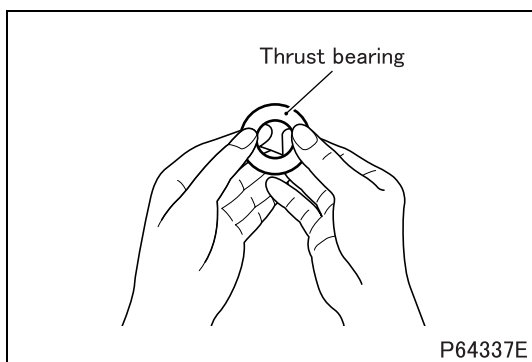
- Remove the bushing and the dust seal at the same time using the bushing installer **Cb**.

# KNUCKLE AND KING PIN, FRONT AXLE



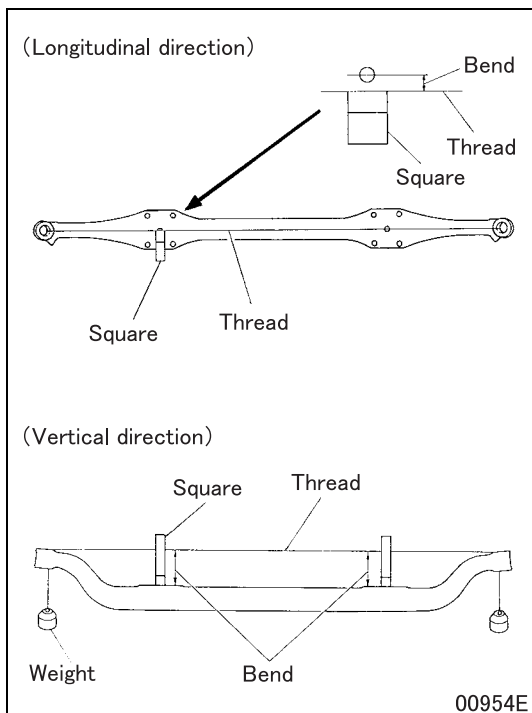
## [Installation]

- Install the bushing using the bushing installer **(C b)** so that a step height between the bushing and knuckle is within 1 mm (0.039 in.).
- The oil hole of the bushing must not deviate from the screw hole of the knuckle more than 5 mm (0.20 in.).



## ■ Inspection: Thrust bearing

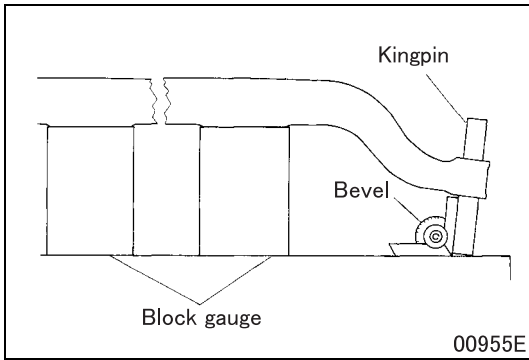
- Inspect the aspect and smooth turning of the thrust bearing. If any crack, damage, or un-smooth turning is found, replace the thrust bearing with a new one.



## ■ Inspection: Front axle

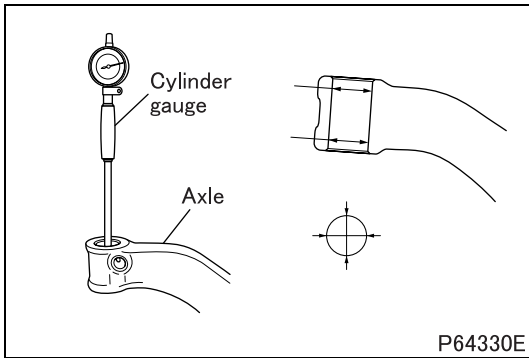
### (1) Bend of front axle in the back-and-forth direction and vertical direction

- Put a piece of thread through king pin holes of the front axle and hang weights at both ends.
- Use a square to find bend to each of back-and-forth and vertical directions.
- If the measured value exceeds the limit, replace the front axle.



## (2) King pin inclination angle

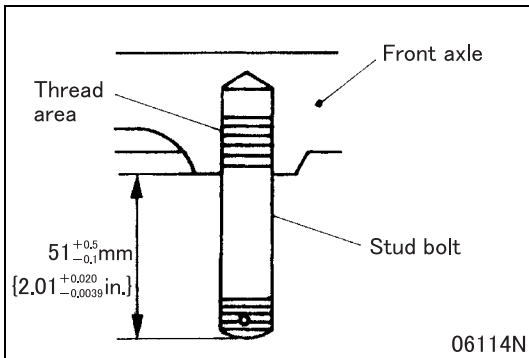
- Set the king pin on the front axle as illustrated to measure the angle.
- If the measured value deviates from the standard value, replace the front axle.



## (3) Clearance between king pin and front axle

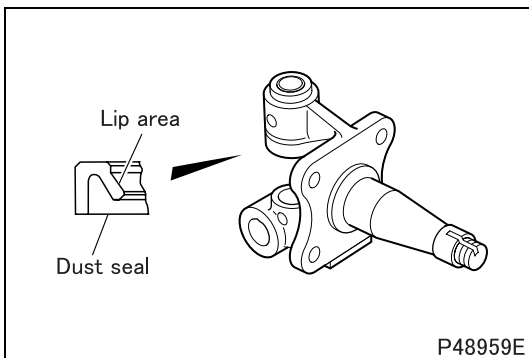
- Measure the inner diameter of the axle's hole where the king pin is inserted using a cylinder gauge and calculate the clearance deducting the outer diameter of the king pin from the inner diameter.
- If the clearance exceeds the limit, replace the axle or the king pin with a new one.

## ◆ Installation procedure ◆



### ■ Installation: Stud bolt

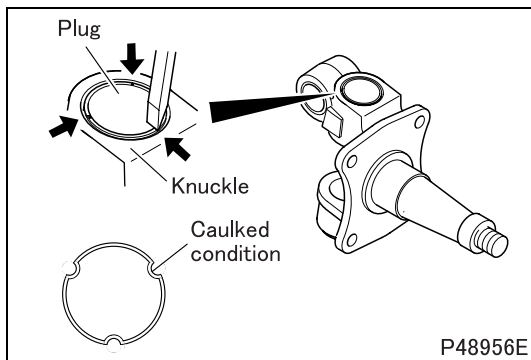
- Apply Loctite to front axle mounting threads of the stud bolt.
- Install the stud bolt to the dimension as illustrated.



### ■ Installation: Dust seal

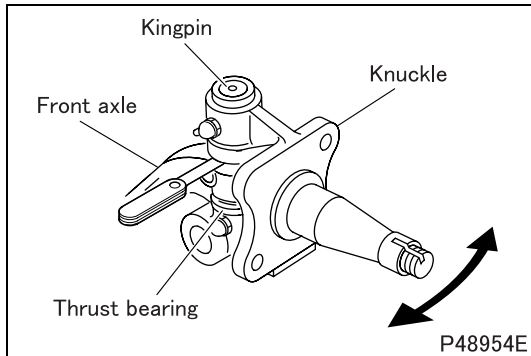
- Apply grease to the lip area of the dust seal and install it on the knuckle in the illustrated direction.

# KNUCKLE AND KING PIN, FRONT AXLE



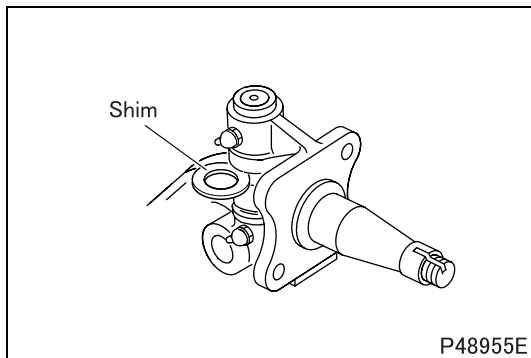
## ■ Installation: Plug

- After installing the plug, caulk the knuckle at three evenly spaced points of the plug circumference avoiding previously caulked points.



## ■ Installation: Knuckle

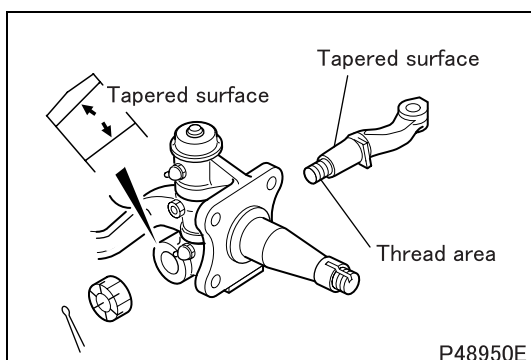
- After temporarily assembling the thrust bearing, knuckle and king pin into the front axle, move the knuckle several times to smooth its operation.
- Measure clearance between the front axle top face and the knuckle bottom.



- If the measured value exceeds the limit, adjust with a king pin shim.  
Thickness of king pin shims available  
0.10, 0.15, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70 mm  
(0.0039, 0.0059, 0.0079, 0.012, 0.016, 0.020, 0.023, 0.028 in.)  
(Eight thickness)

## CAUTION ⚠

- Select a king pin shim so that the clearance is as small as possible within the range of the standard value.
- After assembly, make sure that the knuckle moves smoothly.



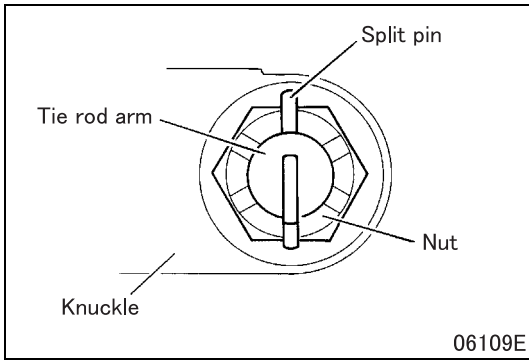
## ■ Installation: Tie rod arm and knuckle

### (1) When one or both of the tie rod arm and knuckle need re-assembly making use of existing parts

- Polish the entire tapered surfaces of the tie rod arm and knuckle evenly by means of sand paper #120 or above until sand paper score is visible on polished surfaces. (This does not apply to new replacement parts.)
- Clean the tapered surfaces and thread areas of the tie rod arm and knuckle.

## NOTE

- Use acetone, cleaning fluid for color check, or equivalent as solvent.



- Apply grease to the thread area of the tie rod arm and install it.

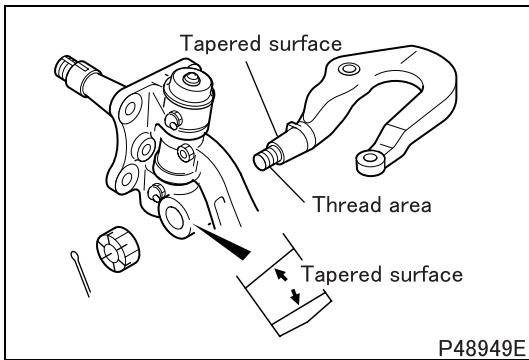
**CAUTION** ⚠

- **When installing the tie rod arm, make sure that tapered surfaces of the tie rod arm and knuckle are free from grease.**

- Tighten the nut to the specified torque. Be sure to align pin holes in the course of tightening and insert the split pin as illustrated.

**(2) When both of the tie rod arm and knuckle for assembling are new parts**

- Clean tapered surfaces and thread areas of the tie rod arm and knuckle.
- Tighten the nut to the specified torque. Be sure to align pin holes in the course of tightening and insert the split pin as illustrated.



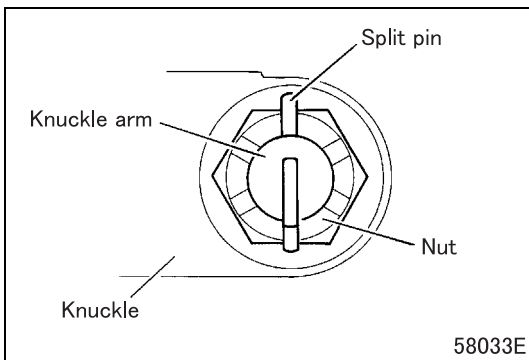
**■ Installation: Knuckle arm and knuckle**

**(1) When one or both of the knuckle arm and knuckle need re-assembly making use of existing parts**

- Polish the entire tapered surfaces of the knuckle arm and knuckle evenly by means of sand paper #120 or above until sand paper score is visible on polished surfaces. (This does not apply to new replacement parts.)
- Clean the tapered surfaces and thread areas of the knuckle arm and knuckle.

**NOTE**

- **Use acetone, cleaning fluid for color check, or equivalent as solvent.**



- Apply grease to the thread area of the knuckle arm and install it.

**CAUTION** ⚠

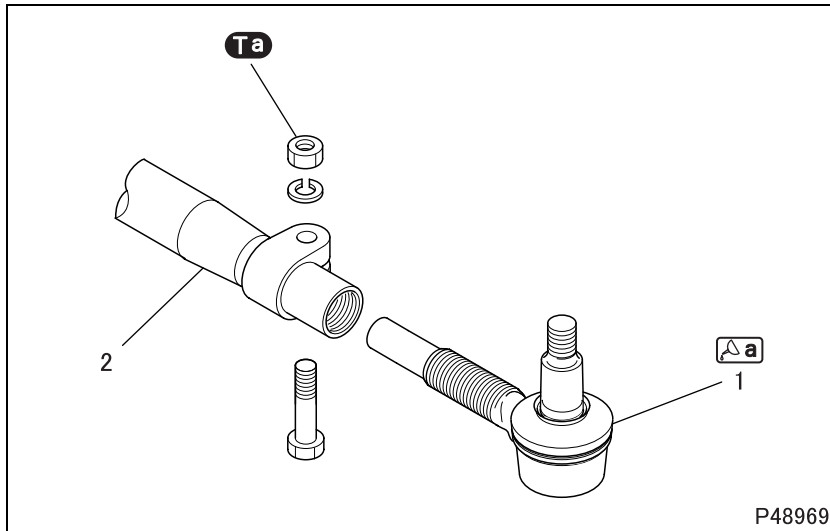
- **When installing the knuckle arm, make sure that tapered surfaces of the knuckle arm and knuckle are free from grease.**

- Tighten the nut to the specified torque. Be sure to align pin holes in the course of tightening and insert the split pin as illustrated.

**(2) When both of the knuckle arm and knuckle for assembling are new parts**

- Clean tapered surfaces and thread areas of the knuckle arm and knuckle.
- Tighten the nut to the specified torque. Be sure to align pin holes in the course of tightening and insert the split pin as illustrated.

# TIE ROD



## ● Disassembly sequence

- 1 Tie rod end
- 2 Tie rod

## CAUTION \_\_\_\_\_

- If any abnormality such as tear is found in the dust boot of the tie rod end, replace the tie rod end.

## NOTE

- Do not disassemble the tie rod end.

## ● Assembly sequence

Follow the disassembly sequence in reverse.

## Service standards: mm (in)

Location	Maintenance item	Standard value	Limit	Remedy
1	Ball joint of tie rod end	Play ( $\pm 980$ N (220 lbs, $\pm 100$ kgf) loaded)	0 to 0.15 (0 to 0.0059)	Replace
		Rotation torque	1.0 to 5.9 N·m (0.7 to 4.4 ft.lbs, 0.1 to 0.6 kgf·m)	
2	Bend of tie rod	–	1 (0.039) or less	Correct or replace

## Torque Value: N·m (lbf·ft)

Mark	Component	Torque value	Remarks
<b>Ta</b>	Nut (tie rod end tightening)	$25 \pm 5$ ( $18 \pm 3.7$ )	–

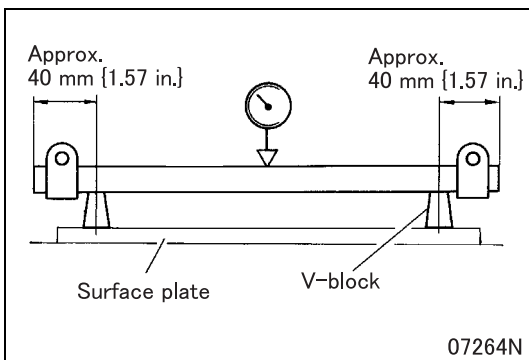
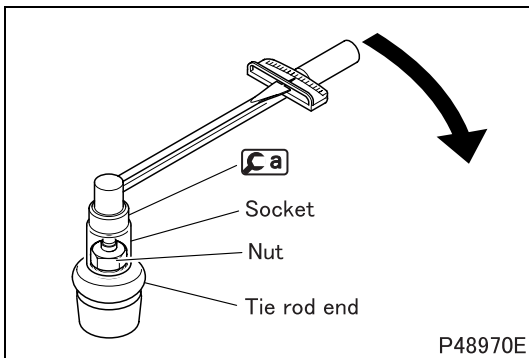
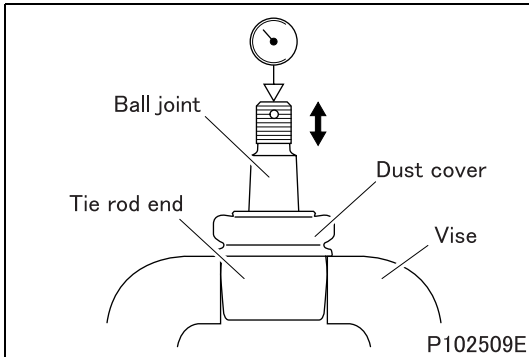
## Lubricant and/or sealant

Mark	Points of application	Specified lubricant and/or sealant	Quantity
	Lip area of dust cover of tie rod end	Wheel bearing grease [NLGI No. 2 (Li soap)]	As required

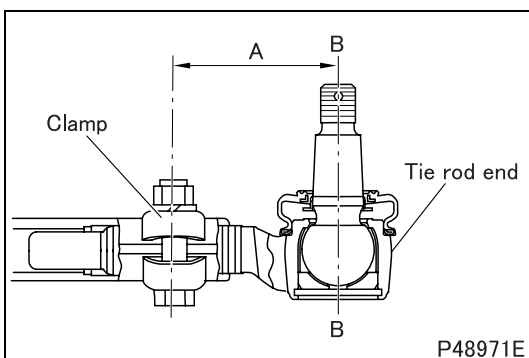
## Special tools

Mark	Tool name and shape	Part No.	Application
	Preload socket  P48876	MB999326	Measurement of rotation torque of tie rod end

## ◆ Inspection procedure ◆



## ◆ Installation procedure ◆



### ■ Inspection: Tie rod end

#### (1) Play

- Fix the tie rod end with a vise.

#### CAUTION ⚠

- Take care not to deform or damage the dust cover when fixing it with a vise.

- If measured value deviates from the standard value with applying the specified load (push and pull) to the ball joint, replace the tie rod end.

#### (2) Rotation torque

- Install the tie rod mounting nut on the tie rod end.
- Install the socket, **Ca** and torque wrench to measure the rotation torque.
- If the measured value deviates from the standard value, replace the tie rod end.

#### (3) Dust cover

- Check the dust cover for wear, cracks and other damage. These abnormalities may cause water infiltration to the ball joint and wear out it at early stage.
- If any abnormality is found in the dust cover, replace the tie rod end.

### ■ Inspection: Bend of tie rod

- Measure the bend of the tie rod at its center.

#### NOTE

- Give the tie rod one complete turn and read the dial gauge at this time. The bend is one half of the reading.

- If the measured value exceeds the limit, correct or replace the tie rod.

### ■ Installation: Tie rod end

- Screw in the tie rod end so that difference of dimension **A** between the tie rod end and the clamp is within 1.5 mm (0.059 in.) between right and left.

A: Approximately 74 mm (2.91 in.)

#### CAUTION ⚠

- Ensure that difference of an amount of screwing in the tie rod end between right and left is within one turn.
- Secure the tie rod ends so that illustrated axis B-B on the right is parallel to that on the left.