SECTION 2A

SUSPENSION DIAGNOSIS

TABLE OF CONTENTS

DIAGNOSIS

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.

Preliminary Checks

Checks	Action
Inspect the tires for improper pressure and uneven wear.	Inflate the tires to the proper pressure.
Inspect the joint from the steering column to the steering gear for loose connections or wear.	Tighten the coupling flange pinch bolts. Replace the coupling flange as needed.
Inspect the front and the rear suspension, the steering gear, and the linkage for loose or damaged parts.	Tighten the front and the rear suspension. Tighten the steering gear mounting bracket bolts. Tighten the coupling flange pinch bolts. Replace the front and the rear suspension as needed. Replace the steering gear as needed. Replace the coupling flange as needed.
Inspect for out-of-round tires.	Perform free runout test. Match-mount the tires.
Inspect for out-of-balance tires, bent wheels, and worn or loose wheel bearings.	Balance the wheels. Replace the wheels. Replace the wheel bearings.
Check the power steering pump drive belt tension.	Tighten the power steering pump drive belt.
Inspect the power steering system for leaks. Also check the power steering fluid level.	Repair any leaks. Perform a power steering gear test. Add power steering fluid.

Car Lead/Pull

Checks	Action
Inspect for mismatched or uneven tires.	Replace the tires.
Inspect for a broken or a sagging spring.	Replace the spring.
Inspect for a radial tire lateral force.	Check the wheel alignment. Switch the tire and wheel assemblies. Replace the tires as needed.
Check the front-wheel alignment.	Align the front wheels.
Inspect for an off-center steering gear.	Reseat the pinion valve assembly. Replace the pinion valve assembly as needed.
Inspect for front-brake dragging.	Adjust the front brakes.

Abnormal or Excessive Tire Wear

Checks	Action
Check the front-wheel and rear-wheel alignment.	Align the front and the rear wheels.
Inspect for excessive toe.	Adjust the toe.
Inspect for a broken or a sagging spring.	Replace the spring.
Inspect for out-of-balance tires.	Balance the tires.
Inspect for worn strut dampeners.	Replace the strut dampeners.
Check for a failure to rotate tires.	Rotate the tires. Replace the tires as needed.
Check for an overloaded vehicle.	Maintain the proper load weight.
Inspect for low tire inflation.	Inflate the tires to the proper pressure.

Scuffed Tires

Checks	Action
Inspect for incorrect toe.	Adjust the toe.
Inspect for a twisted or a bent suspension arm.	Replace the suspension arm.

Wheel Tramp

Checks	Action
Inspect for an out-of-balance tire or wheel.	Balance the tire or the wheel.
Inspect for improper strut dampener action.	Replace the strut dampeners.

Shimmy, Shake, or Vibration

Checks	Action
Inspect for an out-of-balance tire or wheel.	Balance the tire or the wheel.
Inspect for excessive wheel hub runout.	Measure the hub flange runout. Replace the hub as needed.
Inspect for excessive brake drum or brake rotor imbalance.	Adjust the brakes. Replace the brake rotor or the brake drum as needed.
Inspect for worn tie rod ends.	Replace the outer tie rods.
Inspect for wheel trim imbalance.	Balance the wheel.
Inspect for a worn lower ball joint.	Replace the lower ball joint.
Inspect for excessive wheel runout.	Measure the wheel runout. Replace the wheel as needed.
Inspect for excessive loaded radial runout on the tire and wheel assembly.	Match-mount the tire and wheel assembly.

Hard Steering (Manual)

Checks	Action
Inspect for a lack of lubrication of the ball joints, the tie rods and the steering gear.	Lubricate the ball joints, the tie rods, and the steering gear. Replace the ball joints, the tie rods, and the steering gear as needed.
Check the front-wheel alignment.	Align the front wheels.
Check the steering gear adjusment.	Adjust the steering gear.

Hard Steering (Power)

Checks	Action
Check the steering gear preload adjustment.	Perform a rack bearing preload on-vehicle adjustment.
Check the hydraulic system. Test the power steering system pressure with a gauge.	Replace the seals and the hoses as needed.
Inspect for binding or catching in the steering gear.	Lubricate the steering gear. Repair or replace the steering gear as needed.
Inspect for a loose steering gear mounting.	Tighten the steering gear mounting bracket nuts.

Too Much Play in Steering

Checks	Action
Inspect for worn or loose wheel bearings.	Tighten the drive axle nut. Replace the wheel bearings as needed.
Inspect for a loose steering gear mounting.	Tighten the steering gear mounting bracket nuts.
Inspect the joint from the column to the steering gear for loose connections or wear.	Tighten the coupling flange pinch bolts. Replace the coupling flange as needed.
Check the steering gear preload adjustment.	Perform a rack bearing preload on-vehicle adjustment.

Poor Returnability (Manual)

Checks	Action
Inspect for a lack of lubrication of the ball joints, the tie rods and the steering gear.	Lubricate the ball joints, the tie rods, and the steering gear. Replace the ball joints, the tie rods, and the steering gear as needed.
Inspect for binding in the ball joints.	Replace the ball joints.
Inspect for binding in the steering column.	Lubricate the steering column. Replace the steering column as needed.
Inspect for a lack of lubrication in the steering gear.	Lubricate the steering gear. Repair or replace the steering gear as needed.
Check the front-wheel alignment.	Align the front wheels.
Check the steering gear preload adjustment.	Perform a rack bearing preload on-vehicle adjustment.

Poor Returnability (Power)

Checks	Action
Inspect for lack of lubrication of the ball joints and the tie rod ends.	Lubricate the ball joints and the tie rod ends. Replace the ball joints and the outer tie rods as needed.
Inspect for binding in the ball joints.	Replace the ball joint.
Inspect for binding in the steering column.	Lubricate the steering column. Replace the steering column as needed.
Check the front-wheel alignment.	Align the front wheels.
Check the steering gear preload adjustment.	Perform a rack bearing preload on-vehicle adjustment.
Inspect for a sticking valve.	Lubricate the pinion valve assembly. Replace the pinion valve assembly as needed.
Inspect for binding in the coupling flange on the steering gear.	Replace the coupling flange.

Abnormal Noise, Front Suspension

Checks	Action
Inspect for a lack of lubrication of the ball joints and the tie rod ends.	Lubricate the ball joints and the tie rod ends. Replace the ball joints and the outer tie rods as needed.
Inspect for damaged suspension components.	Replace the damaged suspension components.
Inspect for worn control arm bushings or tie rod ends.	Replace the control arm bushings or the tie rods.
Inspect for a loose stabilizer shaft link.	Tighten the stabilizer shaft link.
Inspect for loose wheel bolts.	Tighten the wheel bolts.
Inspect for loose suspension bolts or nuts.	Tighten the suspension bolts or the nuts.
Inspect for loose wheel covers.	Tighten the wheel covers.
Inspect for worn strut dampeners or strut mountings.	Replace the strut dampeners. Tighten the strut mounting bolts.
Inspect for an improperly positioned strut spring.	Adjust the strut spring to the proper position.

Wander or Poor Steering Ability

Checks	Action
Inspect for mismatched or uneven tires.	Replace the tires.
Inspect for lack of lubrication of the ball joints and the tie rod ends.	Lubricate the ball joints and the tie rod ends. Replace the ball joints and the outer tie rods as needed.
Inspect for worn strut dampeners.	Replace the strut dampeners.
Inspect for a loose stabilizer shaft link.	Tighten the stabilizer shaft link.
Inspect for a broken or a sagging spring.	Replace the spring.
Check the steering gear preload adjustment.	Perform a rack bearing preload on-vehicle adjustment.
Check the front-wheel and the rear-wheel alignment.	Align the front and the rear end wheels.

Erratic Steering when Braking

Checks	Action
Inspect for worn or loose wheel bearings.	Replace the wheel bearings.
Inspect for a broken or a sagging spring.	Replace the spring.
Inspect for a leaking wheel cylinder or caliper.	Replace the wheel cylinder or the caliper.
Inspect for warped rotors.	Replace the rotors.
Inspect for 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

Checks	Action
Inspect for a broken or a sagging spring.	Replace the spring.
Check for an overloaded vehicle.	Maintain the proper load weight.
Inspect for an incorrect or weak spring.	Replace the spring.

Ride Too Soft

Checks	Action
Inspect for worn strut dampeners.	Replace the strut dampeners.
Inspect for a broken or a sagging spring.	Replace the spring.

Ride Too Harsh

Checks	Action
Inspect for incorrect strut dampeners.	Replace the strut dampeners.
Inspect for an incorrect spring.	Replace the spring.

Body Leans or Sways in Corners

Checks	Action
Inspect for a loose stabilizer shaft link.	Tighten the stabilizer shaft link.
Inspect for worn strut dampeners or strut mountings.	Replace the strut dampeners. Tighten the strut assembly mounting bolts.
Check for an overloaded vehicle.	Maintain the proper load weight.
Inspect for a broken or a sagging spring.	Replace the spring.

Suspension Bottoms

Checks	Action
Inspect for worn strut dampeners.	Replace the strut dampeners.
Check for an overloaded vehicle.	Maintain the proper load weight.
Inspect for a broken or a sagging spring.	Replace the spring.

Steering Wheel Kickback (Power)

Checks	Action
Inspect for air in the power steering system.	Purge the power steering system of air.
Inspect for a loose steering gear mounting.	Tighten the steering gear mounting bracket nuts.
Inspect the joint from the column to the steering gear for loose connections or wear.	Tighten the coupling flange pinch bolts. Replace the coupling flange as needed.
Inspect for loose tie rod ends.	Tighten the tie rod ends. Replace the outer tie rods as needed.
Inspect for loose or worn wheel bearings.	Tighten the drive axle nut. Replace the wheel bearings as needed.

Steering Wheel Surges or Jerks (Power)

Checks	Action
Check the hydraulic system. Test the power steering system pressure with a gauge.	Replace the seals and the hoses as needed.
Inspect for a sluggish steering gear valve.	Clean the pinion valve assembly. Replace the pinion valve assembly as needed.
Inspect for a loose power steering pump drive belt.	Adjust the power steering pump drive belt.

Cupped Tires

Checks	Action
Check the front-wheel and the rear-wheel alignment.	Align the front and the rear wheels.
Inspect for worn strut dampeners.	Replace the strut dampeners.
Inspect for worn or loose wheel bearings.	Tighten the drive axle nut. Replace the wheel bearings as needed.
Inspect for excessive tire or wheel runout.	Match-mount the tires. Replace the tires as needed. Replace the wheels as needed.
Inspect for a worn ball joint.	Replace the ball joint.
Check the steering gear preload adjustment.	Perform a rack bearing preload on-vehicle adjustment.

TORQUE STEER

A degree of torque steer to the right may normally be experienced during the use of heavy throttle on some front-wheel drive cars with drive axles of unequal length. This torque steer to the right results from the right drive axle being longer than the left drive axle, which creates a difference in the drive axle angle. Cars with intermediate shaft assemblies have axles of almost equal length.

A difference in the drive axle lengths results in more torque toe-in in the left front wheel. You will notice the torque toe-in when the vehicle accelerates from a standing start or at lower speeds.

Inspection Procedure

1. Place a small piece of tape at the top center of the steering wheel.
2. Note the inches of steering wheel deflection required to keep the vehicle straight during heavy acceleration.
3. Compare this finding with similar cars.

Factors that may cause torque steer to be more apparent on a particular vehicle include:

- Variations in the tire and wheel assemblies. This has the most significant effect on torque steer. A slightly smaller diameter on the right front tire will increase a right torque lead.
- Large differences in the right and the left front tire pressure.
- Looseness in the control arm bushings, the tie rod assemblies, or the steering gear mounting. This looseness permits a front wheel to pull forward and toe-in under a torque greater than the wheel on the opposite side. A loose suspension component may result in an opposite lead upon deceleration.
- A high front trim height. This height would increase the drive axle angle and could cause wobble at speeds between 24 to 48 km/h (15 to 30 mph).
- Binding or a tight drive axle joint. A tight drive axle joint or a high front trim height may also cause a wobble at speeds between 24 to 48 km/h (15 to 30 mph).
- Incorrect, worn, or loose engine mounts causing adverse drive angles.

Refer to “General Diagnosis” in this section for actions to remedy these problems.

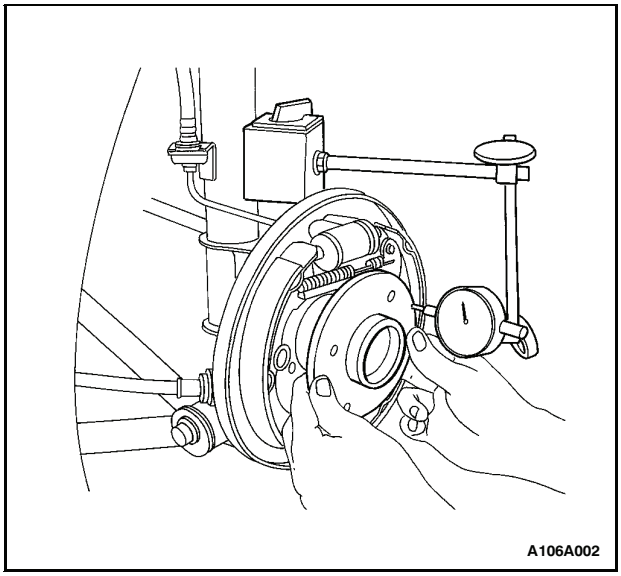
Conditions that may produce an effect similar to torque steer include:

- Incorrect front or rear alignment.
- Frame misalignment or defect.
- Front suspension damage.
- Incorrectly mounted rear crossmember.

TAPERED ROLLER BEARING

Perform the following test to check for looseness in the bearing cartridge assembly:

1. Raise and suitably support the vehicle.
2. Remove the rear wheel. Refer to Section 2E, Tires and Wheels.
3. Remove the brake drum detent screw and the brake drum. Refer to Section 4E, Rear Drum Brakes.
4. Mount a dial indicator set with a magnetic base to a control arm or any other stationary part of the vehicle.
5. Push and pull the wheel hub by hand. If the wheel hub movement exceeds 0.05 mm (0.002 inch), replace the wheel bearing. Refer to Section 2D, Rear Suspension.
6. Install the rear brake drum. Refer to Section 4E, Rear Drum Brakes.
7. Install the rear wheel. Refer to Section 2E, Tires and Wheels.
8. Lower the vehicle.



A106A002

SEALED WHEEL BEARING DIAGNOSIS

Vehicles with antilock braking systems have sealed, non-serviceable cartridge 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. Sealed 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 commerical wheel spinner.
4. If a noise can be heard from the passenger compartment, replace the noisy wheel bearing cartridge. Refer to Section 4D, Rear Suspension.
5. Lower the vehicle.

SECTION 2B

WHEEL ALIGNMENT

TABLE OF CONTENTS

SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS

Application	Front	Rear
Camber	* 1°10′ to 20′	8 2°10′ to * 1° 10′
Caster - Manual Str'g	30′ to 2° 30′	-
Caster - Power Str'g	1° 45′ to 3° 45′	-
Toe-in (2-person load)	* 10′ to 10′	8 10′ to 40′

DIFFERENCE BETWEEN LEFT AND RIGHT

Application	Front	Rear
Camber	1° max	30′ max.
Caster	1° max	-
Toe-in	-	15′ max.

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Inner and Outer Tie Rod Pinch Bolts	20	15	-

DIAGNOSIS

TIRE DIAGNOSIS

Irregular and Premature Wear

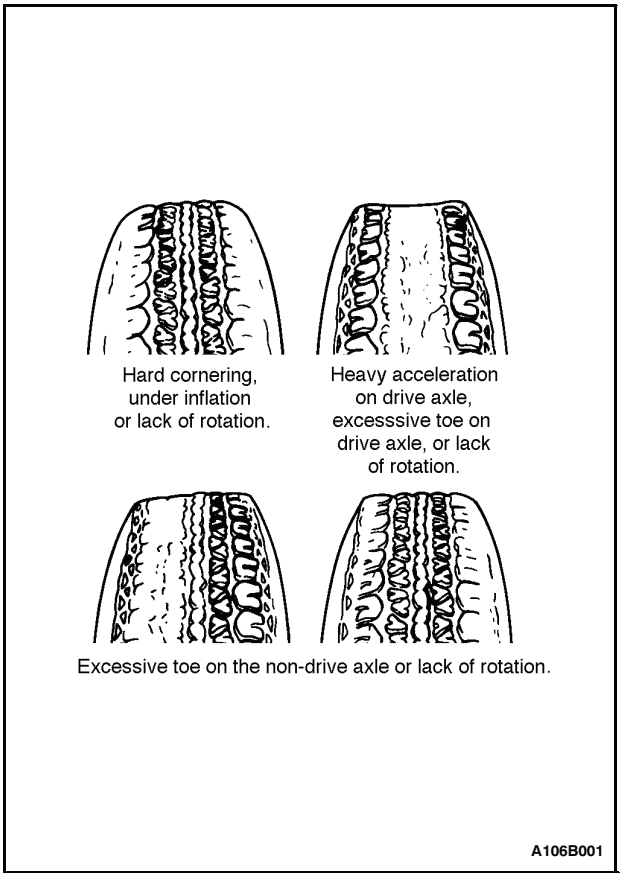
Irregular and premature tire wear has many causes. Some of them are incorrect inflation pressures, lack of regular rotation, poor driving habits, or improper wheel alignment. If the wheel alignment is reset because of tire wear, always reset the toe as close to zero degrees as the specification allows. Refer to "Rear Toe Check" in this section.

Rotate the tires if:

- **The front tire wear is different from the rear.**
- **The left and right front tire wear is unequal.**
- **The left and right rear tire wear is unequal.**

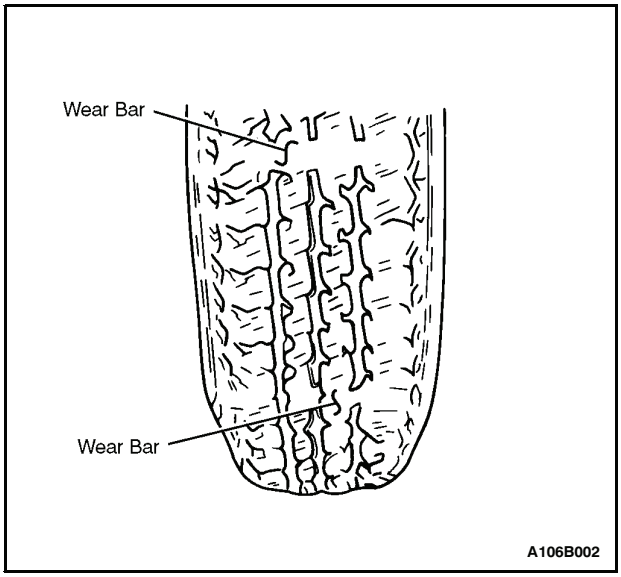
Check wheel alignment if:

- **The left and right front tire wear is unequal.**
- **The wear is uneven across the tread of either front tire.**
- **The front tire treads are scuffed with "feather" edges on the side of the tread ribs or blocks.**



Tread Wear Indicators

The original equipment tires have built-in tread wear indicators to show when the tires need replacement. These indicators appear as bands when the tire tread depth becomes shallow. Tire replacement is recommended when the indicators appear in three or more grooves at six locations.



Radial Tire Waddle

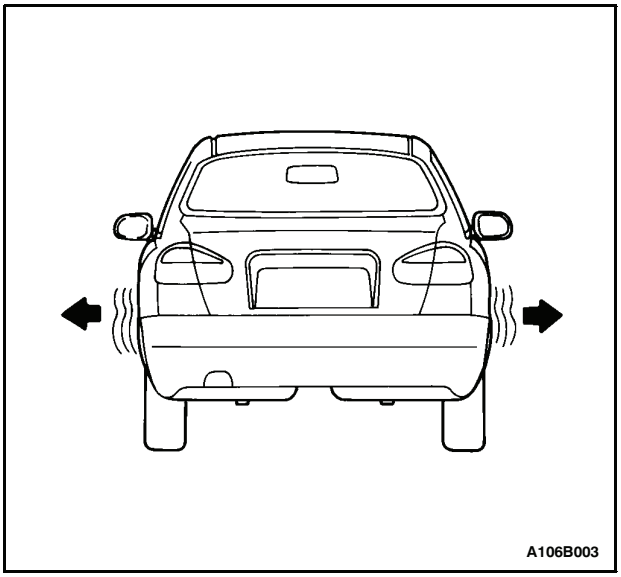
Waddle is side-to-side movement at the front or rear of the vehicle. It is caused by the steel belt not being straight within the tire, or by excessive lateral runout of the tire or wheel. It is most noticeable at low speeds, 8 to 48 km/h (5 to 30 mph), but may appear as ride roughness at 80 to 113 km/h (50 to 70 mph).

The vehicle must be road tested to determine which end of the vehicle has the faulty tire. The rear end of the vehicle will shake from side to side or "waddle" if the waddle tire is on the rear of the vehicle. From the driver's seat, it feels as though someone is pushing on the side of the vehicle. If the faulty tire is on the front of the vehicle, the waddle is more visual. The front sheet metal appears to be moving back and forth, and the driver's seat feels like the pivot point in the vehicle.

Waddle can be diagnosed using the method of substituting known good tire and wheel assemblies on the problem vehicle.

1. **Road test the vehicle to determine if the waddle is coming from the front or the rear of the vehicle.**
2. **Install good tires and wheels from a similar vehicle in place of those on the offending end of the problem vehicle. If the source of the waddle is not obvious, change the rear tires.**

3. Road test the vehicle. If there is improvement, install the original tires to find the offending tire. If there is no improvement, install good tires in place of all four offending tires.
4. Install original tires one at a time to find the offending tire.



RADIAL TIRE LEAD/PULL

Lead/pull is the deviation of the vehicle from a straight path on a level road with no pressure on the steering wheel. Lead is usually caused by:

- Incorrect alignment.
- Uneven brake adjustment.
- Tire construction.

The way in which a tire is built can produce lead/pull in the vehicle. Off-center belts on radial tires can cause the tire to develop a side force while the vehicle rolls straight down the road. If one side of the tire has even a little larger diameter than the diameter of the other side, the tire will tend to roll to one side. Unequal diameters will cause the tire to develop a side force which can produce vehicle lead/pull.

The radial lead/pull diagnosis chart should be used to determine whether the problem originates from an alignment problem or from the tires. Part of the lead diagnosis procedure calls for tire rotation that is different from the proper tire rotation pattern. If a medium- to high-mileage tire is moved to the other side of the vehicle, be sure to check for ride roughness. Rear tires will not cause lead/pull.

Radial Tire Lead/Pull Diagnosis Chart

Step	Action	Value(s)	Yes	No
1	1. Perform wheel alignment preliminary inspection. 2. Check the brakes for dragging. 3. Road test the vehicle. Does the vehicle lead/pull?	-	Go to Step 2	System OK
2	1. Cross switch the front tire and wheel assemblies. 2. Road test the vehicle. Does the vehicle lead/pull?	-	Go to Step 3	System OK
3	1. Check the front wheel alignment. Is the alignment within specifications?	-	Go to Step 4	Adjust alignment
4	1. Compare the front camber and front caster to specifications. Are they within specifications?	–	Go to Step 7	Go to Step 5
5	1. Check the vehicle frame. Is the frame bent?	-	Go to Step 6	Go to Step 1
6	1. Straighten the frame. Is the repair complete?	-	Go to Step 3	-
7	1. The probable cause is the tires. 2. Switch the left front tire and wheel assembly with the left rear tire and wheel assembly. 3. Road test the vehicle. Does the vehicle still lead/pull?	-	Go to Step 9	Go to Step 8
8	1. Switch the left front tire and wheel assembly with the left rear tire and wheel assembly and replace the left front tire. Is the repair complete?	-	System OK	Go to Step 1
9	1. Switch the right front tire and wheel assembly with the right rear tire and wheel assembly. 2. Road test the vehicle. Does the vehicle still lead/pull?	-	Go to Step 1	Go to Step 10
10	1. Switch the right front tire and wheel assembly with the right rear tire and wheel assembly and replace the right front tire. Is the repair complete?	-	System OK	Go to Step 1

VIBRATION DIAGNOSIS

Wheel imbalance causes most highway speed vibration problems. A vibration can remain after dynamic balancing because:

- **A tire is out of round.**
- **A rim is out of round.**
- **A tire stiffness variation exists.**

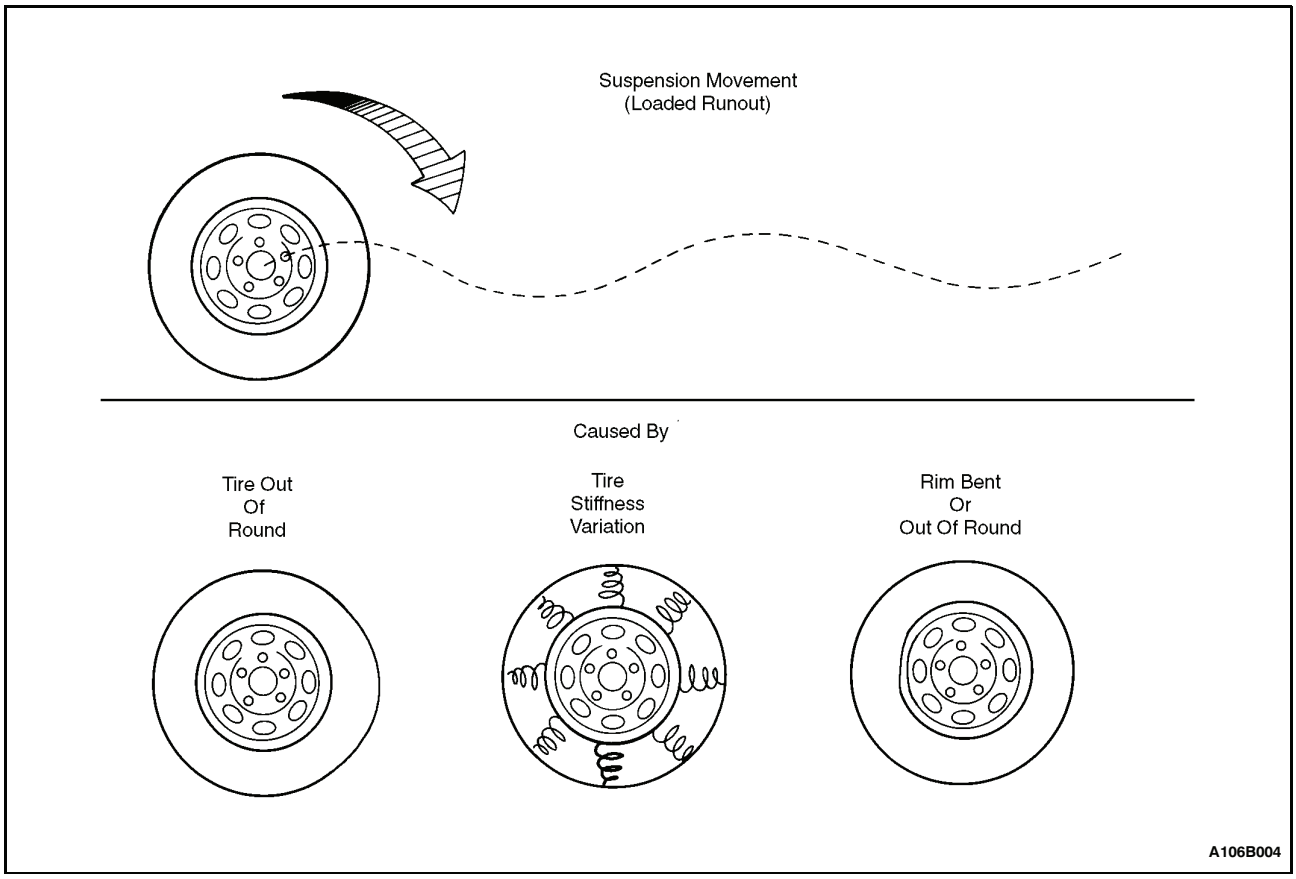
Measuring tire and wheel free runout will uncover only part of the problem. All three causes, known as loaded radial runout, must be checked using method of substituting known good tire and wheel assemblies on the problem vehicle.

Low-speed vibrations, which occur below 64 km/h (40 mph), are usually caused by runout. High-speed vibrations, which occur above 64 km/h (40 mph), can be caused by either imbalance or runout.

Preliminary Checks

Prior to performing any work, always road test the car and perform a careful visual inspection for:

- **Obvious tire and wheel runout.**
- **Obvious drive axle runout.**
- **Improper tire inflation.**
- **Incorrect trim height.**
- **Bent or damaged wheels.**
- **Debris build-up on the tire or the wheel.**
- **Irregular or excessive tire wear.**
- **Improper tire bead seating on the rim.**
- **Imperfections in the tires, including: tread deformations, separations, or bulges from impact damage. Slight sidewall indentations are normal and will not affect ride quality.**



Tire Balancing

Balance is the easiest procedure to perform and should be done first if the vibration occurs at high speeds. Do an off-vehicle, two-plane dynamic balance first to correct any imbalance in the tire and wheel assembly.

An on-vehicle finish balance will correct any brake drum, rotor, or wheel cover imbalance. If balancing does not correct the high-speed vibration, or if the vibration occurs at low speeds, runout is the probable cause.

Runout

Runout can be caused by the tire, the wheel, or the way the wheel is attached to the vehicle. To investigate the possibility of wheel runout, refer to the following procedures as well as the wheel runout diagnosis chart in this section:

1. **If runout is suspected, measure the on-vehicle free lateral and free radial runout of the tire and wheel assembly. Refer to Section 2E, Tires and Wheels. Both**

the free lateral and the free radial runout should be less than 1.5 mm (0.06 inch). If either measurement exceeds this number, proceed to Step 2.

2. Mount the tire and the wheel on a dynamic balancing machine and remeasure the free lateral and the free radial runout. Record the amount of the free lateral and the free radial runout and the location of the highest measurement. Refer to Section 2E, Tires and Wheels. If the free radial or the free lateral runout exceeds 1.3 mm (0.05 inch) at the tire tread, proceed to Step 4.
3. Measure the wheel runout. Refer to Section 2E, Tires and Wheels. If the wheel exceeds specifications, replace it.
4. Deflate the tire and match-mount the high radial runout point of the tire to the low radial runout point of the wheel. Reinflate the tire and mount it on the dynamic balancing machine. Measure and record the free radial and the free lateral runout and their locations. In many cases, match mounting the tire on the wheel will bring the tire and wheel assembly's free runout into an acceptable range of 1.3 mm (0.05 inch) or less.
5. If the free runout of the tire and wheel assembly is 1.3 mm (0.05 inch) or less when it was measured off the vehicle, yet exceeds 1.3 mm (0.05 inch) when measured on the vehicle, the attachment of the tire and wheel assembly to the hub is the probable cause of the vibration. Rotate the assembly's two wheel studs and recheck the runout. Refer to Section 2E, Tires and Wheels. Several positions may have to be tried to find the best location for the studs.
6. If the tire and wheel assembly free runout cannot be reduced to 1.3 mm (0.05 inch) or less, remove the assembly.
   - 6.1 Measure the wheel stud runout using a dial indicator set with a magnetic base.
   - 6.2 Zero the dial indicator set button on one stud.
   - 6.3 Gently lift the set button off the stud. Rotate the flange to position the next stud against the dial indicator set.
   - 6.4 Record the runout of all the studs. The dial indicator should read zero when it is repositioned on the first stud that was checked.
   - 6.5 If the runout exceeds 0.76 mm (0.03 inch), the hub or the hub and bearing assembly should be replaced.

Whenever a tire is rotated on the wheel, or whenever a tire or wheel is replaced, rebalance the assembly.

Wheel Runout Diagnosis Chart

Step	Action	Value(s)	Yes	No
1	Road test the vehicle to verify the vibration complaint. Are the customer's concerns verified?	-	Go to Step 2	System OK
2	1. Perform a vibration diagnosis preliminary check. 2. Repair any of the problems found. Is the vibration still present?	-	Go to Step 3	System OK
3	Determine at what speed the vibration is present. Is the vibration over 64 km/h (40 mph)?	-	Go to Step 4	Go to Step 6
4	Perform off-vehicle dynamic wheel balance. Is the vibration still present?	-	Go to Step 5	System OK
5	Perform on-vehicle finish balance. Is the vibration still present?	-	Go to Step 6	System OK
6	Perform free lateral and radial on-vehicle runout check. Does the runout match the value specified?	1.5 mm (0.06 in.)	Go to Step 4	Go to Step 7
7	Perform free lateral and free radial off-vehicle runout check. Does the runout match the value specified?	1.3 mm (0.05 in.)	Go to Step 8	Go to Step 12
8	1. Index the tire and wheel assembly on the wheel studs. 2. Obtain the least amount of runout possible. Does the runout match the value specified?	0.76 mm (0.03 in.)	Go to Step 9	Go to Step 14
9	Perform off-vehicle dynamic wheel balance. Is the vibration still present?	-	Go to Step 10	System OK
10	Perform on-vehicle finish balance. Is the vibration still present?	-	Go to Step 11	System OK
11	1. Check for any engine driveline imbalance. 2. Thoroughly inspect the drive axles and the constant velocity joints. 3. Repair any problems found. Are the repairs complete?	-	Go to Step 1	-
12	1. Match-mount the tire on the wheel. 2. Perform free lateral and free radial off-vehicle runout check. Does the runout match the value specified?	1.5mm (0.06 in.)	Go to Step 9	Go to Step 13
13	1. Dismount the tire from the wheel of the suspected assembly. 2. Measure the runout of the wheel. Does the runout match the value specified?	0.8 mm (0.03 in.)	Go to Step 15	Go to Step 16
14	Measure the hub flange runout. Does the runout match the value specified?	0.76 mm (0.03 in.)	Go to Step 9	Go to Step 17
15	Replace the tire. Is the repair complete?	-	Go to Step 1	-
16	Replace the wheel. Is the repair complete?	-	Go to Step 1	-
17	Replace the hub. Is the repair complete?	-	Go to Step 1	-

PRELIMINARY INSPECTION

Checks	Action
Check the tires for proper inflation pressures and normal tread wear.	Inflate the tires to the proper tire pressure. Replace the tires as needed.
Check the wheel bearings for looseness.	Tighten the axle nut to the proper specification. Replace the strut wheel bearing as needed.
Check for loose ball joints and tie rod ends.	Tighten the ball joints and the tie rods.
Check the runout of the wheels and the tires.	Measure and correct the tire runout.
Check the vehicle trim heights.	Correct the trim heights. Make the correction before adjusting the toe.
Check for loose rack and pinion mounting.	Tighten the mounting brackets for the rack and pinion assembly.
Check for improperly operating struts.	Replace the strut assembly.
Check for loose control arms.	Tighten the control arm attachment bolts. Replace the control arm bushings as needed.

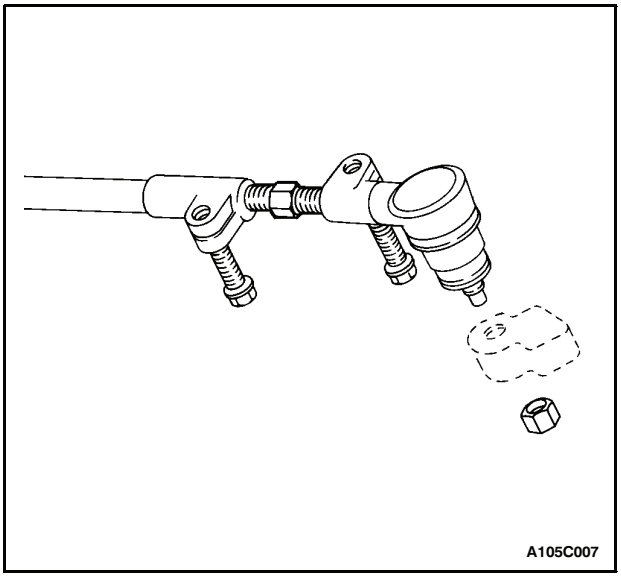
FRONT TOE ADJUSTMENT

1. Loosen the right and the left inner and outer tie rod pinch bolts.
2. Turn the right and the left tie rod adjusters to align the toe to 0 degrees * 10 to +10 minutes.

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

Tighten

Tighten the inner and outer tie rod pinch bolts to 20 N•m (15 lb-ft).



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.

GENERAL DESCRIPTION AND SYSTEM 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 0 degrees 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 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 joint 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.

SECTION 2C

FRONT SUSPENSION

TABLE OF CONTENTS

SPECIFICATIONS

GENERAL SPECIFICATIONS

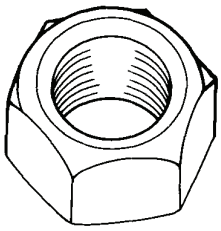
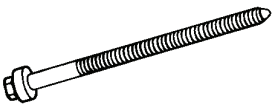
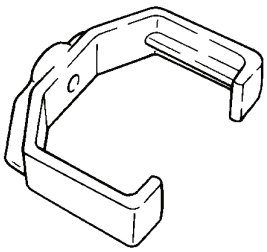
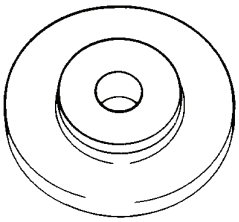
Application	Trim Height
Rocker Panel, Front to Ground	195 mm (7.7 in.)
Rocker Panel, Rear to Ground	191 mm (7.5 in.)

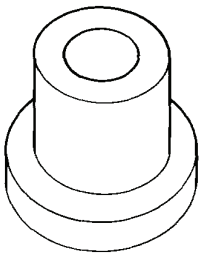
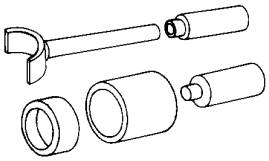
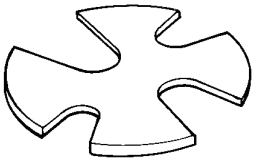
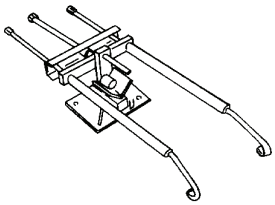
FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Ball Joint-to-Control Arm Nuts	65	48	-
Ball Joint-to-Knuckle/Strut Nut	70	52	-
Control Arm Front Mounting Bolt	140	103	-
Control Arm Rear Mounting Bolts	70	52	-
Drive Axle-to-Hub Caulking Nut (First Torque)	180	133	-
Drive Axle-to-Hub Caulking Nut (Last Torque)	50 +60°	37 +60°	-
Piston Rod Nut	55	41	-
Stabilizer Shaft-to-Body Clamp Bolt	40	30	-
Strut Assembly-to-Body Nuts	25	18	-
Strut Cartridge Closure Nut	200	148	-

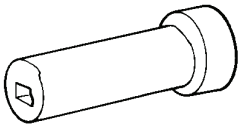
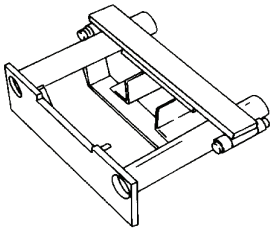
SPECIAL TOOLS

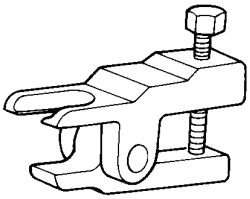
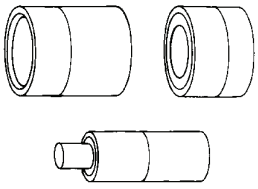
SPECIAL TOOLS TABLE

 A106C056	**500-20 Hex Nut**
 A106C053	**J-36661-2 Forcing Screw**
 A106C052	**J-37105-B-1 Support Bridge**
 A106C054	**J-37105-B-2 Bearing Adapter**

 A106C055	**J-37105-B-3 Hub Adapter**
 A106C029	**KM-158 Remover/Installer**
 A106C030	**KM-307-B Removal Plate**
 A106C031	**KM-329-A Spring Compressor**

SPECIAL TOOLS TABLE (Cont'd)

 A106C062	**J-42468 Front Strut Mount Nut Wrench**
 A106C036	**KM-331 Strut Cartridge Closure Nut Wrench**
 A106C033	**KM-465-A Front Spring Compressor**

 A106C034	**KM-507-B Ball Joint Remover**
 A106C035	**KM-508-A Remover/Installer**

DIAGNOSIS

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.

Struts Seem Weak

Checks	Action
Check the tire pressures.	Adjust the tire pressures to the specifications on the tire placard.
Check the load conditions under which the vehicle is normally driven.	Consult with the owner to confirm the owner's understanding of normal load conditions.
Check the compression and rebound effectiveness of the strut dampener.	Quickly push down and then lift up on the corner of the bumper nearest the strut dampener being tested. Compare the compression and rebound with those of a similar vehicle that has an acceptable ride quality. Replace the strut dampener, if needed.

Struts Are Noisy

Checks	Action
Check the mountings for looseness or damage.	Tighten the strut dampener. Replace the strut dampener, if needed.
Check the compression and rebound effectiveness of the strut dampener.	Quickly push down and then lift up on the corner of the bumper nearest the strut dampener being tested. Compare the compression and rebound with those of a similar vehicle that has an acceptable ride quality. Replace the strut dampener, if needed.

Leaks

Checks	Action
Check for a slight trace of fluid.	The strut dampener is OK.
Check the seal cover on the fully extended strut.	Replace the strut dampener.
Check for an excessive amount of fluid on the strut dampener.	Replace the strut dampener.

BALL JOINT AND KNUCKLE

Ball Joint Inspection

1. Raise the front of the vehicle to allow the front suspension to hang free.
2. Grasp the tire at the top and the bottom.
3. Move the top of the tire in an in-and-out motion.
4. Look for any horizontal movement of the knuckle relative to the control arm.
5. Ball joints 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.

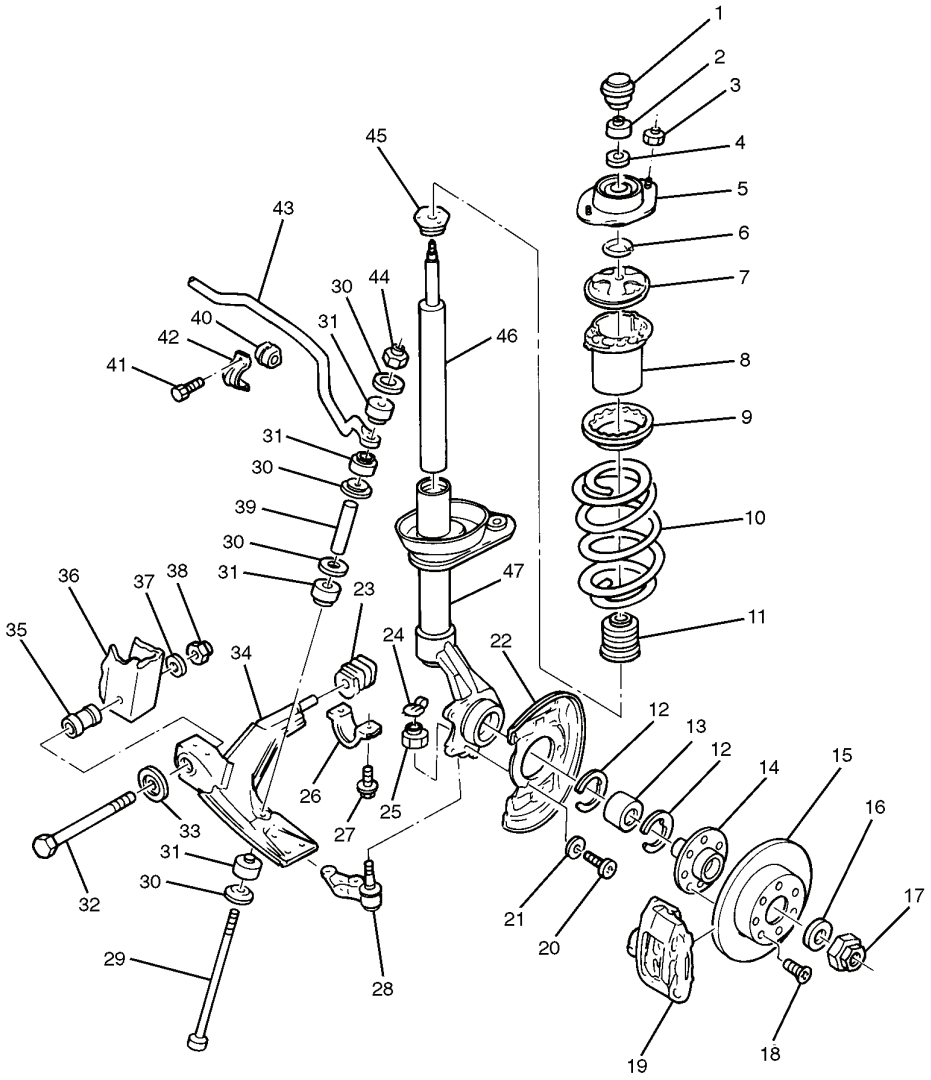
EXCESSIVE FRICTION CHECK

Use the following procedures in order to check excessive friction in the front suspension.

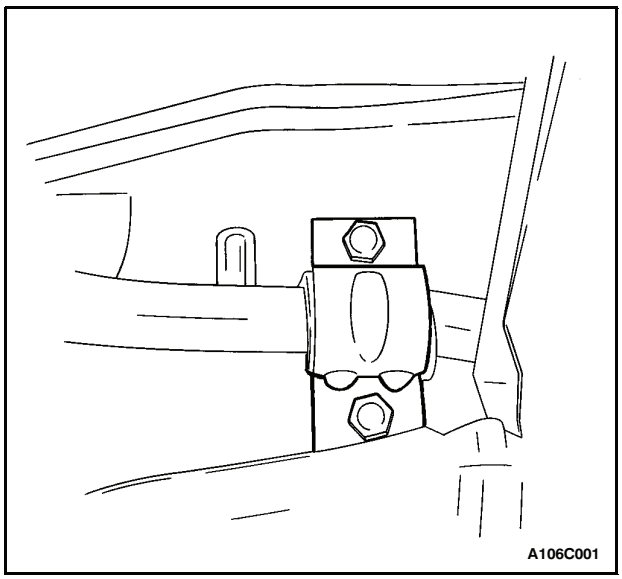
1. **Enlist the help of another technician to lift up on the front bumper, raising the vehicle as high as possible.**
2. **Slowly release the bumper, allowing the vehicle to assume its normal trim height. See "General Specifications" in this section.**
3. **Measure the distance from the street level to the center of the bumper.**
4. **Push down on the bumper, release slowly, and allow the vehicle to assume its normal trim height.**
5. **Measure the distance from the street level to the center of the bumper.**
6. **The difference between the two measurements should be less than 12.7 mm (0.5 inch). If the difference exceeds this limit, inspect the control arms, the struts, and the ball joints for damage or wear.**

COMPONENT LOCATOR

FRONT SUSPENSION



1 Upper Bearing Dust Cover
2 Piston Nut
3 Strut Assembly-to-Body Nut
4 Piston Nut Washer
5 Upper Strut Mount Bearing
6 Bearing Support Washer
7 Plastic Mount
8 Strut Shield
9 Upper Spring Insulator Ring
10 Coil Spring
11 Strut Bumper
12 Snap Ring
13 Front Wheel Bearing
14 Front Wheel Hub
15 Rotor
16 Drive Axle-to-Hub Nut Lock Washer
17 Drive Axle-to-Hub Caulking Nut
18 Detent Screw
19 Front Brake Caliper
20 Brake Shield Attachment Screw
21 Brake Shield Attachment Screw Washer
22 Brake Shield
23 Lower Control Arm Rear Bushing
24 Lower Ball Joint Cotter Pin
25 Lower Ball Joint Nut
26 Lower Control Arm Rear Bushing Mounting Bracket
27 Lower Control Arm Rear Bushing Mounting Bracket Bolt
28 Lower Ball Joint
29 Front Stabilizer Shaft Link Assembly Bolt
30 Front Stabilizer Shaft Link Grommet Washer
31 Front Stabilizer Shaft Link Grommet
32 Lower Control Arm Front Mounting Bracket Bolt
33 Lower Control Arm Front Mounting Bracket Bolt Washer
34 Lower Control Arm
35 Lower Control Arm Front Bushing
36 Vehicle Body
37 Lower Control Arm Front Mounting Bracket Nut Washer
38 Lower Control Arm Front Mounting Bracket Nut
39 Front Stabilizer Shaft Link Assembly Spacer
40 Front Stabilizer Shaft Insulator
41 Front Stabilizer Shaft Clamp Bolt
42 Front Stabilizer Shaft Clamp
43 Front Stabilizer Shaft
44 Front Stabilizer Shaft Link Assembly Nut
45 Strut Cartridge Closure Nut
46 Strut Cartridge
47 Knuckle and Support Tube


A106C001

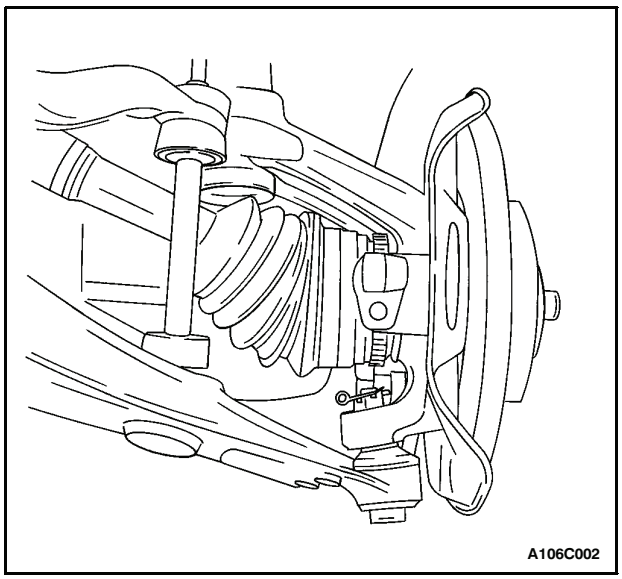
MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

STABILIZER SHAFT AND INSULATORS

Removal Procedure

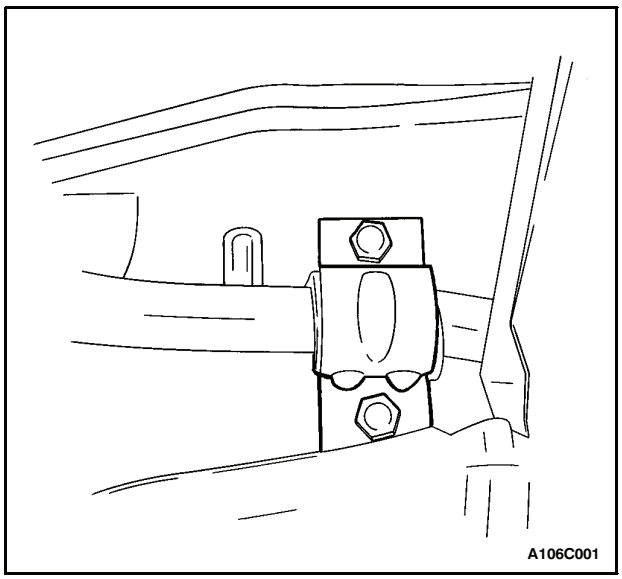
1. Lift and suitably support the vehicle, allowing the front suspension to hang free.
2. Remove the front wheel. Refer to Section 2E, Tires and Wheels.
3. Remove the stabilizer shaft-to-body clamp bolts, the stabilizer shaft clamps, and the insulators from the vehicle.

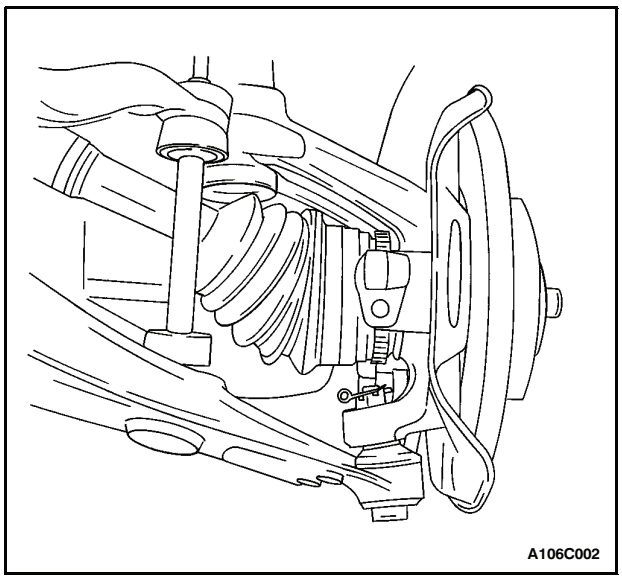

A106C002

4. Disconnect the stabilizer shaft from the lower control arm by removing the stabilizer shaft link assembly.

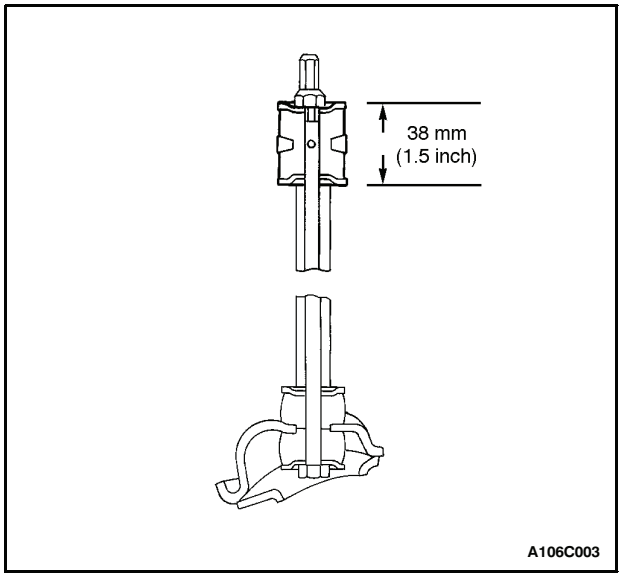
Installation Procedure

1. Install the stabilizer shaft into the vehicle.
2. Install the stabilizer shaft clamp insulators, the stabilizer shaft clamps, and the stabilizer shaft-to-body clamp bolts. Do not tighten the bolts.


A106C001


A106C002

3. Connect the stabilizer shaft to the lower control arm with the stabilizer shaft link assembly.



A106C003

4. Make certain the stabilizer shaft is centered side-to-side.

Tighten

Tighten the stabilizer shaft-to-body clamp bolt to 40 N•m (30 lb-ft).

5. Connect the stabilizer shaft to the control arm with a new self-locking nut.
6. Tighten the self-locking nut to achieve 38 mm (1.5 inch) between the self-locking nut and the control arm spacer.
7. Install the wheel. Refer to Section 2E, Tires and Wheels.
8. Lower the vehicle.

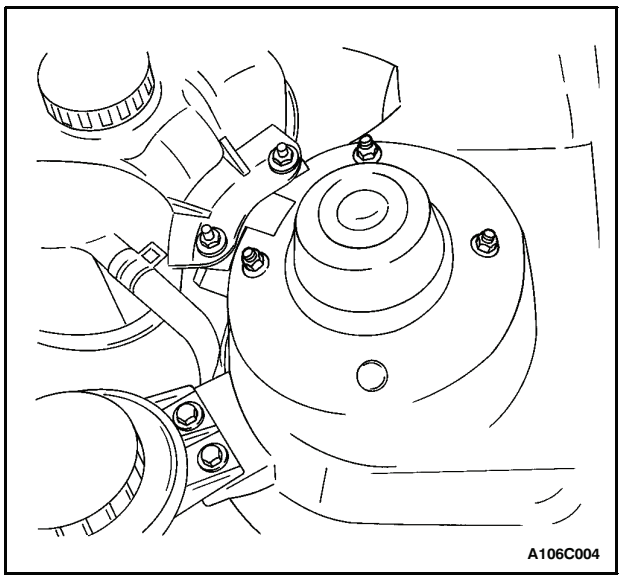
KNUCKLE/STRUT ASSEMBLY

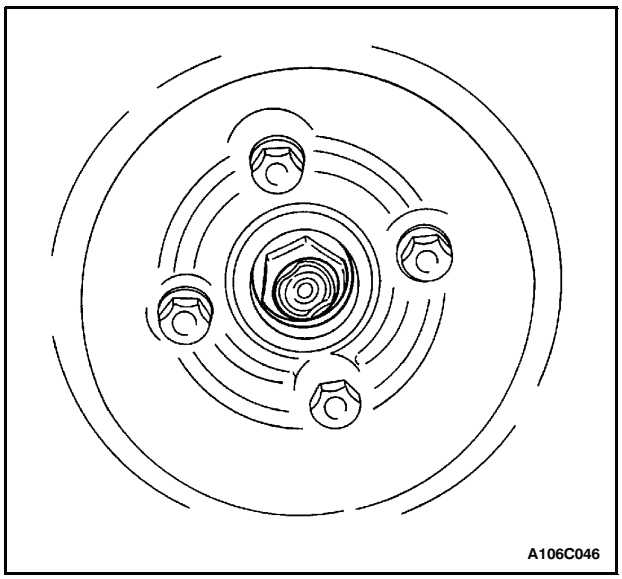
Tools Required

KM-507-B Ball Joint Remover

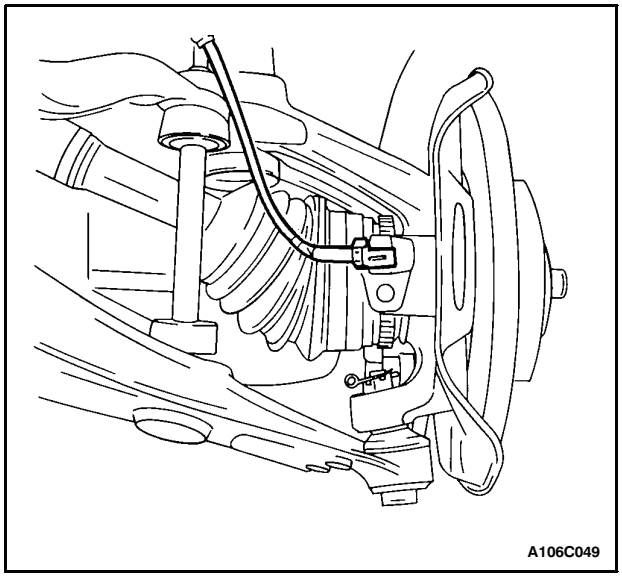
Removal Procedure

1. Loosen the nuts that attach the top of the strut assembly to the vehicle.

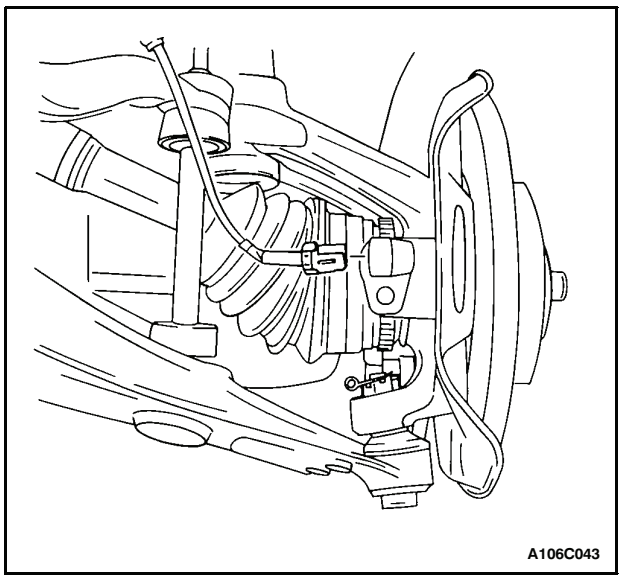

A106C004


A106C046

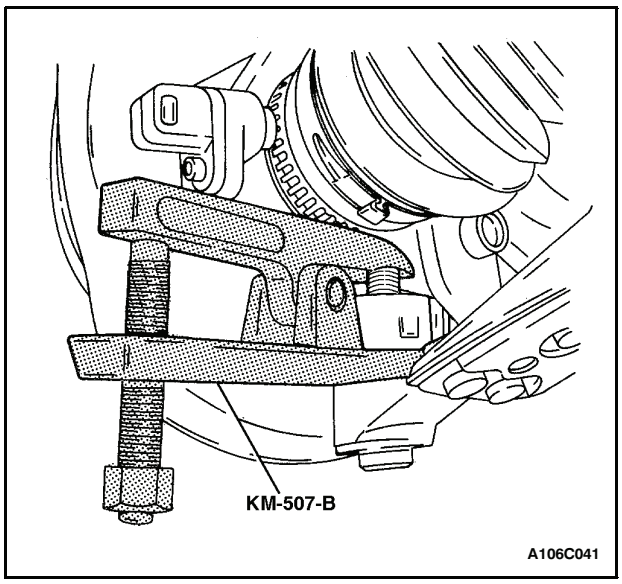
2. Uncrimp the caulking nut sleeve and remove the caulking nut and the washer.


A106C049

3. Raise and suitably support the vehicle.
4. Place the jackstands under the frame of the vehicle.
5. Lower the vehicle slightly so the weight of the vehicle rests on the jackstands and not on the control arms.
6. Remove the wheel. Refer to Section 2E, Tires and Wheels.
7. Disconnect the brake caliper from the knuckle/strut assembly and support the caliper. Do not hang the caliper from the hydraulic brake hose. Refer to Section 4D, Front Disc Brakes.
8. Disconnect the ABS speed sensor electrical connector, if applicable.


A106C043

9. Remove the ball joint cotter pin by lifting up on the rear of the clip and using the two loops on the front of the clip to pull the clip out.
10. Remove the ball joint-to-knuckle-strut nut.



Notice: Failure to use the recommended tool for separating the ball joint from the steering knuckle assembly may damage the ball joint and seal.

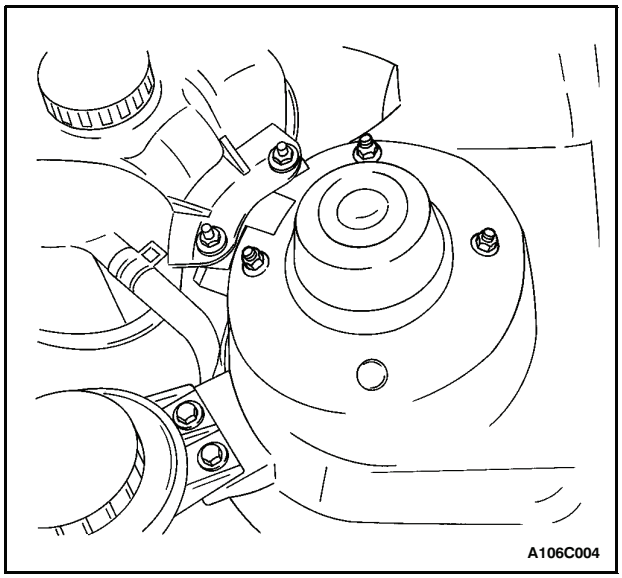
11. **Separate the steering knuckle assembly from the ball joint using the ball joint remover KM-507-B.**
12. **Remove the outer tie rod from the steering knuckle assembly. Refer to Section 6C, Power Steering Gear [Includes Rack & Pinion Gear] or Section 6D, Manual Steering Gear [Includes Rack & Pinion Gear].**

Notice: Take care to prevent the axle joints from being overextended. When either end of the shaft is disconnected, the joint can become overextended. This overextension can cause the internal components to separate. This separation can cause joint failure. Use drive axle joint seal protectors during any service on or near the drive axles. Failure to use joint seal protectors can damage the interior joint seal and cause joint failure.

13. **Push the drive axle shaft from the front wheel hub.**
14. **Support the drive axle.**
15. **Lower the vehicle in order to gain access to the strut-to-body nuts and the washers.**

Notice: Chipping or scratching the spring coating when handling the front suspension coil spring can cause the spring to fail.

16. **Remove the strut assembly-to-body nuts.**
17. **Remove the strut assembly from the vehicle.**



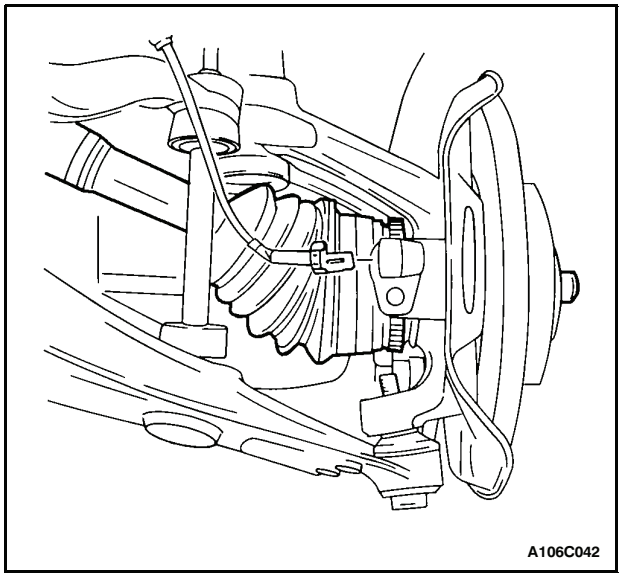
Installation Procedure

Notice: Chipping or scratching the spring coating when handling the front suspension coil spring can cause the spring to fail.

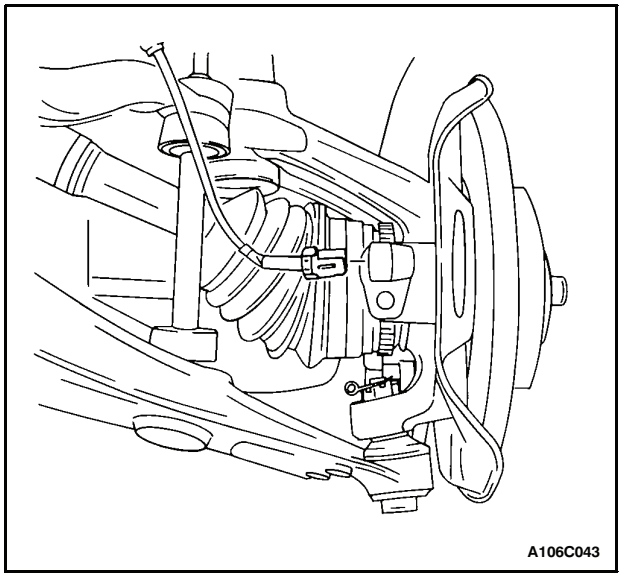
1. **Install the strut assembly into the vehicle with the strut assembly-to-body nuts.**

Tighten

Tighten the strut assembly-to-body nuts to 25 N•m (18 lb-ft).


A106C042

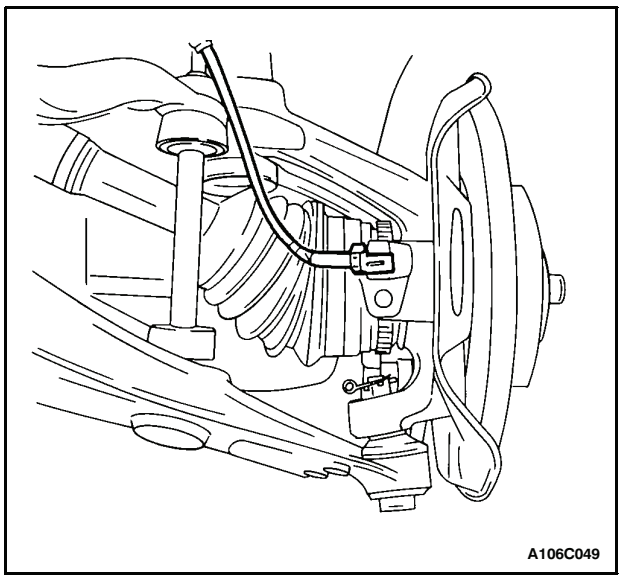
2. Connect the drive axle to the front wheel hub.


A106C043

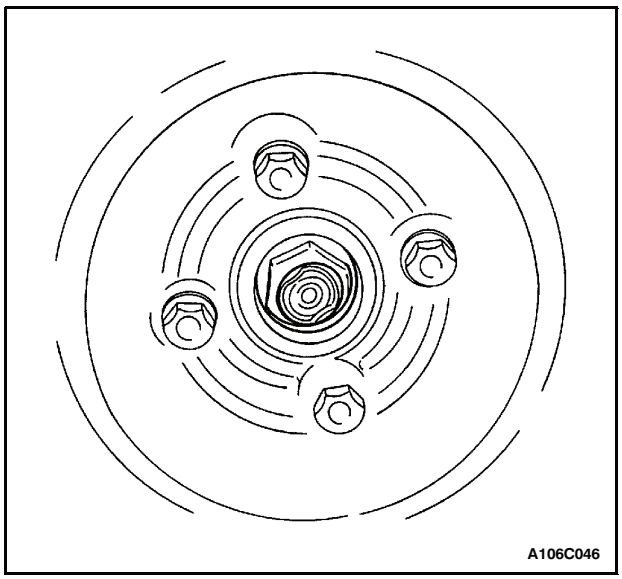
3. Connect the outer tie rod to the steering knuckle assembly. Refer to Section 6C, Power Steering Gear [Includes Rack & Pinion Gear] or Section 6D, Manual Steering Gear [Includes Rack & Pinion Gear].
4. Connect the ball joint to the steering knuckle assembly.
5. Install the ball joint-to-knuckle/strut nut and the ball joint cotter pin.

Tighten

Tighten the ball joint-to-knuckle/strut nut to 70 N•m (52 lb-ft).


A106C049

6. Connect the ABS speed sensor electrical connector, if applicable.

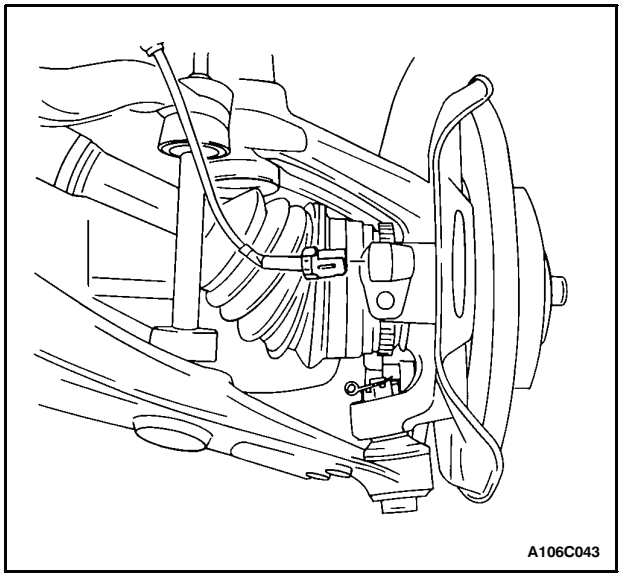

A106C046

7. Connect the brake caliper to the knuckle/strut assembly. Refer to Section 4D, Front Disc Brakes.
8. Install the wheel. Refer to Section 2E, Tires and Wheels.
9. Install a new drive axle-to-hub caulking nut.

Tighten

Tighten the drive axle-to-hub caulking nut to 180 N•m (133 lb-ft). Loosen the nut and retighten the nut to 50 N•m (37 lb-ft). Then tighten the nut an additional 60 degrees.

10. Crimp the caulking nut sleeve onto the drive axle shaft.


A106C043

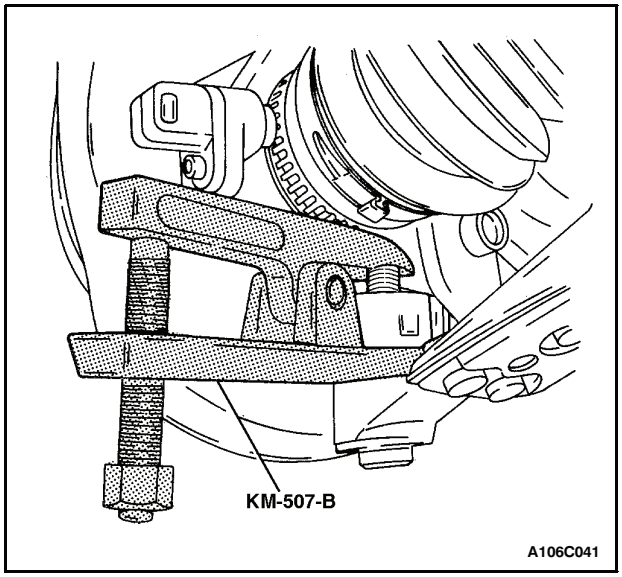
CONTROL ARM

Tools Required

KM-507-B Ball Joint Remover

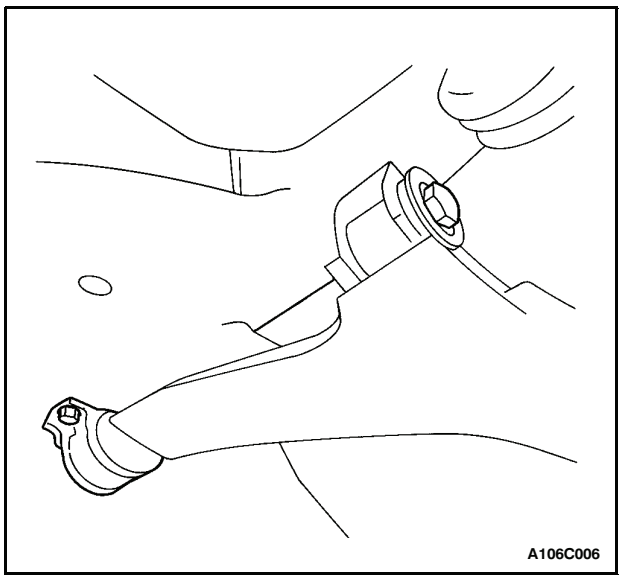
Removal Procedure

1. Raise and suitably support the vehicle.
2. Place the jackstands under the frame of the vehicle.
3. Lower the vehicle slightly so the weight of the vehicle rests on the jackstands and not on the control arms.
4. Remove the wheel. Refer to Section 2E, Tires and Wheels.
5. Disconnect the stabilizer shaft from the control arm by removing the control arm link bolt assembly. Refer to "Stabilizer Shaft and Insulators" in this section.
6. Remove the retaining clip and the ball joint-to-knuckle/strut nut from the ball joint.

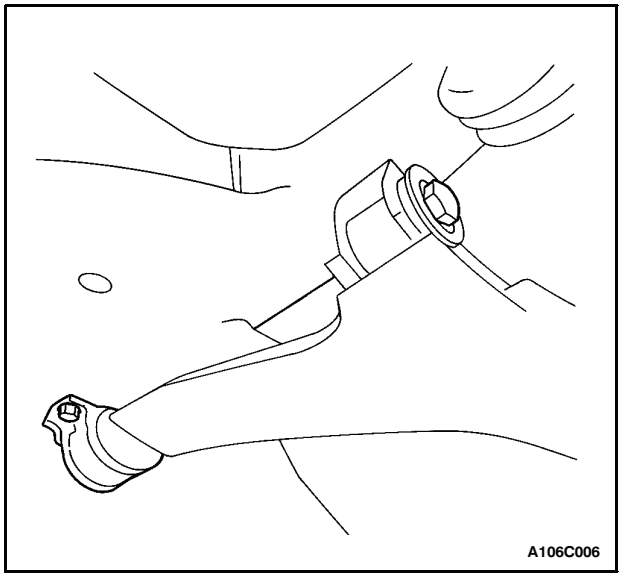


A106C041

7. Disconnect the ball joint from the steering knuckle using the ball joint remover KM-507-B.



8. Remove the control arm front mounting bolt.
9. Remove the control arm rear mounting bolts and the bracket.
10. Remove the control arm from the vehicle.



Installation Procedure

1. Install the control arm onto the vehicle.
2. Connect the front of the control arm to the body of the vehicle with the front mounting bolt and the washer.
3. Apply a thread sealer to the control arm rear mounting bolts.
4. Connect the rear of the control arm to the body of the vehicle with the rear mounting bracket and bolts.

Important: Do not tighten the control arm bolts at this point.

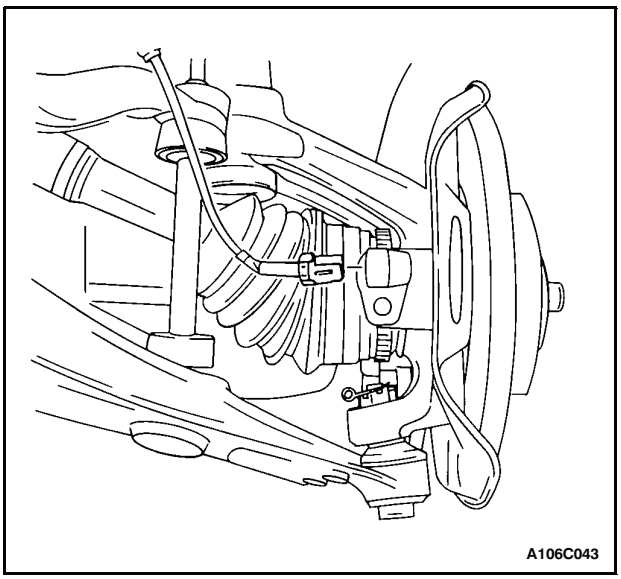
Notice: Use a new self-locking nut to install the control arm link bolt assembly. Failure to do so will allow the normal vibration of the vehicle to loosen the nut and damage the vehicle.

5. Install the stabilizer shaft link bolt assembly. Refer to "Stabilizer Shaft and Insulators" in this section.
6. Connect the ball joint to the steering knuckle.
7. Tighten the ball joint-to-knuckle/strut nut.

Tighten

Tighten the ball joint-to-knuckle/strut nut to 70 N•m (52 lb-ft).

8. Connect the retaining clip to the ball joint stud.
9. Install the wheel. Refer to Section 2E, Tires and Wheels.
10. Raise the vehicle.
11. Place the jackstands under the control arms.
12. Lower the vehicle.


A106C043

Important: The control arms must support the weight of the vehicle while the control arm mounting bolts are being tightened.

13. Tighten the control arm rear mounting bolts.

Tighten

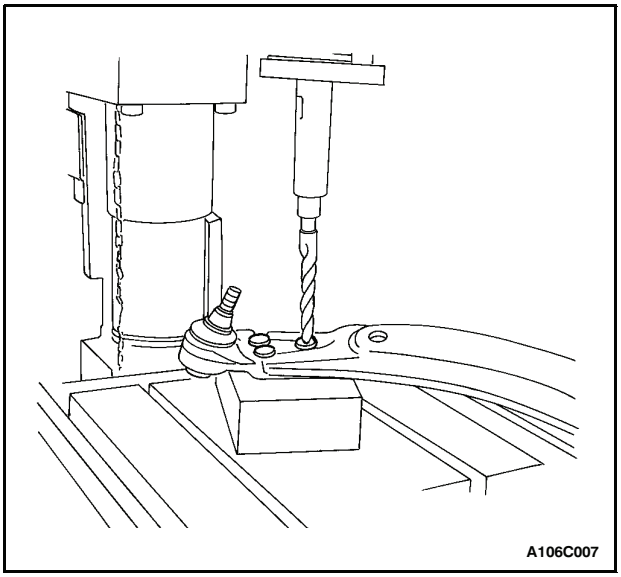
Tighten the control arm rear mounting bolts to 70 N•m (52 lb-ft).

14. Tighten the control arm front mounting bolt.

Tighten

Tighten the control arm front mounting bolt to 140 N•m (103 lb-ft).

15. Raise the vehicle.
16. Remove the jackstands.
17. Lower the vehicle.

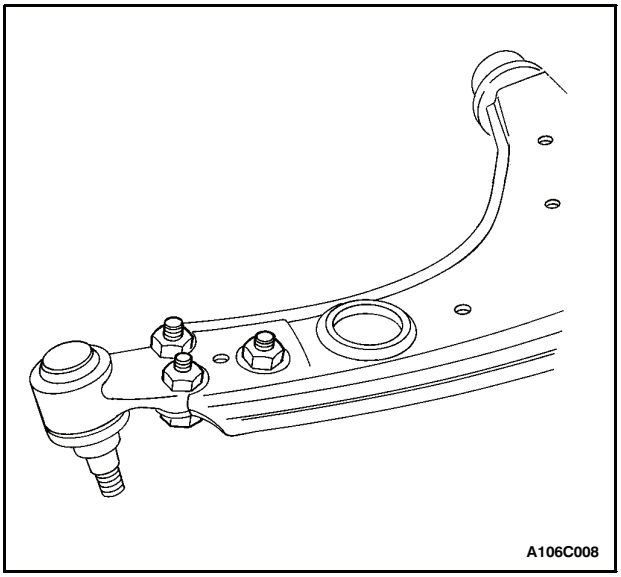

A106C007

UNIT REPAIR

BALL JOINT

Disassembly Procedure

1. Raise and suitably support the vehicle.
2. Place the jackstands under the frame of the vehicle and lower the vehicle slightly so the weight of the vehicle rests on the jackstands and not on the control arms.
3. Remove the wheel. Refer to Section 2E, Tires and Wheels.
4. Remove the control arm. Refer to "Control Arm" in this section.
5. Drill off the heads of the rivets with a 12 mm (0.47-inch) drill bit.
6. Punch out the rivets with a drift.


A106C008

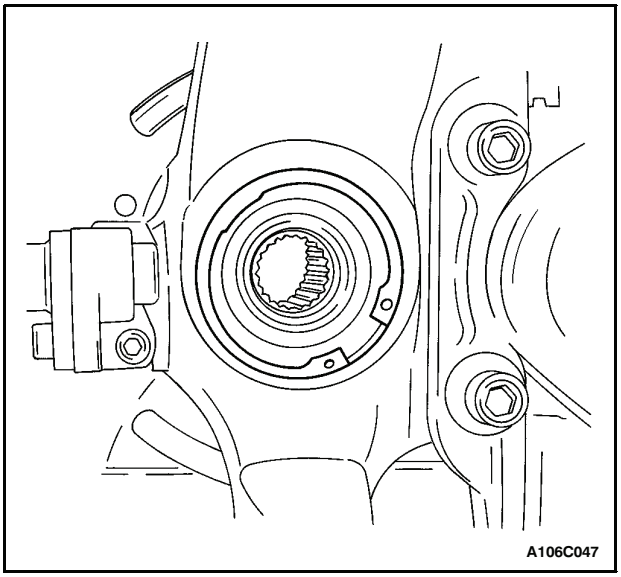
Assembly Procedure

1. Connect the ball joint to the control arm by inserting the ball joint bolts.
2. Install the nuts to secure the bolts from below the control arm.

Tighten

Tighten the ball joint-to-control arm nuts to 65 N•m (48 lb-ft).

3. Install the control arm. Refer to "Control Arm" in this section.


A106C047

HUB AND BEARING

Tools Required

500-20 Hex Nut

J-36661-2 Forcing Screw

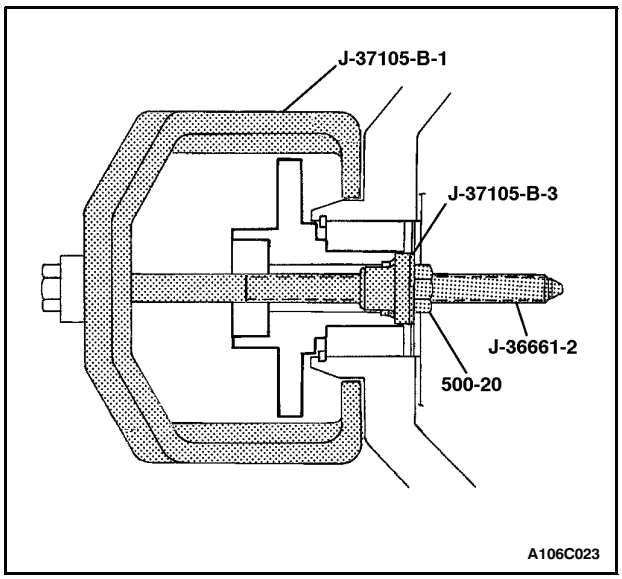
J-37105-B-1 Support Bridge

J-37105-B-2 Bearing Adapter

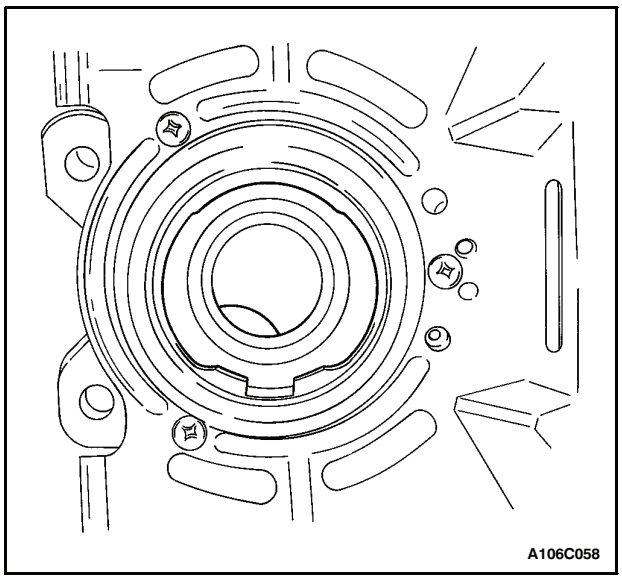
J-37105-B-3 Hub Adapter

Disassembly Procedure

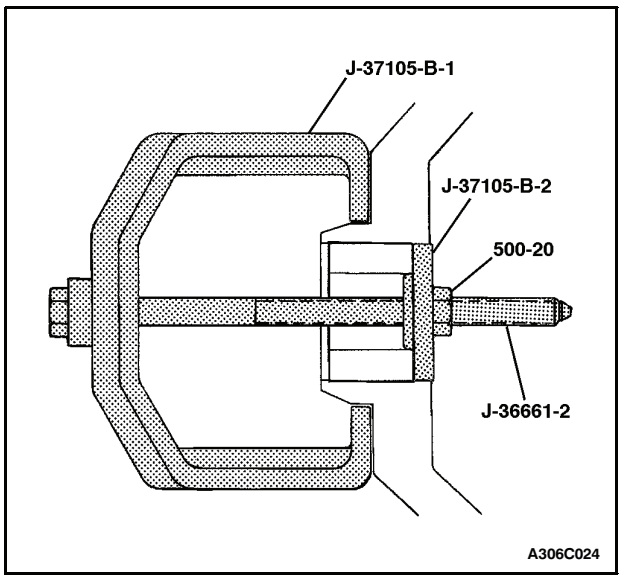
1. Remove the drive axle from the front wheel hub. Refer to "Knuckle/Strut Assembly" in this section.
2. Remove the inner snap ring.



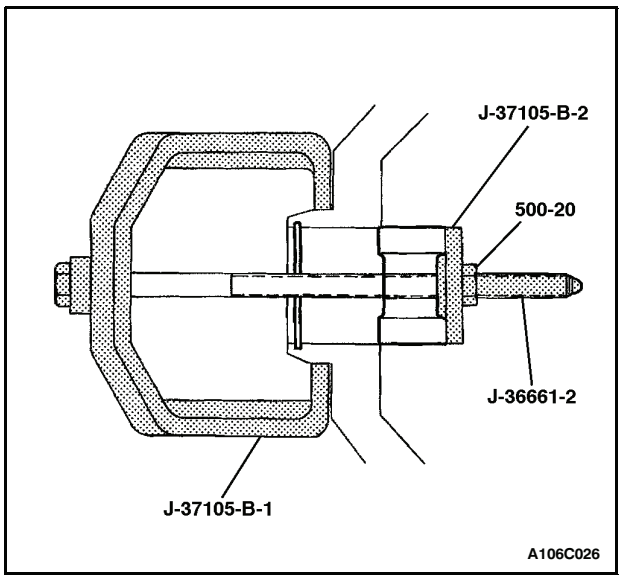
3. Remove the wheel hub with the support bridge J-37105-B-1, the hub adapter J-37105-B-3, the hex nut 500-20, and the forcing screw J-36661-2.



4. Remove the brake shield. Refer to Section 4D, Front Disc Brakes.
5. Remove the outer snap ring.

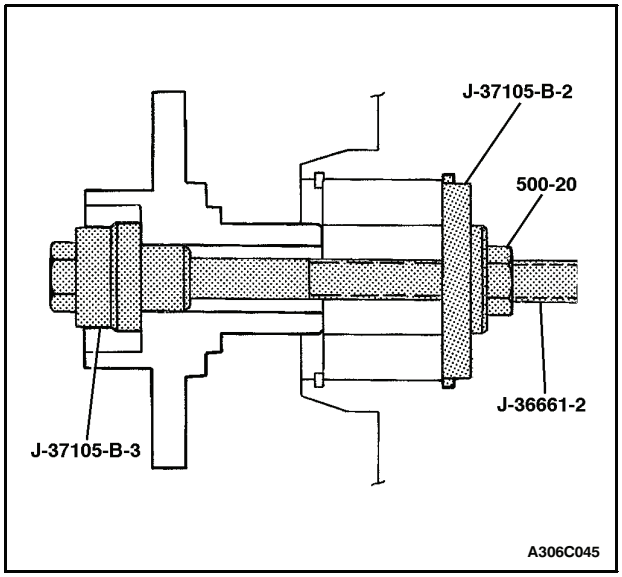


6. Remove the wheel bearing with the support bridge J-37105-B-1, the bearing adapter J-37105-B-2, the hex nut 500-20, and the forcing screw J-36661-2.
7. Clean the bore of the knuckle.

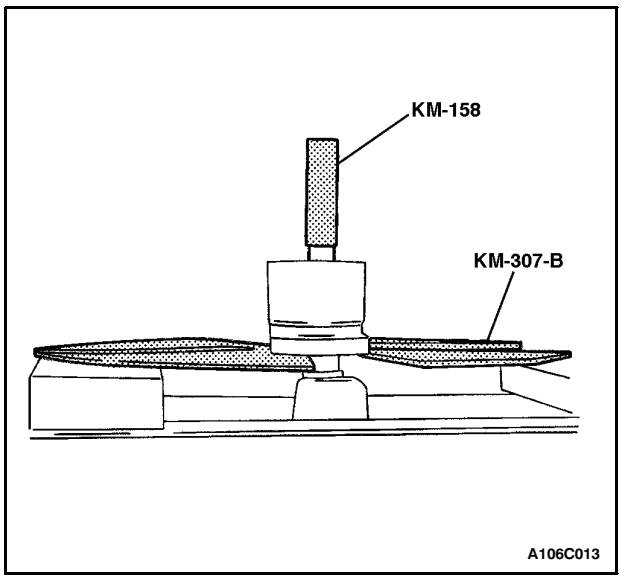


Assembly Procedure

1. Install the outer snap ring and push the wheel bearing into place with the support bridge J-37105-B-1, the bearing adapter J-37105-B-2, the hex nut 500-20, and the forcing screw J-36661-2.



2. Install the brake shield. Refer to Section 4D, Front Disc Brakes.
3. Install the inner snap ring and push the wheel hub into place with the hub adapter J-37105-B-3, the bearing adapter J-37105-B-2, the hex nut 500-20, and the forcing screw J-36661-2.
4. Install the drive axle into the front wheel hub. Refer to "Knuckle/Strut Assembly" in this section.



CONTROL ARM BUSHINGS

Tools Required

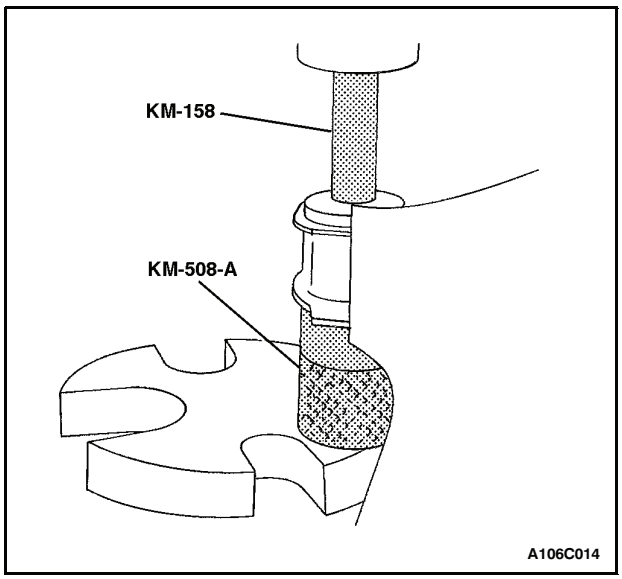
KM-508-A Remover/Installer

KM-158 Remover/Installer

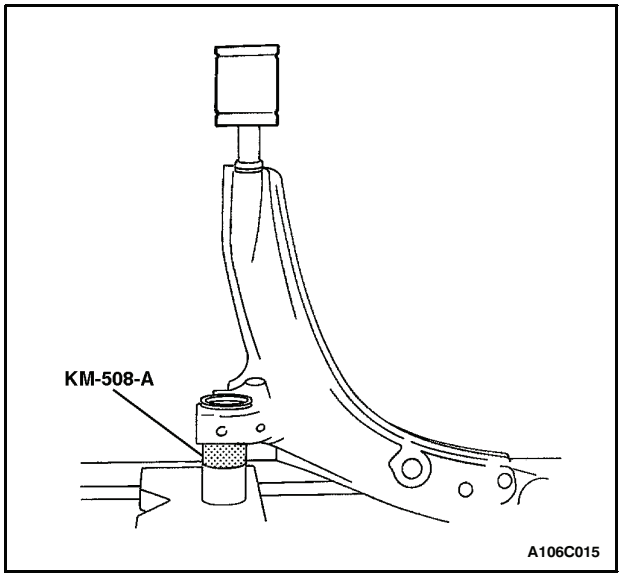
KM-307-B Removal Plate

Disassembly Procedure

1. Remove the control arm. Refer to "Control Arm" in this section.
2. Press off the rear bushing using a press, the remover/installer KM-158, and the removal plate KM-307-B.

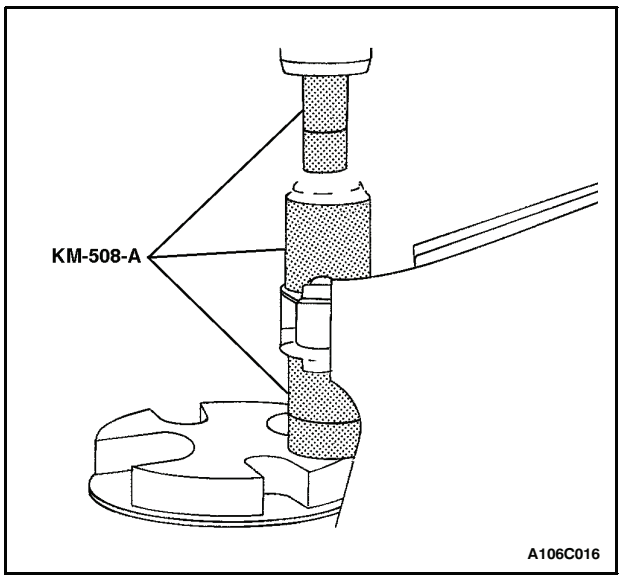


3. Press out the front bushing using the remover/installer KM-508-A, and the remover/installer KM-158.

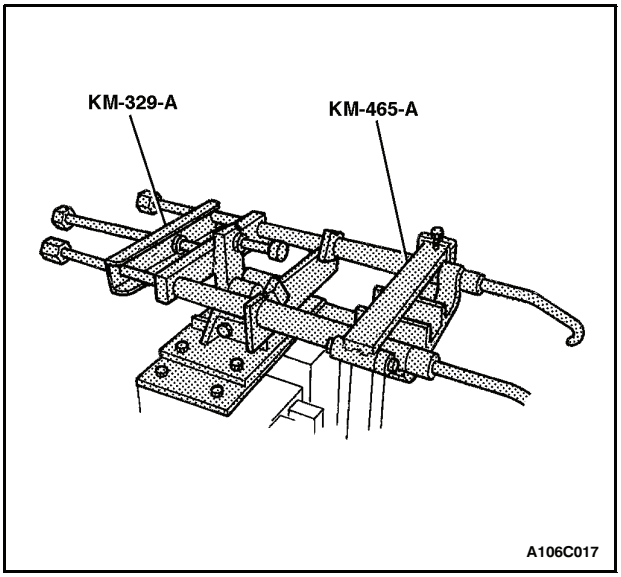


Assembly Procedure

1. Coat the control arm rear shaft with a multipurpose lubricant. Refer to Section 0B, General Information.
2. Press the rear bushing onto the shaft. The flat of the bushing must be on the top side, the same as the ball joint. Use the remover/installer KM-508-A to support the control arm.



3. Coat the outside of the front bushing and the inside of the lower control arm with a multipurpose lubricant. Refer to Section 0B, General Information.
4. Press the new bushing into the control arm from the back to the front, using the remover/installer KM-508-A.
5. Center the bushing.
6. Install the control arm. Refer to "Control Arm" in this section.



FRONT SPRING/STRUT CARTRIDGE

Tools Required

J-42468 Front Strut Mount Nut Wrench

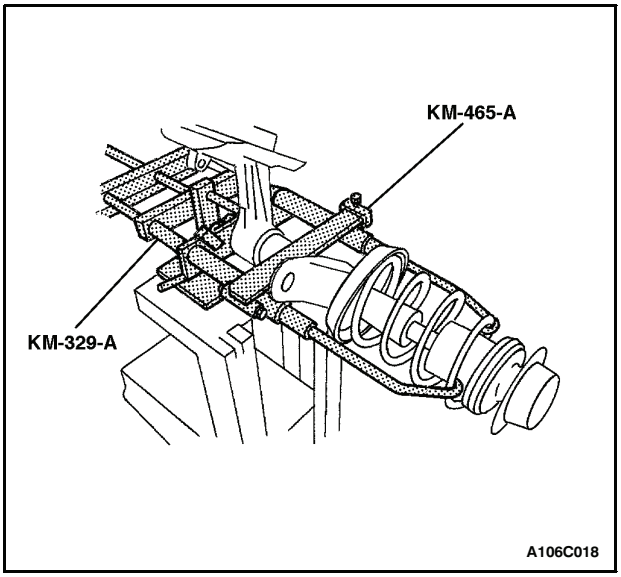
KM-329-A Spring Compressor

KM-331 Strut Cartridge Closure Nut Wrench

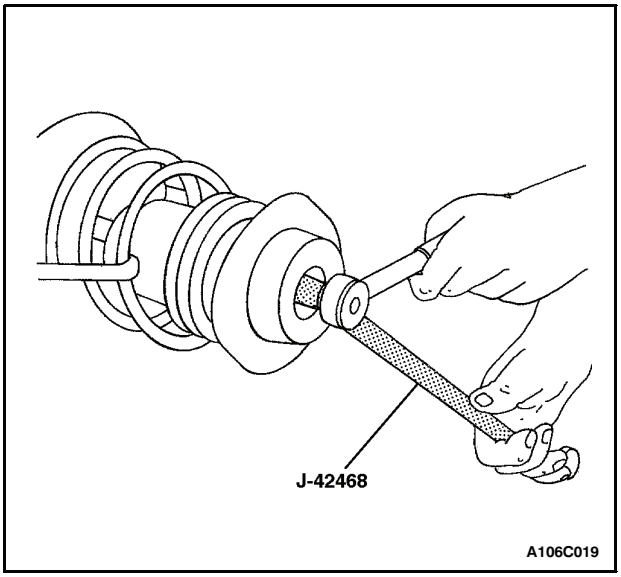
KM-465-A Front Spring Compressor

Disassembly Procedure

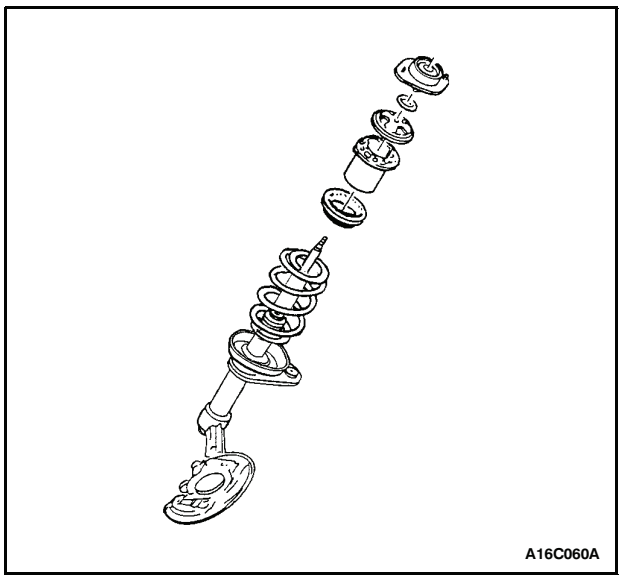
1. **Mount the front spring compressor KM-465-A and the spring compressor KM-329-A on a mounting trestle, a workbench, or any other suitable surface.**



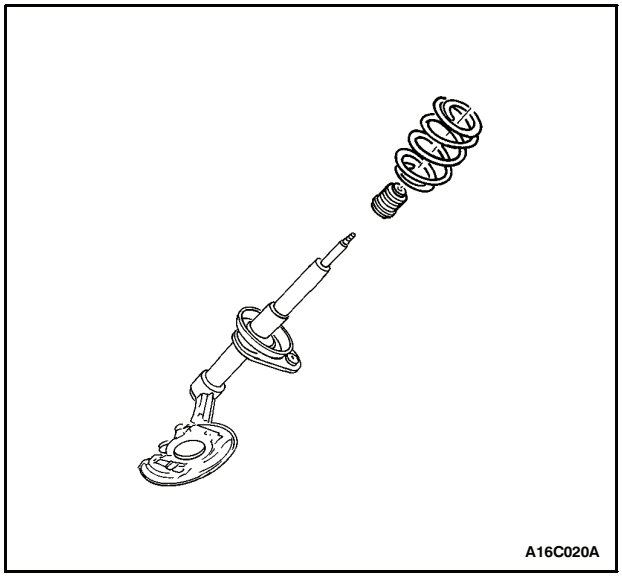
2. **Raise and suitably support the vehicle.**
3. **Remove the wheel. Refer to Section 2E, Tires and Wheels.**
4. **Remove the strut assembly. Refer to "Knuckle/Strut Assembly" in this section.**
5. **Fasten the strut assembly to the spring compressor. Make sure the hooks are seated on the strut spring properly.**
6. **Compress the front spring with the front spring compressor KM-465-A and the spring compressor KM-329-A.**



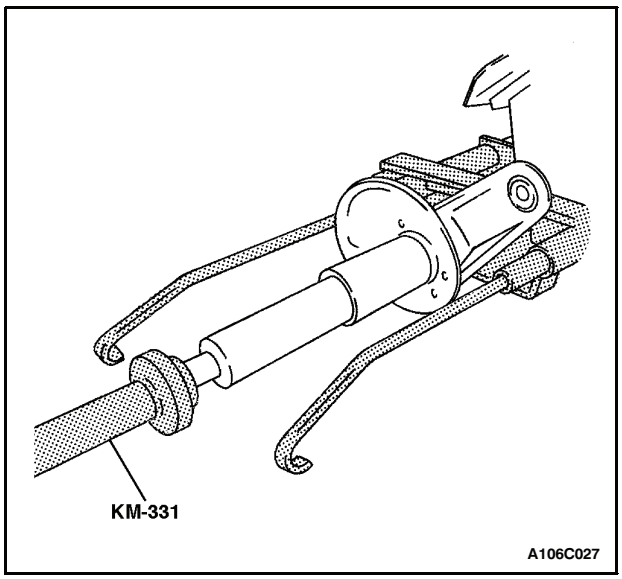
7. **Remove the dust cover from the support bearing assembly.**
8. **Use an open end wrench to hold the threaded piston rod while removing the piston rod nut with the front strut mount nut wrench J-42468. Remove the washer.**


A16C060A

9. Remove the support bearing, the washer, the plastic mount, the shield, and the upper insulator.

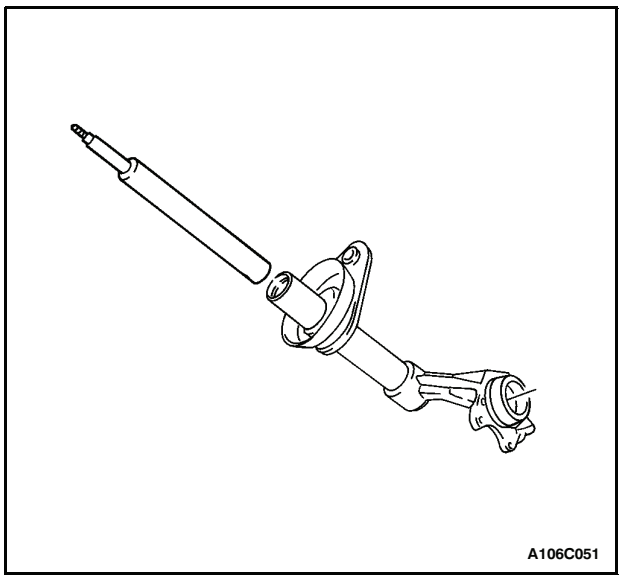

A16C020A

10. Release the spring compressor.
11. Remove the spring and the bumper.

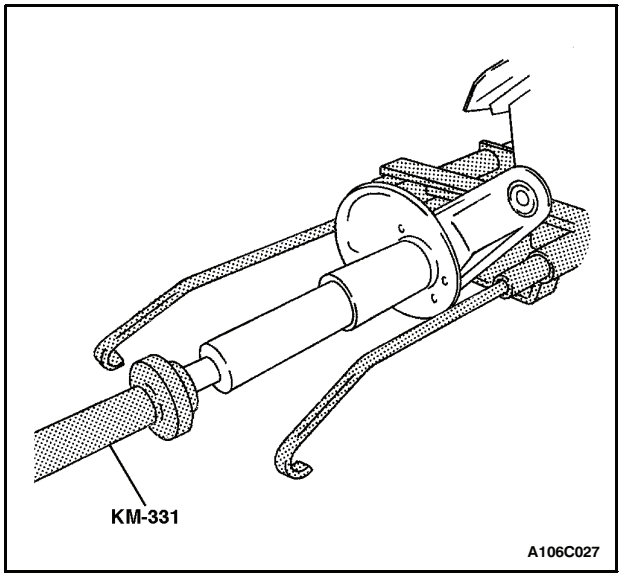


A106C027

12. Remove the strut cartridge closure nut with the strut cartridge closure nut wrench KM-331. This nut is under high torque.


A106C051

13. Remove the strut cartridge.
14. Clean the threaded area of the strut opening.



A106C027

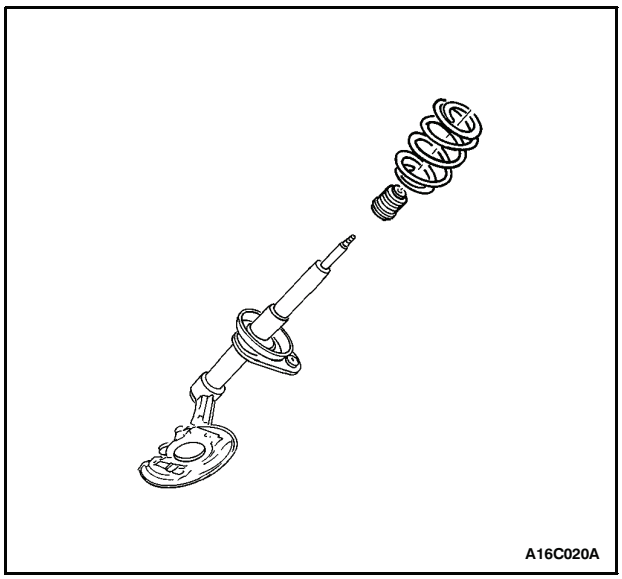
Assembly Procedure

1. Install the strut cartridge and secure it with the strut cartridge closure nut using the strut cartridge closure nut wrench KM-331.

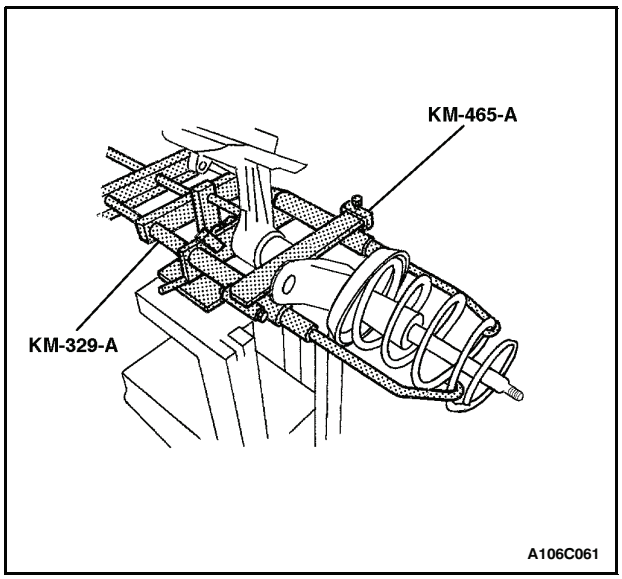
Important: Use a new strut cartridge closure nut. The new nut is coated in wax. Do not wipe off the wax. It is both a lubricant and a corrosion preventative.

Tighten

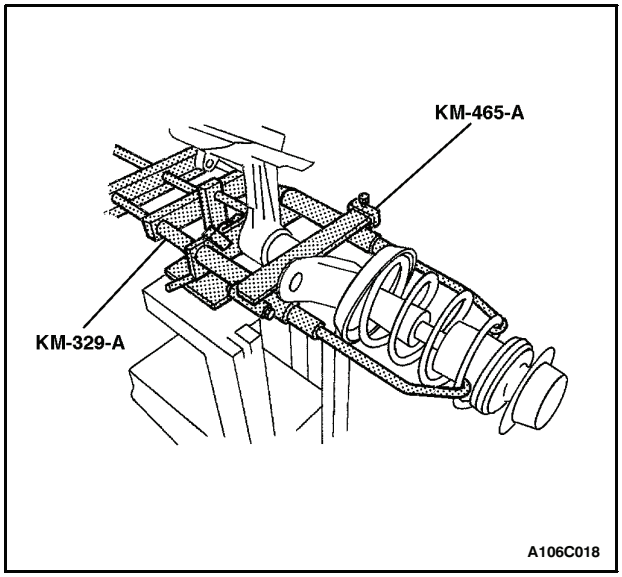
Tighten the strut cartridge closure nut to 200 N•m (148 lb-ft).


A16C020A

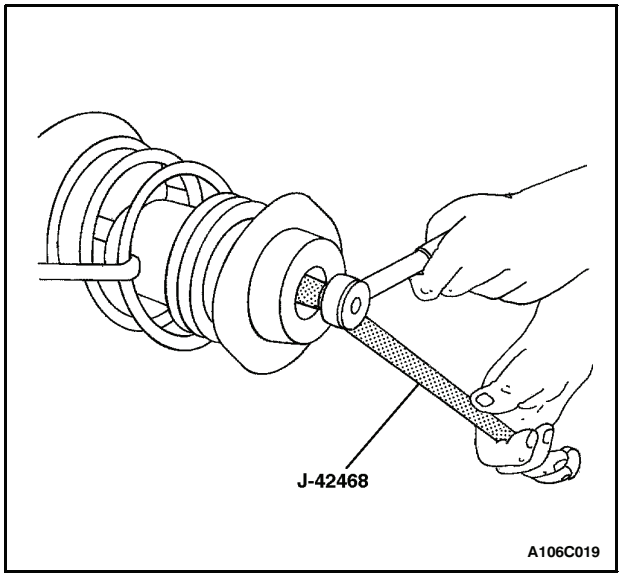
2. Lubricate the upper strut mount bearing with multipurpose grease. Refer to Section 0B, General Information.
3. Install the bumper and the spring.



4. Compress the front spring with the front spring compressor KM-465-A and the spring compressor KM-329-A.



5. Install the upper insulator, the shield, the plastic mount, the washer, and the support bearing.



6. Tighten the piston rod nut using the front strut mount nut wrench J-42468.

Tighten

Tighten the piston rod nut to 55 N•m (41 lb-ft).

7. Remove the strut assembly from the spring compressor and install the strut assembly onto the vehicle. Refer to "Knuckle/Strut Assembly" in this section.
8. Install the wheel. Refer to Section 2E, Tires and Wheels.
9. Lower the vehicle.

SUPPORT BEARING

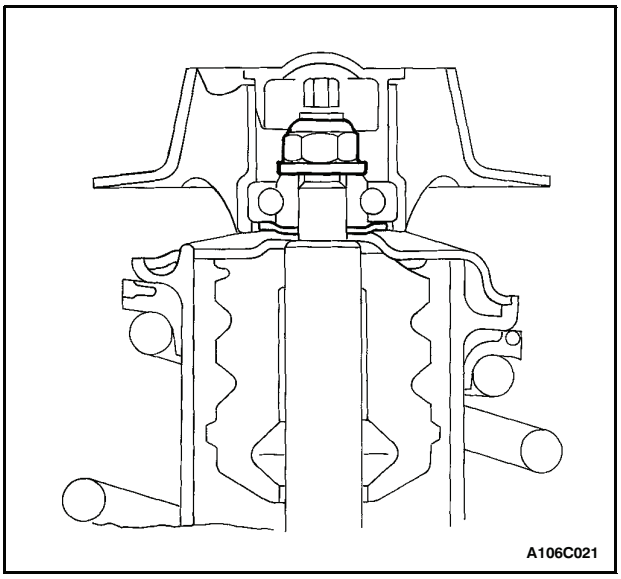
Tools Required

J-42468 Front Strut Mount Nut Wrench

Disassembly Procedure

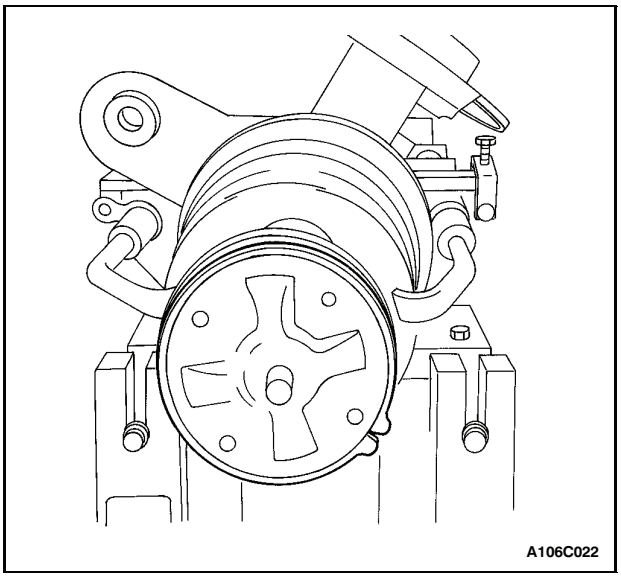
1. Raise and suitably support the vehicle.
2. Remove the wheel. Refer to Section 2E, Tires and Wheels.
3. Remove the strut assembly. Refer to "Knuckle/Strut Assembly" in this section.
4. Compress the spring and remove the support bearing. Refer to "Front Spring/Strut Cartridge" in this section.

Important: The support bearing is only supplied as an assembly with the ball bearing. This assembly cannot be further disassembled.

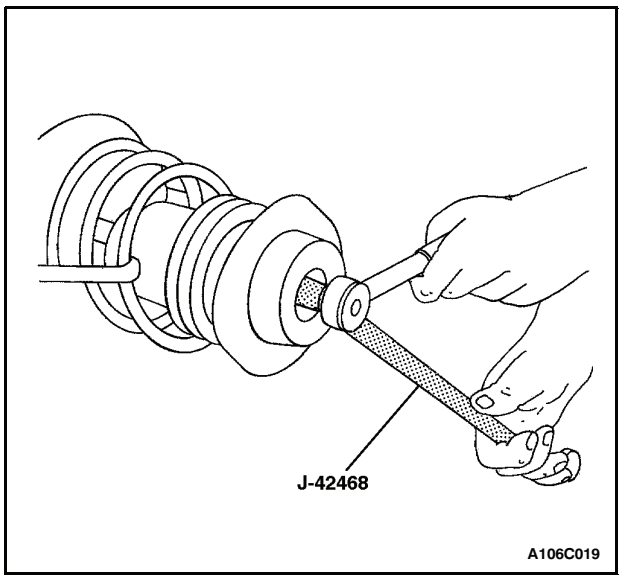

A106C021

Assembly Procedure

1. Lubricate the support bearing assembly with a multi-purpose grease. Refer to Section 0B, General Information.
2. Push the support bearing assembly onto the piston rod. Make sure that the metal washer with the raised edge is below the bearing and that the thrust washer is on top of the bearing.


A106C022

3. Use the lug on the plastic front spring mount as an installation guide. When looking in the direction of travel, the lug should point forward on the spring strut for the left side of the vehicle, and backward for the right side of the vehicle.



4. Tighten the piston rod nut using the front strut mount nut wrench J-42468.

Tighten

Tighten the piston rod nut to 55 N•m (41 lb-ft).

5. Remove the strut assembly from the spring compressor. Refer to "Knuckle/Strut Assembly" in this section.
6. Install the strut assembly onto the vehicle. Refer to "Knuckle/Strut Assembly" in this section.
7. Install the wheel. Refer to Section 2E, Tires and Wheels.
8. Lower the vehicle.

KNUCKLE

Disassembly Procedure

1. Raise and suitably support the vehicle.
2. Remove the knuckle/strut assembly from the vehicle. Refer to "Knuckle/Strut Assembly" in this section.
3. Remove the wheel hub and the wheel bearing. Refer to "Hub and Bearing" in this section.
4. Remove the spring and the strut cartridge. Refer to "Front Spring/Strut Cartridge" in this section.

Assembly Procedure

1. Install the strut cartridge and the spring. Refer to "Front Spring/Strut Cartridge" in this section.
2. Install the wheel bearing and hub. Refer to "Hub and Bearing" in this section.
3. Install the knuckle/strut assembly. Refer to "Knuckle/Strut Assembly" in this section.
4. Lower the vehicle.

GENERAL DESCRIPTION AND SYSTEM OPERATION

FRONT SUSPENSION (SOHC ENGINE)

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 bushings. 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 nut, and to the lower control arm with rivets.

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.

FRONT SUSPENSION (DOHC ENGINE)

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 bushings. 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 nut, and to the lower control arm with rivets.

When servicing the control arm-to-body attachment and the stabilizer shaft-to-body insulators, make sure that 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.

The springs in Front Suspension (DOHC engine) are stronger and the shocks are heavier than are the springs and shocks in Front Suspension (SOHC engine).

SECTION 2D

REAR SUSPENSION

TABLE OF CONTENTS

SPECIFICATIONS

GENERAL SPECIFICATIONS

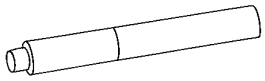
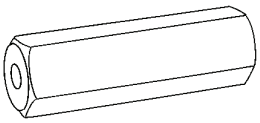
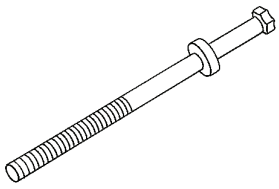
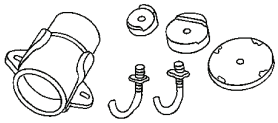
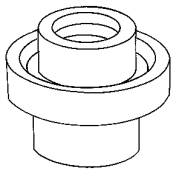
Application	Description
Shock Absorber Stud Thread Above Upper Mounting Nut	9.0 mm (0.36 in.)
Lubrication	Wheel Bearing Lubricant GM P/N 1051344

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Brake Anchor Plate-to-Rear Axle Arm Bolts	28	21	-
Rear Axle-to-Body Bracket Nuts	105	78	-
Shock Absorber-to-Axle Bolt	70	52	-
Stabilizer Shaft-at-Axle Nuts	80	59	-
Wheel Bearing Spindle Nut	25 - 180° +2	18 - 180° +1.5	-
Wheel Hub and Bearing Assembly Nuts	40 +60° +15°	30 +60° +15°	-

SPECIAL TOOLS

SPECIAL TOOLS TABLE

 A106D020	KM-266-A Remover
 A106D029	J-21474-18 Nut
 A106D030	J-21474-19 Puller Bolt/ Thrust Washer
 A106D031	J-29376-A, Rear Control Arm Bushing Service Set. Includes: • J-29376-6A Rear Control Arm Bushing Remover/Installer • J-29376-7 Rear Control Arm Bushing Plate • J-29376-A Rear Control Arm Bushing Housing
 A106D028	J-36791 Installer

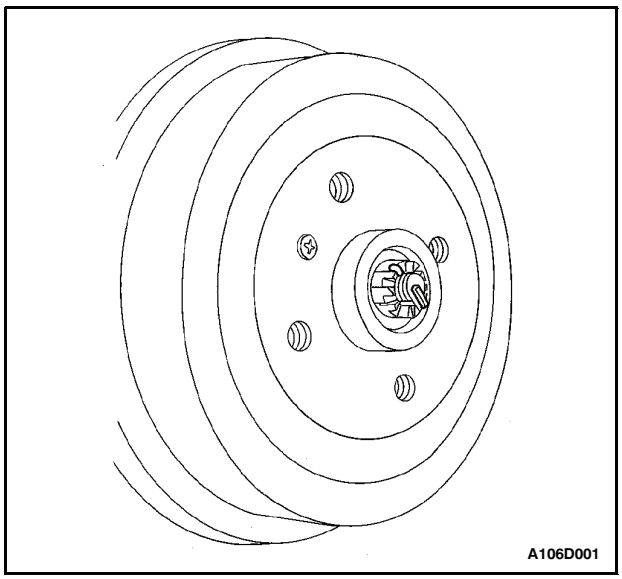
DIAGNOSIS

EXCESSIVE FRICTION TEST

Check excessive friction in the rear suspension as follows:

1. **With the aid of a helper, lift up on the rear bumper and raise the vehicle as high as possible. Slowly release the bumper and allow the car to assume normal trim height.**
2. **Measure the distance from the floor to the center of the bumper.**
3. **Push down on the bumper, release slowly, and allow the car to assume normal trim height.**
4. **Measure the distance from the floor to the center of the bumper.**

The difference between the two measurements should be less than 12.7 mm (0.50 inch). If the difference exceeds this limit, inspect the control arms for damage or wear.


A106D001

MAINTENANCE AND REPAIR

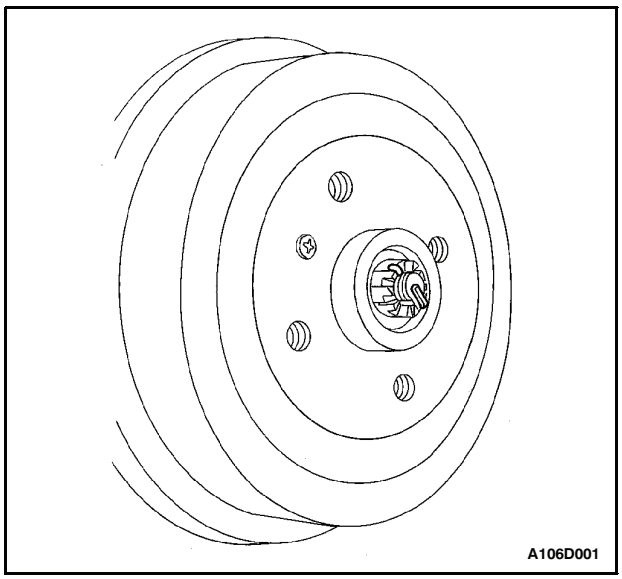
ON-VEHICLE SERVICE

WHEEL BEARING ADJUSTMENT

Adjustment Procedure

Notice: The wheel bearings can only be adjusted on cars without the anti-lock braking system.

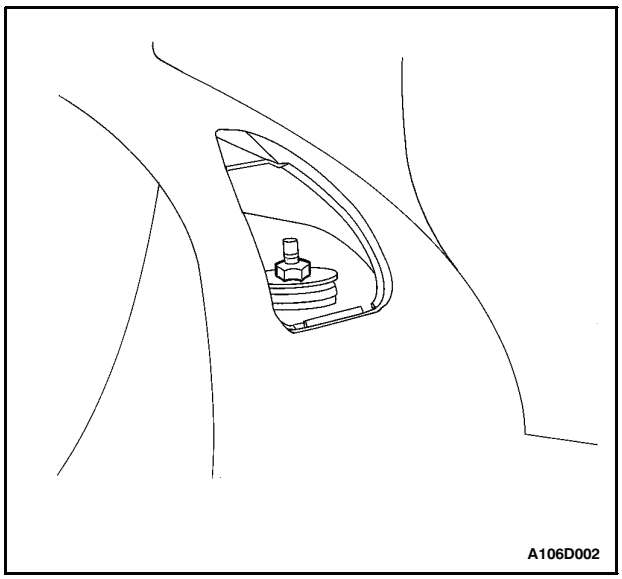
1. Remove the dust cap from the hub and the cotter pin from the spindle.


A106D001

Tighten

Tighten the wheel bearing spindle nut to 25 N•m (18 lb-ft) while turning the wheel assembly forward by hand to fully seat the bearings. This will remove any grease or burrs which could cause excessive wheel bearing play. Loosen the wheel bearing spindle nut 180 degrees. Tighten the wheel bearing spindle nut to 2 N•m (18 lb-in).

2. Install the new cotter pin and bend the ends.
3. Measure the end play. There will be from 0.03 to 0.13mm (0.001 to 0.005 inch) end play when properly adjusted.
4. Install the dust cap on the hub.

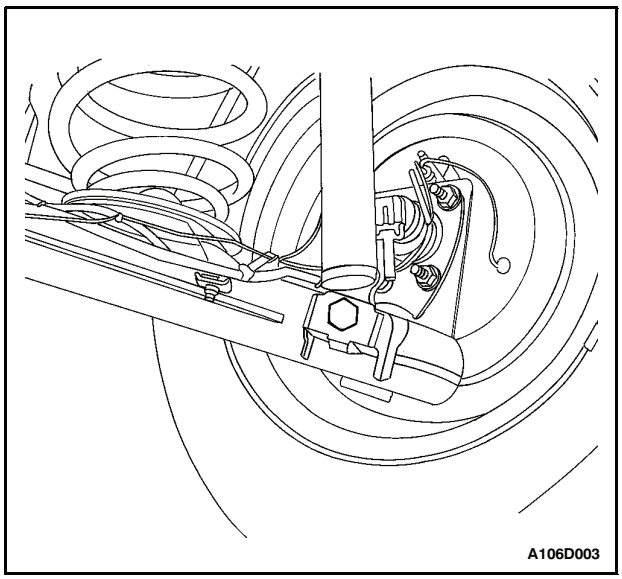

A106D002

SHOCK ABSORBER

Removal Procedure

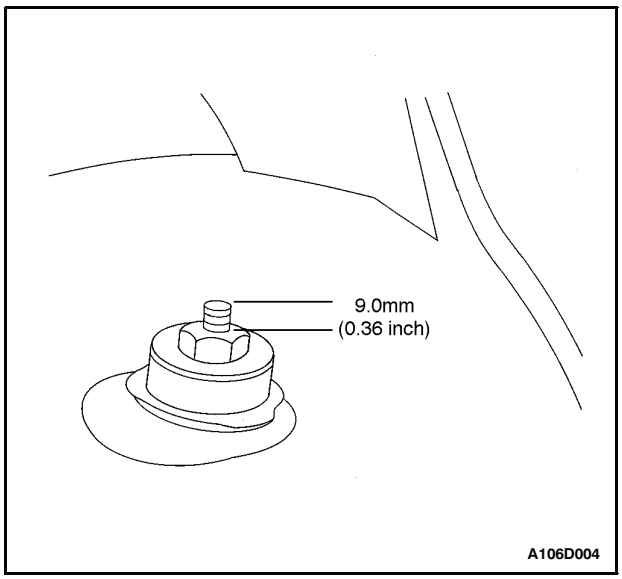
Notice: Remove only one shock at a time when both shocks are being replaced. Suspending the rear axle at full length can result in damage to brake lines and hoses.

1. Open the trunk and remove the section of the trim cover covering the upper mount nut.
2. Counterhold the threaded shock absorber shaft and remove the upper mounting nut.


A106D003

Important: When lifting the vehicle with a body hoist, it will be necessary to support the rear axle with adjustable jack stands.

3. **Raise the vehicle and support the rear axle assembly.**
4. **Remove the lower shock absorber-to-axle nut and the bolt. Remove the shock.**



A106D004

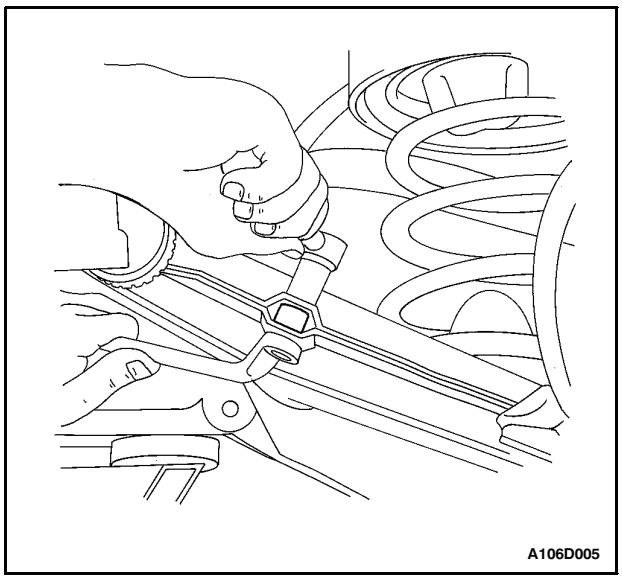
Installation Procedure

Important: It will be necessary to bring the axle assembly to trim height prior to tightening the shock absorber attachment bolts.

1. **Insert the lower shock absorber-to-axle bolt through the shock absorber lower attachment bracket and into the axle. Loosely attach the nut.**
2. **Lower the vehicle enough to guide the upper shock stud through the body opening and loosely install the attaching nut.**

   #### Tighten

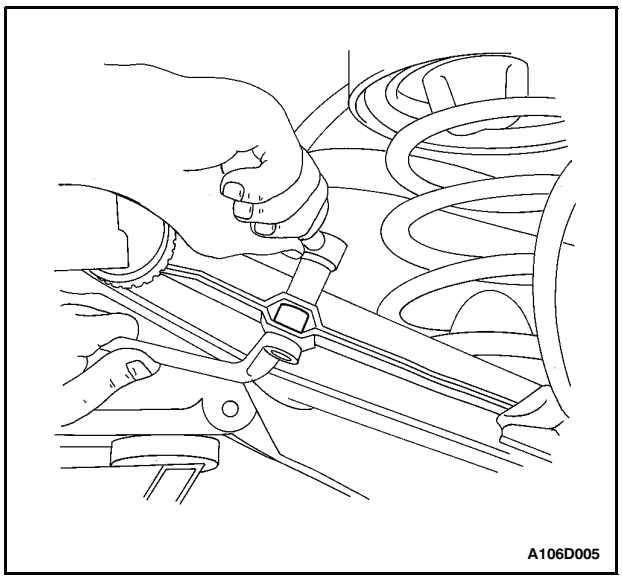
   Tighten the lower shock absorber-to-axle bolt to 70 N•m (52 lb-ft).
3. **Remove the axle support, lower the vehicle all the way, and tighten the upper nut until 9.0 mm (0.36 inch) of thread is visible.**
4. **Replace the trim cover.**


A106D005

STABILIZER

Removal Procedure

1. **Raise and suitably support the vehicle.**
2. **Remove the rear wheel. Refer to Section 2E, Tires and Wheels.**
3. **Remove the nut, the washer, and the bolt at both sides of the axle.**
4. **Remove the insulator and the stabilizer shaft.**
5. **Pull the stabilizer toward the side of the car without the wheel.**


A106D005

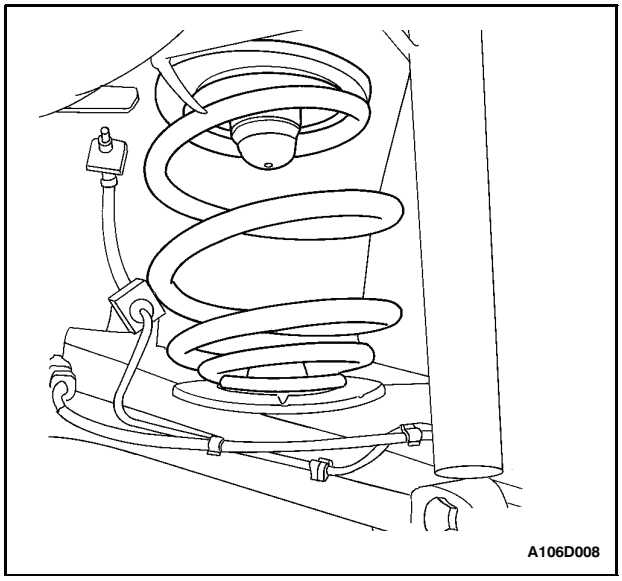
Installation Procedure

1. Install the stabilizer shaft inside the axle.
2. Install the bolts with the washers through the control arms of the axle and the stabilizer shaft. Attach the nuts onto the bolts.

Tighten

Tighten the stabilizer shaft-at-axle nuts to 80 N•m (59 lb-ft).

3. Coat the insulators with lubricant and insert them into the rear axle.
4. Replace the rear wheel. Refer to Section 2E, Tires and Wheels.
5. Lower the vehicle.

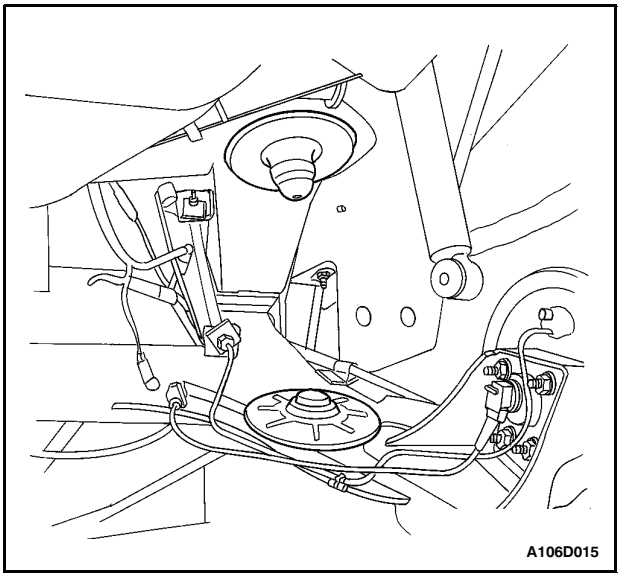

A106D008

SPRINGS AND INSULATORS

Caution: When removing the rear springs, do not use a twin-post type hoist. The tendency of the rear axle assembly to swing when certain fasteners are removed may cause it to slip from the hoist. This may result in personal injury. Perform the operation on the floor if necessary.

Removal Procedure

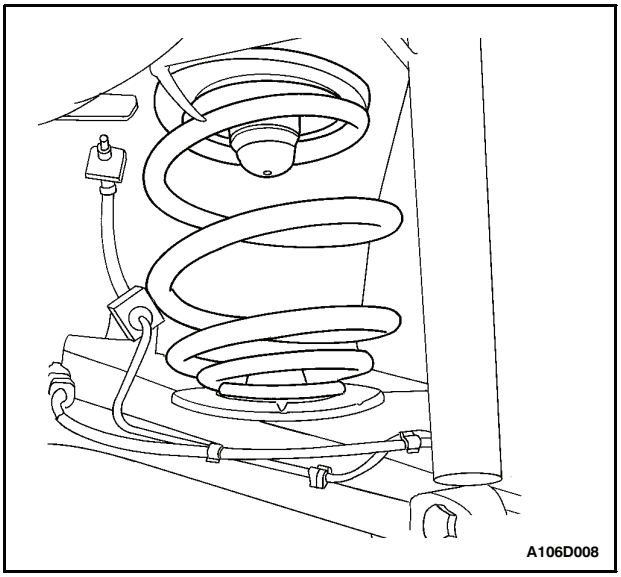
1. Raise and suitably support the vehicle. Use a frame contact hoist if possible and support the rear control arms with jack stands. If it becomes necessary to lift the vehicle with a twin-post hoist, lift the body and support the control arms with jack stands.
2. Remove the wheel. Refer to Section 2E, Tires and Wheels.
3. Remove the right and the left shock absorber bolts. Refer to "Shock Absorber" in this section.
4. Lower the rear axle and remove the springs and the top insulator.



Installation Procedure

Important: Prior to installing the springs, it will be necessary to install the upper insulators to the body with adhesive to keep them in position while raising the axle assembly and the springs.

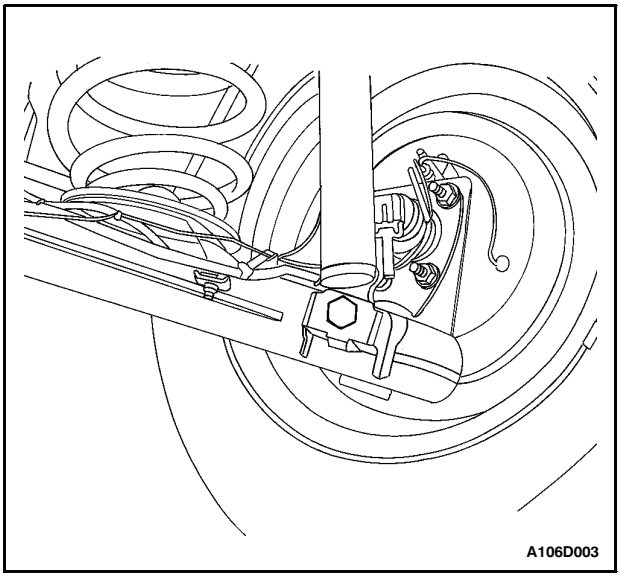
1. **Install the upper insulator and seat the lower bumper.**



2. **Install the springs and raise the axle.**
3. **Install the shock absorbers. Refer to "Shock Absorber" in this section.**

Important: It will be necessary to bring the axle assembly to trim height prior to tightening the shock absorber attachment bolts.

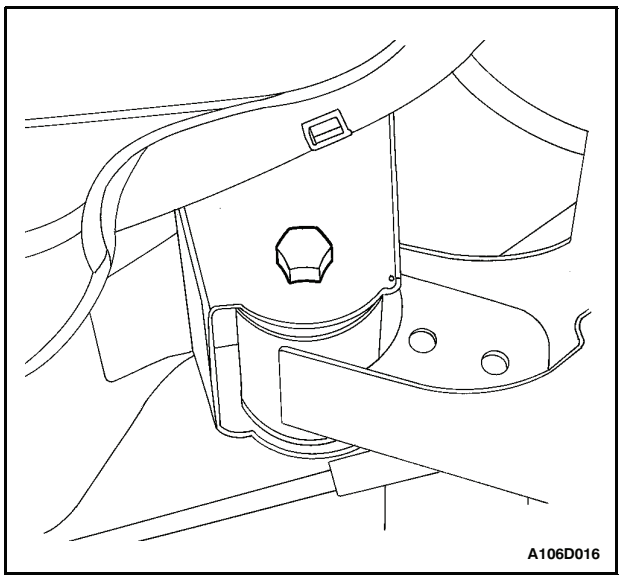
4. **Install the wheel. Refer to Section 2E, Tires and Wheels.**
5. **Remove the jack stands and lower the vehicle.**



REAR AXLE ASSEMBLY

Removal Procedure

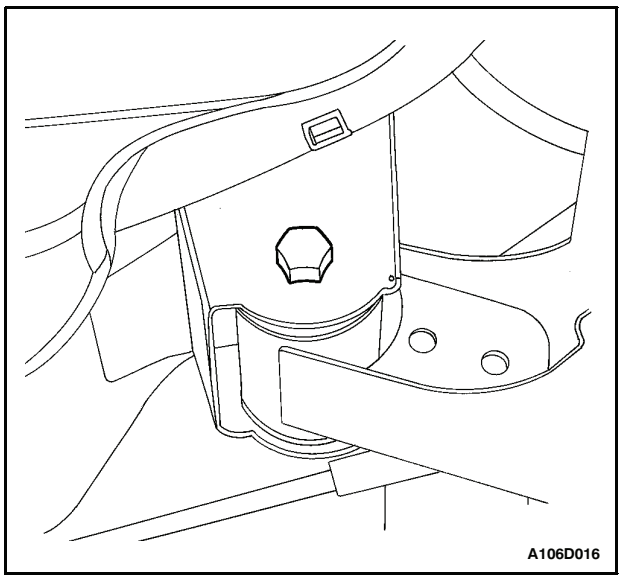
1. **Raise and suitably support the vehicle.**
2. **Remove the rear wheels. Refer to Section 2E, Tires and Wheels.**
3. **Disconnect the parking brake. Refer to Sectlon 4G, Parking Brake.**
4. **Disconnect the ABS sensor line.**



5. Disconnect the brake pipes from the brake hoses at the rear axle brackets by removing the cap screws and the retaining clip. Cap or tape the brake hose openings to prevent entry of foreign matter. Unclip the brake hose from the rear axle brackets. Refer to Section 4E, Rear Drum Brakes.
6. Place support jacks under the arms of the rear axle and raise the rear axle arms slightly.
7. Remove the shock absorbers. Refer to "Shock Absorbers" in this section.
8. Lower the support jacks and remove the rear springs. Refer to "Springs and Insulators" in this section.
9. Remove the rear axle support bolts and nuts from the underbody. Pry the rear axle slightly with a screwdriver, if required.
10. Remove the rear axle.

Installation Procedure

1. Raise the rear axle and loosely fasten it to the vehicle underbody mountings with the rear axle-to-body bracket nuts and bolts.
2. Install the rear springs and insulators. Refer to "Springs and Insulators" in this section.
3. Raise the rear axle arm with the support jacks. Attach the shock absorber to the axle with the lower attachment bolt. Refer to "Shock Absorbers" in this section.
4. Connect the brake pressure hoses into the bracket on the rear axle. Mount the retaining clips. Connect the brake pipes to the brake hoses. Bleed the brakes. Refer to Section 4E, Rear Drum Brakes.
5. Install the parking brake. Refer to Section 4G, Parking Brake.

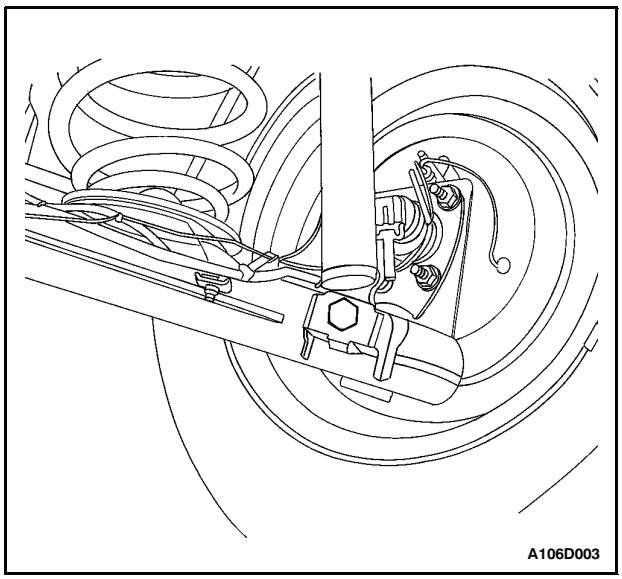


6. Lower the vehicle slightly and install the rear wheels. Refer to Section 2E, Tires and Wheels.
7. Adjust the wheel bearing (if applicable). Refer to "Wheel Bearing Adjustment" in this section.
8. At curb height, tighten the rear axle-to-body bracket nuts

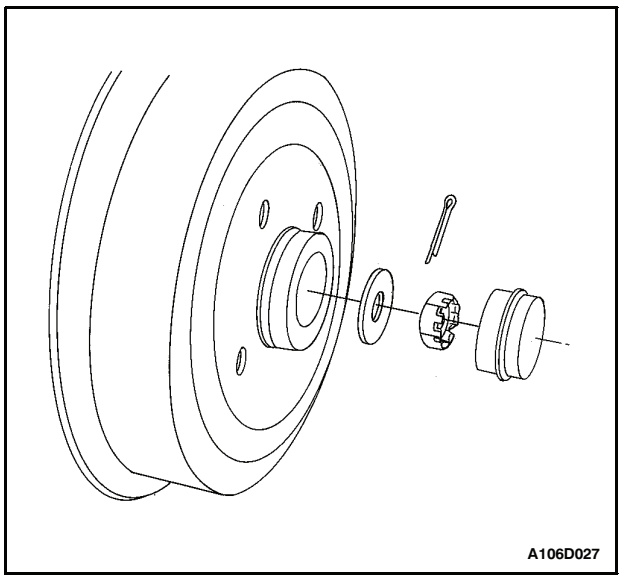
Tighten

Tighten the rear axle-to-body bracket nuts to 105 N•m (78 lb-ft).

9. Adjust the rear wheel brakes. Bleed the brake system and check for leaks. Refer to Section 4E, Rear Drum Brakes.


A106D003

10. Connect the ABS sensor line.
11. Adjust the parking brake. Refer to Section 4G, Parking Brake.
12. Lower the vehicle completely.


A106D027

HUB AND BEARING ASSEMBLY WITHOUT ABS

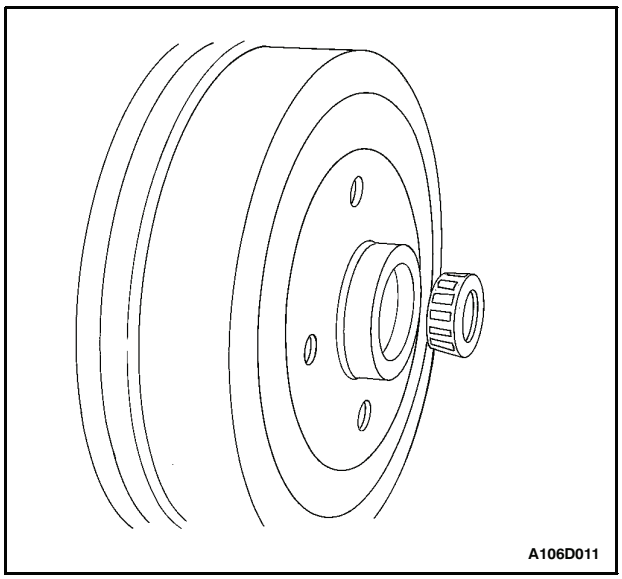
Tools Required

J-36791 Installer

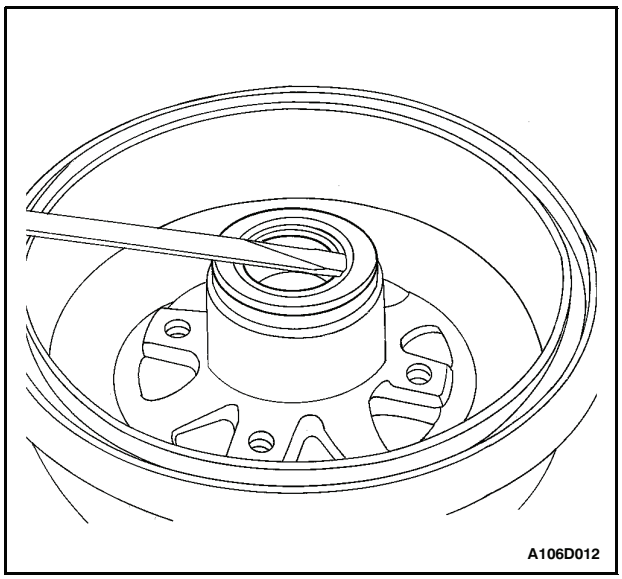
KM-266-A Installer

Removal Procedure

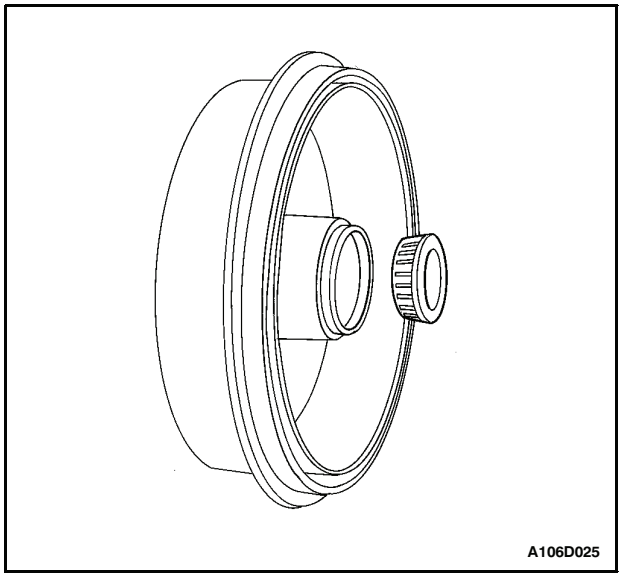
1. Raise and suitably support the vehicle.
2. Remove the wheel. Refer to Section 2E, Tires and Wheels.
3. Loosen the parking brake cable. Refer to Section 4G, Parking Brake.
4. Remove the dust cap, the cotter pin, the spindle nut and the lock washer.


A106D011

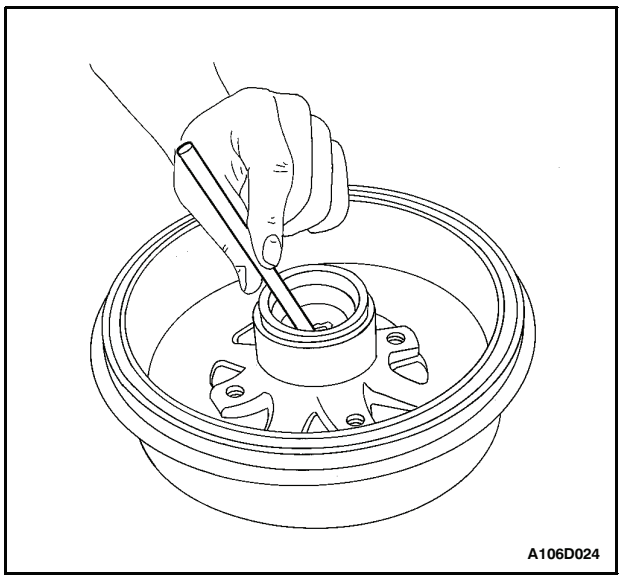
5. Remove the wheel hub and the outer tapered roller bearing.



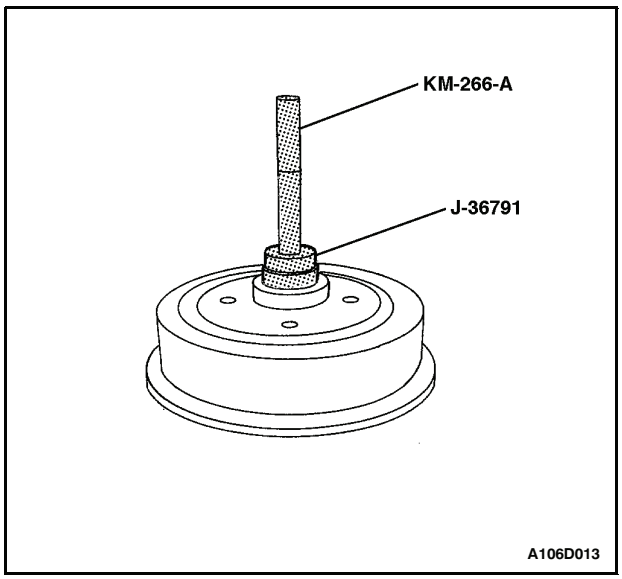
6. Pry the seal ring from the inside of the wheel hub with a screwdriver.



7. Remove the inner tapered roller bearing from the wheel hub.

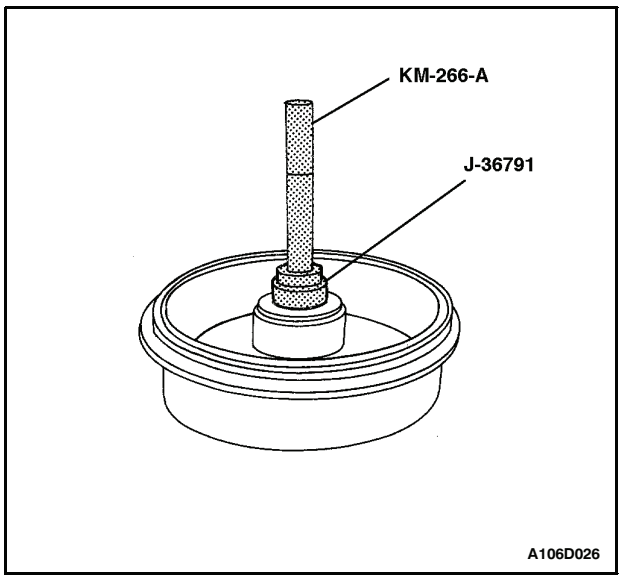


8. Remove the races of the inner and the outer bearings from the wheel hub using a drift.
9. Clean the spindle and check it for damage.

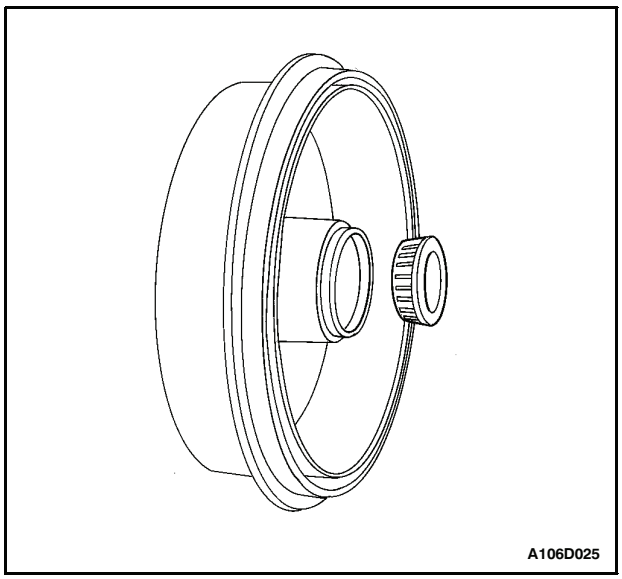


Installation Procedure

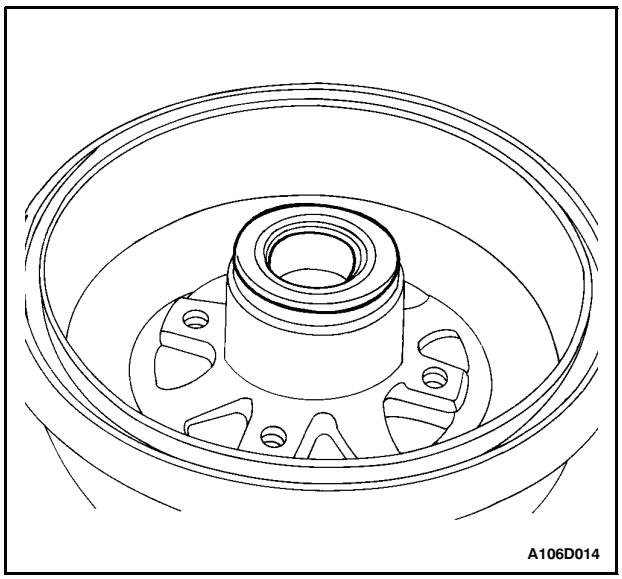
1. Press the outer race of the outer bearing into the wheel hub using installers J-36791 and KM-266-A.



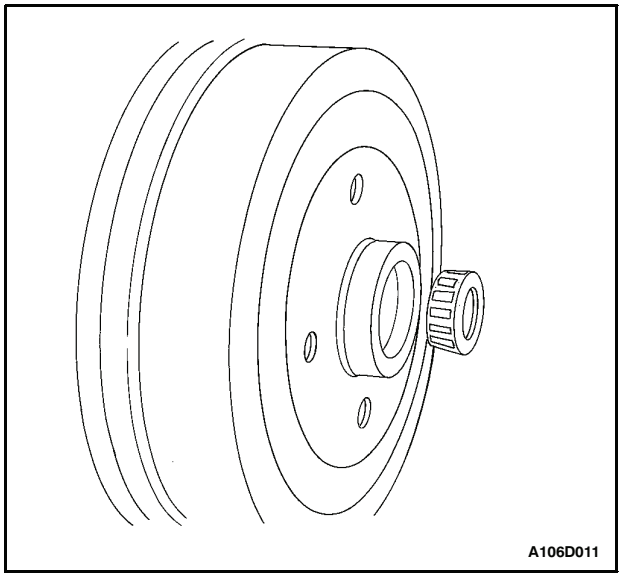
2. Press the outer race of the inner bearing into the wheel hub using installers J-36791 and KM-266-A.



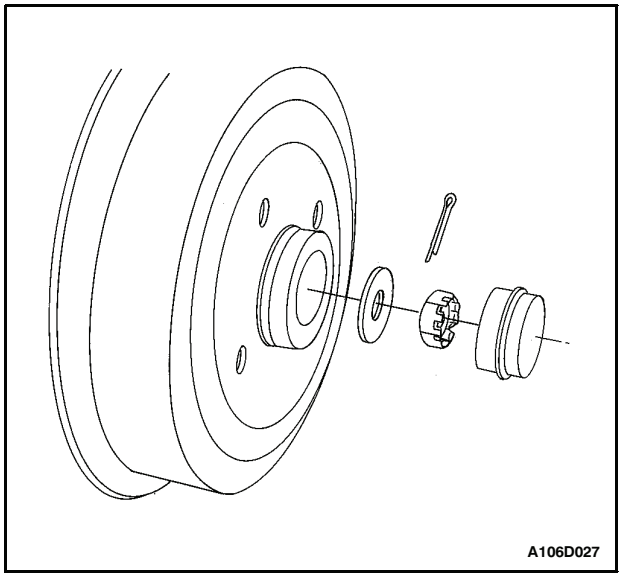
3. Install the inner tapered roller bearing.



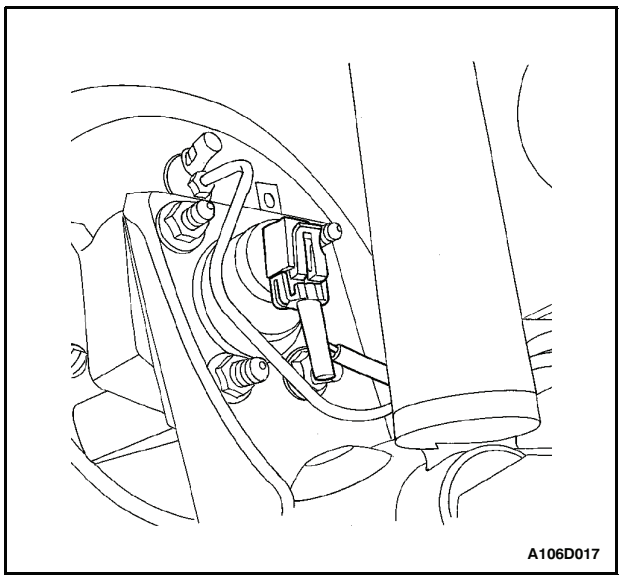
4. Coat or fill all the hollow spaces of both wheel bearings, the ring seal lip, and the wheel hub with antifriction grease. Press the seal into the hub.



5. Install the hub and bearing assembly onto the rear axle spindle.



6. Install the lock washer and spindle nut. Hand tighten the spindle nut.
7. Install the brake drum detent screw. Refer to Section 4E, Rear Drum Brakes.
8. Mount the rear wheel. Refer to Section 2E, Tires and Wheels.
9. Adjust the wheel bearing. Refer to "Wheel Bearing Adjustment" in this section.
10. Adjust the parking brake. Refer to Section 4G, Parking Brake.
11. Install the dust cap.
12. Lower the vehicle.


A106D017

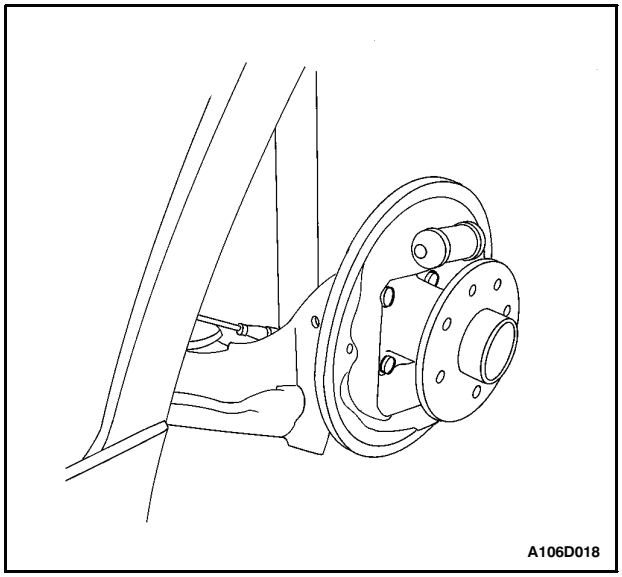
HUB AND BEARING ASSEMBLY WITH ABS

Removal Procedure

1. Raise and suitably support the vehicle.
2. Remove the wheel. Refer to Section 2E, Tires and Wheels.

Notice: Do not hammer on the brake drum. Damage to the bearing could result.

3. Remove the brake drum and the detent screw. Refer to Section 4E, Rear Drum Brakes.
4. Loosen the parking brake cable. Refer to Section 4G, Parking Brake.
5. Disconnect the ABS sensor line.


A106D018

6. Remove the wheel hub and bearing assembly by removing the bolts and the nuts.

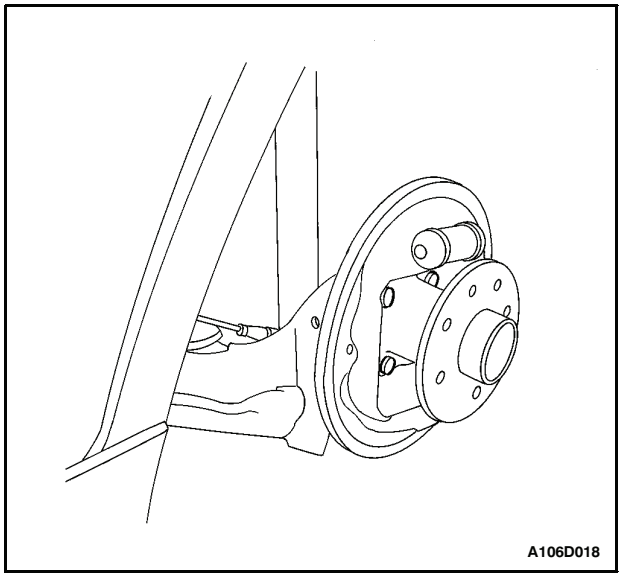
Installation Procedure

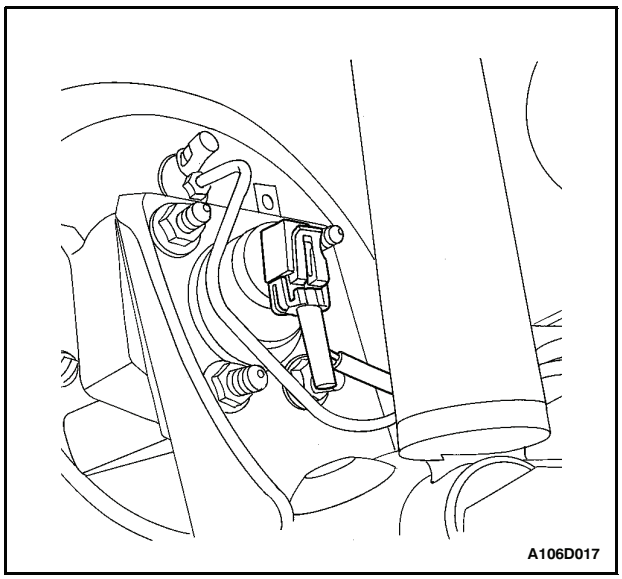
Notice: The wheel hub and bearing assembly is not to be serviced. The assembly must be replaced.

1. Install the wheel hub and bearing assembly with the bolts and the nuts.

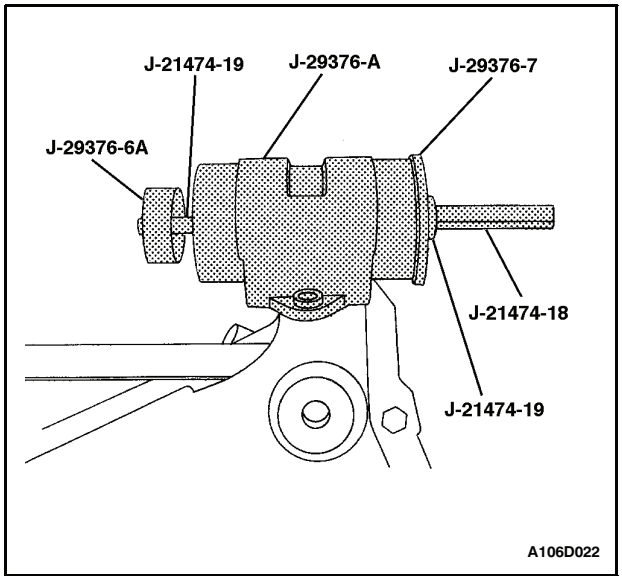
Tighten

Tighten the wheel hub and bearing assembly nuts to 40 N•m (30 lb-ft). Turn the nut an additional 60 degrees followed by an additional 15 degrees.


A106D018



2. Connect the ABS sensor line.
3. Install the brake drum and tighten the brake detent screw. Refer to Section 4E, Rear Drum Brakes.
4. Mount the rear wheel. Refer to Section 2E, Tires and Wheels.
5. Adjust the parking brake. Refer to Section 4G, Parking Brake.
6. Lower the vehicle.



UNIT REPAIR

CONTROL ARM BUSHINGS

Tools Required

KM-266-A Remover

J-21474-18 Nut

J-21474-19 Puller Bolt/Thrust Washer

J-29376-A Control Arm Bushing Housing

J-29376-6A Rear Control Arm Bushing Remover/Installer

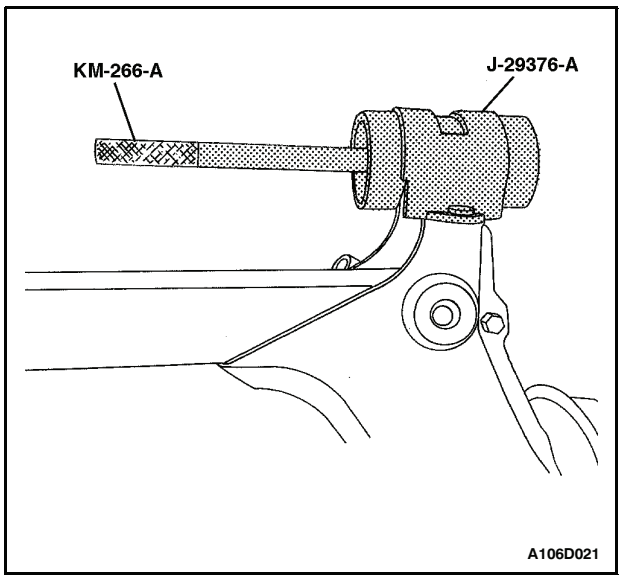
J-29376-7 Rear Control Arm Bushing Plate

Disassembly Procedure

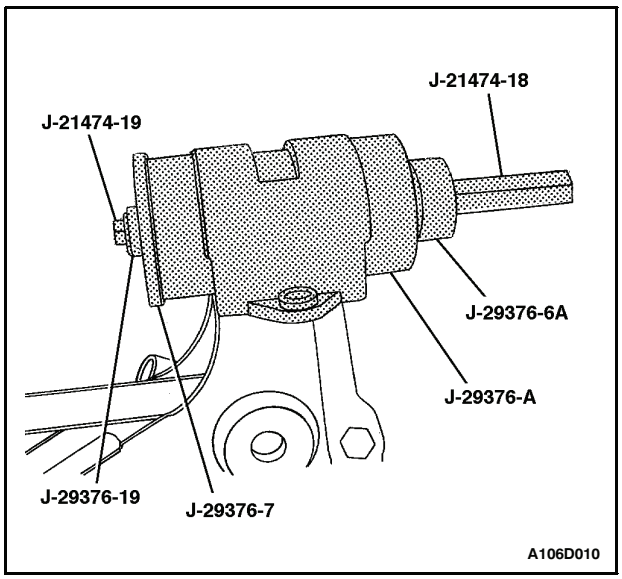
1. Raise and suitably support the vehicle.
2. Remove the rear axle and secure it to a workbench. Refer to "Rear Axle Assembly" in this section.

Notice: To facilitate removal of damping bushings, warm the rear axle in the area of the bushings to approximately 50 to 75° C (122 to 158° F) using an industrial hot air dryer.

3. Place the control arm bushing housing J-29376-A on the rear axle. Slide the puller bolt/thrust washer J-21474-19 through the control arm bushing remover/installer J-29376-6A, the rear control arm bushing, the control arm bushing plate J-29376-7 and into the nut J-21474-18.
4. Partially remove the rear axle bushing by turning the nut J-21474-18 and counterholding the puller bolt J-21474-19.

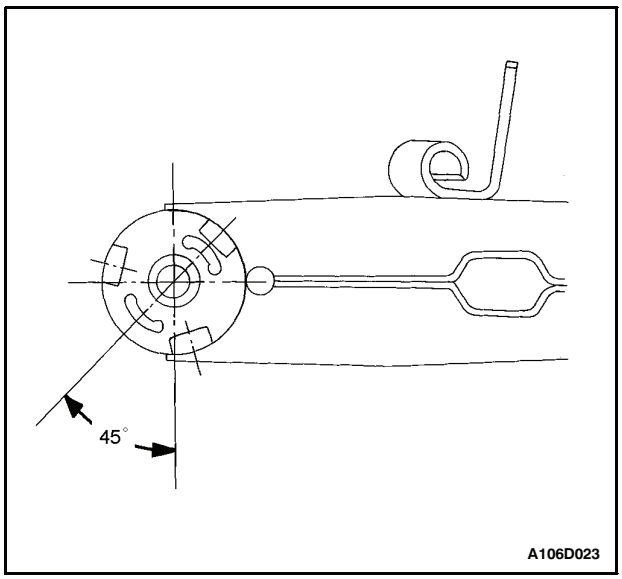


5. Remove the rear axle bushing completely by striking the control arm bushing remover/installer J-29376-6A with the remover KM-266-A.



Assembly Procedure

1. Place the control arm bushing housing J-29376-A on the rear axle. Slide the puller bolt J-21474-19 through the thrust washer J-1474-19, the control arm bushing plate J-29376-7, the rear control arm bushing, the control arm bushing remover/installer J-29376-6A and into the nut J-21474-18.
2. Install the rear axle bushing by turning the nut J-21474-18 and counterholding the puller bolt J-21474-19.



3. Be sure the bushing angle is 40 to 50 degrees to the axis of the rear axle.
4. Install the rear axle. Refer to "Rear Axle Assembly" in this section.
5. Lower the vehicle.

REAR AXLE WITHOUT ABS

Disassembly Procedure

1. Remove the rear axle. Refer to "Rear Axle Assembly" in this section.
2. Remove the hub and bearing assembly. Remove the spindle from the rear axle. Refer to "Hub and Bearing Assembly Without ABS" in this section.
3. Remove the rear brake assembly. Refer to Section 4E, Rear Drum Brakes.
4. Remove the stabilizer shaft. Refer to "Stabilizer" in this section.
5. Remove the rear control arm bushings. Refer to "Control Arm Bushings" in this section

Assembly Procedure

1. Install the rear control arm bushings. Refer to "Control Arm Bushings" in this section
2. Install the stabilizer shaft. Refer to "Stabilizer" in this section.
3. Install the rear brake assembly. Refer to Section 4E, Rear Drum Brakes.
4. Thinly coat the wheel spindle with antifriction bearing grease in the area of the brake anchor plate. Install the spindle and the hub and bearing assembly. Refer to "Hub and Bearing Assembly Without ABS" in this section.
5. Install the rear axle. Refer to "Rear Axle Assembly" in this section.
6. Adjust the wheel bearing. Refer to "Wheel Bearing Adjustment" in this section.

REAR AXLE WITH ABS

Disassembly Procedure

1. Remove the rear axle. Refer to "Rear Axle Assembly" in this section.
2. Remove the hub and bearing assembly. Refer to "Hub and Bearing Assembly" in this section.
3. Remove the rear brake assembly. Refer to Section 4E, Rear Drum Brakes.
4. Remove the stabilizer shaft. Refer to "Stabilizer" in this section.
5. Remove the rear control arm bushings. Refer to "Control Arm Bushings" in this section.

Assembly Procedure

1. Install the rear control arm bushings. Refer to "Control Arm Bushings" in this section.
2. Insert the stabilizer shaft into new rear axle and screw the shaft into place. Refer to "Stabilizer" in this section.
3. Install the rear brake assembly. Refer to Section 4E, Rear Drum Brakes.
4. Install the hub and bearing assembly. Refer to "Hub and Bearing Assembly" in this section.
5. Install the rear axle. Refer to "Rear Axle Assembly with ABS" in this section.

GENERAL DESCRIPTION AND SYSTEM OPERATION

REAR SUSPENSION

General Description

The rear suspension consists of an axle with trailing arms and a twisting cross beam, two coil springs, two shock absorbers, two upper spring insulators, and two spring compression bumper. The axle support assembly attaches to the underbody through a rubber bushing located at the front of each of the control arms. The brackets are integral with the underbody side rails. The axle structure maintains the relationship of the wheels to the body. A serviceable stabilizer shaft, incorporated with the axle beam, attaches to each of the control arms.

Each coil spring is retained between a seat in the underbody and a seat welded to the top of the rear axle control arm. The coil spring lower end rests on a compression bumper in the welded bracket on top of the rear axle, while a rubber insulator is used to isolate the coil spring upper end from the vehicle underbody seat.

SECTION 2E

TIRES AND WHEELS

TABLE OF CONTENTS

SPECIFICATIONS

TIRE SIZE AND PRESSURE SPECIFICATIONS

Inflation Pressure at Full Load

Engine	Tires	Wheel	Front		Rear	
			kPa	psi	kPa	psi
1.3 SOHC	155/80R13	5Jx13	240	35	240	35
	175/70R13	5Jx13	220	32	220	32
1.5 SOHC	175/70R13	5Jx13	220	32	220	32
	185/60R14	5.5Jx14 (steel)	220	32	220	32
	185/60R14	5.5Jx14 (Aluminum)	220	32	220	32
1.6 DOHC	185/60R14	5.5Jx14 (Steel)	220	32	220	32
	185/60R14	5.5Jx14 (Aluminum)	220	32	220	32

INFLATION PRESSURE CONVERSION SPECIFICATIONS

kPa	psi	kPa	psi	kPa	psi
140	20	185	27	235	34
145	21	190	28	240	35
155	22	200	29	250	36
160	23	205	30	275	40
165	24	215	31	310	45
170	25	220	32	345	50
180	26	230	33	380	55

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Wheel Bolt (Aluminum Wheel)	90	66	-
Wheel Bolt (Steel Wheel)	90	66	-

DIAGNOSIS

WHEEL RUNOUT

Measure wheel runout with an accurate dial indicator. Measurements may be taken with the wheels either on or off the vehicle, using an accurate mounting surface such as a wheel balancer. Measurements may be taken with or without the tire mounted on the wheel.

Measure radial runout and lateral runout on both the inboard and the outboard rim flanges. With the dial indicator firmly seated next to the wheel and tire assembly, slowly rotate the wheel one revolution and record the indicator reading. If any measurement exceeds the following specifications and there is a vibration that wheel balancing will not correct, replace the wheel. Disregard any indicator readings due to welds, paint runs, or scratches.

Steel Wheels

- **Radial runout: 0.8 mm (0.03 inch)**
- **Lateral runout: 1.0 mm (0.04 inch)**

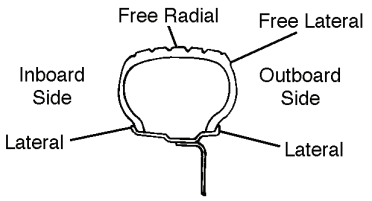
Aluminum Wheels

- **Radial runout: 0.8 mm (0.03 inch)**
- **Lateral runout: 0.8 mm (0.03 inch)**

Measure free radial runout on the center of the tire tread. The tread can be taped to present a smooth surface. Measure free lateral runout on the outboard side of the tire nearest to the tread.

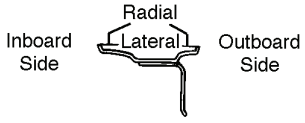
Steel and Aluminum Wheels

- **Free radial runout: 1.5 mm (0.06 inch)**
- **Free lateral runout: 1.5 mm (0.06 inch)**



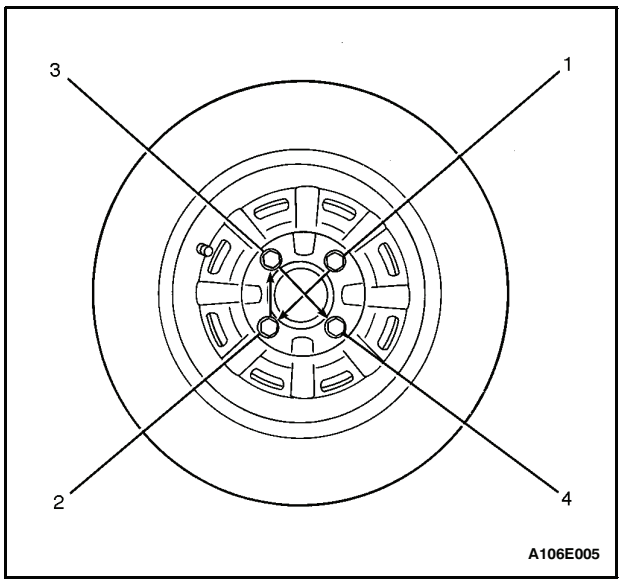
If Wheel Design Makes This Outboard Measurement Impossible, The Inboard Side Only May Be Used

Tire Removed from Wheel



A Dial Indicator Should Be Used

C106E004



MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

WHEEL

Removal Procedure

1. Loosen the wheel bolts.
2. Raise and suitably support the vehicle.
3. Remove the wheel bolts.

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.

4. 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 bolts on the affected wheel and then loosening the wheel bolts 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.

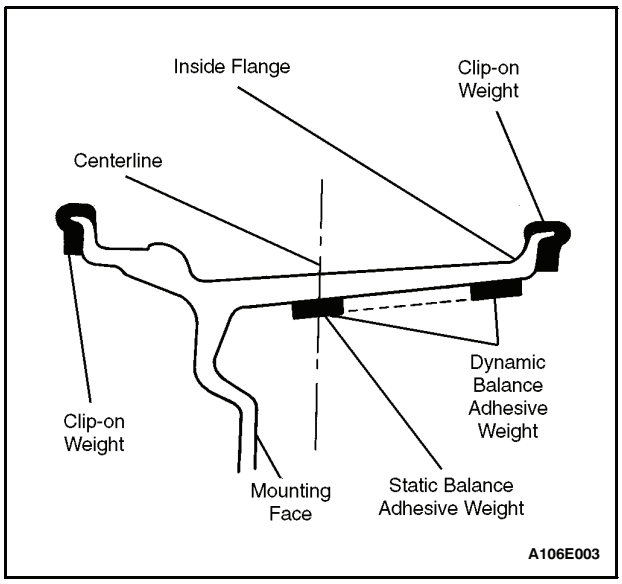
Installation Procedure

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 bolts 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 bolts in the sequence shown. Do not tighten the wheel bolts.
3. Lower the vehicle.

Tighten

Tighten the wheel bolts to 90 N•m (66 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.**

Caution: Do not spin the drive wheels faster than 55km/h (35 mph) as indicated by the speedometer. This limit is necessary because the speedometer indicates only one-half of the actual wheel speed when one drive wheel is spinning and the other drive wheel is stopped. Personal injury and damage may result from high-speed spinning.

3. **Spin the driven tire and wheel assemblies using the engine.**

UNIT REPAIR

ALUMINUM WHEEL POROSITY

Wheel repairs that use welding, heating or peening are not approved.

1. **Raise and suitably support the vehicle.**
2. **Remove the tire and wheel assembly. Refer to "Wheel" in this section.**

Caution: To avoid serious injury, do not stand over the tire when inflating, because the bead may break when it snaps over the safety hump. Do not exceed 275 kPa (40 psi) of air pressure in any tire if the beads are not seated. If 275 kPa (40 psi) of air pressure will not seat the beads, deflate the tire. Relubricate the beads. Reinflate the tire. Overinflation may cause the bead to break and cause serious injury.

3. **Locate leaking areas by inflating the tire to 345 kPa (50 psi) and dipping the tire and wheel assembly into a water bath.**
4. **Mark the leak areas and remove the tire from the wheel.**
5. **Scuff the inside wheel surface at the leak area with 80-grit sandpaper. Clean the leak area with a general-purpose cleaner.**
6. **Apply a 3.3 mm (0.13 inch) thick layer of adhesive/sealant to the leak area. Allow it to dry for 12 hours.**
7. **Install the tire on the wheel. Inflate the tire to 345 kPa (50 psi) and check for leaks as in step 3.**

8. Adjust the tire pressure to meet specifications. Refer to "Tire Size and Pressure Specifications" in this section.
9. Balance the tire and wheel assembly. Refer to "Tire and Wheel Balancing" in this section.
10. Install the tire and wheel assembly. Refer to "Wheel" in this section.
11. Lower the vehicle.

ALUMINUM WHEEL REFINISHING

A protective clear or color coating is applied to the surface of the original equipment cast aluminum wheels. Surface degradation can develop if this clear coating is damaged or removed. This can happen at some automatic car wash facilities that use silicone carbide-tipped tire brushes to clean white walls and tires. Once the protective coating is damaged, exposure to caustic cleaners or road salt causes further surface degradation. The following procedure details how to strip, clean and recoat aluminum wheels.

Caution: Follow the manufacturer's recommendaĆ tions and cautions when using these materials.

Required materials:

Amchem Alumi Prep No. 23, stock No. DX533 or equivalent cleaning and conditioning chemical for aluminum.

Amchem Alodine No. 101, stock No. DX50T or equivalent coating chemical for aluminum.

Ditzler Delclear Acrylic Urethane Clear, Stock No. DAU-75 or equivalent.

Ditzler Delthane Ultra-Urethane Additive, Stock No. DXR-80 or equivalent.

Before repairing the aluminum damage or the clear coat damage, prepare the wheels and the tires.

1. Remove the wheel from the vehicle.
2. Mark the location of the outboard weights and remove them.
3. Wash the wheel inside and out with a water-based, all-purpose cleaner. Remove the grease and oil with a solvent cleaner.
4. Mask the tire prior to painting.
5. Using a 400-grit wet or dry sandpaper, sand over the painted areas that will not require recoloring. Sanding will promote the adhesion of the clear coat.

Aluminum Damage on Wheel Surface

1. Mount the wheel on a brake lathe and spin the assembly slowly.

2. Sand the wheel with a backing block or pad. Hold the backing block or pad flat to the surface of the wheel and sand slowly back and forth from the center to the outer edge of the tire to remove the damage. Use the following sandpaper grits in the order listed:
   2.1. 80 grit.
   2.2. 150 grit.
   2.3. 240 grit.

Clear Coat Damage on Unpainted Wheels

1. Apply the chemical stripper Amchem Alumi Prep No. 23. Use a small 1/4-inch detail brush to apply the stripper around the perimeter and spoke-like areas.
2. Remove the stripper according to manufacturer's recommendations.

Caution: To avoid serious personal injury, do not use engine power to rotate the wheel while sanding.

1. Sand the wheel with 240-grit sandpaper by rotating the wheel on a slow-spinning brake lathe or by mounting the wheel on the car and spinning it by hand. Sanding restores the machined appearance and promotes adhesion.

After repairing the aluminum or clear coat damage, the wheels must be recoated.

Recoating Procedure

Caution: To avoid serious personal injury when apÇ plying any two- part component paint system, folC low the specific precautions provided by the paint manufacturer. Failure to follow these precautions may cause lung irritation and an allergic respiratory reaction.

1. Clean the surface.
2. Soak the wheel with Amchem Alumi Prep No. 33 or equivalent for 1 to 3 minutes. Rinse the wheel with water and blow it dry.
3. Soak the wheel with Amchem Alodine No. 1001 or equivalent for 1 to 3 minutes. Rinse the wheel with water and blow it dry.
4. Finish with Ditzler Delclear Urethane and Ditzler Ultra-Urethane Additive or equivalent, using three coats.
   1st coat - spray on a light mist coat; let dry.
   2nd coat - spray or paint on a light coat; let dry.
   3rd coat - spray or paint on a heavy double wet coat; let dry.
5. Let the urethane dry for 24 hours or flash for 30 minutes and force dry at 60°C (140°F) for 30 minutes. Allow the urethane to cool for 5 minutes before mounting the wheel on the vehicle.

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 (usually to within 1/8 ounce). Secure the wheel on the balancer with a cone through the back side of the centerhole, not through the wheel bolt 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.

TIRE MOUNTING AND DISMOUNTING

Notice: Use a tire-changing machine to mount or dismount the tires. Follow the equipment manufacturer's instructions. Do not use hand tools or tire irons to change tires. These tools may damage the beads or the wheel rim.

1. **Clean the rim bead seats with a wire brush or coarse steel wool to remove lubricants, old rubber, and light rust. Before mounting or dismounting a tire, lubricate the bead area well with an approved tire lubricant.**

Caution: To avoid serious injury, do not stand over the tire when inflating it, because the bead may break when it snaps over the safety hump. Do not exceed 275 kPa (40 psi) of air pressure in any tire if the beads are not seated. If 275 kPa (40 psi) of air pressure will not seat the beads, deflate the tire. ReĆ lubricate the bead and reinflate the tire. OverinflaĆ tion may cause the bead to break and cause serious injury.

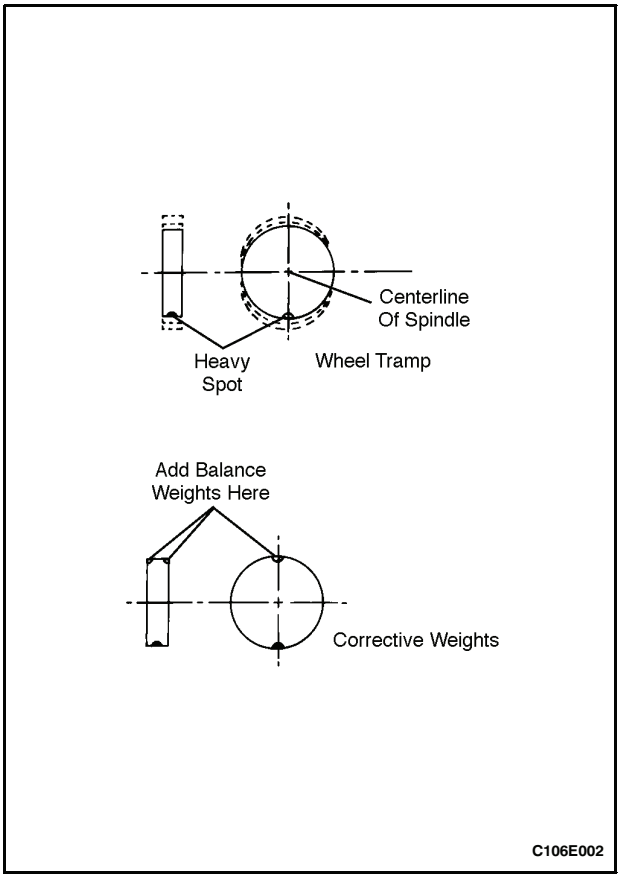
2. **After mounting the tire, inflate it until the beads are seated. Never exceed 275 kPa (40 psi) to seat the beads.**
3. **Install the valve core and inflate the tire to the proper pressure. Make sure the locating ring outside of the bead of the tire shows around the rim flanges of the wheel on both sides. This positioning of the tire will insure that the bead of the tire is seated.**

GENERAL DESCRIPTION AND SYSTEM OPERATION

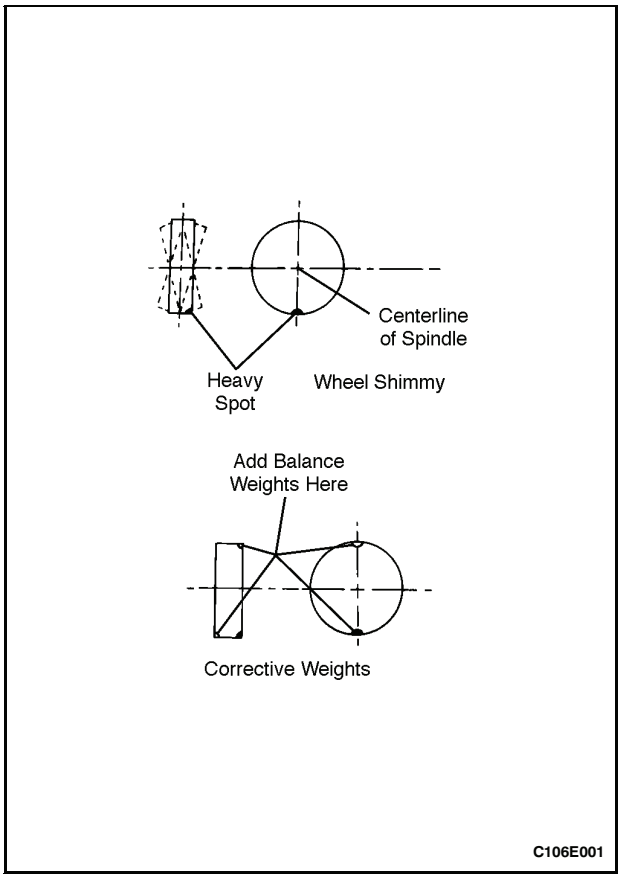
TIRE AND WHEEL BALANCING

There are two types of tire and wheel balancing: static and dynamic.

Static balance is the equal distribution of weight around the wheel. Assemblies that are statically unbalanced cause a bouncing action called wheel tramp. This condition may eventually cause uneven tire wear.



Dynamic balance is the equal distribution of weight on each side of the centerline so that when the assembly spins there is no tendency for it to move from side to side. Assemblies that are dynamically unbalanced may cause wheel shimmy.



General Balance Precautions

Remove all deposits of foreign material from the inside of the wheel.

Caution: Remove stones from the tread in order to avoid operator injury during spin balancing.

Inspect the tire for any damage. Balance the tire according to the equipment manufacturer's recommendations.

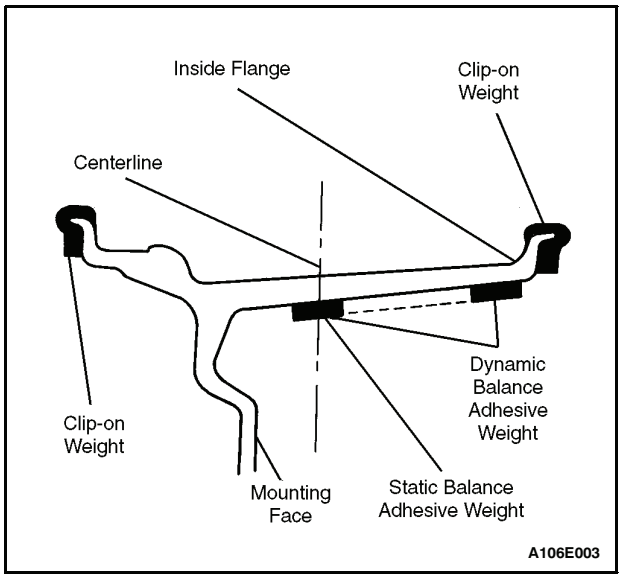
Wheel Weights

If more than 85 grams (3.0 ounces) are needed to static balance the wheel, split the wheel weights as equally as possible between the inboard and the outboard flanges.

Balancing the assemblies with factory aluminum wheels requires the use of special nylon-coated, clip-on wheel weights. These weights are designed to fit over the

thicker rim flange of the aluminum wheel. Install these weights with a plastic-tipped hammer.

Adhesive wheel weights are also available. Use the following procedure to install adhesive wheel weights.



Adhesive Wheel Weight Installation

1. Clean the wheel by sanding it to bare aluminum where the wheel weight will be installed.
2. Use a clean cloth or paper towel saturated with a mixture of half isopropyl alcohol and half water to wipe the place where the wheel weight will be installed.
3. Dry the area with hot air. The surface of the wheel should be warm to the touch.
4. Warm the adhesive backing on the wheel weights to room temperature.
5. Remove the tape from the back of the weights. Do not touch the adhesive surface.
6. Apply the the wheel weight and press it on with hand pressure.
7. Secure the wheel weight with a 70-110 N (16-25 lb) force applied with a roller.

TIRE CHAIN USAGE

Due to limited tire-to-body clearance on certain vehicles, recommendations for tire chain use are published in the Owner's Manual. When tire chains need to be used, most current Daewoo vehicles require SAE Class "S" tire chains. These may also be designated as 1100 Series, type PL tire chains. These chains are specifically designed to limit the "fly off" effect which occurs when the wheel rotates.

Be sure that only fine-link chains are used which do not add more than 15 mm (0.590 inch), including the lock, to the tread surface and the inner sides of the tires. Manufacturers of tire chains have a specific chain size for each tire size to ensure a proper fit when the chain is installed. Be sure to purchase the correct chains for the tires on which they are to be used. Use rubber adjusters to take up any slack or clearance in loose chains.

Use of chains may adversely affect vehicle handling.

When tire chains are installed, follow these precautions:

- Adjust speed to road conditions.
- Avoid sharp turns.
- Avoid locked-wheel braking.

To prevent chain damage to the vehicle, install the chains on the front tires as tightly as possible. Tighten them again after driving 0.4 to 0.8 kilometer (0.3 to 0.5 mile). The use of chains on the rear tires is not recommended because they may contact the vehicle and possibly damage it. If chains must be used on the rear tires, be sure there is sufficient clearance between the chains and the body. Do not exceed 70 km/h (45 mph) or the chain manufacturer's speed limit, if lower. Avoid large bumps, potholes, severe turns and any other maneuvers which could cause the tires to bounce. Follow any other instructions of the chain manufacturer which do not disagree with the above instructions.

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.

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.

PASSENGER METRIC SIZED TIRES

All Daewoo vehicles now use Passenger (P) metric sized tires. P-metric tires are available in two load ranges: standard load (35 psi maximum) and extra load (41 psi maximum). Most passenger vehicle tires are standard load.

Most P-metric tire sizes do not have exact corresponding alphanumeric tire sizes. For example, a P175/70R13 is not exactly equal in size and load-carrying capacity to an FR70-13. For this reason, replacement tires should be of the same TPC specification number as the originals. If P-metric tires must be replaced with other sizes, consult a tire dealer. Tire companies can best recommend the closest match of alphanumeric to P-metric sizes within their own tire lines.

The metric term for measuring tire inflation pressure is the kilopascal (kPa). Tire pressure may be printed in both kPa and psi. One psi equals 6.895 kPa.

See the tire label or refer to "Tire Size and Pressure Specifications" in this section for tire inflation pressures.

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. The wheel offset is 49 $\pm$1 mm (1.93 $\pm$0.04 inches). Steel wheels may be identified by a two- or three-letter code stamped into the rim near the valve stem. Aluminum wheels should have the code, the part number, and the manufacturer ID cast into the back side.

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.

For sustained driving at speeds up to 140 km/h (85 mph), inflate the tires to the pressure recommended on the tire. Sustained driving at speeds faster than 140 km/h (85 mph), even if permitted by law, is not advised unless the vehicle has special high-speed tires available from many tire dealers. Tire pressures may increase as much as 41 kPa (6 psi) when the tires are hot.

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