

# SECTION 2A

## SUSPENSION DIAGNOSIS

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## DIAGNOSTIC INFORMATION AND PROCEDURES

### GENERAL DIAGNOSIS

Problems in the steering, the suspension, the tires, and the wheels involve several systems. Consider all systems when you diagnose a complaint. Some problems, such as abnormal or excessive tire wear and scuffed tires, may be the result of hard driving. Always road test

the vehicle first. If possible, do this road test with the customer.

Proceed with the following preliminary checks. Correct any substandard conditions.

Application	Checks	Correction
Preliminary Checks	<ul style="list-style-type: none"> <li>Inspect the tires for improper pressure and uneven wear.</li> </ul>	<ul style="list-style-type: none"> <li>Inflate the tires to the proper pressure.</li> </ul>
	<ul style="list-style-type: none"> <li>Inspect the joint from the steering column to the intermediate shaft for loose connections or wear.</li> <li>Inspect the joint from the intermediate shaft to the steering gear for loose connections or wear.</li> </ul>	<ul style="list-style-type: none"> <li>Tighten the coupling flange pinch bolts.</li> <li>Replace the intermediate shaft as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>Inspect the front and the rear suspension, the steering gear, and the linkage for loose or damaged parts.</li> </ul>	<ul style="list-style-type: none"> <li>Tighten the front and the rear suspension.</li> <li>Tighten the steering gear mounting bracket bolts.</li> <li>Replace the front and the rear suspension as needed.</li> <li>Replace the steering gear as needed.</li> <li>Replace the coupling flange as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>Inspect for out-of-round tires.</li> </ul>	<ul style="list-style-type: none"> <li>Perform free runout test.</li> <li>Match-mount the tires.</li> </ul>
	<ul style="list-style-type: none"> <li>Inspect for out-of-balance tires, bent wheels, and worn or loose wheel bearings.</li> </ul>	<ul style="list-style-type: none"> <li>Balance the wheels.</li> <li>Replace the wheels.</li> <li>Replace the wheel bearings.</li> </ul>
	<ul style="list-style-type: none"> <li>Check the power steering pump drive belt tension.</li> </ul>	<ul style="list-style-type: none"> <li>Tighten the power steering pump drive belt.</li> </ul>
	<ul style="list-style-type: none"> <li>Inspect the power steering system. Also, check the power steering fluid level.</li> </ul>	<ul style="list-style-type: none"> <li>Repair any leaks.</li> <li>Perform a power steering gear test.</li> <li>Add power steering fluid.</li> </ul>

Condition	Probable Cause	Correction
Car Lead/Pull	<ul style="list-style-type: none"> <li>● Mismatched or uneven tires.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the tires.</li> </ul>
	<ul style="list-style-type: none"> <li>● A broken or a sagging coil spring.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the coil spring.</li> </ul>
	<ul style="list-style-type: none"> <li>● A improperly radial tire lateral force.</li> </ul>	<ul style="list-style-type: none"> <li>● Check the wheel alignment.</li> <li>● Switch the tire and wheel assemblies.</li> <li>● Replace the tires as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● The front-wheel alignment is out-of-align.</li> </ul>	<ul style="list-style-type: none"> <li>● Align the front wheels.</li> </ul>
	<ul style="list-style-type: none"> <li>● Off-center steering gear.</li> </ul>	<ul style="list-style-type: none"> <li>● Reseat the pinion valve assembly.</li> <li>● Replace the pinion valve assembly as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● Front-brake dragging.</li> </ul>	<ul style="list-style-type: none"> <li>● Adjust the front brakes.</li> </ul>
Abnormal or Excessive Tire Wear	<ul style="list-style-type: none"> <li>● The front-wheel and rear-wheel alignment is out-of-align.</li> </ul>	<ul style="list-style-type: none"> <li>● Align the front and the rear wheels.</li> </ul>
	<ul style="list-style-type: none"> <li>● Excessive toe.</li> </ul>	<ul style="list-style-type: none"> <li>● Adjust the toe.</li> </ul>
	<ul style="list-style-type: none"> <li>● A broken or a sagging coil spring.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the coil spring.</li> </ul>
	<ul style="list-style-type: none"> <li>● Out-of-balance tires.</li> </ul>	<ul style="list-style-type: none"> <li>● Balance the tires.</li> </ul>
	<ul style="list-style-type: none"> <li>● Worn strut dampeners.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the strut dampeners.</li> </ul>
	<ul style="list-style-type: none"> <li>● A failure to rotate tires.</li> </ul>	<ul style="list-style-type: none"> <li>● Rotate the tires.</li> <li>● Replace the tires as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● Overloaded vehicle.</li> </ul>	<ul style="list-style-type: none"> <li>● Maintain the proper load weight.</li> </ul>
	<ul style="list-style-type: none"> <li>● Low tire inflation.</li> </ul>	<ul style="list-style-type: none"> <li>● Inflate the tires to the proper pressure.</li> </ul>
Scuffed Tires	<ul style="list-style-type: none"> <li>● Incorrect toe.</li> </ul>	<ul style="list-style-type: none"> <li>● Adjust the toe.</li> </ul>
	<ul style="list-style-type: none"> <li>● A twisted or a bent suspension arm.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the suspension arm.</li> </ul>
Wheel Tramp	<ul style="list-style-type: none"> <li>● An out-of-balance tire or wheel.</li> </ul>	<ul style="list-style-type: none"> <li>● Balance the tire or the wheel.</li> </ul>
	<ul style="list-style-type: none"> <li>● Improper strut dampener action.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the strut dampeners.</li> </ul>
Shimmy, Shake, or Vibration	<ul style="list-style-type: none"> <li>● An out-of-balance tire or wheel.</li> </ul>	<ul style="list-style-type: none"> <li>● Balance the tire or the wheel.</li> </ul>
	<ul style="list-style-type: none"> <li>● Excessive wheel hub runout.</li> </ul>	<ul style="list-style-type: none"> <li>● Measure the hub flange runout.</li> <li>● Replace the hub as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● Excessive brake drum or brake rotor imbalance.</li> </ul>	<ul style="list-style-type: none"> <li>● Adjust the brakes.</li> <li>● Replace the brake rotor or the brake drum as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● Worn tie rod ends.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the tie rod ends.</li> </ul>
	<ul style="list-style-type: none"> <li>● Wheel trim imbalance.</li> </ul>	<ul style="list-style-type: none"> <li>● Balance the wheel.</li> </ul>
	<ul style="list-style-type: none"> <li>● A worn ball joint.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the control arm and ball joint assembly.</li> </ul>
	<ul style="list-style-type: none"> <li>● Excessive wheel runout.</li> </ul>	<ul style="list-style-type: none"> <li>● Measure the wheel runout.</li> <li>● Replace the wheel as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● Excessive loaded radial runout on the tire and wheel assembly.</li> </ul>	<ul style="list-style-type: none"> <li>● Match-mount the tire and wheel assembly.</li> </ul>

Condition	Probable Cause	Correction
Hard Steering (Manual)	<ul style="list-style-type: none"> <li>● A lack of lubrication of the ball joints, the tie rods and the steering gear.</li> </ul>	<ul style="list-style-type: none"> <li>● Lubricate the ball joints, the tie rods, and the steering gear.</li> <li>● Replace the control arm and ball joint assembly, the tie rods, and the steering gear as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● The front-wheel alignment is out-of-align.</li> </ul>	<ul style="list-style-type: none"> <li>● Align the front wheels.</li> </ul>
	<ul style="list-style-type: none"> <li>● Steering gear adjustment is out-of-adjustment.</li> </ul>	<ul style="list-style-type: none"> <li>● Adjust the steering gear.</li> </ul>
Hard Steering (Power)	<ul style="list-style-type: none"> <li>● The steering preload adjustment is out-of-adjustment.</li> </ul>	<ul style="list-style-type: none"> <li>● Perform a rack bearing preload on-vehicle adjustment.</li> </ul>
	<ul style="list-style-type: none"> <li>● The leaked hydraulic system.</li> </ul>	<ul style="list-style-type: none"> <li>● Test the power steering system pressure with a gauge.</li> <li>● Replace the seals and the hoses as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● A loose steering gear mounting.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the steering gear mounting bracket bolts.</li> </ul>
Too Much Play in Steering.	<ul style="list-style-type: none"> <li>● Worn or loose wheel bearings.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the drive axle nut.</li> <li>● Replace the wheel bearing as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● A loose steering gear mounting.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the steering gear mounting bracket bolts.</li> </ul>
	<ul style="list-style-type: none"> <li>● The steering preload adjustment is out-of-adjustment.</li> </ul>	<ul style="list-style-type: none"> <li>● Perform a rack bearing preload on-vehicle adjustment.</li> </ul>
	<ul style="list-style-type: none"> <li>● Loose connections or wear of the joint from the steering column to the intermediate shaft.</li> <li>● Loose connections or wear of the joint from the intermediate shaft to the steering gear.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the coupling pinch bolts.</li> <li>● Replace the intermediate shaft as needed.</li> </ul>
Poor Returnability	<ul style="list-style-type: none"> <li>● Binding in the ball joints.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the control arm and ball joint assembly.</li> </ul>
	<ul style="list-style-type: none"> <li>● Binding in the steering column.</li> </ul>	<ul style="list-style-type: none"> <li>● Lubricate the steering column.</li> <li>● Replace the steering column as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● The front-wheel alignment is out-of-align.</li> </ul>	<ul style="list-style-type: none"> <li>● Align the front wheels.</li> </ul>
	<ul style="list-style-type: none"> <li>● The steering preload adjustment is out-of-adjustment.</li> </ul>	<ul style="list-style-type: none"> <li>● Perform a rack bearing preload on-vehicle adjustment.</li> </ul>
	<ul style="list-style-type: none"> <li>● A sticking valve.</li> </ul>	<ul style="list-style-type: none"> <li>● Lubricate the pinion valve assembly.</li> <li>● Replace the pinion valve assembly as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● Binding in the coupling on the intermediate shaft.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the intermediate shaft.</li> </ul>
Abnormal Noise, Front Suspension	<ul style="list-style-type: none"> <li>● Damaged suspension components.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the damaged suspension components.</li> </ul>
	<ul style="list-style-type: none"> <li>● Worn control arm bushings or tie rod ends.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the control arm bushings or the tie rods.</li> </ul>

Condition	Probable Cause	Correction
Abnormal Noise, Front Suspension	● A loose stabilizer shaft link.	● Tighten the stabilizer shaft link.
	● Loose wheel nuts.	● Tighten the wheel nuts.
	● Loose suspension bolts or nuts.	● Tighten the suspension bolts or the nuts.
	● Loose wheel covers.	● Tighten the wheel covers.
	● Worn strut dampeners or strut mountings.	● Replace the strut dampeners. ● Tighten the strut mounting nuts.
	● An improperly positioned strut spring.	● Adjust the strut spring to the proper position.
Wander or Poor Steering Ability	● Mismatched or uneven tires.	● Replace the tires.
	● Worn strut dampeners.	● Replace the strut dampeners.
	● A loose stabilizer shaft link.	● Tighten the stabilizer shaft link.
	● A broken or a sagging coil spring.	● Replace the coil spring.
	● The steering preload adjustment is out-of-adjustment.	● Perform a rack bearing preload on-vehicle adjustment.
	● The front-wheel and the rear-wheel alignment are out-of-align.	● Align the front and the rear end wheels.
Erratic Steering when Braking	● Worn or loose wheel bearings.	● Replace the wheel bearings.
	● A broken or a sagging coil spring.	● Replace the coil spring.
	● A leaking caliper.	● Replace the caliper.
	● Warped rotors.	● Replace the rotors.
	● An incorrect or an uneven caster.	● If the caster is beyond specifications, check the frame and repair it as needed.
Low or Uneven Trim Height	● A broken or a sagging coil spring.	● Replace the coil spring.
	● An overloaded vehicle.	● Maintain the proper load weight.
	● An incorrect or weak coil spring.	● Replace the coil spring.
Ride Too Soft	● Worn strut dampeners.	● Replace the strut dampeners.
	● A broken or a sagging coil spring.	● Replace the coil spring.
Ride Too Harsh	● Incorrect strut dampeners.	● Replace the strut dampeners.
	● An incorrect coil spring.	● Replace the coil spring.
Body Leans or Sways in Corners	● A loose stabilizer shaft link.	● Tighten the stabilizer shaft link.
	● Worn strut dampeners or strut mountings.	● Replace the strut dampeners. ● Tighten the strut assembly mounting nuts.
	● an overloaded vehicle.	● Maintain the proper load weight.
	● A broken or a sagging coil spring.	● Replace the coil spring.
Suspension Bottoms	● Worn strut dampeners.	● Replace the strut dampeners.
	● An overloaded vehicle.	● Maintain the proper load weight.
	● A broken or a sagging coil spring.	● Replace the coil spring.

Condition	Probable Cause	Correction
Steering Wheel Kickback (Power)	<ul style="list-style-type: none"> <li>● Air in the power steering system.</li> </ul>	<ul style="list-style-type: none"> <li>● Bleed the power steering system.</li> </ul>
	<ul style="list-style-type: none"> <li>● A loose steering gear mounting.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the steering gear mounting bracket bolts.</li> </ul>
	<ul style="list-style-type: none"> <li>● Loose connections or wear of the joint from the steering column to the intermediate shaft.</li> <li>● Loose connections or wear of the joint from the intermediate shaft to the steering gear.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the coupling pinch bolts.</li> <li>● Replace the intermediate shaft as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● Loose tie rod ends.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the tie rod ends.</li> <li>● Replace the tie rods as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● Loose or worn wheel bearings.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the drive axle nut.</li> <li>● Replace the wheel bearing as needed.</li> </ul>
Steering Wheel Surges or Jerks (Power)	<ul style="list-style-type: none"> <li>● Low pressure in the power steering system.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the seals and the hoses as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● A sluggish steering gear valve.</li> </ul>	<ul style="list-style-type: none"> <li>● Clean the pinion valve assembly.</li> <li>● Replace the pinion valve assembly as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● A loose power steering pump drive belt.</li> </ul>	<ul style="list-style-type: none"> <li>● Adjust the power steering pump drive belt.</li> </ul>
Cupped Tires	<ul style="list-style-type: none"> <li>● The front-wheel and the rear-wheel alignment are out-of-align.</li> </ul>	<ul style="list-style-type: none"> <li>● Align the front and the rear wheels.</li> </ul>
	<ul style="list-style-type: none"> <li>● Worn strut dampeners.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the strut dampeners.</li> </ul>
	<ul style="list-style-type: none"> <li>● Worn or loose wheel bearing.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten the drive axle nut.</li> <li>● Replace the wheel bearings as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● Excessive tire or wheel runout.</li> </ul>	<ul style="list-style-type: none"> <li>● Match-mount the tires.</li> <li>● Replace the tires as needed.</li> <li>● Replace the wheels as needed.</li> </ul>
	<ul style="list-style-type: none"> <li>● A worn ball joints.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the control arm and ball joint assembly.</li> </ul>
	<ul style="list-style-type: none"> <li>● The steering gear preload adjustment is out-of-adjustment.</li> </ul>	<ul style="list-style-type: none"> <li>● Perform a rack bearing preload on-vehicle adjustment.</li> </ul>

### WHEEL BEARING DIAGNOSIS

This vehicle with non-serviceable bearings in the rear wheels. If any fault is found with a wheel bearing, it must be replaced.

#### Wheel Bearing Noise

A road test usually reveals excessive wheel bearing noise. Wheel bearings emit a howling sound when loose or damaged. Wheel bearing noise is present only when the vehicle is moving. It is constant and unwavering and increases with the speed of the vehicle. If the wheel bearing noise cannot be positively diagnosed, or if the

origin of the noise cannot be determined, perform the following test :

1. Raise and suitably support the vehicle.
2. Spin the wheels using your hand. Check for out-of-round or out-of-balance tires, bent rims, or loose wheel bearings.
3. Spin the rear wheels using a commercial wheel spinner.
4. If a noise can be heard from the passenger compartment, replace the noisy wheel bearings. Refer to *Section 2D, Rear Suspension*.
5. Lower the vehicle.

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## SECTION 2B

# WHEEL ALIGNMENT

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## DESCRIPTION AND OPERATION

### FOUR WHEEL ALIGNMENT

The first responsibility of engineering is to design safe steering and suspension systems. Each component must be strong enough to withstand and absorb extreme punishment. Both the steering system and the front and the rear suspension must function geometrically with the body mass.

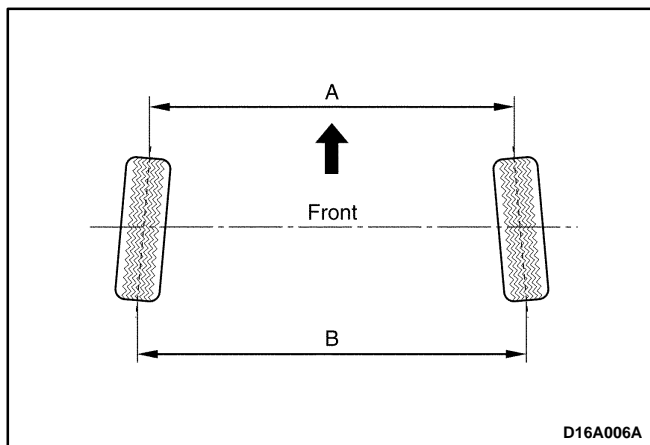
The steering and the suspension systems require that the front wheels self-return and that the tire rolling effort and the road friction be held to a negligible force in order to allow the customer to direct the vehicle with the least effort and the most comfort.

A complete wheel alignment check should include measurements of the rear toe and camber.

Four-wheel alignment assures that all four wheels will be running in precisely the same direction.

When the vehicle is geometrically aligned, fuel economy and tire life are at their peak, and steering and performance are maximized.

### TOE



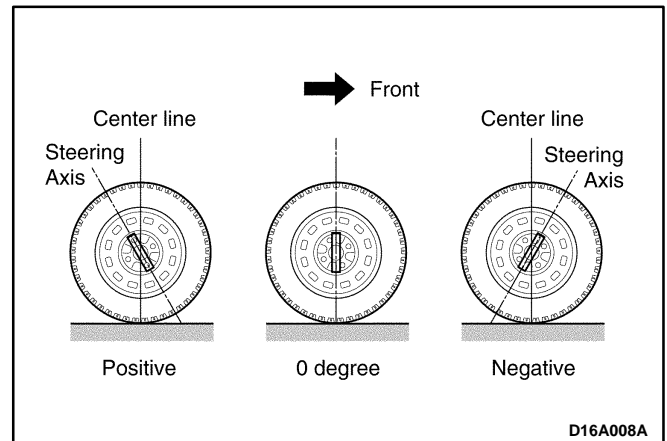
Toe-in is the turning in of the tires, while toe-out is the turning out of the tires from the geometric centerline or thrust line. The toe ensures parallel rolling of the wheels.

The toe serves to offset the small deflections of the wheel support system which occur when the vehicle is rolling forward. The specified toe angle is the setting which achieves—degrees ( $0^\circ$ ) of toe when the vehicle is moving.

Incorrect toe-in or toe-out will cause tire wear and reduced fuel economy. As the individual steering and suspension components wear from vehicle mileage, additional toe will be needed to compensate for the wear.

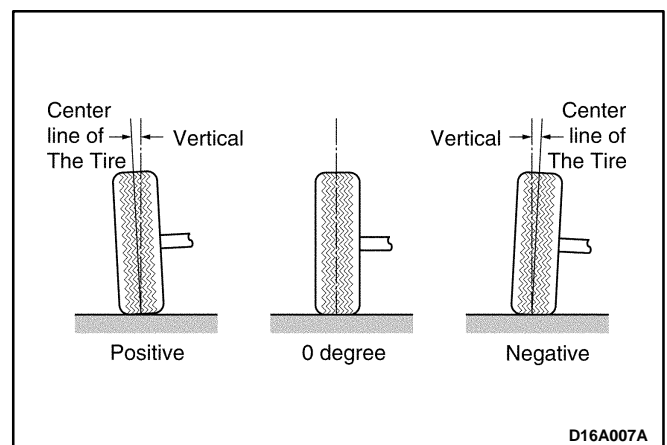
Always correct the toe dimension last.

### CASTER



Caster is the tilting of the uppermost point of the steering axis either forward or backward from the vertical when viewed from the side of the vehicle. A backward tilt is positive, and a forward tilt is negative. Caster influences directional control of the steering but does not affect tire wear. Weak springs or overloading a vehicle will affect caster. One wheel with more positive caster will pull toward the center of the car. This condition will cause the car to move or lean toward the side with the least amount of positive caster. Caster is measured in degrees and is not adjustable.

### CAMBER



Camber is the tilting of the top of the tire from the vertical when viewed from the front of the vehicle. When the tires tilt outward, the camber is positive. When the tires tilt inward, the camber is negative. The camber angle is measured in degrees from the vertical. Camber influences both directional control and tire wear.

If the vehicle has too much positive camber, the outside shoulder of the tire will wear. If the vehicle has too much negative camber, the inside shoulder of the tire will wear. Camber is measured in degrees and is not adjustable.



## STEERING AXIS INCLINATION

Steering Axis Inclination (SAI) is the tilt at the top of the steering knuckle from the vertical. Measure the SAI angle from the true vertical to a line through the center of the strut and the lower ball joint as viewed from the front of the vehicle.

SAI helps the vehicle track straight down the road and assists the wheel back into the straight ahead position. SAI on front wheel drive vehicles should be negative.

## INCLUDED ANGLE

The included angle is the angle measured from the camber angle to the line through the center of the strut and the lower ball joints as viewed from the front of the vehicle.

The included angle is calculated in degrees. Most alignment racks will not measure the included angle directly. To determine the included angle, subtract the negative

or add the positive camber readings to the Steering Axis Inclination (SAI).

## SCRUB RADIUS

The scrub radius is the distance between true vertical and the line through the center of the strut and lower ball joint to the road surface. Scrub radius is built into the design of the vehicle. Scrub radius is not adjustable.

## SETBACK

The setback is the distance in which one front hub and bearing assembly may be rearward of the other front hub and bearing assembly. Setback is primarily caused by a road hazard or vehicle collision.

## TURNING ANGLE

The turning angle is the angle of each front wheel to the vertical when the vehicle is making a turn.

# DIAGNOSTIC INFORMATION AND PROCEDURES

## TIRE DIAGNOSIS

Condition	Probable cause	Correction
Irregular and Excessive Tire Wear	• Incorrect inflation pressure.	• Inflate the tires to the proper pressure.
	• Inbalanced wheel.	• Balance the wheel. • Replace the wheel.
	• A lack of regular rotation.	• Rotate the tires.
	• Incorrect alignment.	• Align the front and rear wheels.
Premature Tire Wear	• Excessive inflation pressure.	• Inflate the tires to the proper pressure.
	• High speed driving with the low inflation pressure.	• Inflate the tires to the proper pressure.
Uneven Braking	• Inbalanced inflation pressure.	• Inflate the tires to the proper pressure.
	• Irregular tire wear.	• Replace the tires.
Noise and Vibration of The Body	• Low inflation pressure.	• Inflate the tires to the proper pressure.
	• Inbalanced wheel.	• Balance the wheel. • Replace the wheel.
	• Damaged wheel or tire.	• Replace the wheel and the tire.
	• Irregular tire wear.	• Replace the tire.
Vibration of The Steering Wheel	• Irregular tire wear.	• Replace the tire.
	• Inbalanced inflation pressure.	• Inflate the tires to the proper pressure.
	• Damaged tire.	• Replace the tire.
	• Bent or damaged wheel.	• Replace the wheel.

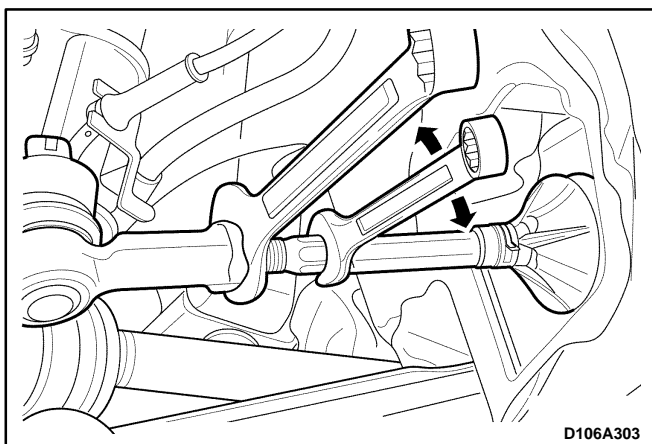
## FRONT TOE ADJUSTMENT

1. Separate the clamps from the both rack and pinion boots.
2. Loosen the right and the left tie rod end lock nuts.
3. Turn the right and the left tie rod to align the toe.

In this adjustment, the right and left tie rods must be equal in length.

<b>Front Toe-In</b>	$10' \pm 10'$
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Rotation Number of Tie Rod	Difference of Toe-In
1/2	0.75 mm (0.03 in.)
1	1.5 mm (0.06 in.)



4. Tighten the tie rod end lock nut to 45 N•m (33 lb-ft).
5. Install the rack and pinion boots clamp.

## FRONT CAMBER AND CASTER CHECK

The front camber and caster are not adjustable. Refer to "Wheel Alignment Specifications" in this section. Jounce the bumper three times before measuring the camber or the caster in order to prevent an incorrect reading. If the front camber or caster measurements deviate from the specifications, locate and replace or repair any damaged, loose, bent, dented, or worn suspension part. If the problem is body related, repair the body.

## REAR CAMBER CHECK

The rear camber is not adjustable. Refer to "Wheel Alignment Specifications" in this section. If the rear camber deviates from the specification, locate the cause and correct it. If damaged, loose, bent, dented, or worn suspension parts are found, they should be repaired or replaced. If the problem is body related, repair the body.

## REAR TOE CHECK

The rear toe is not adjustable. Refer to "Wheel Alignment Specifications" in this section. If the toe deviates from the specification, check the rear axle assembly and the wheel spindle on vehicles without an anti-lock braking system (ABS) or the rear axle assembly and the hub and bearing assembly on vehicles with ABS for possible damage.

## SPECIFICATIONS

### WHEEL ALIGNMENT SPECIFICATIONS

Application	Front	Rear
Camber	$0^{\circ}30' \pm 0^{\circ}30'$	$0^{\circ} \pm 20'$
Caster—Manual Steering	$2^{\circ}48' \pm 30'$	—
Caster—Power Steering	$2^{\circ}48' \pm 30'$	—
Toe-in (2-person load)	$10' \pm 10'$	$20' \pm 20'$

### FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Tie Rod End Lock Nut	45	33	—

---

## SECTION 2C

# FRONT SUSPENSION

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## DESCRIPTION AND OPERATION

### FRONT SUSPENSION

The front suspension for this vehicle is a combination knuckle/strut and spring design.

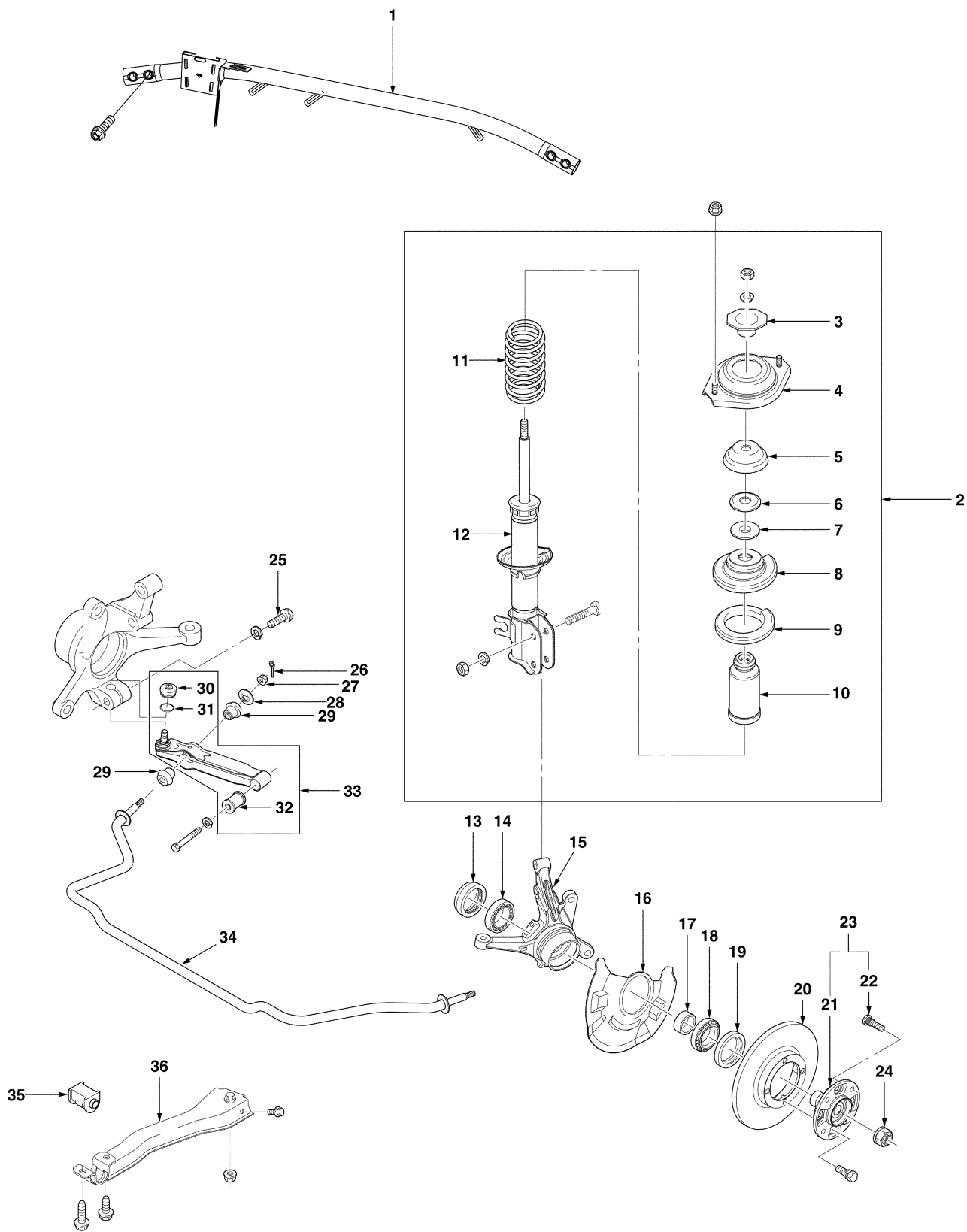
The control arms pivot from the body. The lower control arm pivots use rubber bushing. The upper end of the strut is isolated by a rubber mount and contains a bearing to allow the wheel to turn.

The lower end of the steering knuckle pivots on a ball joint bolted to the control arm. The ball joint is fastened to the steering knuckle with a bolt.

When servicing the control arm-to-body attachment and the stabilizer shaft-to-body insulators, make sure the attaching bolts are loose until the control arms are moved to the trim height, which is curb height. Trim height is the normal position to which the control arms move when the vehicle is sitting on the ground. Refer to “General Specifications” in this section.

# COMPONENT LOCATOR

## FRONT SUSPENSION



D16B401A

## 2C –4 FRONT SUSPENSION

---

- |                                    |                                    |
|------------------------------------|------------------------------------|
| 1. Strut Bar                       | 19. Outer Bearing Oil Seal         |
| 2. Front Suspension Strut Assembly | 20. Rotor                          |
| 3. Strut Inner Support             | 21. Wheel Hub                      |
| 4. Strut Mount Assembly            | 22. Hub Bolt                       |
| 5. Strut Mount Seat                | 23. Hub Assembly                   |
| 6. Strut Bearing Seat              | 24. Drive Axle-to-Hub Caulking Nut |
| 7. Strut Bearing                   | 25. Control Arm Ball Stud Bolt     |
| 8. Coil Spring Upper Seat          | 26. Cotter Pin                     |
| 9. Coil Spring Seat                | 27. Castellated Nut                |
| 10. Bumper Stopper                 | 28. Washer                         |
| 11. Coil Spring                    | 29. Stabilizer Shaft Bushing       |
| 12. Strut                          | 30. Control Arm Dust Seal          |
| 13. Inner Bearing Oil Seal         | 31. Clip                           |
| 14. Inner Hub Bearing              | 32. Control Arm Bushing            |
| 15. Steering Knuckle               | 33. Control Arm Assembly           |
| 16. Dust Cover                     | 34. Stabilizer Shaft               |
| 17. Hub Bearing Spacer             | 35. Stabilizer Shaft Mount         |
| 18. Outer Hub Bearing              | 36. Front Under Longitudinal Frame |
-



# DIAGNOSTIC INFORMATION AND PROCEDURES

## STRUT DAMPENER

A strut dampener is basically a shock absorber. However, strut dampeners are easier to extend and retract by hand than are shock absorbers. Strut dampeners are used only on the front in most vehicles, including this vehicle. Shock absorbers are used on the rear wheels.

Condition	Probable cause	Correction
Struts Seem Weak	<ul style="list-style-type: none"> <li>Improper tire pressures.</li> </ul>	<ul style="list-style-type: none"> <li>Adjust the tire pressures to the specifications on the tire placard.</li> </ul>
	<ul style="list-style-type: none"> <li>Abnormal load conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Consult with the owner to confirm the owner's understanding of normal load conditions.</li> </ul>
	<ul style="list-style-type: none"> <li>Improper compression and rebound effectiveness of the strut dampener.</li> </ul>	<ul style="list-style-type: none"> <li>Quickly push down and then lift up on the corner of the bumper nearest the strut dampener being tested.</li> <li>Compare the compression and rebound with those of a similar vehicle that has an acceptable ride quality.</li> <li>Replace the strut dampener, if needed.</li> </ul>
Struts are Noisy	<ul style="list-style-type: none"> <li>Loose or damaged mountings.</li> </ul>	<ul style="list-style-type: none"> <li>Tighten the strut dampener.</li> <li>Replace the strut dampener if needed.</li> </ul>
	<ul style="list-style-type: none"> <li>Improper compression and rebound effectiveness of the strut dampener.</li> </ul>	<ul style="list-style-type: none"> <li>Quickly push down and then lift up on the corner of the bumper nearest the strut dampener being tested.</li> <li>Compare the compression and rebound with those of a similar vehicle that has an acceptable ride quality.</li> <li>Replace the strut dampener, if needed.</li> </ul>
Leaks	<ul style="list-style-type: none"> <li>A slight trace of fluid.</li> </ul>	<ul style="list-style-type: none"> <li>The strut dampener is OK.</li> </ul>
	<ul style="list-style-type: none"> <li>Leaks of the seal cover on the fully extended strut.</li> </ul>	<ul style="list-style-type: none"> <li>Replace the strut dampener.</li> </ul>
	<ul style="list-style-type: none"> <li>Excessive leaks of fluid on the strut dampener.</li> </ul>	<ul style="list-style-type: none"> <li>Replace the strut dampener.</li> </ul>

## BALL JOINT AND KNUCKLE

### Ball Joint Inspection

- Raise the front of the vehicle to allow the front suspension to hang free.
- Grasp the tire at the top and the bottom.
- Move the top of the tire in an in-and-out motion.
- Look for any horizontal movement of the knuckle relative to the control arm.
- Control arms assembly must be replaced if the following conditions exist:
  - The joint is loose.
  - The ball seal is cut.
  - The ball stud is disconnected from the knuckle.

- The ball stud is loose at the knuckle.
- The ball stud can be twisted in its socket with finger pressure.

### Ball Stud Inspection

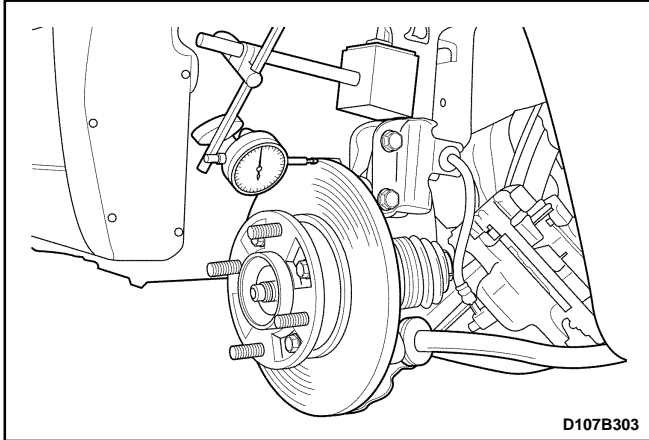
Make sure to check the tightness of the ball stud in the knuckle boss during each inspection of the ball joint. One way to inspect the ball stud for wear is to shake the wheel and feel for movement of the stud end or the castellated nut at the knuckle boss.

Another way to inspect the ball stud for wear is to check the fastener torque at the castellated nut. A loose nut can indicate a stressed stud or a hole in the knuckle boss.

Worn or damaged ball joints and knuckles must be replaced.

## FRONT WHEEL BEARING

### Bearing Axial End Play Inspection



1. Lift and suitably support the vehicle.
2. Inspect the end play of the bearing.
3. If excessive play is detected, free shoes from the disc or remove the calipers.

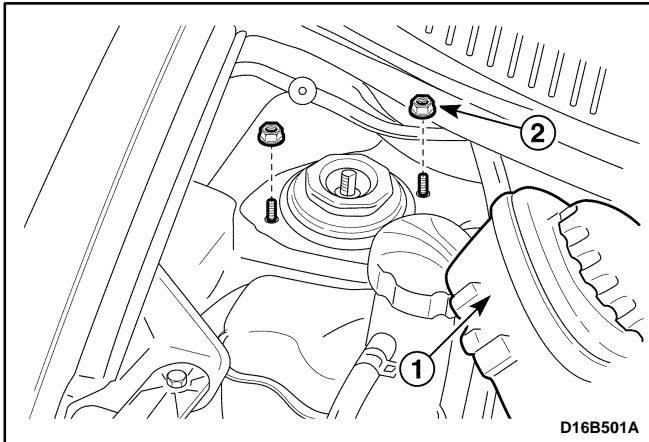
4. Check the standard torque of the drive nut (spec. : 210 N•m (155 lb-ft)).
5. Check the bearing end play according to the following method.
  - Place a dial gauge against the disc surface, grasp the disc.
  - Using a push-pull movement, note gage readings.

Specification	0.130mm or less (0.005 in)	Standard tightening torque of drive shaft nut : 210 N•m (155 lb-ft)
---------------	----------------------------	---

6. If the axial end play of the front wheel bearing exceed 0.130mm torque the drive shaft nut successively (Max. allowance : 240 N•m (177 lb-ft))
7. Check the axial end play again.
8. If the axial end play is above spec., replace the front wheel bearing.

# REPAIR INSTRUCTIONS

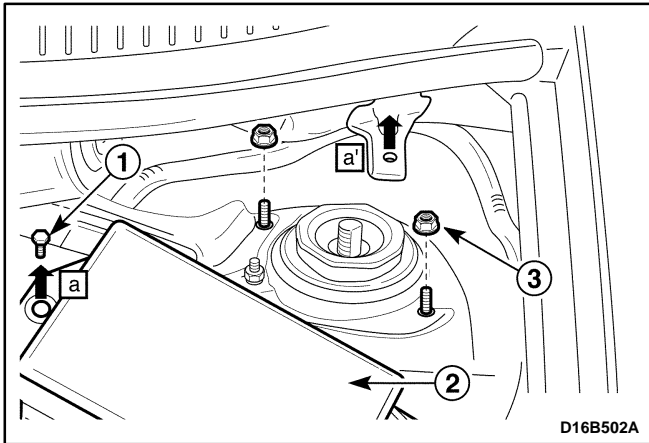
## ON-VEHICLE SERVICE



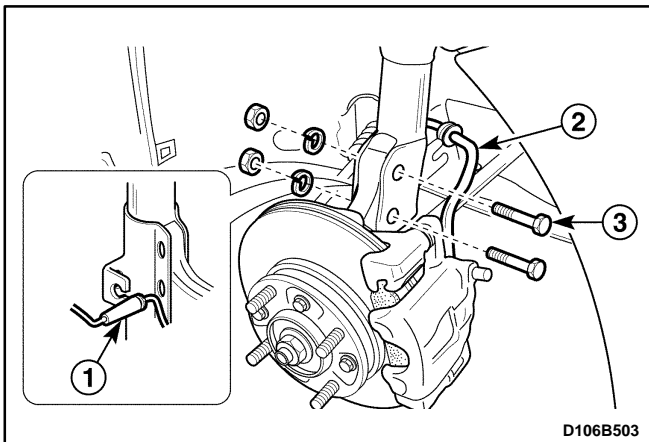
### STRUT ASSEMBLY

#### Removal Procedure

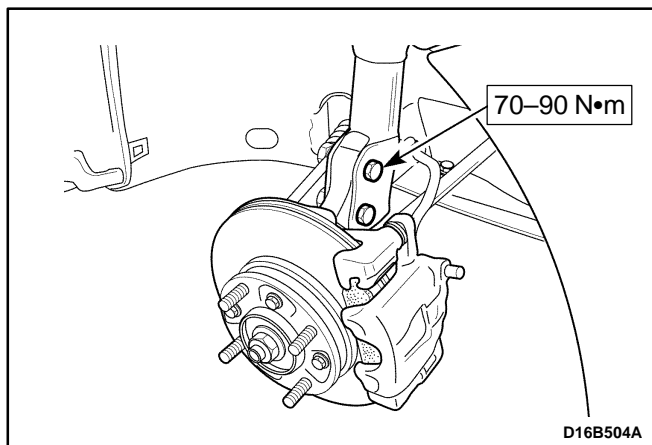
1. Open the hood.
2. Remove the top of the strut assembly at passenger seat side.
  - For vehicle with power steering, remove the power steering fluid reservoir (1).
  - Remove the nuts (2).



3. Remove the top of the strut assembly at driver side.
  - Remove the bolt and the fuse box (1, 2).
  - Remove the nuts (3).



4. Remove the lower of the strut assembly.
  - Raise and suitably support the vehicle.
  - Remove the wheel. Refer to *Section 2E, Tires and Wheels*.
  - Remove the ABS front speed sensor electrical wire from the bracket, if applicable (1).
  - Disconnect the brake hose from the bracket (2).
  - Remove the strut bracket bolts (3).
5. Remove the strut bracket assembly from the vehicle.



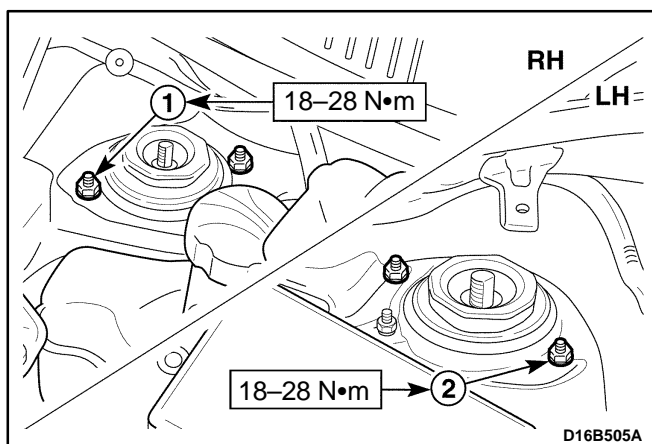
## Installation Procedure

1. Install the strut assembly to the vehicle with the strut assembly-to-strut bracket bolts.

### Tighten

Tighten the strut assembly-to-strut bracket bolts to 70–90 N•m (52–66 lb-ft).

2. Connect the brake hose to the bracket.
3. Install the ABS front speed sensor electrical wire to the bracket, if applicable.



4. Install the wheel. Refer to *Section 2E, Tires and Wheels*.

5. Lower the vehicle.

6. Install the nuts.

- Install the nuts at passenger side (1).

### Tighten

Tighten the nuts to 18–28 N•m (13–21 lb-ft).

- Install the nuts at driver side (2).

### Tighten

Tighten the nuts to 18–28 N•m (13–21 lb-ft).

7. Install the power steering fluid reservoir.

8. Install the fuse box and bolt.

## KNUCKLE ASSEMBLY

### Tools Required

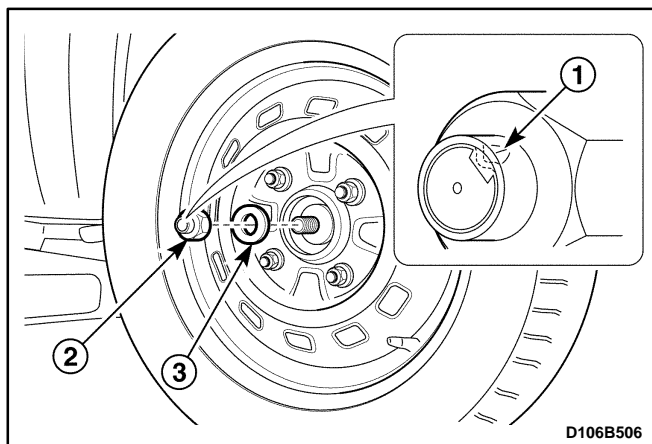
KM 507–B Ball Joint Remover

### Removal Procedure

1. Remove the caulking nut.

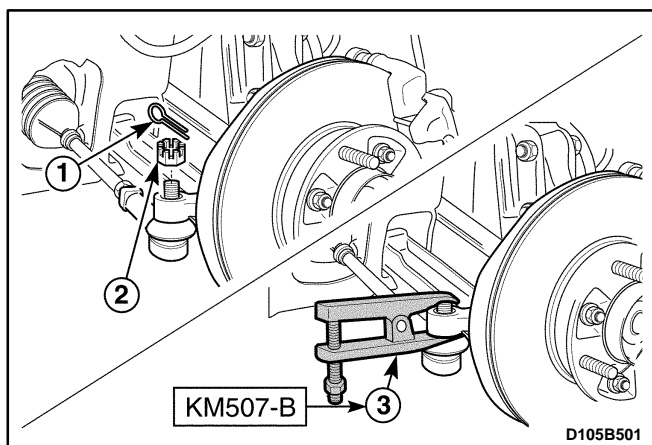
- Straighten the bent flange caulking nut (1).
- Remove the caulking nut (2).
- Remove the washer (3).

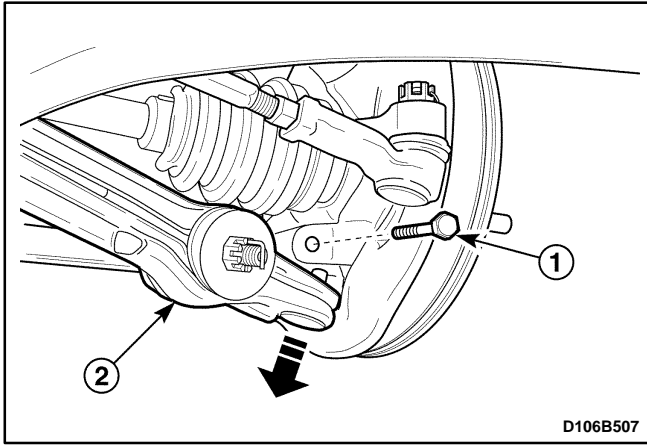
2. Remove the wheel. Refer to *Section 2E, Tires and Wheels*.



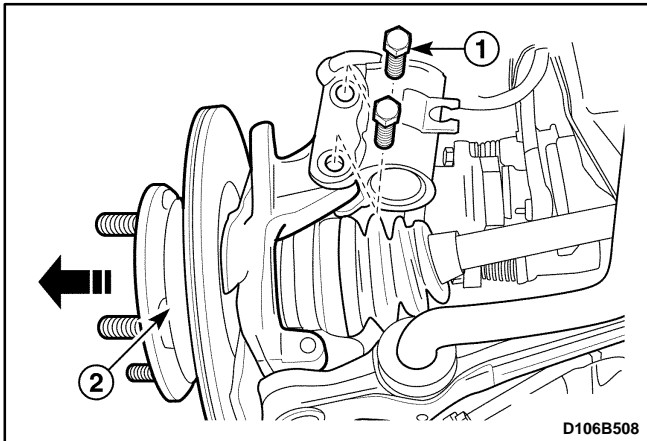
3. Separate the tie rod end from the knuckle assembly.

- Remove the cotter pin (1).
- Remove the castellated nut (2).
- Install the ball joint remover KM 507–B.
- Separate the tie rod end from the knuckle assembly using a ball joint remover KM 507–B (3).

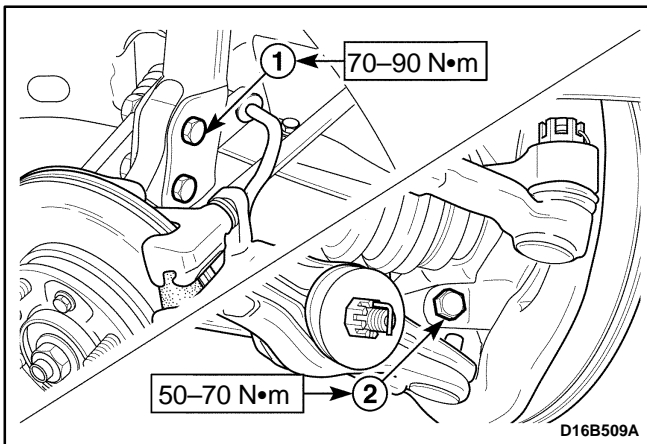




4. Remove the control arm from the knuckle assembly.
  - Remove the stud bolt (1).
  - Separate the control arm from the knuckle assembly (2).



5. Remove the brake caliper from the knuckle assembly. Refer to *Section 4D, Front Disc Brakes*.
6. Remove the ABS wheel speed sensor from the knuckle assembly, if applicable. Refer to *Section 4F, Anti-lock Brake System*.
7. Remove the steering knuckle assembly from the vehicle.
  - Remove the strut bracket bolts (1).
  - Separate the knuckle assembly from the drive shaft by pulling the steering knuckle assembly (2).



## Installation Procedure

1. Install in the reverse order of removal.
2. Install the steering knuckle assembly in the vehicle with strut bracket bolts (1).

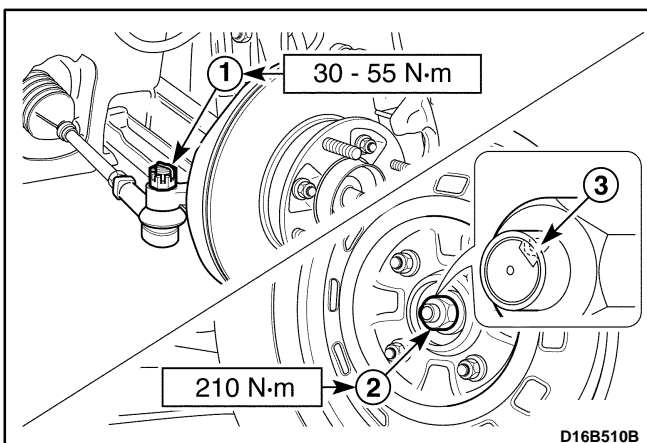
### Tighten

Tighten the strut bracket bolts to 70-90 N·m (52-66 lb-ft).

3. Install the brake caliper from the knuckle assembly.
4. Install the control arm into the knuckle assembly with the stud bolt (2).

### Tighten

Tighten the stud bolt to 50-70 N·m (36-52 lb-ft).



5. Install the tie rod end to the knuckle assembly.
6. Install the tie rod end-to-knuckle castellated nut (1) and the cotter pin.

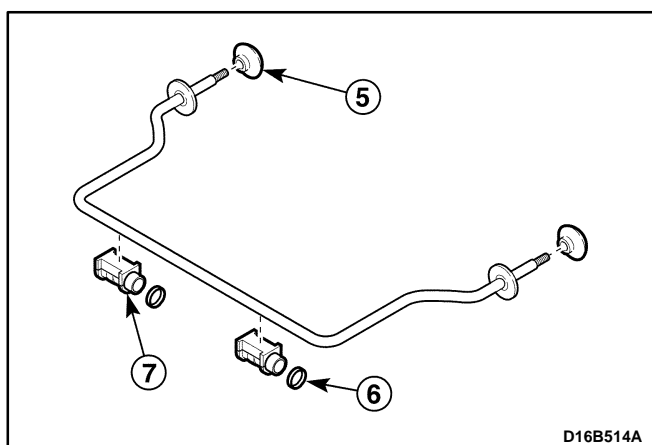
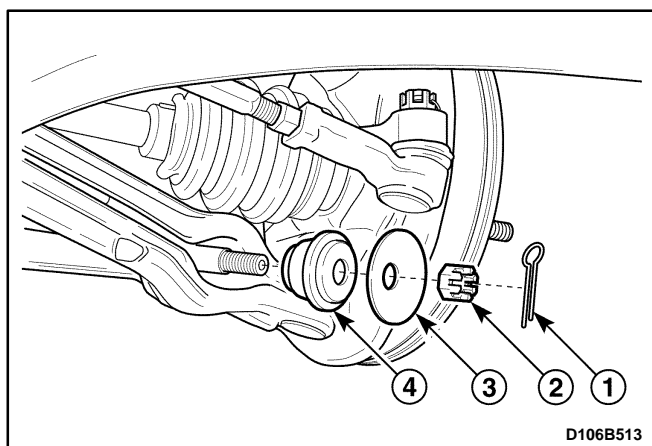
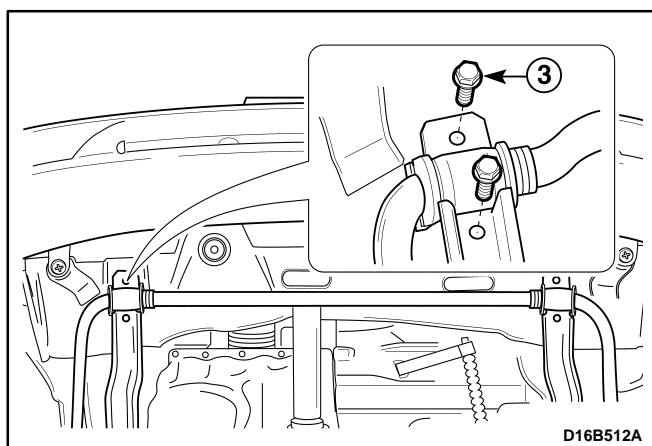
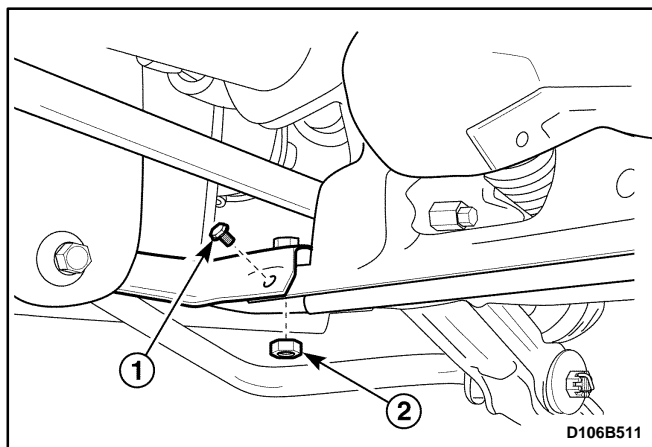
### Tighten

Tighten the castellated nut to 30-55 N·m (22-41 lb-ft).

7. Install the caulking nut (2).
  - Bend the caulking nut flange (3).

### Tighten

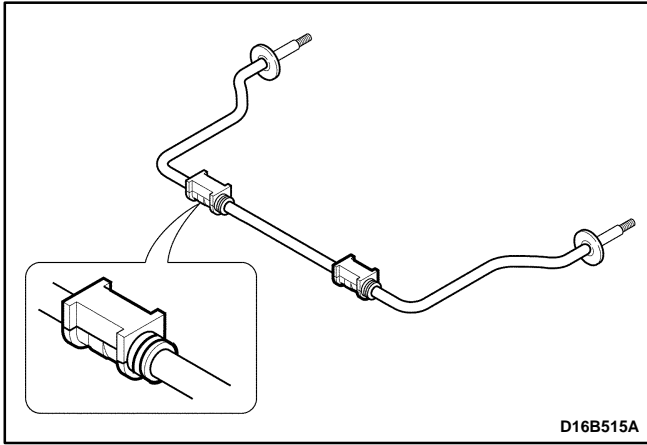
Tighten the caulking nut to 210 N·m (155 lb-ft).



## FRONT LONGITUDINAL FRAME AND STABILIZER SHAFT

### Removal Procedure

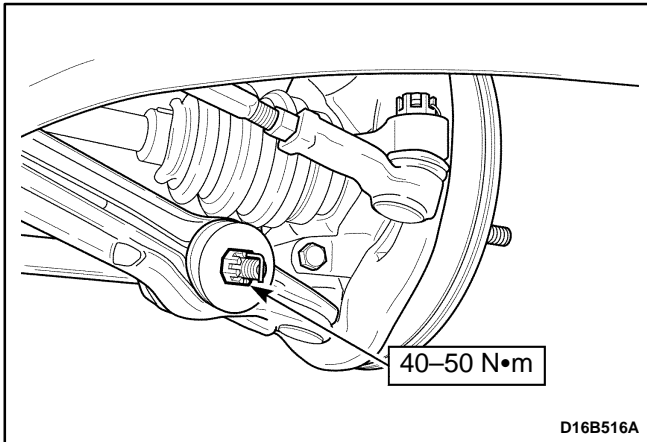
1. Remove the front under longitudinal frame.
  - Raise and suitably support the vehicle.
  - Remove the front wheel. Refer to *Section 2E, Tires and Wheels*.
  - Remove the transaxle under cover. Refer to *Section 5B, Manual Transaxle*.
  - Remove the front under longitudinal frame bolt (1).
  - Remove the front under longitudinal frame nut (2).
  - Remove the stabilizer shaft mounting bolts (3).
  - Remove the front under longitudinal frame.
2. Remove the stabilizer shaft from the vehicle.
  - Remove the cotter pin (1).
  - Remove the castellated nut (2).
  - Remove the washer (3).
  - Remove the rear bushing with separating the stabilizer shaft from the control arm (4).
  - Remove the bushing (5).
  - Remove the wire clamps (6).
  - Remove the mountings (7).



## Installation Procedure

1. Install in the reverse order of removal.

**Important:** When installing the mountings, position the opened mountings forward.



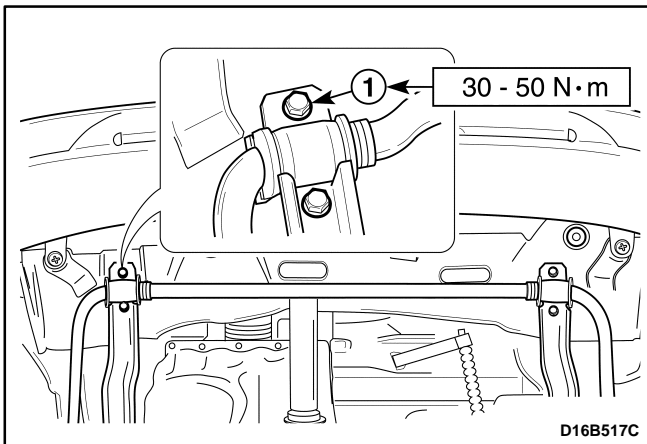
2. Install the stabilizer shaft to the vehicle.

- Install the castellated nut.

### Tighten

Tighten the stabilizer shaft-to-body castellated nut to 40-50 N·m (30-36 lb-ft).

- Install the cotter pin.

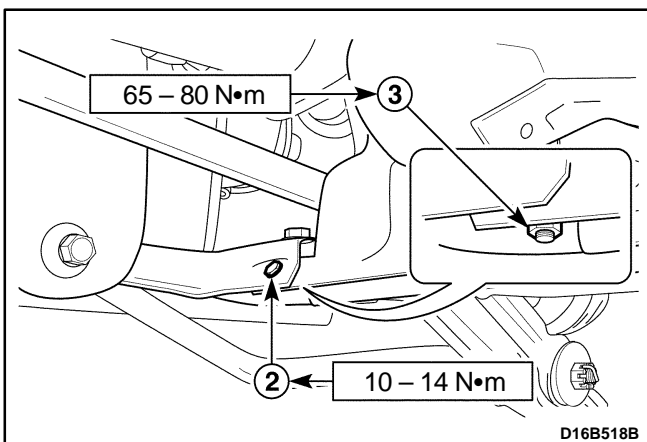


3. Install the front under longitudinal frame.

- Install the stabilizer shaft mounting bolts (1).

### Tighten

Tighten the mounting bolts to 30-50 N·m (22-36 lb-ft).



- Install the front under longitudinal frame bolt (2).

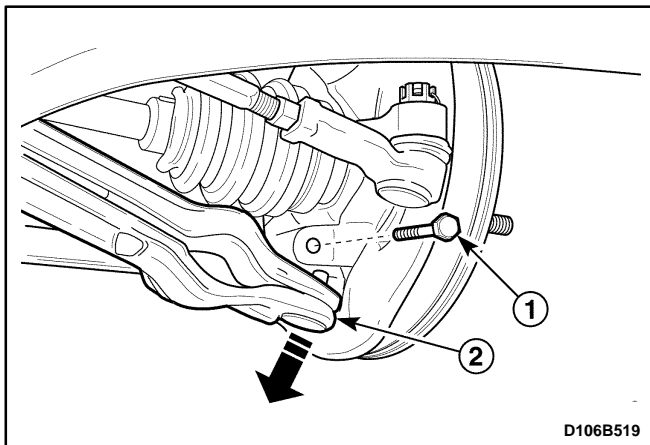
### Tighten

Tighten to bolt to 10-14 N·m (89-124 lb-in).

- Install the front under longitudinal frame nut (3).

### Tighten

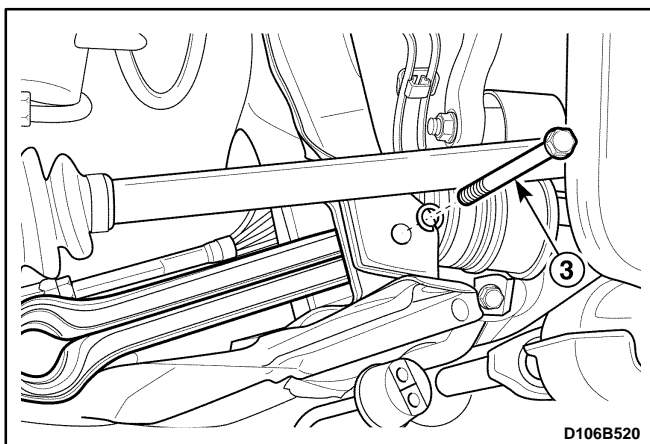
Tighten to nut to 65-80 N·m (48-59 lb-ft).



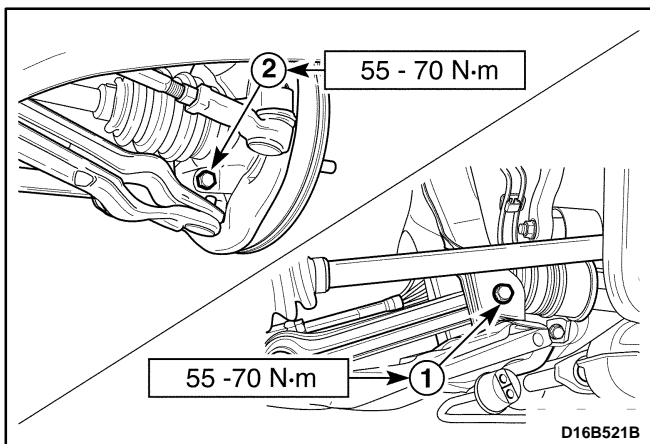
## CONTROL ARM

### Removal Procedure

1. Remove the stabilizer shaft. Refer to "Front Longitudinal Frame and Stabilizer Shaft" in this section.
2. Remove the control arm.
  - Remove the stud bolt (1).
  - Separate the control arm from the knuckle assembly using a lever (2).



- Remove the bolt (3).
- Remove the control arm.



### Installation Procedure

1. Install the control arm onto the vehicle.
  - Install the control arm bolt (1).

#### Tighten

Tighten the control arm bolt to 55–70 N•m (41–52 lb-ft).

- Install the control arm to the knuckle assembly.
- Install the stud bolt (2).

#### Tighten

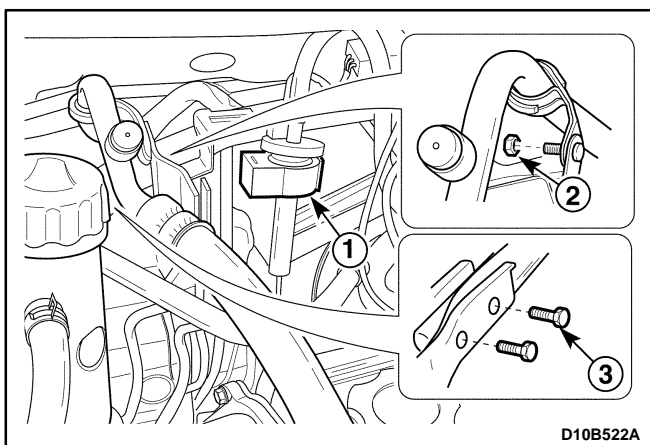
Tighten the stud bolt to 50–70 N•m (36–52 lb-ft).

2. Install the stabilizer shaft.

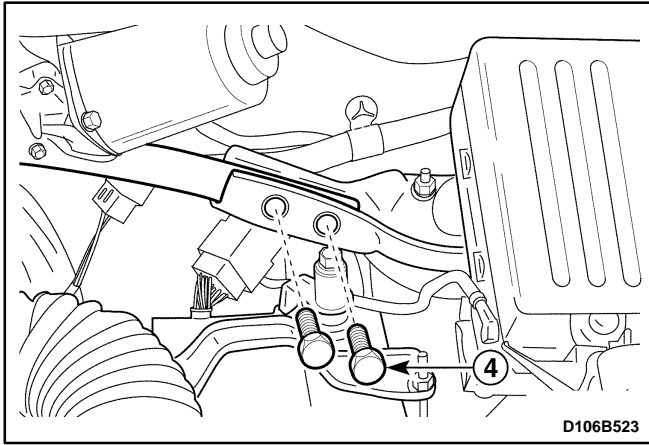
## STRUT BAR

### Removal Procedure

1. Open the hood.
2. Remove the strut bar from the vehicle.
  - Remove the purge control valve (1).
  - Remove the A/C low pressure pipe bracket-to-strut bar nut (2).
  - Remove the strut bar bolts at passenger side (3).



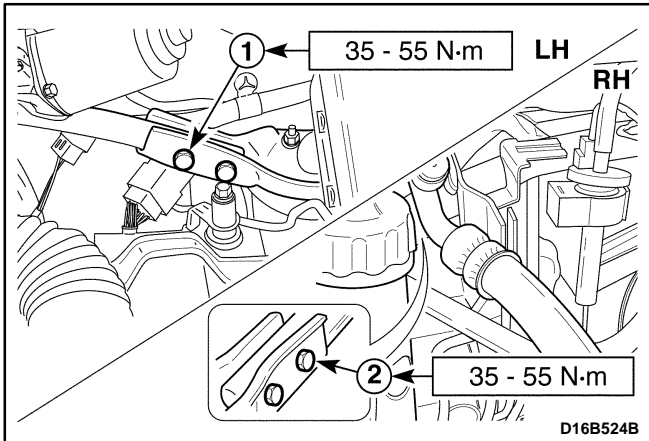




- Remove the strut bar bolts at driver side (4).

**Important:** When removing the bolts using the tool, do not contact the battery terminal.

- Remove the strut bar at passenger side



## Installation Procedure

1. Install the strut bar to the vehicle.

- Install the strut bar at passenger side.
- Install the strut bar bolts at driver side (1).

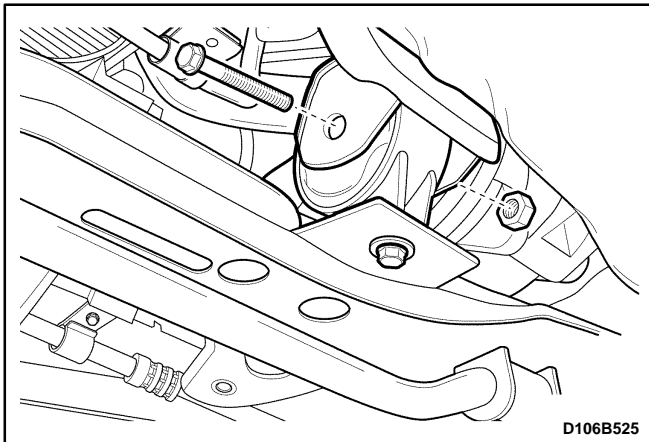
**Important:** When installing the bolts using the tool, do not contact the battery terminal.

- Install the strut bar bolts at passenger side (2).
- Install the A/C low pressure pipe bracket-to-strut bar nut.

## Tighten

Tighten the strut bar bolts to 35–55 N·m (25–41 lb-ft).

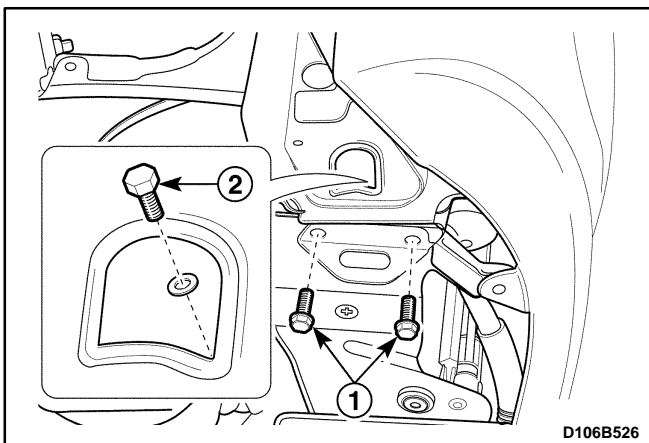
- Install the purge control valve to the strut bar.



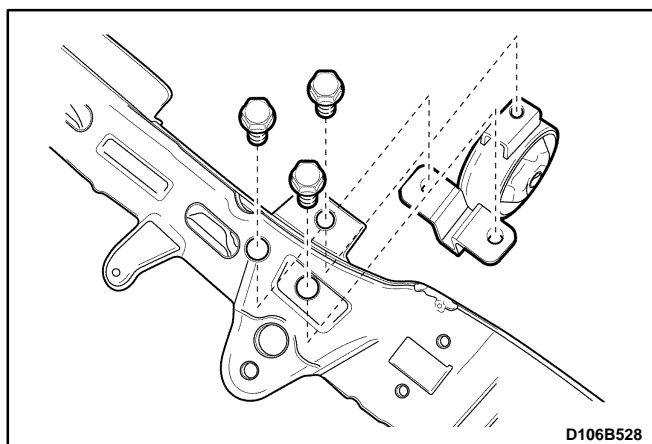
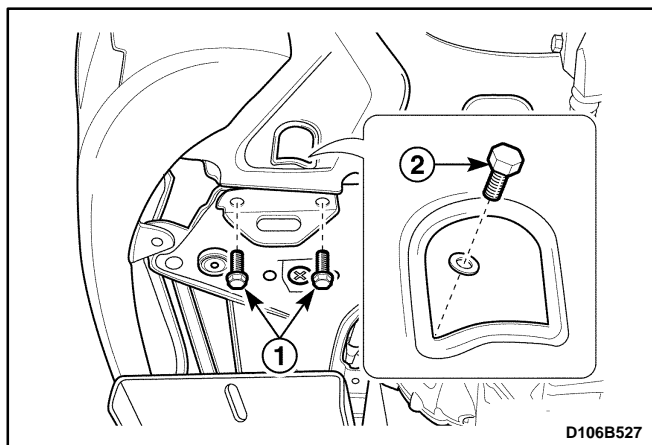
## CROSSMEMBER

### Removal Procedure

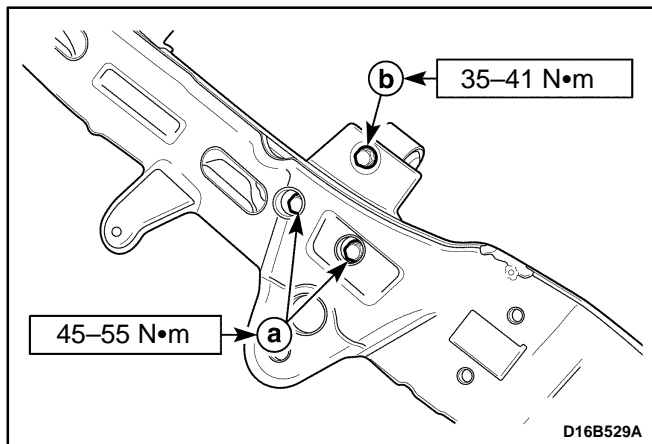
1. Remove the transaxle under cover. Refer to *Section 5B, Five-Speed Manual Transaxle*.
2. Remove the front under longitudinal frame. Refer to "Stabilizer Shaft" in this section.
3. Remove the damping bush bolt and nut.



4. Disconnect the power steering pressure line from the crossmember. Refer to *Section 6B, Power Steering Pump*.
5. Remove the crossmember from the vehicle.
  - Place support jack under the crossmember.
  - Remove the bumper fascia screws.
  - Remove the rear bolts (1).
  - Remove the side bolts (2).
  - Lower the support jack and remove the crossmember from the vehicle.



6. Remove the front damping bush bolts and damping bush from the crossmember.

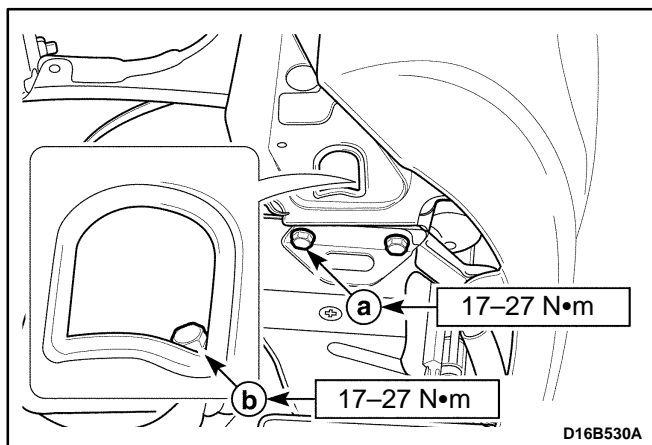


### Installation Procedure

1. Install in the reverse order of removal.
2. Install the front damping bush to the crossmember.

#### Tighten

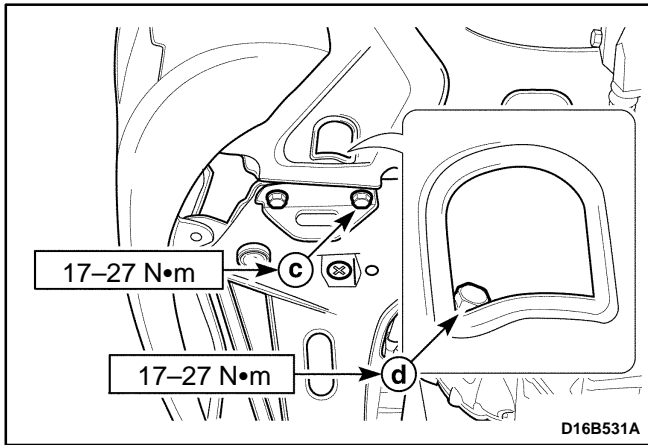
- Tighten the bolts to 45-55 N•m (33-41 lb-ft).
  - a. Front damping bush bolt.
- Tighten the bolt to 35-41 N•m (25-30 lb-ft).
  - b. Front damping bush bolt.



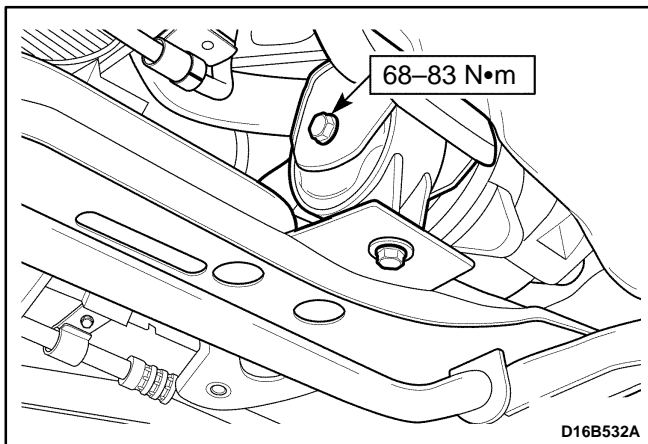
3. Install the crossmember to the vehicle with the bolts.

#### Tighten

- Tighten the bolts to 17-27 N•m (13-20 lb-ft).
- a. Crossmember right rear bolt.
  - b. Crossmember right side bolt.



- c. Crossmember left rear bolt.
- d. Crossmember left side bolt.



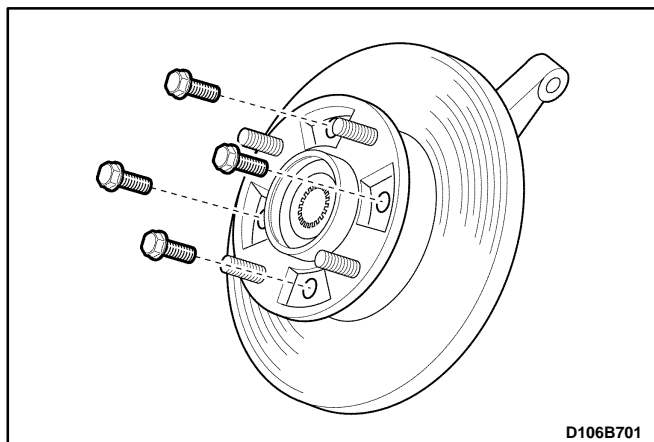
4. Install the front damping bush to the vehicle.

### **Tighten**

Tighten the front damping bush bolt and nut to 68-83 N·m (51-61 lb-ft).

5. Install the front under longitudinal frame. Refer to "Stabilizer Shaft" in this section.

## UNIT REPAIR



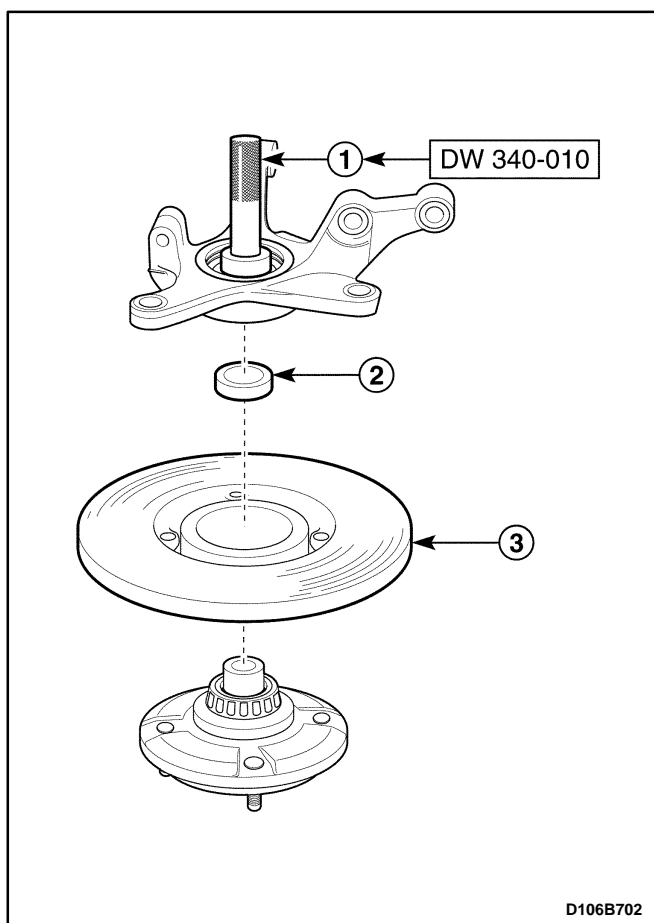
### HUB BEARING AND KNUCKLE

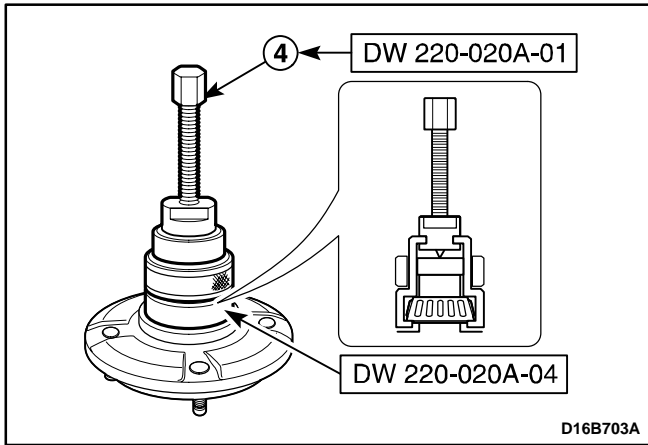
#### Tools Required

DW 220-020A-01	Differential Bearing Puller.
DW 220-020A-04	Differential Bearing Plate Adapter.
DW 340-010	Front Wheel Hub Remover.
DW 340-020	Front Wheel Bearing Race Installer.
DW 340-030	Front Wheel Bearing Installer.
09940-71430	Front Spring Compressor.

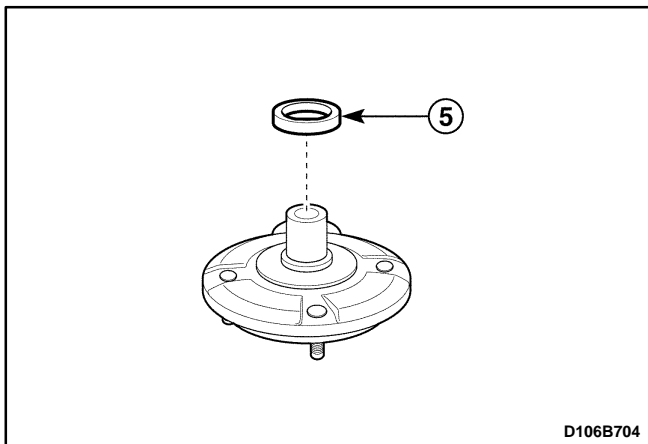
#### Disassembly Procedure

1. Remove the steering knuckle assembly. Refer to "Knuckle Assembly" in this section.
2. Remove the bolts from the wheel hub.
3. Remove the wheel hub from the knuckle assembly using the front wheel hub remover DW 340-010.
  - Remove the wheel hub using the front wheel hub remover DW 340-010 (1).
  - Remove the bearing spacer (2).
  - Remove the brake rotor (3).



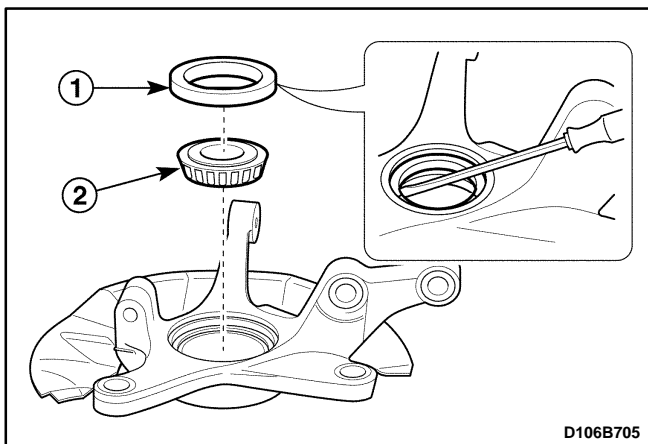


- Remove the wheel bearing from the wheel hub using the differential bearing puller DW 220-020A-01 and differential bearing plate adapter DW 220-020A-04 (4).



- Remove the oil seal from the wheel hub (5).

**Important:** Do not use removed oil seal.

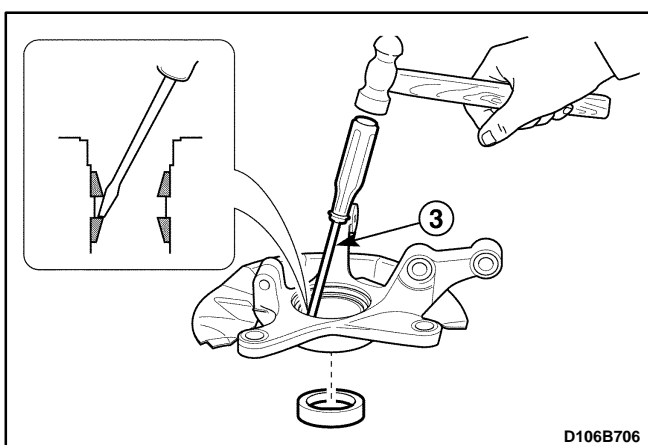


4. Remove the steering knuckle assembly.

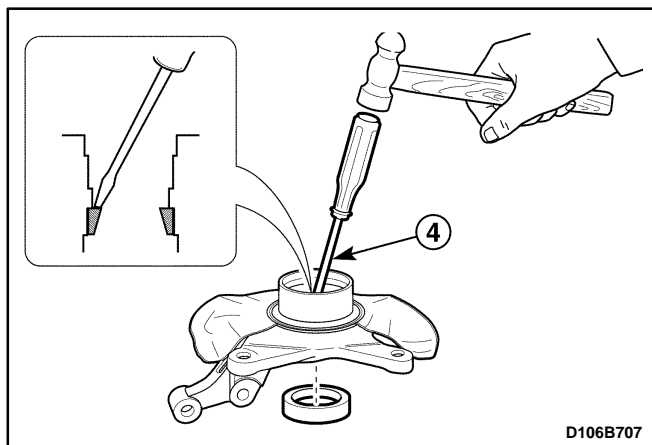
- Remove the oil seal (1).

**Important:** Do not use removed oil seal.

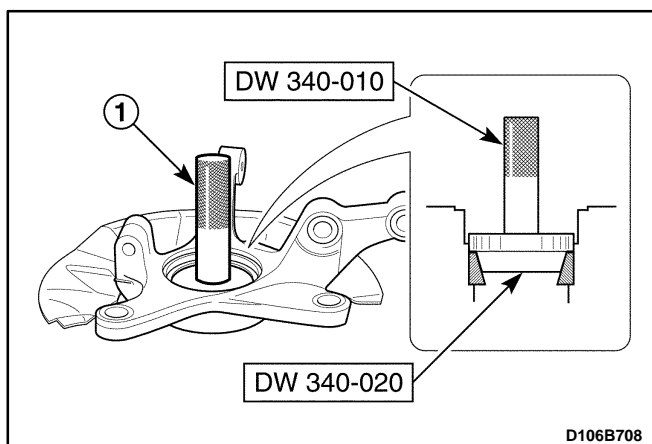
- Remove the wheel bearing (2).



- Remove the outer bearing race (3).



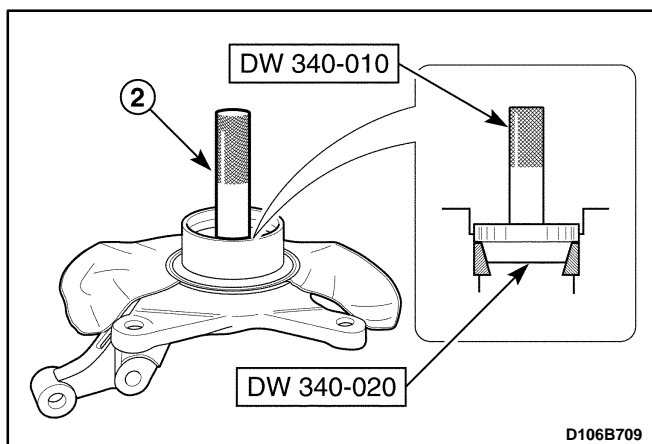
- Remove the inner bearing race (4).



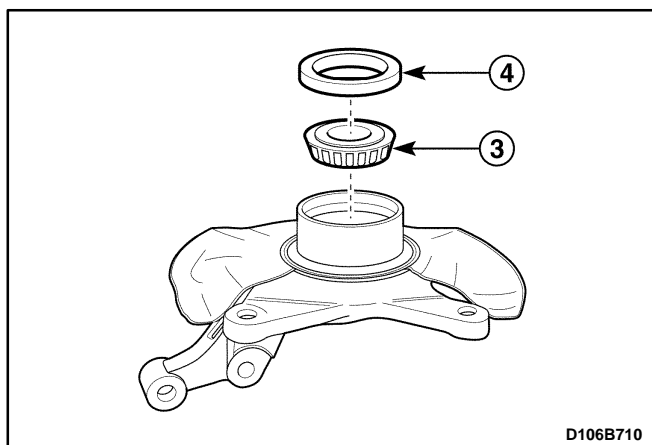
### Assembly Procedure

1. Assemble the steering knuckle assembly.

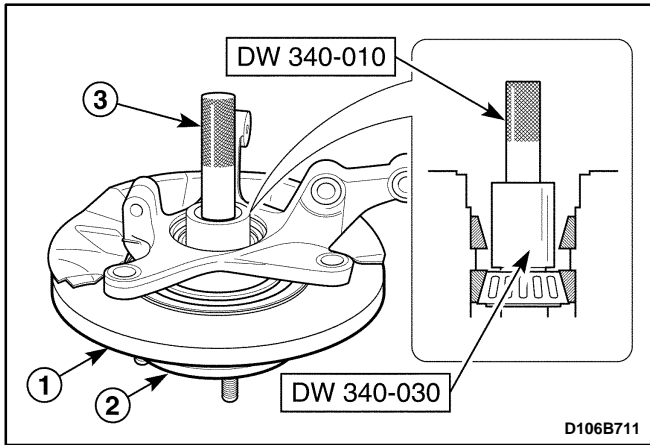
- Assemble the inner bearing race using the front wheel hub remover DW 340-010 and the front bearing race installer DW 340-020 (1).



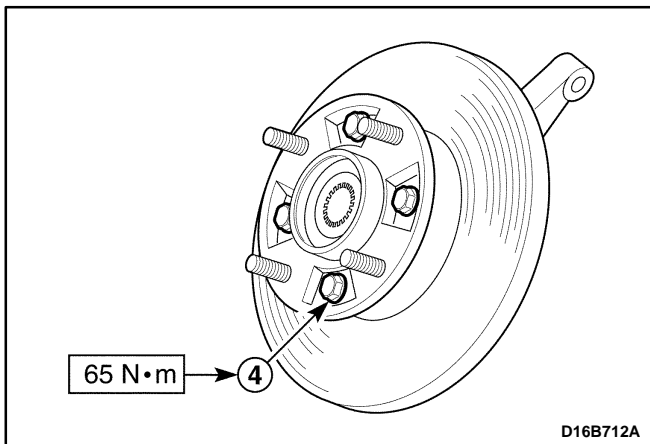
- Assemble the outer bearing race using the front wheel hub remover DW 340-010 and the front wheel bearing race installer DW 340-020 (2).



- Assemble the outer wheel bearing (3).
- Assemble the outer wheel bearing oil seal (4).



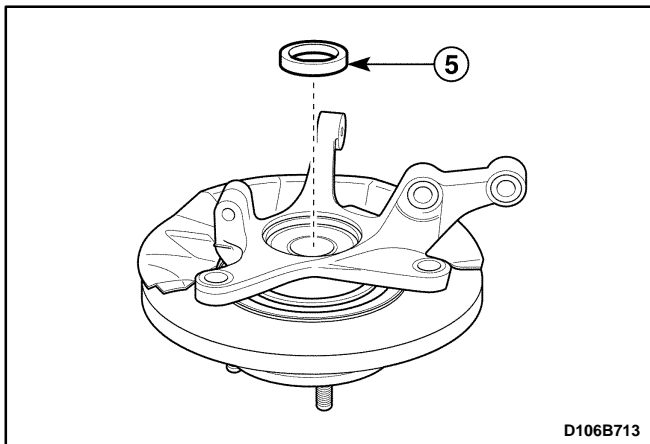
2. Install the wheel hub to steering knuckle assembly.
  - Install the brake rotor (1).
  - Install the wheel hub to the steering knuckle assembly temporary (2).
  - Press the outer wheel bearing into the wheel hub using the front wheel hub remover DW 340-010 and the front wheel bearing installer DW 340-030 (3).



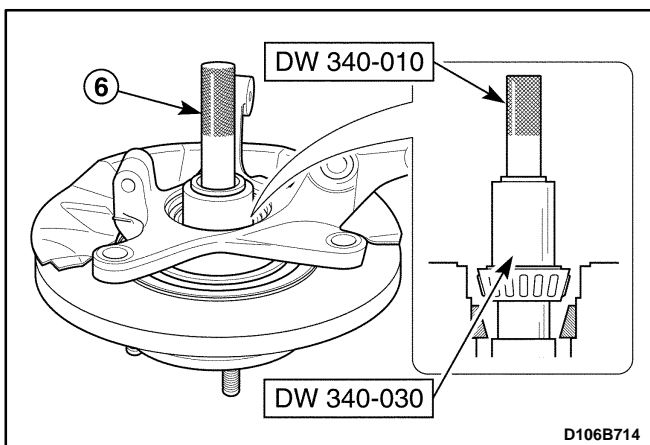
- Tighten the bolts (4).

### Tighten

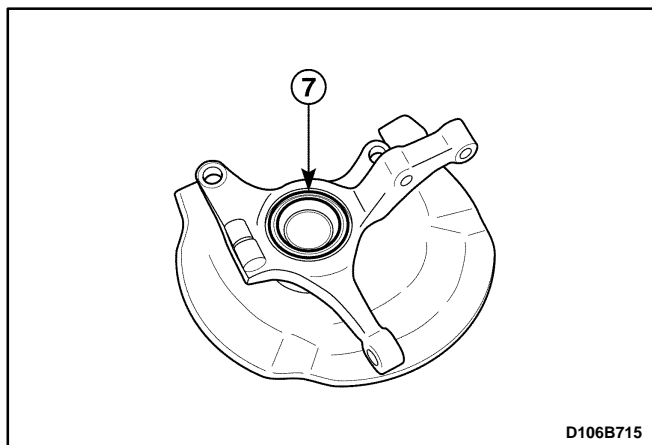
Tighten the bolt to 65 N·m (48 lb-ft).



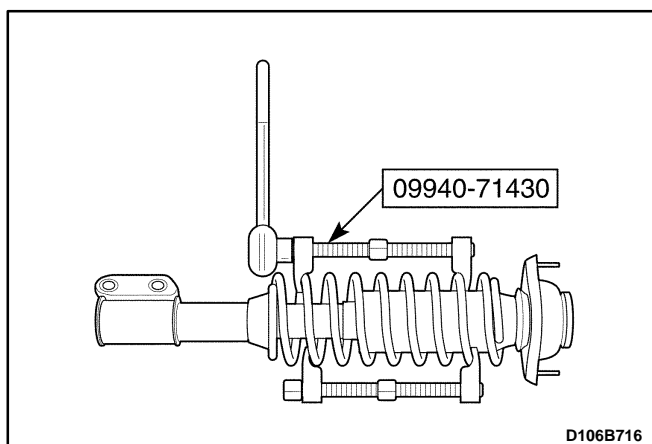
- Install the bearing spacer (5).



- Press the inner wheel bearing into the wheel hub using the front wheel hub remover DW 340-010 and the front wheel bearing installer DW 340-030 (6).



- Install the inner wheel bearing oil seal (7).
3. Install the steering knuckle assembly.  
Refer to "Knuckle Assembly" in this section.



### FRONT STRUT (INCLUDING COIL SPRING)

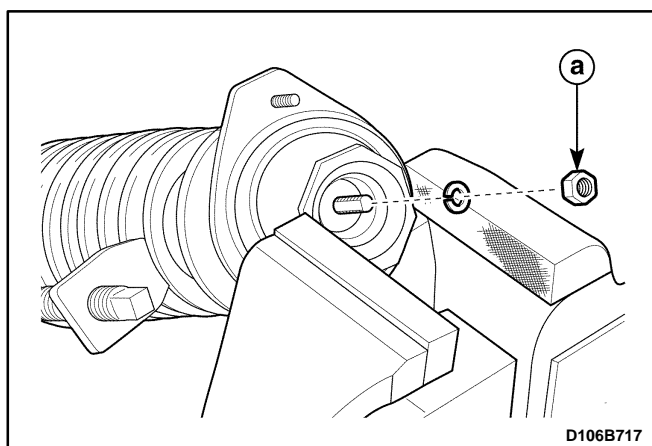
#### Tools Required

09940-71430 Front Spring Compressor.

#### Disassembly Procedure

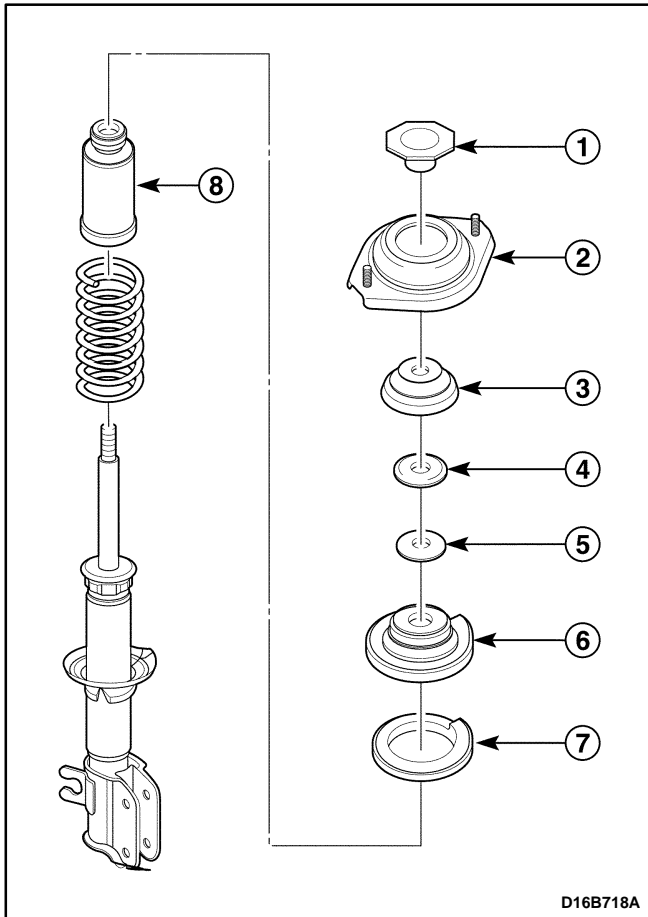
1. Remove the strut assembly. Refer to "Strut Assembly" in this section.
2. Compress the front spring with the front spring compressor 09940-71430.

**Caution:** During compressing spring, do not make spring end point to operator or dangerous direction.



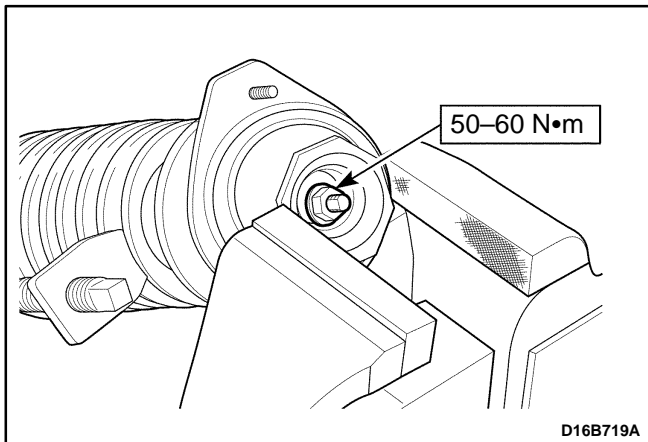
3. Fix the strut support using the bench vise and remove the strut nut.
  - a. Strut nut.





#### 4. Remove the coil spring.

- Remove the strut inner support (1).
- Remove the strut mount assembly (2).
- Remove the strut mount seat (3).
- Remove the strut bearing seat (4).
- Remove the strut bearing (5).
- Remove the coil spring upper seat (6).
- Remove the coil spring seat (7).
- Remove the bumper stopper (8).

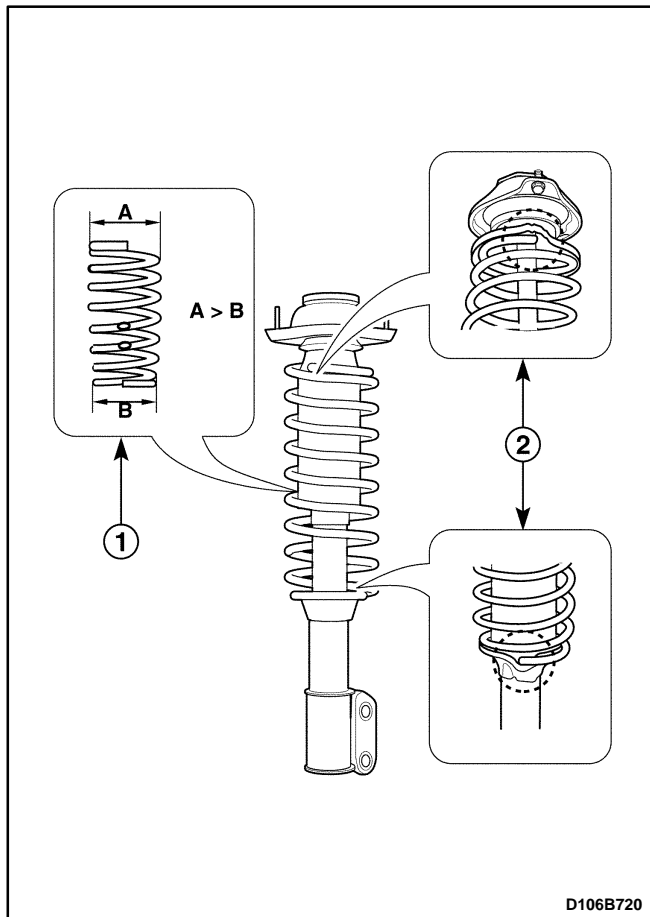


### Assembly Procedure

1. Install the coil spring, front bumper stopper, coil spring seat, coil spring upper seat, strut bearing, bearing seat, mounting seat, mount assembly and inner support to the strut.
2. Tighten the strut nut.
  - Fix the strut support using the bench vise.
  - Tighten the nut.

### Tighten

Tighten the strut nut to 50-60 N•m (36-44 lb-ft).



3. Inspect the installation of coil spring (1, 2).

4. Install the strut assembly. Refer to "Strut Assembly" in this section.

# SPECIFICATIONS

## GENERAL SPECIFICATIONS

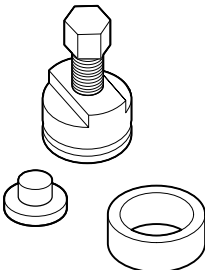
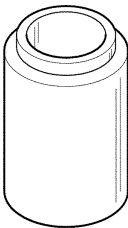
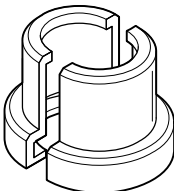
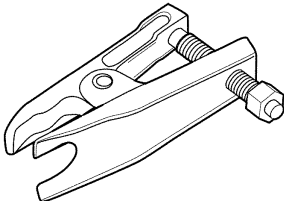

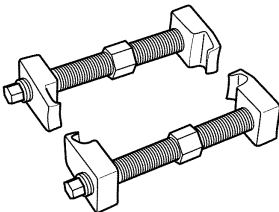
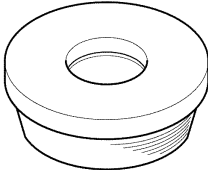
Application		Unit	Description
Suspension Type		–	Mcpherson (Strut)
Shock Absorber	Maximum Length	mm (in.)	475–481 (18.7–18.94)
	Minimum Length	mm (in.)	321–327 (12.64–12.87)
	Stroke	mm (in.)	154 (6.06)
Stabilizer Shaft Diameter		mm (in.)	24 (0.94)
Coil Spring Height (No Load)		mm (in.)	374 (14.72 )
Grease Type (Front Wheel Bearing and Hub)		–	M-8143 ANTIF BRG GREASE

## FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Strut Assembly-to-Body Nuts	18 – 28	13 – 21	–
Strut Closure Nut	50 – 60	36 – 44	–
Strut Assembly-to-Knuckle Bolts	70 – 90	52 – 66	–
Control Arm Mounting Bolt	55 – 70	41 – 52	–
Control Arm Ball Stud Bolt	50 – 70	36 – 52	–
Stabilizer Shaft Castellated Nut	40 – 50	30 – 36	–
Stabilizer Shaft Mounting Bolt	30 – 50	22 – 36	–
Front Under Longitudinal Frame Bolts	10 – 14	–	89 – 124
Front Under Longitudinal Frame Nut	65 – 80	48 – 59	–
Drive Axle-to-Hub Caulking Nut	210	155	–
Crossmember Bolt	17 – 27	13 – 20	–
Strut Bar Bolts	35 – 55	25 – 41	–
ABS Front Speed Sensor Retaining Bolt	18 – 28	13 – 21	–
Wheel Hub-to-Brake Disc Bolt	55 – 75	41 – 55	–

# SPECIAL TOOLS AND EQUIPMENT

## SPECIAL TOOLS TABLE

 <p>D13B112A</p>	<p><b>DW 220-020A-01</b> <b>Differential Bearing Puller</b></p>	 <p>D106B103</p>	<p><b>DW 340-030</b> <b>Front Wheel Bearing Installer</b></p>
 <p>D13B113A</p>	<p><b>DW 220-020A-04</b> <b>Differential Bearing Plate Adapter</b></p>	 <p>D105B101</p>	<p><b>KM 507-B</b> <b>Ball Joint Remover</b></p>
 <p>D16B101A</p>	<p><b>DW 340-010</b> <b>Front Wheel Hub Remover</b></p>	 <p>D106B104</p>	<p><b>09940-71430</b> <b>Front Spring Compressor</b></p>
 <p>D106B102</p>	<p><b>DW 340-020</b> <b>Front Wheel Bearing Race Installer</b></p>		

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## SECTION 2D

# REAR SUSPENSION

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## DESCRIPTION AND OPERATION

### REAR SUSPENSION

The rear suspension consists of an axle with trailing arms and a lateral rod, two coil springs, two shock absorbers, two upper spring seats, and two bump stop-

pers. The axle structure maintains the relationship of the wheels to the body.

Each coil spring is retained between a seat in the underbody and a seat welded to the top of the rear axle.



# DIAGNOSTIC INFORMATION AND PROCEDURES

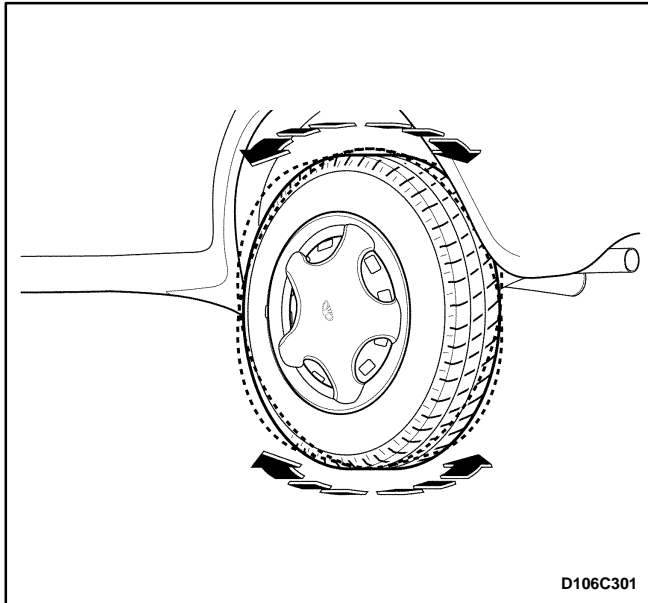
## REAR SUSPENSION

Condition	Probable cause	Correction
Noise	● The loosened joints.	● Tighten the joints.
	● Wheel bearing is worn or damaged.	● Replace the wheel bearing.
	● Faulty shock absorber.	● Replace the shock absorber.
Uncomfortable	● Faulty shock absorber.	● Replace the shock absorber.
	● Faulty coil spring.	● Replace the coil spring.
	● Lateral rod bushing is worn or damaged.	● Replace the lateral rod bushing.
	● Trailing arm bushing is worn or damaged.	● Replace the trailing arm bushing.
Vehicle Leans Toward the Side	● Rear axle deformation.	● Replace the rear axle.
	● Lateral rod deformation.	● Replace the lateral rod.
	● Trailing arm deformation.	● Replace the trailing arm.
	● Faulty coil spring.	● Replace the coil spring.
	● Lateral rod bushing is worn or damaged.	● Replace the lateral rod bushing.
	● Trailing arm bushing is worn or damaged.	● Replace the trailing arm bushing.



## CHECKING THE REAR WHEEL BEARING END PLAY

1. Release the parking brake.
2. Raise the vehicle.
3. Check the wheel bearing play by moving the top and the down of the tire in an in-and-out motion.



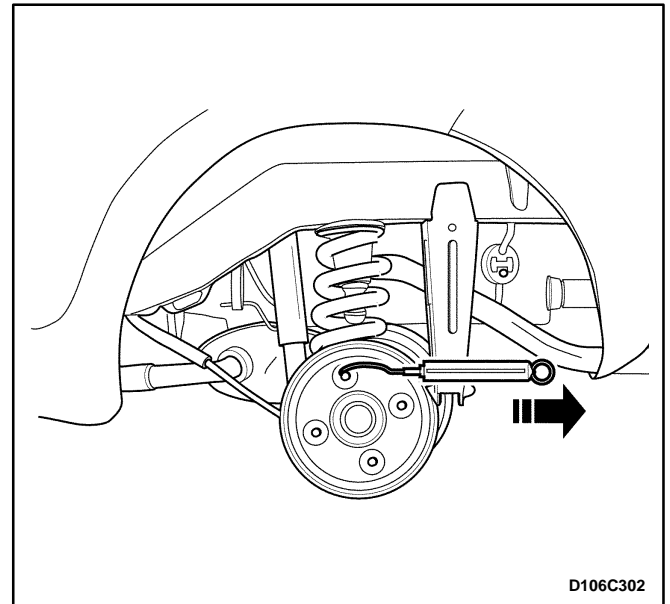
Rear Wheel Bearing Play	0 mm (0 in.)
-------------------------	--------------

4. If the bearing play is high, tighten the castellated nut.
5. If the bearing play is high after tightening, replace the wheel bearing.

## REAR WHEEL BEARING FREE LOAD

1. Release the parking brake.
2. Raise the vehicle and rotate the wheel.
3. Remove the wheels.
4. Check the torque when the hub moves by a spring scale.

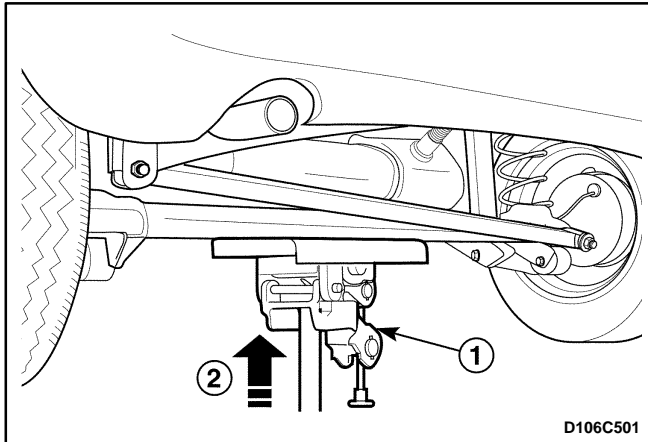
Standard (No Load)	0.137 – 0.422 N•m (0.9 – 3.7 lb-in)
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5. If the checked torque exceeds the specification, tighten the castellated nut.
6. If the checked torque exceeds the specification after tightening, replace the wheel bearing.

# REPAIR INSTRUCTIONS

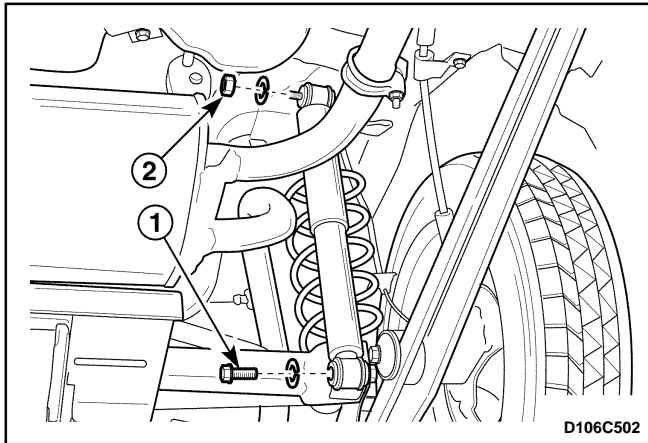
## ON-VEHICLE SERVICE



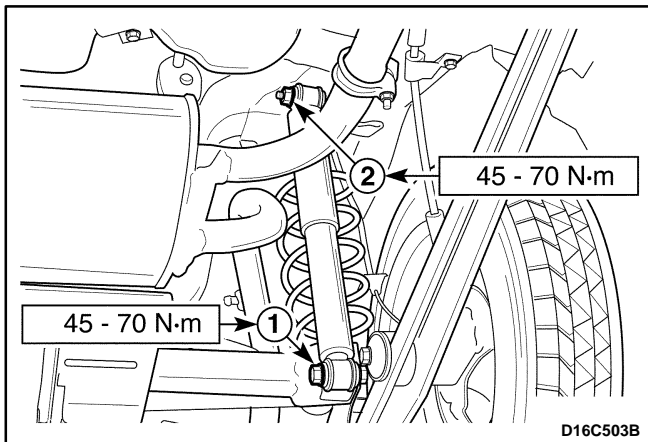
### SHOCK ABSORBER

#### Removal Procedure

1. Support the rear axle with adjustable jack stands.
  - Raise the vehicle and support the rear axle assembly (1, 2).



2. Remove the shock absorber.
  - Remove the bolt (1).
  - Remove the nut (2).



#### Installation Procedure

1. Install the shock absorber.
  - Install the shock absorber-to-rear axle bolt (1).

#### Tighten

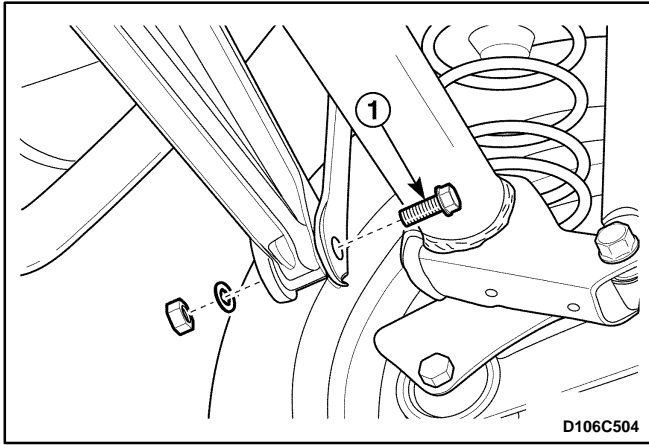
Tighten the bolt to 45–70 N•m (33–52 lb-ft).

- Install the shock absorber-to-body bracket nut (2).

#### Tighten

Tighten the shock absorber nut to 45–70 N•m (33–52 lb-ft).

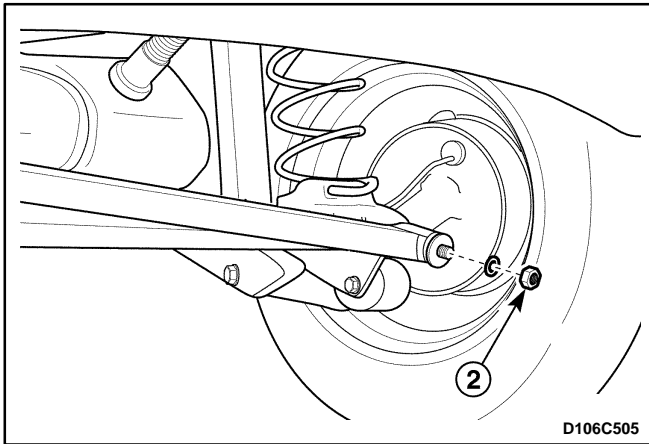
2. Remove the jack stand and lower the vehicle.



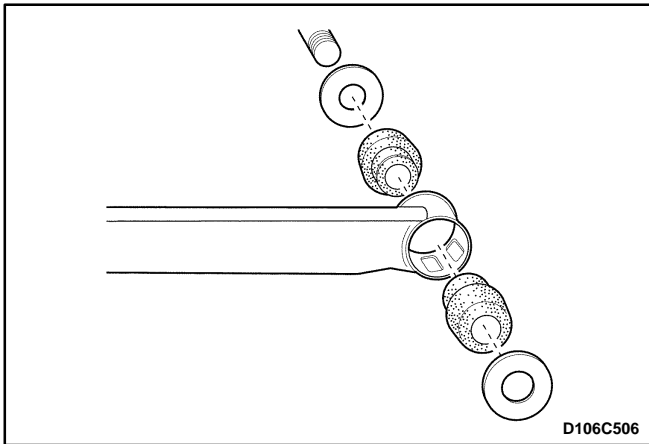
## LATERAL ROD

### Removal Procedure

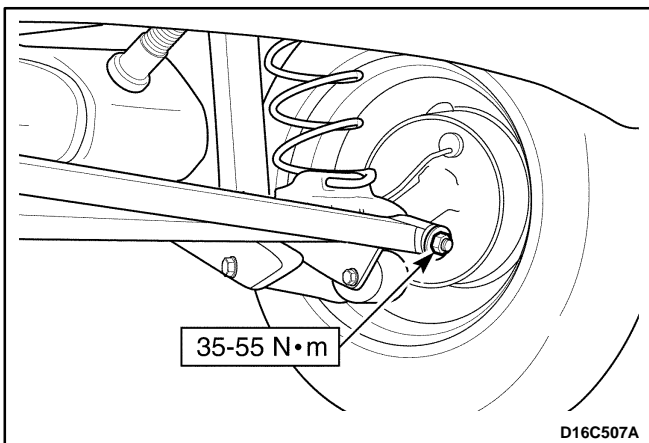
1. Raise and suitably support the vehicle.
2. Remove the lateral rod.
  - Remove the lateral rod-to-body bracket bolt (1).



- Remove the lateral rod-to-rear axle nut (2).



2. Remove the lateral rod axle side bushing and washer from the lateral rod.

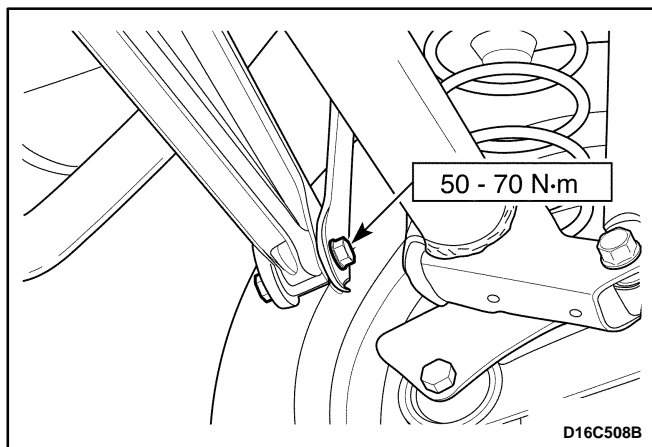


### Installation Procedure

1. Install in the reverse order of removal.
2. Install the lateral rod-to-rear axle side nut.

### Tighten

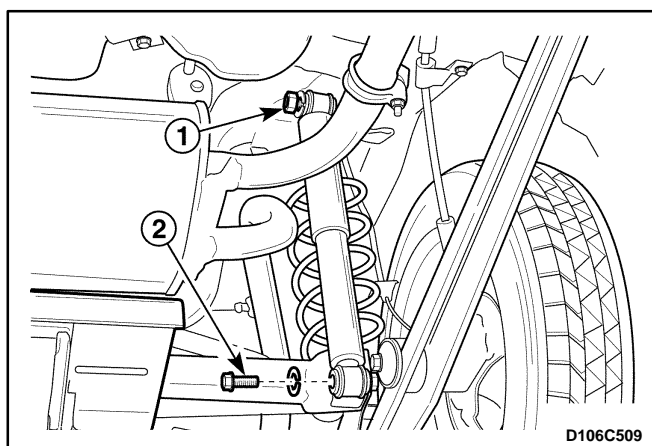
Tighten the lateral rod axle side nut to 35–55 N•m (25–41 lb-ft).



3. Install the lateral rod-to-body bracket bolt.

### Tighten

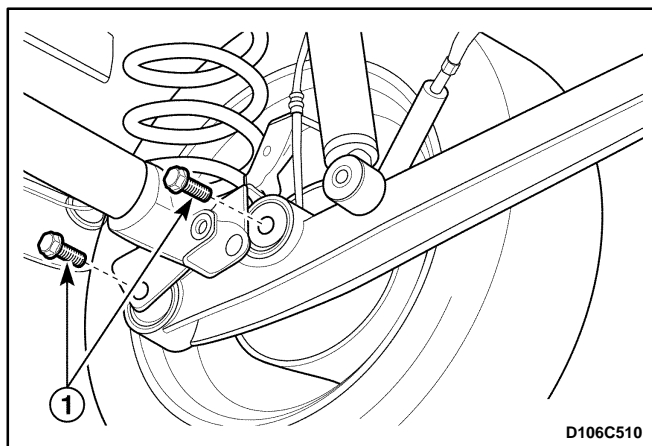
Tighten the lateral rod-to-body bracket bolt to 50–70 N•m (37–52 lb-ft).



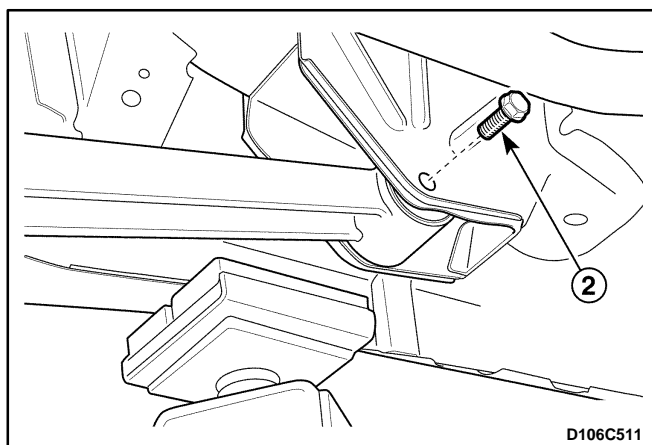
## TRAILING ARM

### Removal Procedure

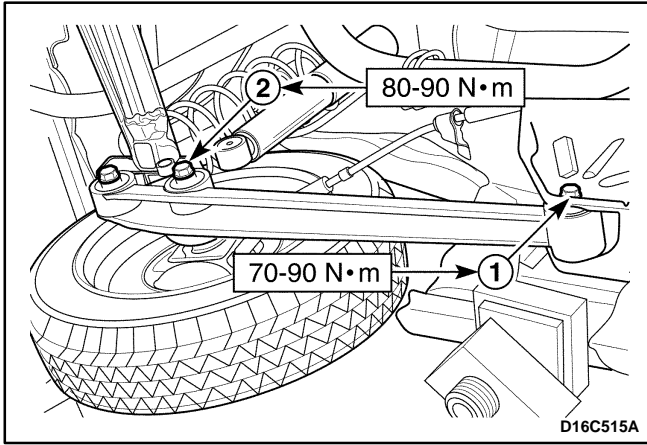
1. Raise and suitably support the vehicle.
2. Support the rear axle with adjustable jack stands.
3. Separate the rear shock absorber from the rear axle assembly.
  - Loosen the shock absorber-to-body bracket nut (1).
  - Remove the shock absorber-to-rear axle bolt (2).



4. Remove the trailing arm.
  - Remove the trailing arm-to-rear axle bolts (1).



- Remove the trailing arm-to-body bracket bolt (2).



## Installation Procedure

1. Install the trailing arm.

- Install the trailing arm-to-body bracket bolt (1).

### Tighten

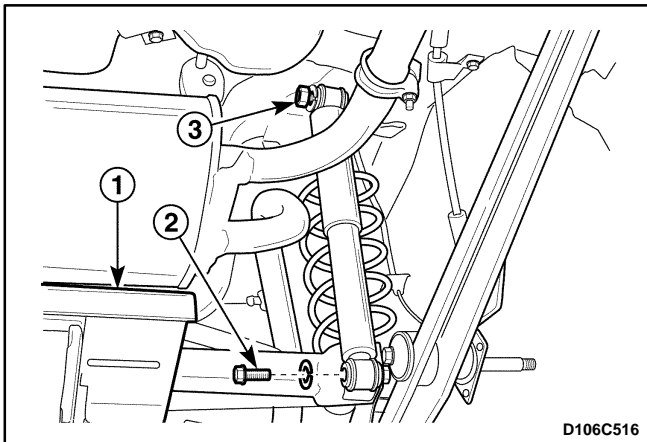
Tighten the trailing arm-to-body bracket bolt to 70–90 N·m (55–66 lb-ft).

- Install the trailing arm-to-rear axle bolts (2).

### Tighten

Tighten the trailing arm-to-rear axle bolts to 80–90 N·m (59–66 lb-ft).

2. Install the rear shock absorber. Refer to “Shock Absorber” in this section.



## REAR AXLE ASSEMBLY (INCLUDING COIL SPRING)

### Removal Procedure

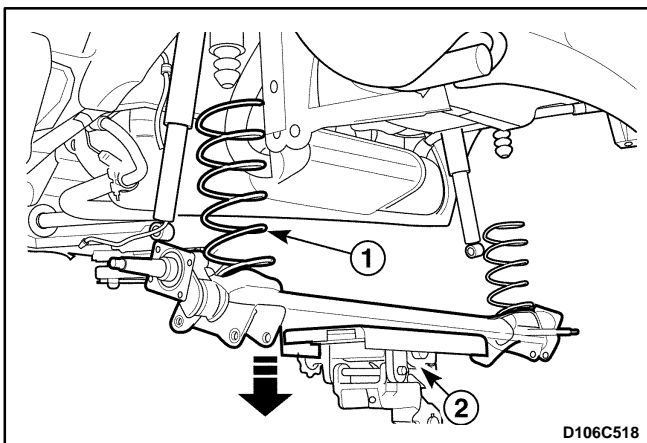
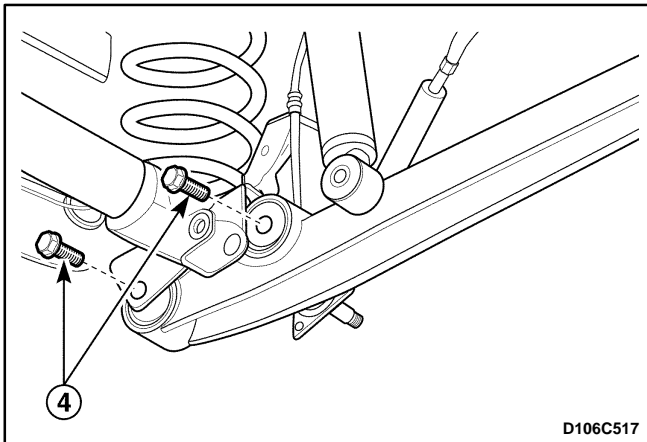
1. Remove the rear brake drum, shoe and brake plate. Refer to *Section 4E, Rear Drum Brakes*.

2. Remove the lateral rod. Refer to “Lateral Rod” in this section.

3. Disconnect the rear axle and the trailing arm.

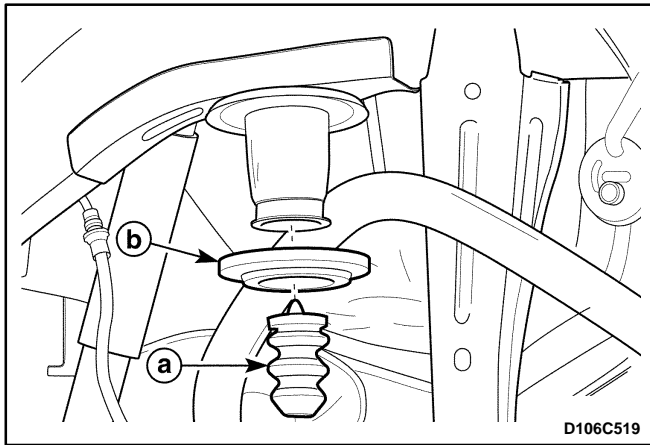
- Support the rear axle with adjustable jack stands (1).
- Remove the shock absorber-to-rear axle bolt (2).
- Loosen the shock absorber-to-body bracket nut (3).
- Remove the trailing arm-to-rear axle bolt (4).

**Caution:** When disconnecting the rear axle and the trailing arm, coil spring tension may cause the adjustable jack stand to slip from the rear axle. This may result in personal injury. Carry out the operation with co-worker.

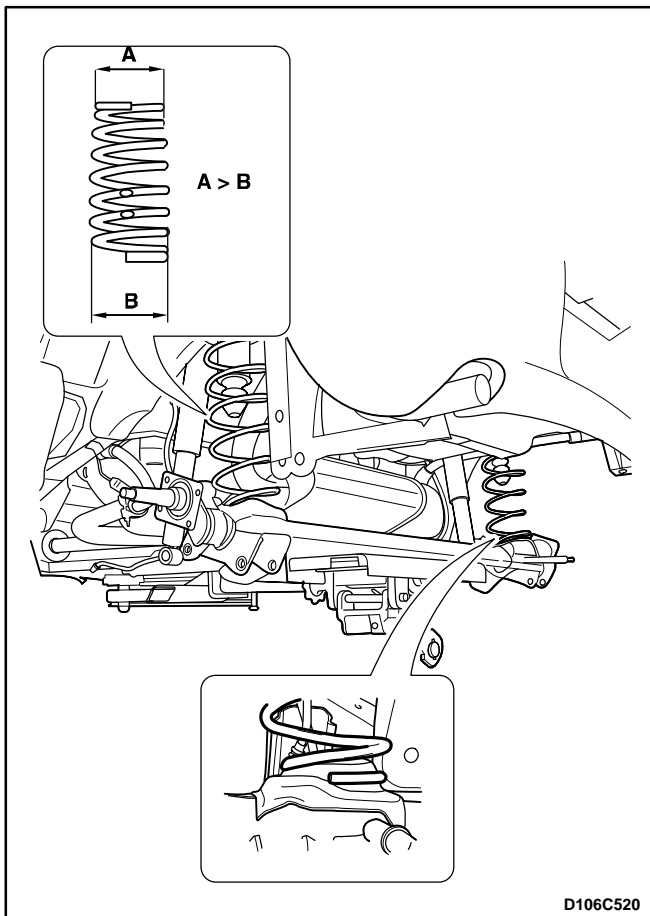


4. Remove the rear axle from the vehicle.

- Remove the coil spring by lowering the jack stand slowly (1).
- Lower the support jack and remove the rear axle (2).



5. Remove the rear bumper stopper and rear spring upper seat.
  - a. Rear bumper stopper.
  - b. Rear spring upper seat.

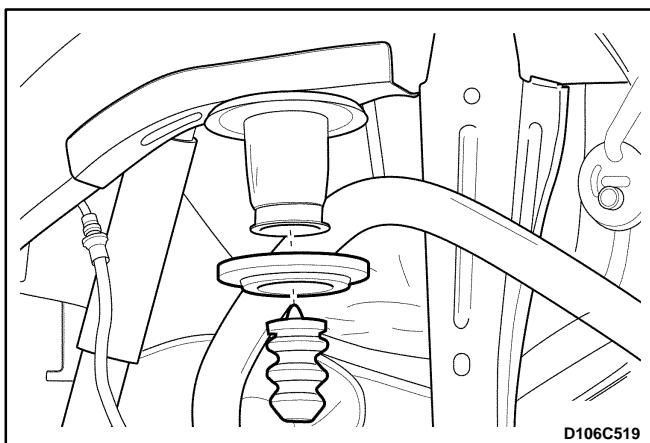


### Installation Procedure

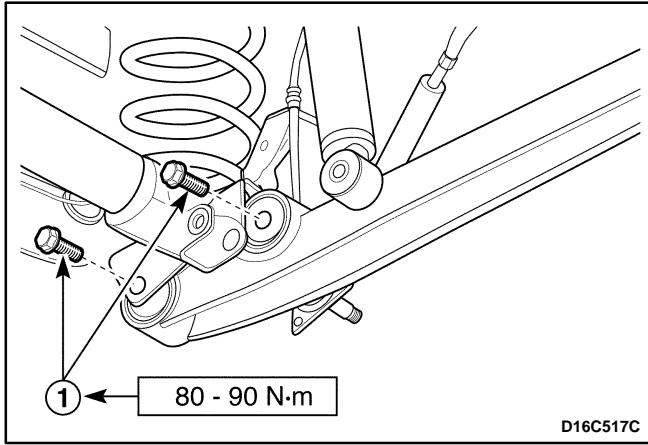
1. Install in the reverse order of removal.

**Important:** Make sure the spring diameter prior to installing the spring. Upper spring diameter is smaller than lower spring diameter.

**Caution:** Support the jack stand to the rear axle securely until installing the trailing arm bolts.



2. Install the rear bumper stopper and rear spring upper seat.

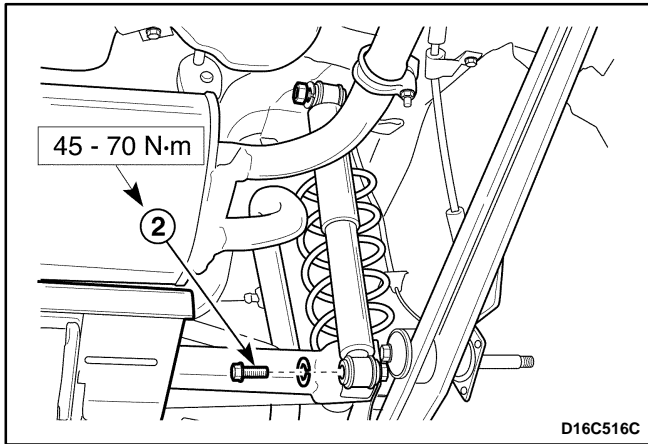


3. Install the trailing arm and the shock absorber to the rear axle.

- Install the trailing arm-to-rear axle bolt (1).

### Tighten

Tighten the trailing arm-to-rear axle bolt to 80–90 N·m (59–66 lb-ft).



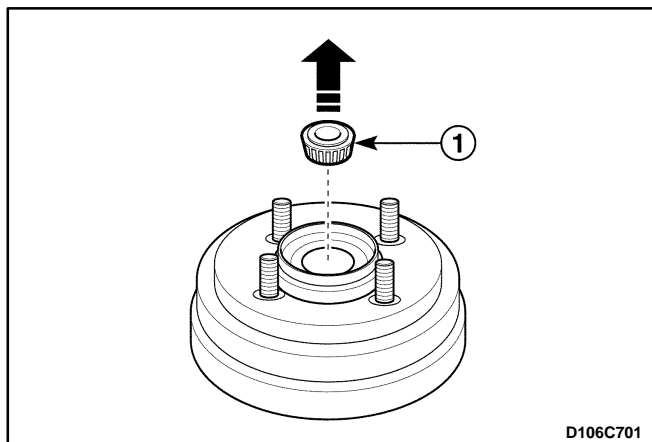
- Install the shock absorber-to-rear axle bolt (2).

### Tighten

Tighten the shock absorber-to-rear axle bolt to 45–70 N·m (33–52 lb-ft).

4. Install the lateral rod. Refer to “Lateral Rod” in this section.
5. Install the rear brake drum, shoe and brake plate. Refer to *Section 4E, Rear Drum Brake*.

## UNIT REPAIR



### HUB AND BEARING ASSEMBLY

#### Tools Required

DW 340–010 Front Wheel Hub Remover

DW 350–030 Rear Wheel Bearing Race Installer

#### Disassembly Procedure

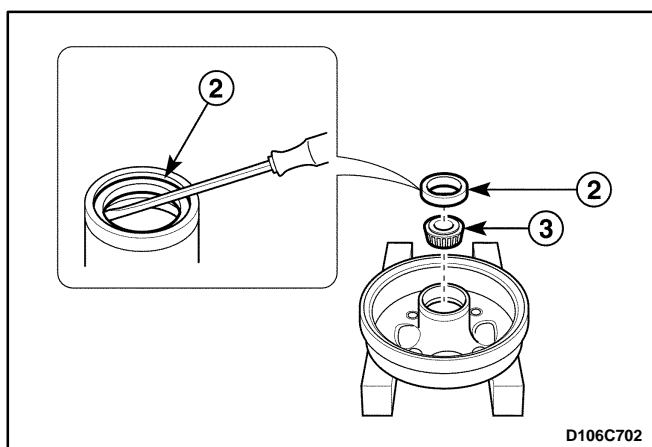
1. Remove the rear brake drum. Refer to *Section 4E, Rear Drum Brakes*.

2. Remove the rear wheel bearing.

- Remove the outer tapered roller bearing (1).

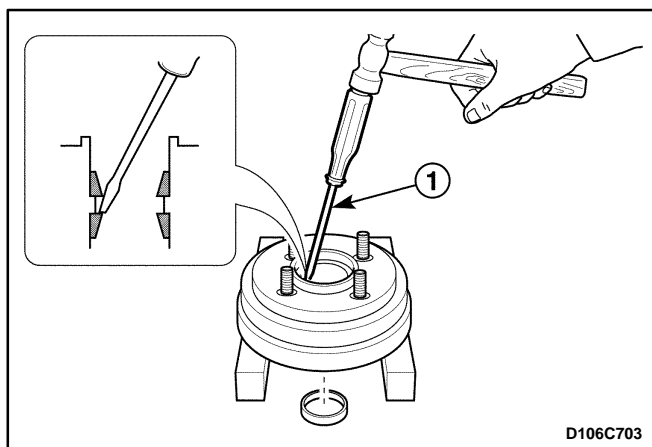
- Remove the oil seal (2).

- Remove the inner tapered roller bearing (3).

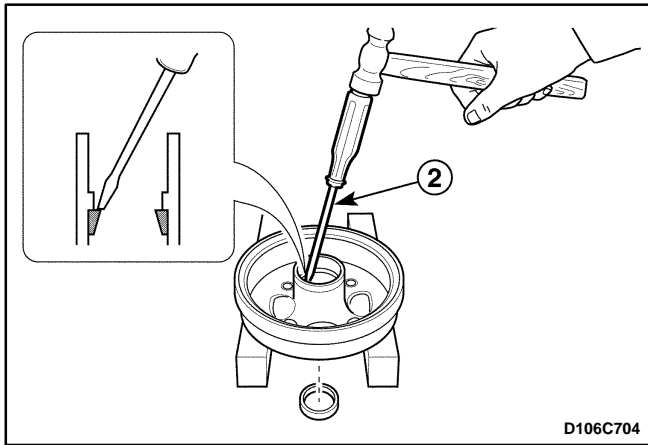


3. Remove the bearing races from the brake drum.

- Remove the inner bearing race (1).

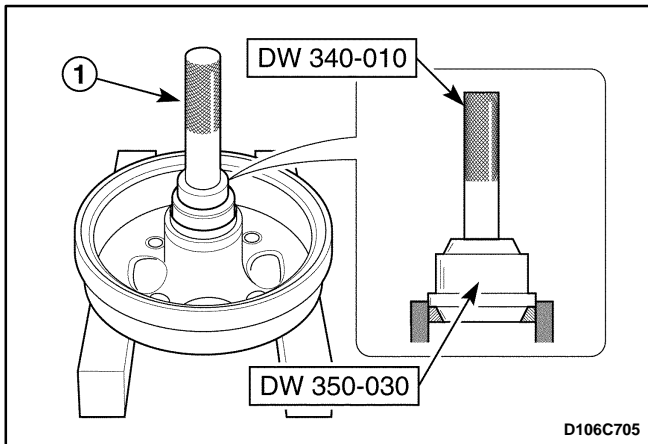






- Remove the outer bearing race (2).

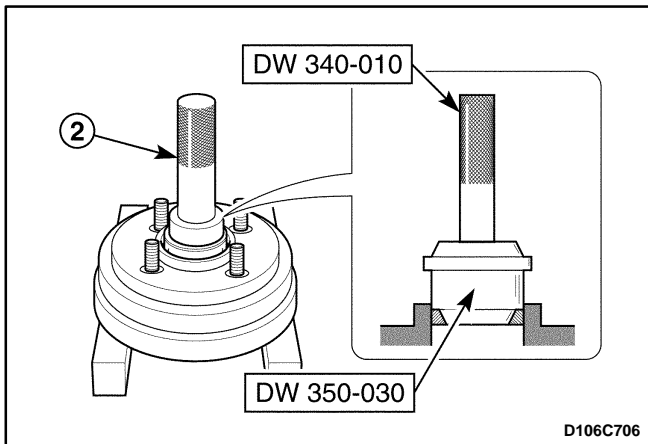
**Important:** Use only new bearing race.



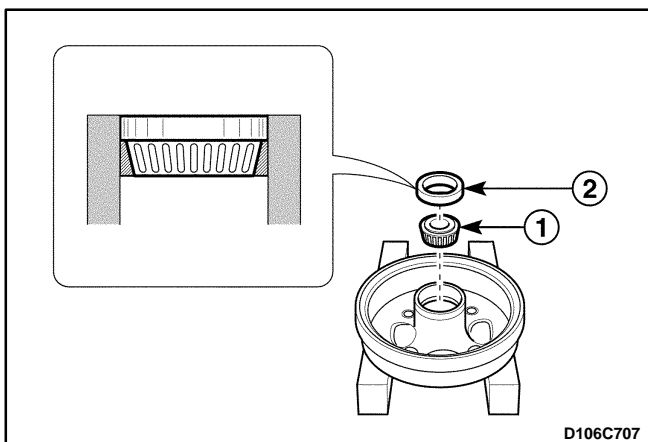
### Assembly Procedure

- Press the bearing race into the brake drum using the front wheel hub remover DW 340-010 and the rear wheel bearing race installer DW 350-030.

- Press the inner bearing race (1).



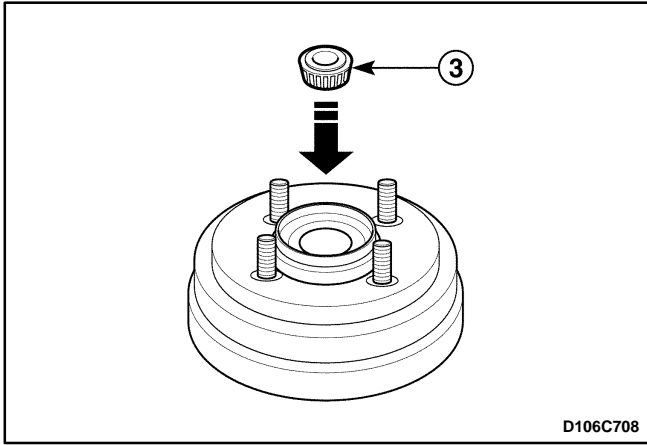
- Press the outer bearing race (2).



- Install the wheel bearing and oil seal into the brake drum.

**Important:** Coat or fill all the hollow spaces of both wheel bearing, the ring seal lip and the brake drum with antifriction grease.

- Install the inner bearing (1).
- Install the oil seal (2).



- Install the outer bearing (3).
3. Install the brake drum. Refer to *Section 4E, Rear Drum Brakes*.
  4. Adjust the end play and free load of the bearing. Refer to "Check and Adjustments" in this section.

# SPECIFICATIONS

## GENERAL SPECIFICATIONS

Application		Unit	Description
Suspension Type		–	Isolated Trailing Link
Shock Absorber	Maximum Length	mm (in.)	394.5 ± 3 (15.53 ± 0.12)
	Minimum Length	mm (in.)	257.5 ± 3 (10.14 ± 0.12)
	Stroke	mm (in.)	137 (5.39)
Rear Wheel Bearing	Clearance	mm (in.)	0
	No Load	N•m (lb-in.)	0.137 – 0.422 (0.9 – 3.7)
Coil Spring Height (No Load)		mm (in.)	291 (11.46)
Grease Type (Rear Wheel Bearing and Hub)		–	M-8143 ANTIF BRG GREASE


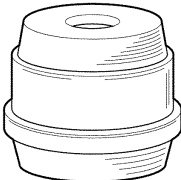
## FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Shock Absorber-to-Body Bracket Nut	45 – 70	33 – 52	–
Shock Absorber-to-Rear Axle Bolt	45 – 70	33 – 52	–
Trailing Arm-to-Rear Axle Bolt	80 – 90	59 – 66	–
Trailing Arm-to-Body Bracket Bolt	70 – 90	55 – 66	–
Lateral Rod-to-Body Bracket Bolt	50 – 70	37 – 52	–
Lateral Rod-to-Rear Axle Nut	35 – 55	25 – 41	–
Rear Axle Castellated Nut*	–	–	–
ABS Rear Speed Sensor Retaining Bolt	9 – 13	–	80 – 115

\* Rear Axle Castellated Nut : Refer to *Section 4E, Rear Drum Brakes*

## SPECIAL TOOLS AND EQUIPMENT

### SPECIAL TOOLS TABLE

 <p>D16B101A</p>	<p><b>DW 340-010</b> <b>Front Wheel Hub</b> <b>Remover</b></p>	 <p>D106C101</p>	<p><b>DW 350-030</b> <b>Rear Wheel Bearing</b> <b>Race Installer</b></p>
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## SECTION 2E

# TIRES AND WHEELS

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## DESCRIPTION AND OPERATION

### TIRE

#### Tread

A part (that contacts) road surfaces directly is fixed on the outside of carcass and breaker. It is a strong rubber coat made of high anti-abrasion rubber. Its running performance depends on its surface profile.

#### Breaker

A cord belt between tread and carcass prevents damages of inner code due to outer shock and vibration.

#### Carcass

This major part made by pilling code papers of strong synthetic fiber forms a structure of tire. Since it maintains tire pressure and endures applied load and shock to tire, it should have a high anti-fatigue characteristic.

#### Bead

A steel wire winding the ending part of carcass code, coated with rubber film and wrapped with nylon cord papers. It fixes tire to a rim.

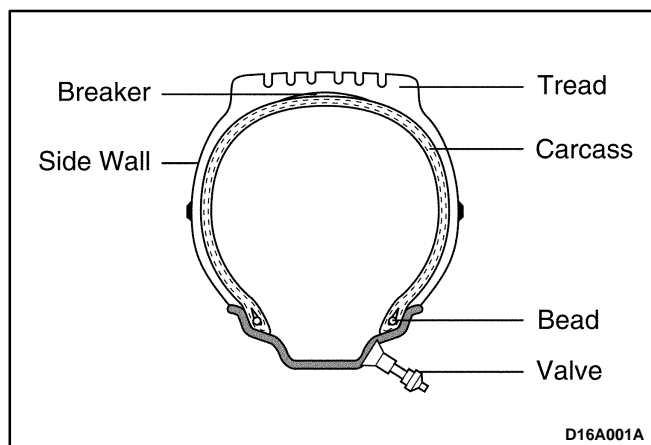
#### Tube

Tires used in mostly current vehicle are mostly tubeless tires.

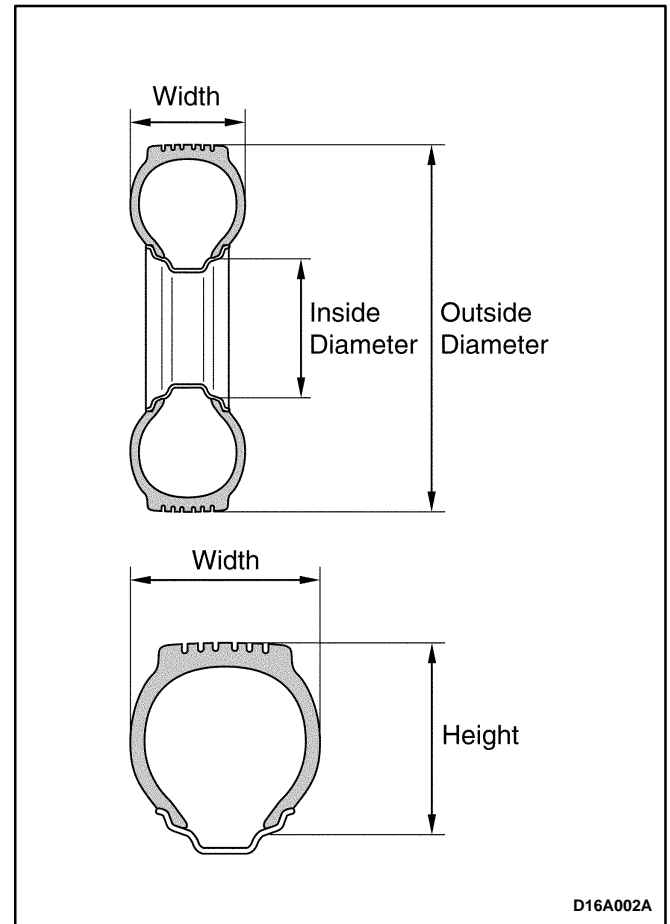
#### Side Wall

It is provided to improve the comfortable driving by protecting carcass and cushion movement.

#### Structure of Tubeless Tube



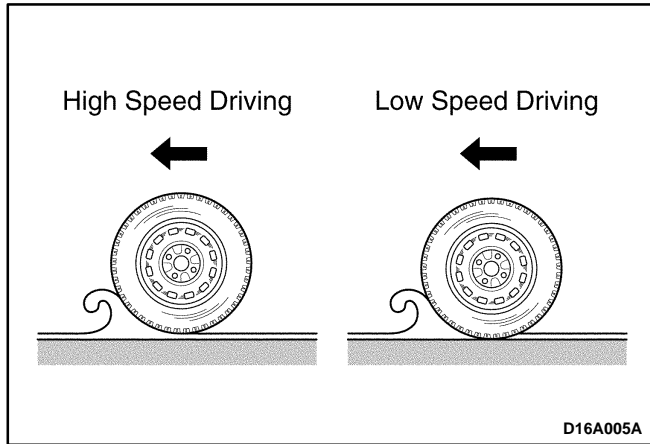
### Nomenclature



175/60R13 77H	175	Width (mm)
	60	Flatness ratio 60% (Height/Width) × 100
	R	Radial
	13	Rim diameter (= Tire I.D, Inch)
	77	Max. load index
	H	Max. speed symbol

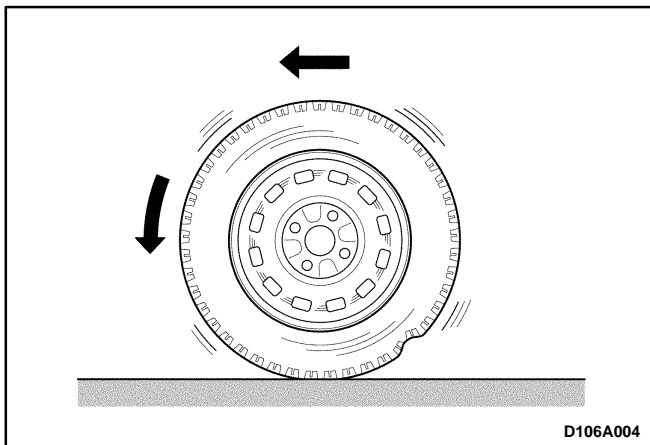
## Hydroplaning

The condition of driving a vehicle fast on the road surface covered with water can cause tires to fail to rotate with a good contact on the surface, so results in remaining them afloat. This is so-called hydroplaning. It causes brake failure, lower tractive force, and losing the steering performance so it is very vulnerable condition.



## Standing Wave

During running the rotating tire repeats deformation and restoring movement generated in tread. But when the wheel rotating speed reaches high, the next deformation applied to tire before restoring last deformation so the trembling wave appears in the tread portion. The lower the tire pressure the severe the trembling wave appears. And during the high speed.



## REPLACEMENT TIRES

A Tire Performance Criteria (TPC) specification number is molded in the sidewall near the tire size of all original equipment tires. This specification number assures that the tire meets performance standards for traction, endurance, dimensions, noise, handling and rolling resistance. Usually a specific TPC number is assigned to each tire size.

**Caution:** Do not mix different types of tires on the same vehicle such as radial, bias and bias-belted tires except in emergencies, because vehicle handling may be seriously affected and may result in loss of control.

**Caution:** Do not change 145/70 R13 tires or 155/65 R13 tires for 175/60 R13 tires, because vehicle handling may be seriously affected and may result in loss of control. If you change 145/70 R13 tires or 155/65 R13 tires for 175/60 R13 tires, you have to change the steering gear assembly.

Use only replacement tires with the same size, load range, and construction as the original. The use of any other tire size or construction type may seriously affect ride, handling, speedometer/odometer calibration, vehicle ground clearance, and tire clearance to the body and the chassis. This does not apply to the spare tire furnished with the vehicle.

It is recommended that new tires be installed in pairs on the same axle.

If it is necessary to replace only one tire, pair it with the tire having the most tread to equalize the braking action.

Although they may appear different in tread design, tires built by different manufacturers with identical TPC specifications may be used on the same vehicle.

## ALL SEASON TIRES

Most vehicles are now equipped with steel-belted all season radial tires as standard equipment. These tires qualify as snow tires, with a 37 percent higher average rating for snow traction than the non-all season radial tires previously used. Other performance areas, such as wet traction, rolling resistance, tread life, and air retention, have also been improved. This was done by improvements in both tread design and tread compounds. These tires are identified by an "M + S" molded in the tire sidewall following the size number. The suffix "MS" is also molded in the sidewall after the TPC specification number.

The optional handling tires used on some vehicles are not all season tires. These will not have the "MS" marking after the tire size or the TPC specification number.

## TIRE LABEL

The tire label is permanently located on the rear face of the driver's door and should be referred to for tire information. It lists the maximum vehicle load, the tire size (including the spare tire), and the cold inflation pressure (including the spare tire).

## SPARE TIRE

This vehicle comes equipped with a full-sized spare tire and wheel.

## WHEELS

Wheels must be replaced if they are bent, dented, have excessive lateral or radial runout, leak air through welds, have elongated bolt holes, or if the wheel bolts won't stay tight or are heavily rusted. Wheels with excessive runout may cause vehicle vibration. Replacement wheels must be equivalent to the original equipment wheels in load capacity, diameter, rim width, offset, and mounting configuration. A wheel of improper size or type may affect wheel and bearing life, brake cooling, speedometer/odometer calibration, vehicle ground clearance, and tire clearance to the body and the chassis.

## INFLATION OF TIRES

The pressure recommended for any vehicle line is carefully calculated to give a satisfactory ride, handling, tread life, and load-carrying capacity.

Tire pressure should be checked monthly or before any extended trip. Check the tires when they are cold, after the vehicle has sat for 3 hours or more or has been driven less than 1 mile. Set the tire pressure to the specifications on the tire label located on the rear face of the driver's door. Tire inflation pressure is also given under "Tire Size and Pressure Specifications" in this section.

Valve caps or extensions should be on the valves to keep dust and water out.

Higher than recommended tire pressure can cause:

- Hard ride
- Tire bruising or damage
- Rapid tread wear at the center of the tire

Lower than recommended pressure can cause:

- Tire squeal on turns
- Hard steering
- Rapid and uneven wear on the edges of the tread
- Tire rim bruises and rupture
- Tire cord breakage
- High tire temperatures

Unequal tire pressures on same axle can cause:

- Uneven braking
- Steering lead

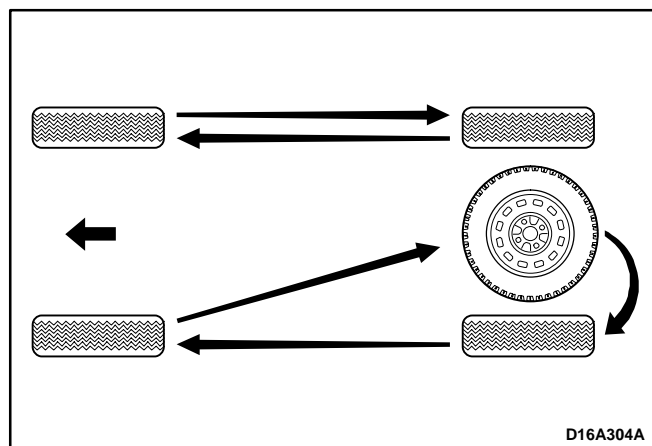
- Reduced handling
- Swerve on acceleration
- Torque steer

## ROTATION TIRES

Front and rear tires perform different jobs and can wear differently depending on the tires of road driven, driving habit, etc.

The front tires will wear faster than the rear ones.

To avoid uneven wear of tires and to prolong tire life, inspect and rotate the tires every 5,000 km (3,100 miles). After rotating the tires, adjust the tire inflation pressures and be sure to check wheel nuts tightness.



## WHEEL BALANCE

Balance is the easiest procedure to perform and should be done first if the vibration occurs at high speeds, or if the tires or the wheels are replaced.

When proceeding the wheel balancing procedure regard the belows.

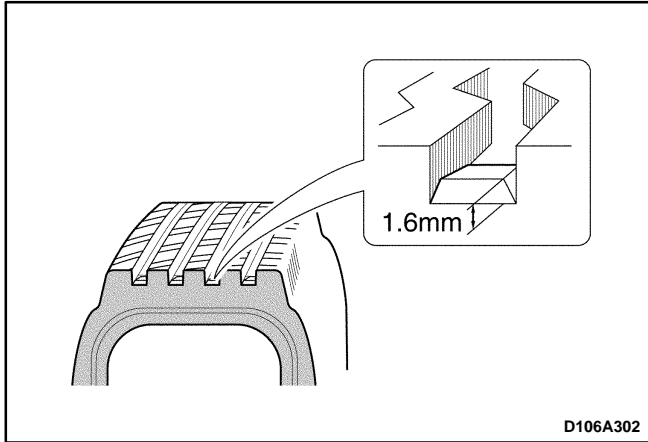
1. Do not use the wheel weight over two at the inboard and the outboard flanges.
2. The total weight of the wheel weights should not exceed the 100 grams (3.5 ounces).
3. Blanching the assemblies with factory aluminum wheels requires the use of special nylon-coated, clip-on wheel weights.



## DIAGNOSTIC INFORMATION AND PROCEDURES

### TIRE WEAR

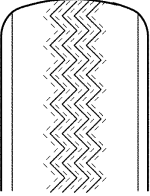
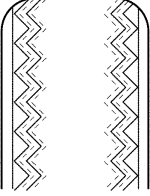
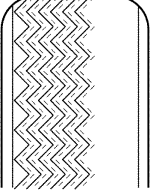
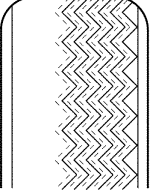
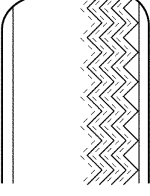
1. Measure the depth of the tire tread.
2. If the depth of the tread is below the specified value, replace the tire.



<b>Limit of The Tread Wear</b>	1.6mm (0.06 in.)
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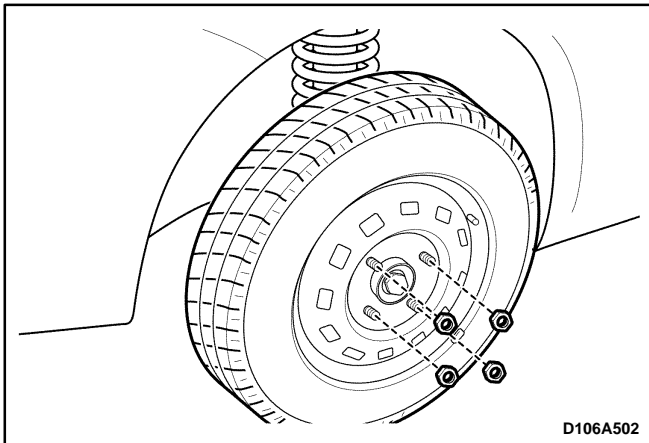
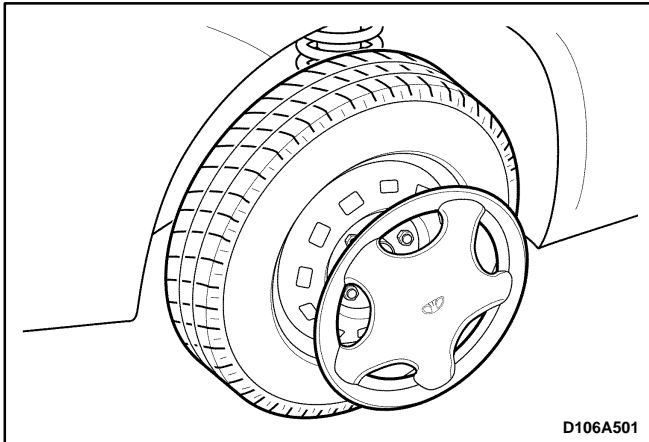
3. Indicators appear when the tire tread depth becomes shallow (less than 1.6mm (0.06 in.)).

## IRREGULAR OR EXCESSIVE TIRES WEAR

Condition	Probable Cause	Correction
 <p style="text-align: center;">D16A305A</p>	<ul style="list-style-type: none"> <li>• Low tire inflation pressures.</li> <li>• Improper the tire rotation.</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust tire inflation pressures.</li> <li>• Rotate the tires.</li> </ul>
 <p style="text-align: center;">D16A305B</p>	<ul style="list-style-type: none"> <li>• Excessive tire inflation pressures.</li> <li>• Improper the tire rotation.</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust tire inflation pressures.</li> <li>• Rotate the tires.</li> </ul>
 <p style="text-align: center;">D16A305C</p>	<ul style="list-style-type: none"> <li>• Poor toe-in.</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust the toe-in.</li> </ul>
 <p style="text-align: center;">D16A305D</p>	<ul style="list-style-type: none"> <li>• toe-out.</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust the toe-in.</li> </ul>
 <p style="text-align: center;">D16A305E</p>	<ul style="list-style-type: none"> <li>• Poor camber or caster.</li> <li>• Faulty suspensions.</li> <li>• Poor wheel balancing.</li> <li>• Improper the tire rotation.</li> </ul>	<ul style="list-style-type: none"> <li>• Check the steering knuckle, control arm, drive axle, and suspensions. Repair or replace them, as needed.</li> <li>• Adjust the wheel balancing.</li> <li>• Rotate the tires.</li> </ul>

# REPAIR INSTRUCTIONS

## ON-VEHICLE SERVICE



### WHEEL

#### Removal Procedure

1. Remove the wheel cover on the vehicle equipped with steel wheel.
2. Loosen the wheel nuts.
3. Raise and suitably support the vehicle.
4. Remove the wheel nuts.

**Notice:** Never use heat to loosen a tight wheel. It can shorten the life of the wheel, the wheel nuts and the wheel bearings. Excessive force, such as hammering the wheel or tire, can also cause damage and is not recommended. Slight tapping of the wheel sidewall with one's hand or with a rubber mallet is acceptable.

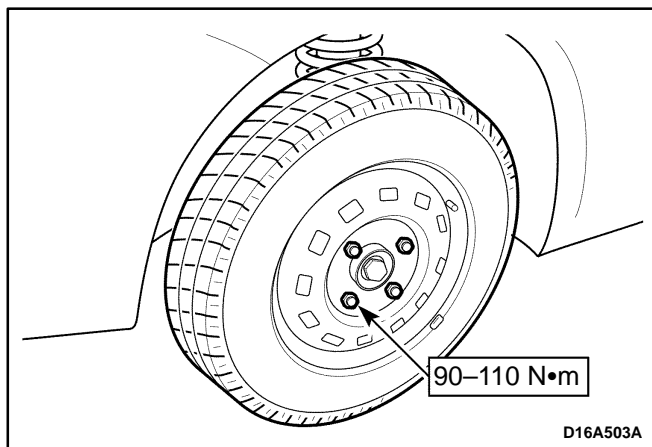
5. Remove the wheel.

Difficulty in removing the wheels from the vehicle can be due to foreign material or to a tight fit between the wheel centerhole and the hub or the rotor. These wheels can be removed by

1. Retightening the wheel nuts on the affected wheel and then loosening the wheel nuts by two turns.
2. Lowering the vehicle and rocking it from side to side as hard as possible, using one or more person's body weight to loosen the wheel.
3. Raising the vehicle and removing the wheel.

**Caution:** *Do not allow the penetrating oil to get on the vertical surfaces between the wheel and the drum (or rotor) because penetrating oil in this area could cause the wheel to work loose as the vehicle is driven, resulting in loss of control and an injury accident.*

Penetrating oil is not effective in removing tight wheels. If it is used, however, apply it sparingly and only to the wheel's centerhole area.



## Installation Procedure

**Notice:** Before installing the wheels, remove any build-up of corrosion on the wheel mounting surface and the brake drum or the rotor mounting surface by scraping and brushing them with a wire brush. Installing the wheels without good metal-to-metal contact at the mounting surfaces can cause the wheel nuts to loosen, which can later allow a wheel to come off while the vehicle is moving. Wheel nuts must be tightened in sequence and to the proper torque to avoid bending the wheel, the brake drum or the rotor.

1. Mount the wheel.
2. Install the wheel nuts in the diagonally. Do not tighten the wheel nuts.
3. Lower the vehicle.

### Tighten

Tighten the wheel nuts to 90–110 N•m (66–81 lb-ft).

## ON-VEHICLE BALANCING

On-vehicle balancing will help correct vibrations due to brake drum, rotor, and wheel cover imbalances.

**Notice:** Do not allow the front suspension to hang free. When the drive axle is run at an extreme angle, extra vibrations can occur, as well as damage to seals and joints.

1. During on-vehicle balancing, do not remove the balance weights from the off-vehicle dynamic balance.
2. If more than 1 ounce of additional weight is required, split the weight between the inner and the outer rim flanges.
3. Spin the driven tire and wheel assemblies using the engine.

## OFF-VEHICLE BALANCING

Perform wheel balancing with an electronic off-vehicle balancer. The balancer is easy to use and gives both a static and a dynamic balance. Unlike on-vehicle balancing, the off-vehicle balancer does not correct for drum or rotor imbalance. This drawback is overcome by its accuracy. Secure the wheel on the balancer with a cone through the back side of the centerhole, not through the wheel nut holes.

## CORRECTING NON-UNIFORM TIRES

There are two ways to correct properly balanced tires which still vibrate. One method uses an automatic machine which loads the tire and buffs small amounts of rubber from high spots on the outer two tread rows. Correction by this method is usually permanent and, if it is done properly, does not significantly affect the appearance or the tread life of the tire. Tire truing with a blade-type machine is not recommended because it substantially reduces the tread life and often does not correct the problem permanently.

Another method is to dismount the tire and rotate it 180 degrees on the rim. Do this only on the tire and wheel assemblies which are known to be causing a vibration because this method is just as likely to cause good assemblies to vibrate.

## **TIRE AND WHEEL MATCH-MOUNTING**

The tires and wheels are match-mounted at the assembly plant. Match-mounting aligns the radially stiffest part of the tire, or high spot, to the smallest radius, or low spot, of the wheel.

The high spot of the tire is originally marked by a red paint mark or an adhesive label on the outboard sidewall.

The low spot of the wheel will be at the location of the valve stem.

Before dismounting a tire from its wheel, scribe a line on the tire at the valve stem to assure that it is remounted in the same position.

Replacement tires that are of original equipment quality will have their high and low spot marked in the same manner.

## SPECIFICATIONS

### TIRE SIZE AND PRESSURE SPECIFICATIONS

#### Inflation Pressure

Engine	Tires	Wheel	Front		Rear	
			kPa	psi	kPa	psi
0.8 SOHC	145/70 R13	4.5Jx13 (Steel)	207 (207)*	30 (30)*	207 (234)*	30 (34)*
	155/65 R13	4.5Jx13 (Alloy)	207 (207)*	30 (30)*	207 (234)*	30 (34)*

**Important:** ( )\* : 4 – 5 occupants

### INFLATION PRESSURE CONVERSION SPECIFICATIONS

kPa	psi	kPa	psi	kPa	psi
140	20	186	27	234	34
145	21	193	28	241	35
152	22	200	29	248	36
159	23	207	30	276	40
166	24	214	31	310	45
172	25	221	32	345	50
179	26	228	33	379	55

### FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Wheel Nuts (Aluminum Wheel)	90 – 110	66 – 81	–
Wheel Nuts (Steel Wheel)	90 – 110	66 – 81	–