SUSPENSION
10

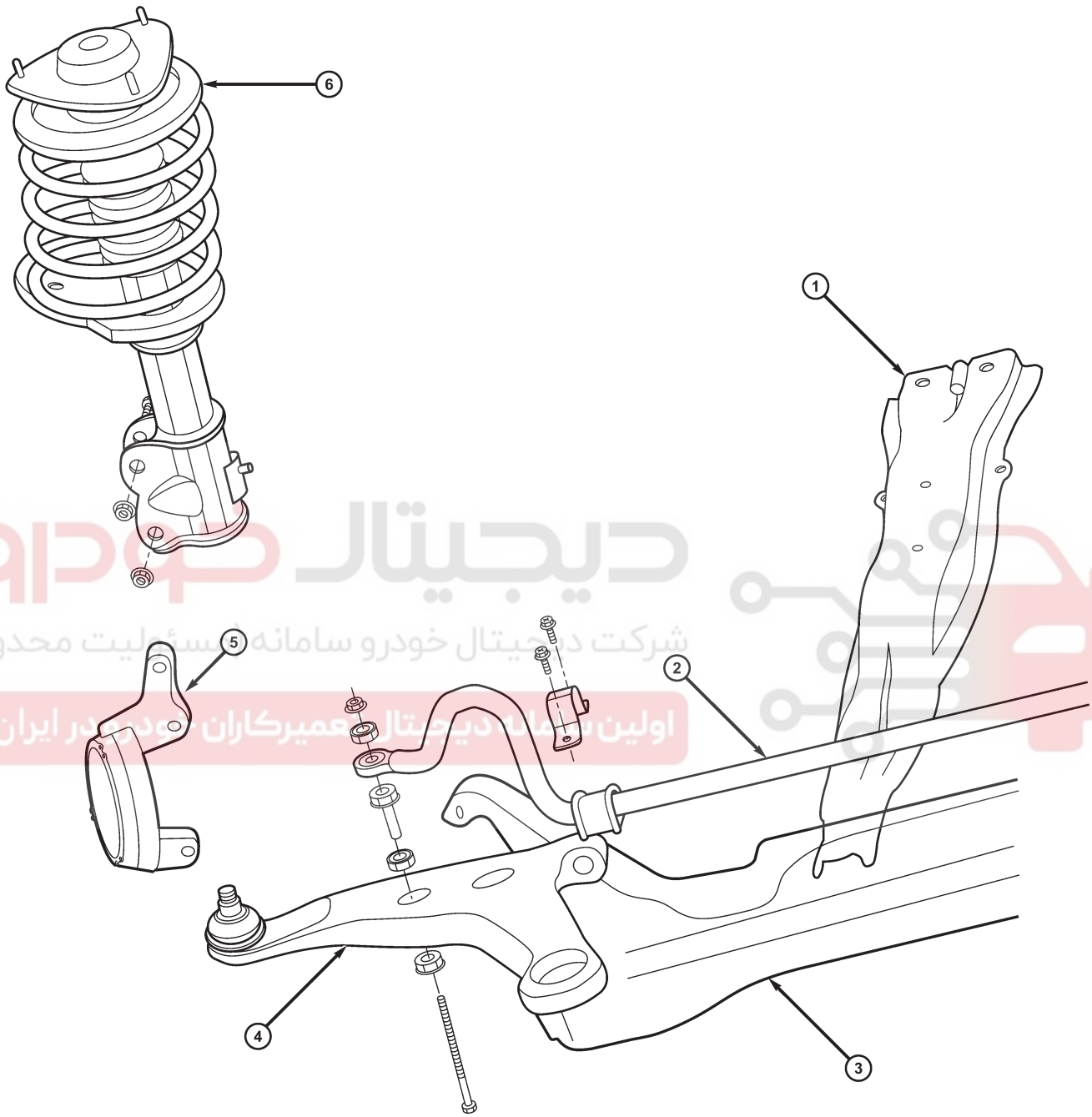
CONTENTS

FRONT SUSPENSION

GENERAL INFORMATION

Description

The suspension system incorporates a strut assembly that takes the place of the upper control arm and upper ball joint. The strut carries out the function of a shock absorber and is encompassed by a coil spring. The strut and spring assembly supports the weight of the vehicle and is also the pivot point for the steering knuckle. This system uses a lower control arm and ball joint for the lower pivot point of the steering knuckle.



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The front suspension consists of the following components:
- Hub and bearing
- Side sill (1)
- Stabilizer bar (2)
- Sub-frame (3)
- Lower control arm (4)
- Steering knuckle (5)
- Front strut assembly (6)

WARNING!

Do not remove the strut rod nut while the strut assembly is installed in the vehicle, or before the coil spring is compressed with a spring compressor. The spring is held under high pressure and must be compressed before the strut rod nut can be removed.

CAUTION:
At no time when servicing a vehicle can a sheet metal screw, bolt, or other metal fastener be installed in the shock tower to replace the original plastic clip. It may come in contact with the strut or coil spring.

CAUTION:
Wheel bearing damage will result if the vehicle is rolled or the weight of the vehicle is allowed to be supported by the tires for any length of time with the axle hub nut loose.

Operation

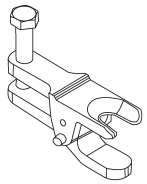
The front suspension utilizes a MacPherson strut system. This suspension system incorporates a strut assembly that takes the place of the upper arm and ball joint. The strut performs the function of a shock absorber and is encompassed by a coil spring.

Specifications

Torque Specifications

DESCRIPTION	TORQUE (N·m)
Axle Shaft Hub Nut	135
Sub-frame Mounting Bolts	115
Dust Shield Bolts	65
Hub And Bearing Mounting Bolts	135
Lower Control Arm Ball Joint Pinch Bolt	110
Lower Control Arm Front Pivot Bolt	180
Lower Control Arm Rear Pivot Bolt	180
Stabilizer Bar Clamp Bolts	25
Stabilizer Bar Link Nuts	50
Steering Knuckle Pinch Bolt	110
Strut Clevis To Steering Knuckle Nut	110
Strut-To-Tower Nuts	30
Strut To Steering Knuckle Bolts	110
Inner Tie Rod Adjuster Jam Nut	30
Outer Tie Rod End To Steering Knuckle Nut	35
Wheel Mounting Nuts	110

Special Tools

Ball Joint Separator CH-10002	 besm020086

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DIAGNOSIS & TESTING

Vehicle Suspension Troubleshooting Chart

CONDITION	POSSIBLE CAUSES	CORRECTION
Front End Whine On Turns	· Defective wheel bearing · Incorrect wheel alignment · Low power steering fluid level	· Replace wheel bearing · Check and reset wheel alignment · Fill power steering fluid reservoir to proper level and check for leaks (make sure all air is bled from the system)
Road Wander	· Incorrect tire pressure · Incorrect front or rear wheel toe · Worn wheel bearings · Worn control arm bushings · Excessive friction in strut upper bearing	· Inflate tires to recommended pressure · Correct front or rear wheel toe · Replace wheel bearing · Replace control arm · Replace strut bearing
Lateral Pull	· Unequal tire pressure · Incorrect front wheel camber · Wheel braking · Excessive cross-caster	· Inflate all tires to recommended pressure · Check and reset front wheel camber · Correct braking condition causing lateral pull · Check wheel alignment and adjust as necessary

ON-VEHICLE SERVICE

Front Steering Knuckle

Description

The steering knuckle is a single casting with legs machined for attachment to the front strut assembly on the top and steering linkage on the trailing leading end. The steering knuckle also has two machined, drilled legs on the end casting to support and align the front disc brake caliper adapter.

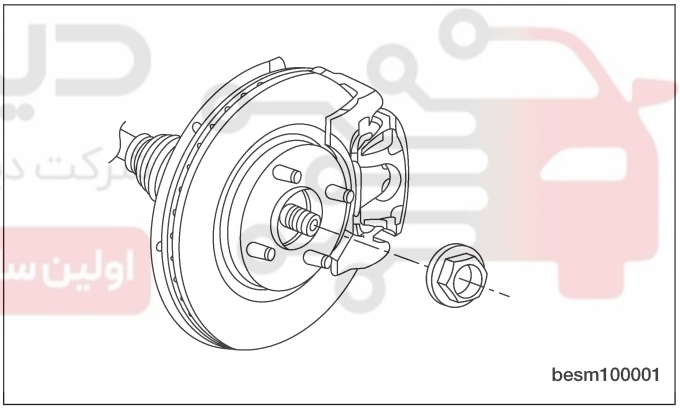
Operation

The steering knuckle supports the hub and bearing. The front suspension steering knuckle is not a repairable component of the front suspension. It must be replaced if found to be damaged in any way. If it is determined that the steering knuckle is bent when servicing the vehicle, no attempt should be made to straighten the steering knuckle.

Removal & Installation

NOTE :
The following special tools are required to perform the repair procedure:
- CH-10002 - Ball Joint Separator

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly. (Tighten: Wheel mounting nuts to 110 N·m)
3. While a helper applies the brakes to keep the hub from rotating, remove the front axle shaft hub nut. (Tighten: Axle shaft hub nut to 110 N·m)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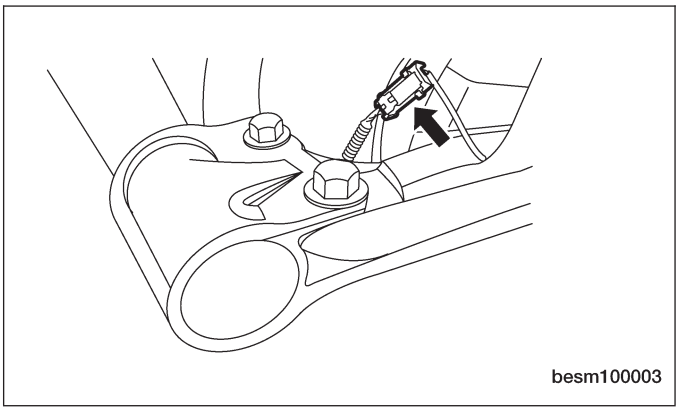
4. Remove the front brake rotor (See Front Brake Rotor Remove & Installation in Section 12 Brakes).
5. Disconnect the wheel speed sensor.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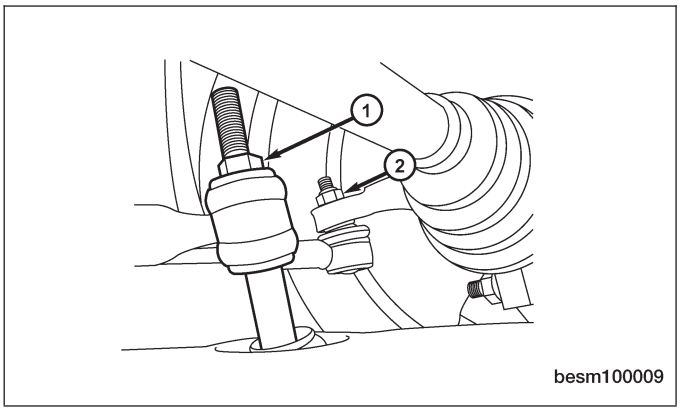
6. Remove the stabilizer bar clamp nut (1) from the lower control arm.
   (Tighten: Stabilizer bar clamp nut to 25 N·m)
7. Remove the nut (2) attaching the outer tie rod end to the steering knuckle.
   (Tighten: Outer tie rod end nut to 35 N·m)
8. Using special tool CH-10002, separate the outer tie rod end from the steering knuckle.



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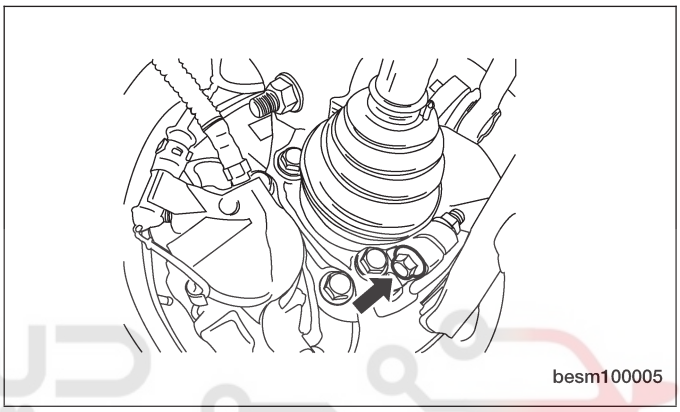
9. Remove the pinch bolt from the steering knuckle.
   (Tighten: Steering knuckle pinch bolt to 110 N·m)
10. Using special tool CH-10002, separate the ball joint from the steering knuckle.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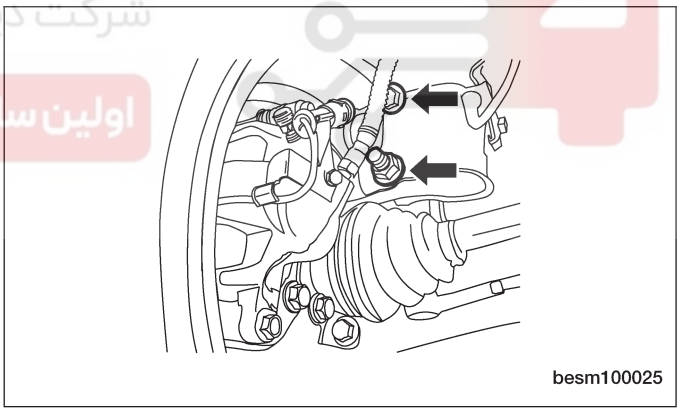
11. Remove the strut to the steering knuckle bolts.
    (Tighten: Strut to steering knuckle bolts to 110 N·m)
12. Pull the steering knuckle off the half shaft outer C/V joint splines and remove the steering knuckle from the vehicle.

NOTE :
Do not allow the half shaft to hang by the inner C/V joint; it must be supported to keep the joint from separating during this operation.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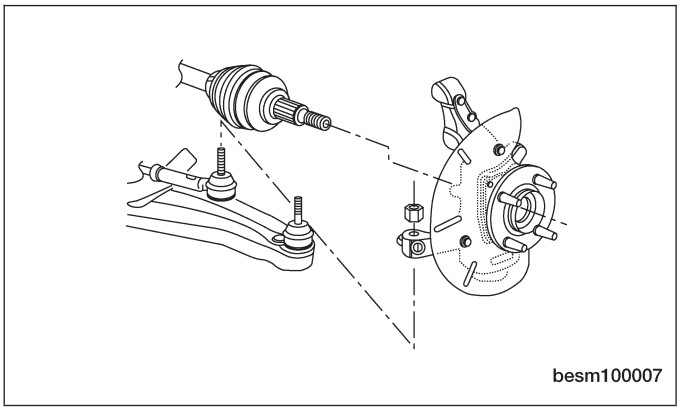
13. If required, remove the screws fastening the shield to the steering knuckle. Remove the shield.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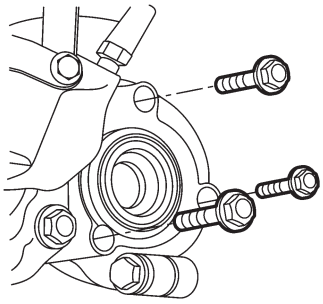
14. If required, remove the three bolts fastening the hub and bearing to the steering knuckle.
15. If required, slide the hub and bearing out of the steering knuckle.
16. Installation is in the reverse order of removal.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Front Lower Control Arm

Description

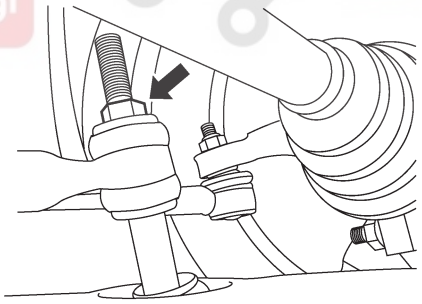
Inspect the lower control arm for signs of damage from contact with the ground or road debris. If the lower control arm shows any sign of damage, look for distortion. Do not attempt to repair or straighten a broken or bent lower control arm. If damaged, the lower control arm is serviced only as a complete component.

Operation

The front lower control arm supports the lower ball joint.

Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
   (Tighten: Wheel mounting nuts to 110 N·m)
3. Remove the stabilizer bar clamp nut from the lower control arm.
   (Tighten: Stabilizer bar clamp bolt to 25 N·m)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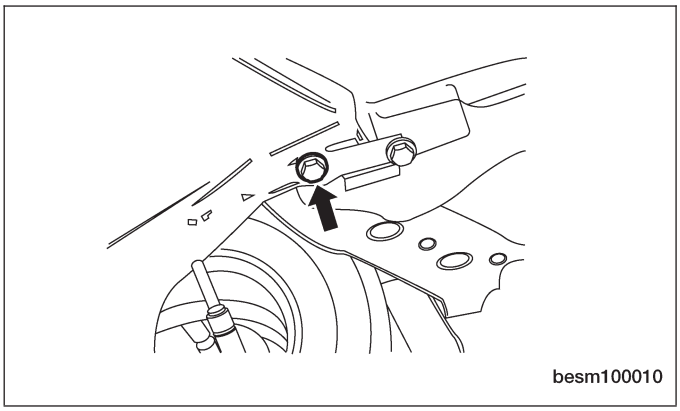
4. Remove the pinch bolt from the steering knuckle, then separate the lower control arm ball joint from the steering knuckle.
   (Tighten: Steering knuckle pinch bolt to 110 N·m)
5. Remove the lower control arm front pivot bolt to the vehicle sub-frame.
   (Tighten: Lower control arm front pivot bolt to 180 N·m)

6. Remove the lower control arm rear pivot bolt to the vehicle sub-frame.
   (Tighten: Lower control arm rear pivot bolt to 180 N·m)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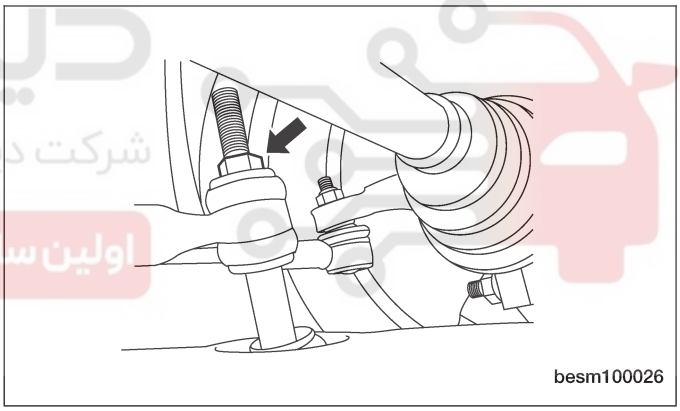
7. Remove the lower control arm from the sub-frame.
8. Installation is in the reverse order of removal.

Front Stabilizer Bar

Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
   (Tighten: Wheel mounting nuts to 110 N·m)
3. Remove the stabilizer bar link nuts attaching the stabilizer bar to the lower control arm.
   (Tighten: Stabilizer bar link nuts to 50 N·m)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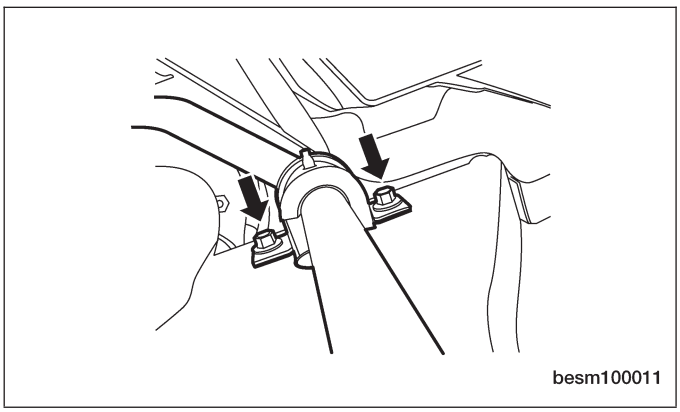
4. Remove the screws securing the stabilizer bushing retainers to the sub-frame.
5. Remove the two stabilizer bushing retainers.
6. Remove the stabilizer bar from the vehicle.
7. Installation is in the reverse order of removal.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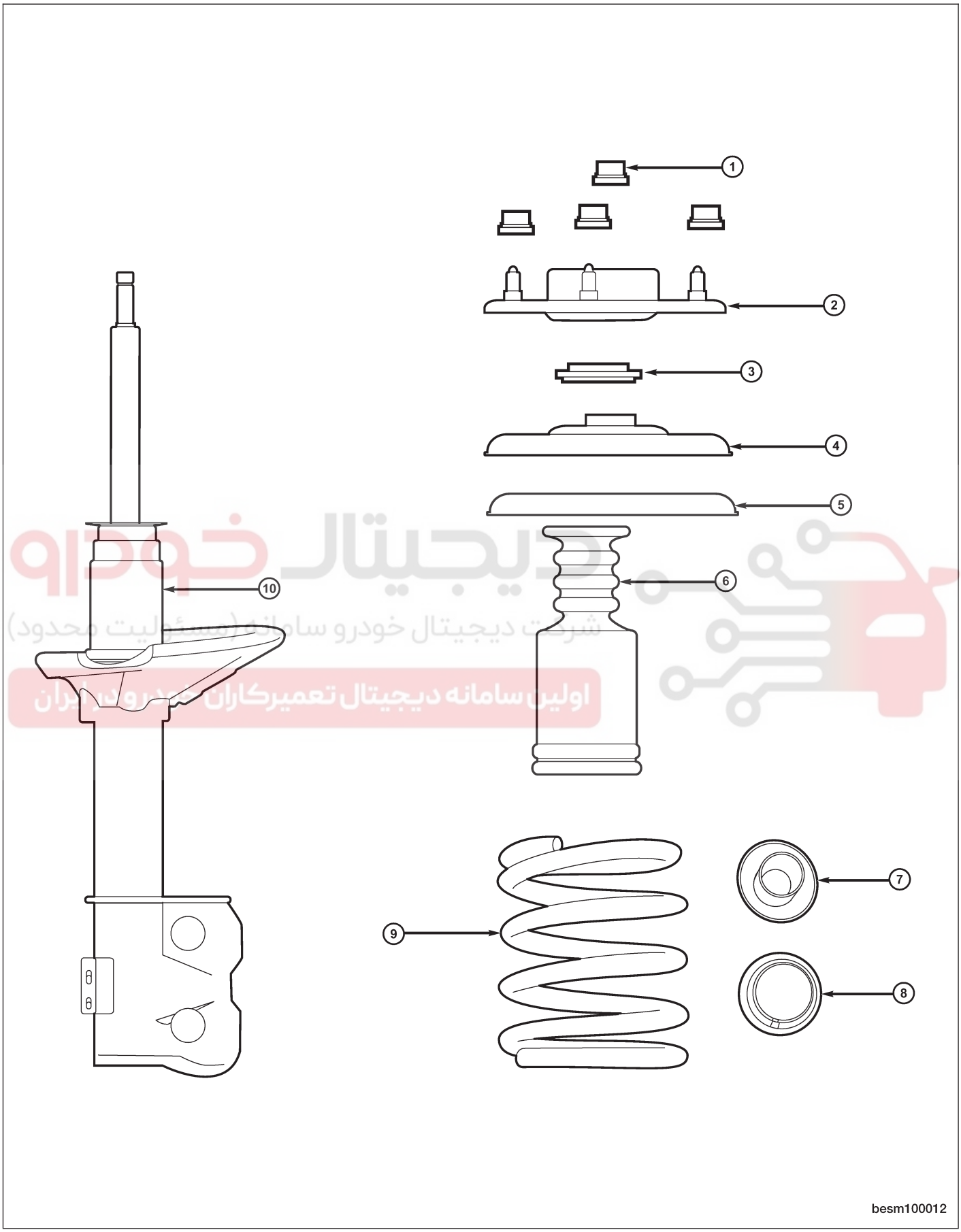
Front Strut Assembly

Description

A Macpherson type design strut assembly is used in place of the traditional front suspension upper control arm and upper ball joint. The bottom of the strut mounts directly to the steering knuckle using two attaching bolts and nuts going through the strut clevis bracket and steering knuckle. The top of the strut mounts directly to the strut tower of the vehicle using the three threaded studs on the strut assembly's upper mount.



The strut assembly includes the following components:
- Nut (1)
- Upper Mount (2)
- Pivot Bearing (3)
- Bearing and Upper Spring Seat (4)
- Upper Spring Isolator (5)
- Dust Shield (6)
- Plastic Cover (7)
- Cushion (8)
- Coil Spring (9)
- Strut (Damper) (10)

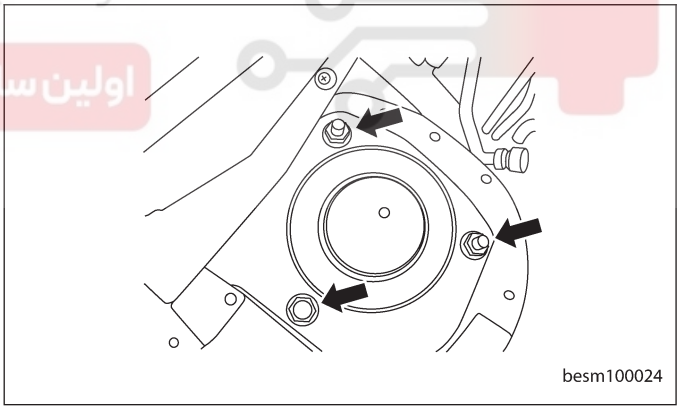
Operation

The strut assembly cushions the ride of the vehicle, controlling vibration, jounce and rebound of the suspension. The coil spring controls ride quality and maintains proper ride height. The spring isolators isolate the coil spring at the top and bottom from coming into metal-to-metal contact with the upper mounting seat and the strut. The strut dampens jounce and rebound motions of the coil spring and suspension.

Removal & Installation

CAUTION:
At no time when servicing a vehicle can a sheet metal screw, bolt or other metal fastener be installed into the strut tower to take the place of an original plastic clip. Also, do not drill holes in the front strut tower for the installation of any metal fasteners.

1. Open the engine hood.
2. Raise and support the vehicle.
3. Remove the wheel mounting nuts and the tire and wheel assembly.
   (Tighten: Wheel mounting nuts to 110 N·m)
4. Remove the strut-to-tower nuts attaching the strut assembly upper mount to the strut tower.
   (Tighten: Strut-to-tower nuts to 30 N·m)



5. Remove the strut to the steering knuckle bolts.
   (Tighten: Strut to steering knuckle bolts to 110 N·m)
6. Remove the strut assembly from the vehicle.
7. Installation is in the reverse order of removal.

Front Coil Spring

Description

A coil-over front strut assembly supports each front coil spring. The top of the strut assembly mounts to the strut tower.

Operation

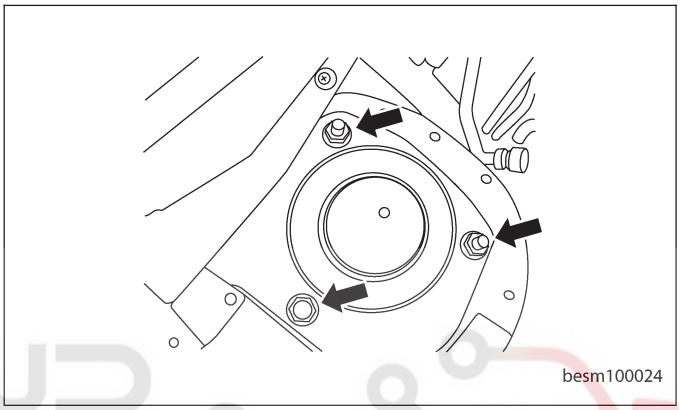
Coil springs are designed to store energy and subsequently release it and to absorb shock and maintain a force between contacting surfaces. Coil springs are rated for specific vehicle applications.

NOTE :
Each component is serviced by removing the strut assembly from the vehicle and disassembling it. Coil springs are rated separately for each corner or side of the vehicle depending on optional equipment and type of vehicle service. If a coil spring requires replacement, be sure that it is replaced with a spring meeting the correct load rating for the vehicle and its specific options.

Removal & Installation

CAUTION:
At no time when servicing a vehicle can a sheet metal screw, bolt or other metal fastener be installed into the strut tower to take the place of an original plastic clip. Also, do not drill holes into the front strut tower for the installation of any metal fasteners into the strut tower area indicated.

1. Remove the front strut assembly (See Front Strut Removal & Installation in Section 10 Suspension).



WARNING!

Do not remove the strut rod nut before the coil spring is properly compressed. The coil spring is held under pressure. The coil spring must be compressed, removing spring tension from the upper mount and bearing, before the strut rod nut is removed.

2. Position the strut assembly in the strut coil spring compressor following the manufacturer's instructions and set the lower and upper hooks of the compressor on the coil spring.
3. Compress the coil spring until all coil spring tension is removed from the upper mount and bearing.
4. Once the spring is sufficiently compressed, install the strut nut wrench on the strut rod nut.
5. Install a deep socket on the end of the strut rod.
6. While holding the strut rod, remove the nut using the strut nut wrench.
7. Remove the lower spring isolator from the strut seat.
8. Remove the dust shield and jounce bumper.
9. Remove the upper mounting bracket.
10. Remove the upper spring seat and isolator.
11. Release the tension from the coil spring by backing off the compressor drive completely. Release the compressor hooks and remove the coil spring.
12. Assembly is in the reverse order of disassembly.

UNIT REPAIR

Front Strut

Disassemble

NOTE :
The strut assembly must be removed from the vehicle for it to be disassembled and assembled. For the disassembly and assembly of the strut assembly, use strut spring compressor, or the equivalent, to compress the coil spring. Follow the manufacturer's instructions closely.

WARNING!

Do not remove the strut rod nut before the coil spring is properly compressed. The coil spring is held under pressure. The coil spring must be compressed, removing spring tension from the upper mount and bearing, before the strut rod nut is removed.

1. If both struts are being serviced at the same time, mark both the coil springs and strut assemblies according to which side of the vehicle the strut is being removed from.
2. Position the strut assembly in the strut coil spring compressor following the manufacturer's instructions and set the lower and upper hooks of the compressor on the coil spring.
3. Compress the coil spring until all coil spring tension is removed from the upper mount and bearing.

CAUTION:
Never use impact or high speed tools to remove the strut rod nut. Damage to the strut internal bearings can occur.

4. Once the spring is sufficiently compressed, install the strut nut wrench on the strut rod nut.
5. Install a deep socket on the end of the strut rod. While holding the strut rod, remove the nut using the strut nut wrench.
6. Remove the lower spring isolator from the strut seat.
7. Remove the dust shield and jounce bumper.
8. Remove the upper mounting bracket.
9. Remove the upper spring seat and isolator.
10. Release the tension from the coil spring by backing off the compressor drive completely. Release the compressor hooks and remove the coil spring.

Inspection

Inspect the strut assembly for damage and evidence of fluid running from the upper end of the fluid reservoir (actual leakage will be a stream of fluid running down the side of the reservoir tube and dripping off lower end of unit).

Inspect the strut assembly components for the following and replace as necessary:
- Inspect the strut (damper) for shaft binding over the full stroke of the shaft.
- Inspect the jounce bumper for cracks and signs of deterioration.
- Inspect the dust shield for cracks and tears.
- Check the upper mount for cracks and distortion and its retaining studs for any sign of damage.
- Check the bearing and upper spring seat for any binding.
- Inspect the upper and lower spring isolators for material deterioration and distortion.
- Inspect the coil spring for any sign of damage to the coating.

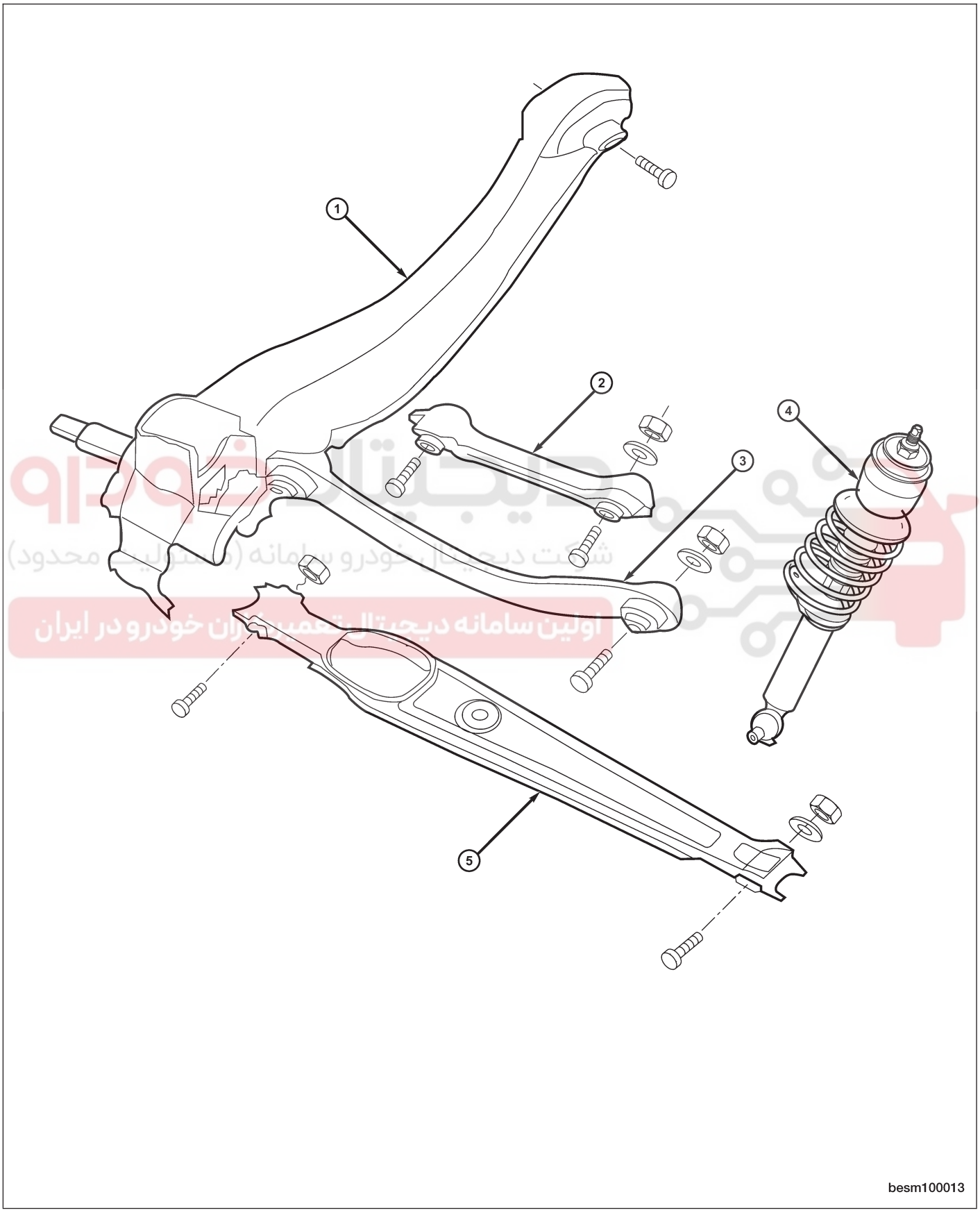
Assemble

Assembly is in the reverse order of disassembly.

REAR SUSPENSION

GENERAL INFORMATION

Description



The rear suspension consists of the following components:
- Trailing arm (1)
- Upper control arm (2)
- Rear guide bar (3)
- Rear strut assembly (4)
- Lower control arm (5)

WARNING!

Only frame contact or wheel lift hoisting equipment can be used on this vehicle. It cannot be hoisted using equipment designed to lift a vehicle by the rear axle. If this type of hoisting equipment is used, damage to rear suspension components will occur.

CAUTION:

If a rear suspension component becomes bent, damaged or fails, no attempt should be made to straighten or repair it. Always replace it with a new component.

Operation

The rear suspension utilizes an independent multi-link arm design. This suspension system allows the wheels to react to road imperfections independent of each other. This independent action offers improved isolation from the effects of jounce and rebound.

Specifications

Torque Specifications

DESCRIPTION	TORQUE (N·m)
Lower Control Arm Mounting Bolt	115
Strut Assembly Lower Mounting Bolt	100
Strut Assembly Upper Mounting Nuts	80
Strut Rod Nut	50
Trailing Arm Mounting Bolts	45
Upper Control Arm Mounting Bolts	120
Guide Arm Mounting Bolt	100

DIAGNOSIS & TESTING

Vehicle Inspection

Inspect the rear axle for the following:
- Check the rear axle for loose bearings.
- Check the rear axle hub for any damage or excessive runout.

Vibration At Highway Speeds

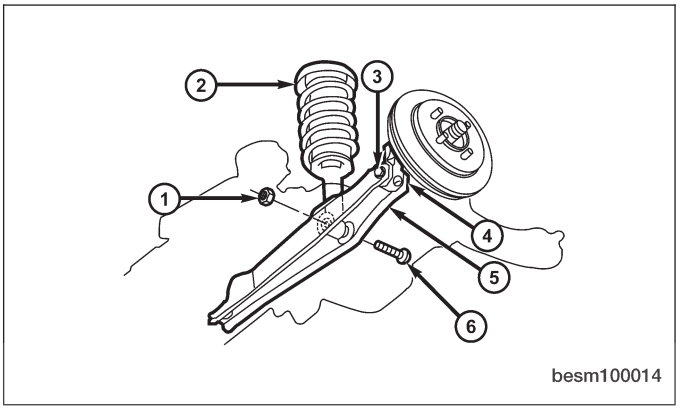
This problem could be a result of:
- Foreign material (mud, etc.) packed on the backside of the wheel(s).
- Out of balance tires or wheels.
- Improper tire or wheel runout.

ON-VEHICLE SERVICE

Rear Lower Control Arm

Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
   (Tighten: Wheel mounting nuts to 110 N·m)
3. Use a jack to support the lower control arm.
4. Remove the lower strut mounting nut (1) and bolt (6).
   (Tighten: Lower strut mounting nut to 100 N·m)
5. Remove the nut and bolt securing the lower control arm to the trailing arm.
   (Tighten: Lower control arm to the trailing arm bolts to 45 N·m)
6. Remove the nut (3) and bolt (4) securing the lower control arm to the vehicle body.
   (Tighten: Lower control arm to the vehicle body bolts to 115 N·m)
7. Lower the jack and remove the lower control arm (5).
8. Installation is in the reverse order of removal.



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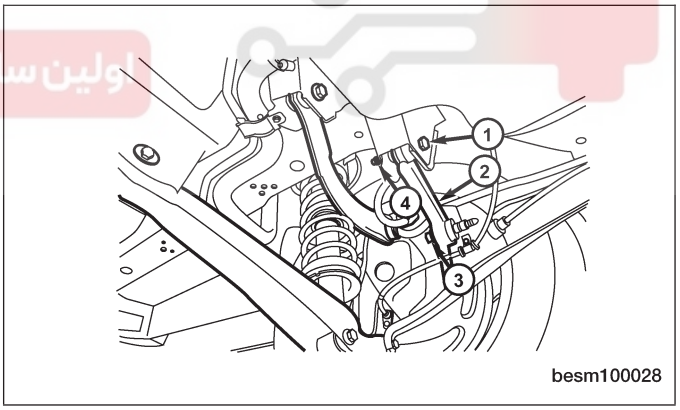
Rear Upper Control Arm

Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
   (Tighten: Wheel mounting nuts to 110 N·m)
3. Remove the bolt (3) securing the upper control arm (2) to the trailing arm.
   (Tighten: Upper control arm to trailing arm bolt to 45 N·m)
4. Remove the nut (4) and bolt (1) securing the upper control arm (2) to the vehicle body.
   (Tighten: Upper control arm to vehicle body bolt to 120 N·m)
5. Remove the upper control arm (2).
6. Installation is in the reverse order of removal.



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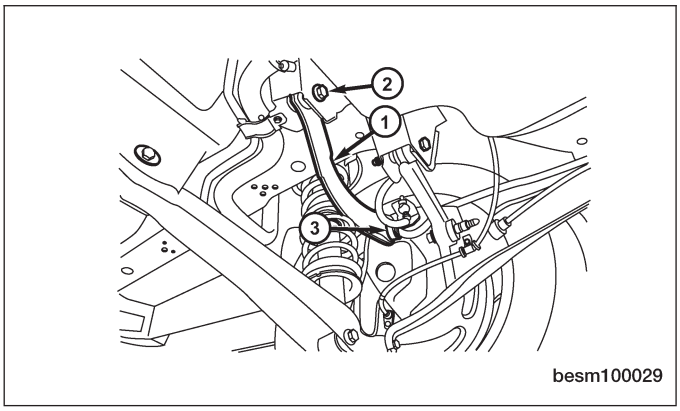
Rear Guide Bar

Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
   (Tighten: Wheel mounting nuts to 110 N·m)
3. Remove the nut and bolt (3) securing the guide arm (1) to the trailing arm.
   (Tighten: Guide arm to trailing arm bolt to 45 N·m)
4. Remove the nut and bolt (2) securing the guide arm (1) to the vehicle body.
   (Tighten: Guide arm to vehicle body bolt to 100 N·m)
5. Remove the guide arm (1).
6. Installation is in the reverse order of removal.



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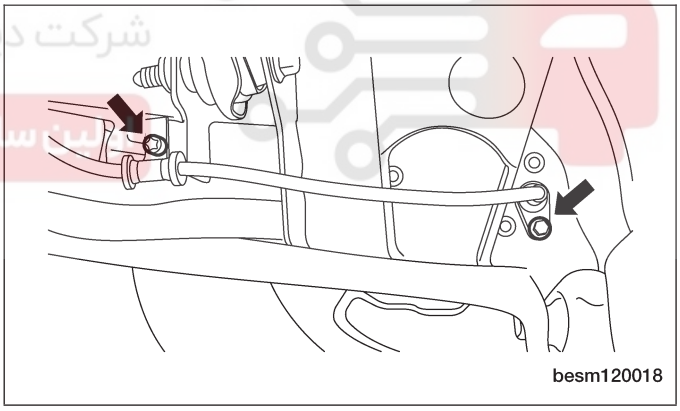
Trailing Arm

Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
   (Tighten: Wheel mounting nuts to 110 N·m)
3. Remove the rear brake rotor (See Brake Rotor Removal & Installation in Section 12 Brake).
4. Remove the wheel speed sensor in the rear of the hub and bearing assembly.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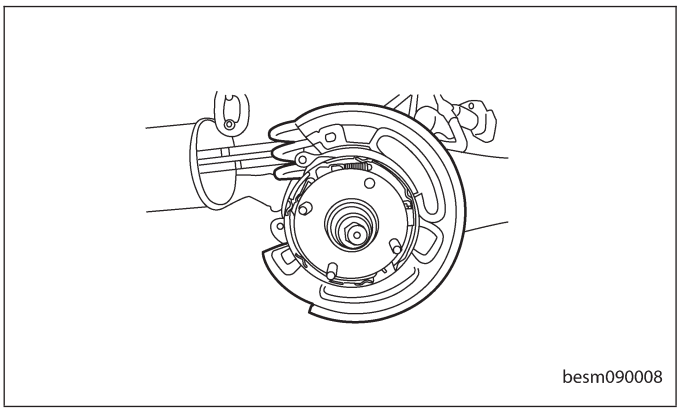
5. Remove the hub and bearing using puller (See Rear Hub and Bearing Removal & Installation in Section 9 Axle).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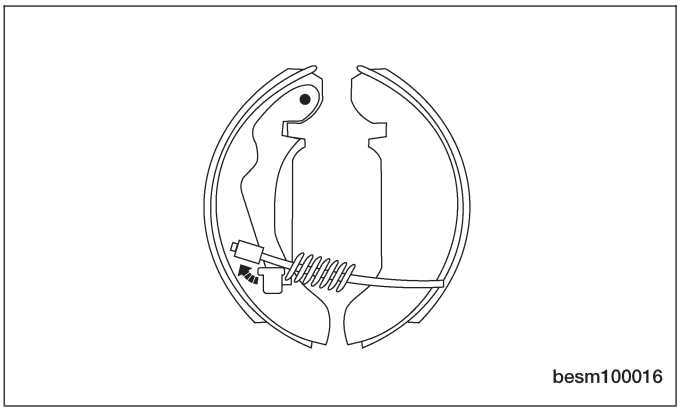
6. Use a jack to support the lower control arm.

7. Remove the parking brake cable (See Parking Brake Cable Removal & Installation in Section 12 Brakes).

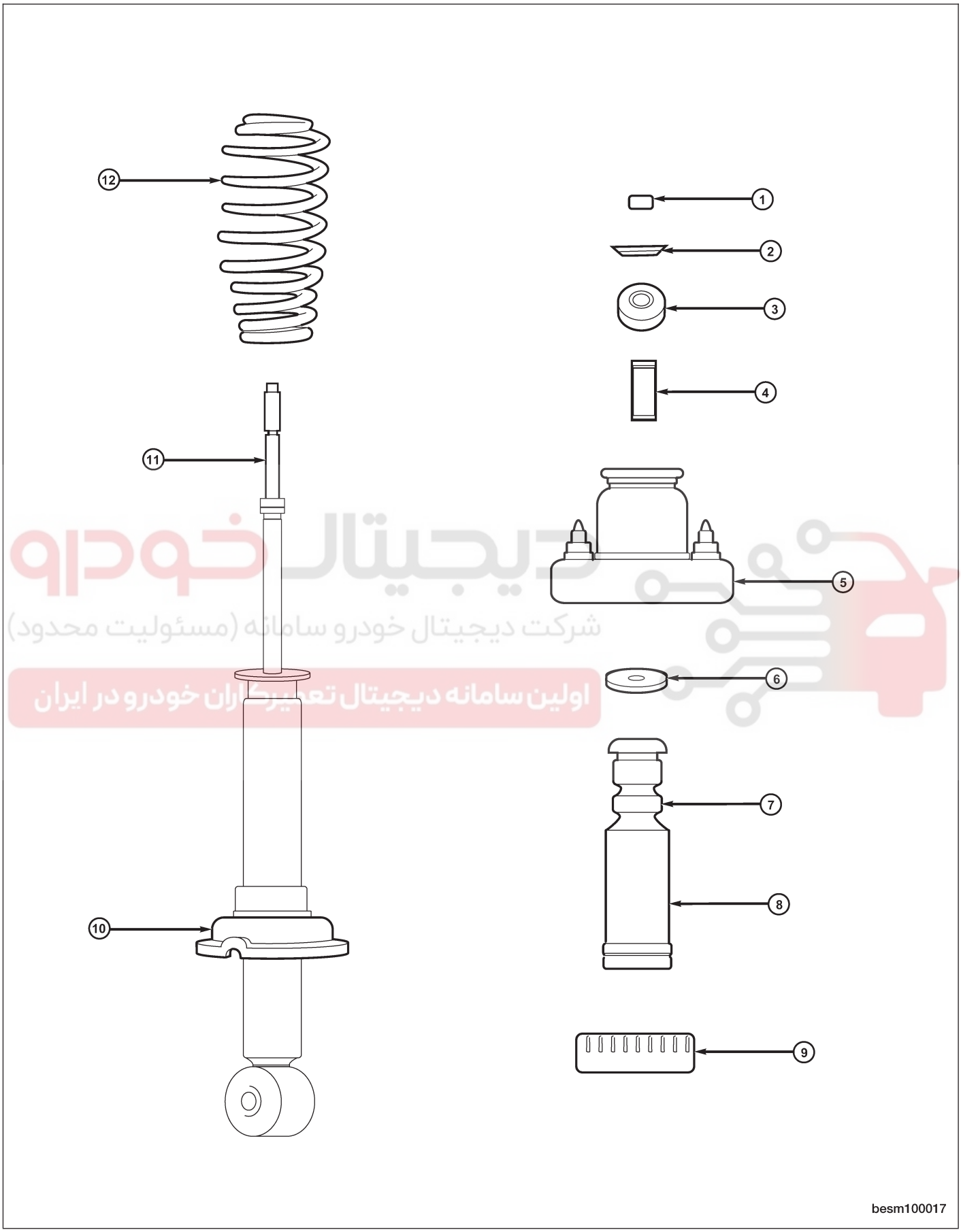


8. Remove rear upper control arm (See Rear Upper Control Arm Removal & Installation in Section 10 Suspension).
9. Remove rear lower control arm (See Rear Lower Control Arm Removal & Installation in Section 10 Suspension).
10. Remove rear guide bar (See Rear Guide Bar Removal & Installation in Section 10 Suspension).
11. Remove the trailing arm.
12. Installation is in the reverse order of removal.

Rear Strut Assembly

Description

A coil-over rear strut assembly supports each side of the vehicle. The bottom of the strut assembly mounts to the lower control arm. The top of the strut assembly mounts to the body.



The strut assembly includes the following major components:
- Nut (1)
- Cambered Spacer (2)
- Upper Bushing (3)
- Sleeve (4)
- Upper Mounting Bracket (5)
- Lower Bushing (6)
- Jounce Bumper (7)
- Dust Shield (8)
- Upper Spring Isolator (9)
- Lower Spring Isolator (10)
- Strut Absorber (Damper) (11)
- Coil Spring (12)

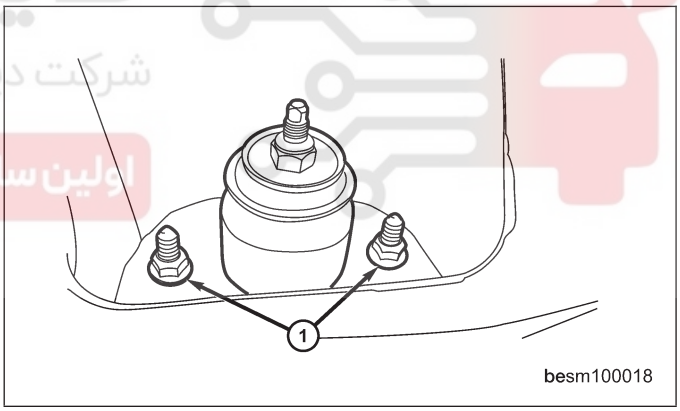
Operation

The strut assembly cushions the ride of the vehicle, controls vibration, jounce and rebound of the suspension. The coil spring controls ride quality and maintains proper ride height. The spring isolators isolate the coil spring at the top and bottom from coming into metal-to-metal contact with the upper mounting seat and the strut. The strut dampens jounce and rebound motions of the coil spring and suspension.

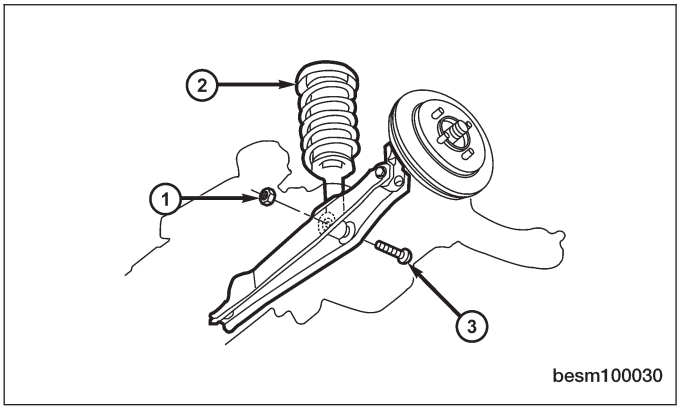
Removal & Installation

CAUTION:
At no time when servicing a vehicle can a sheet metal screw, bolt or other metal fastener be installed into the strut tower to take the place of an original plastic clip. Also, do not drill holes into the front strut tower for the installation of any metal fasteners into the strut tower area indicated.

1. Position the luggage compartment carpet as necessary to access the strut assembly upper mounting nuts.
2. Remove the two nuts (1) securing the upper strut assembly to the body bracket.
   (Tighten: Upper strut mounting nuts to 80 N·m)



3. Raise and support the vehicle.
4. Remove the wheel mounting nuts and the tire and wheel assembly.
   (Tighten: Wheel mounting nuts to 110 N·m)
5. Use a jack to support the trailing arm.
6. Remove the lower strut mounting nut (1) and bolt (3).
   (Tighten: Lower strut mounting bolt to 100 N·m)
7. If necessary, remove the lower control arm.
8. Lower the strut assembly (2) and remove it from the rear suspension.
9. Installation is in the reverse order of removal.



Rear Coil Spring

Description

A coil-over rear strut assembly supports each rear coil spring. The top of the strut assembly mounts to the body.

Operation

Coil springs are designed to store energy and subsequently release it and to absorb shock and maintain a force between contacting surfaces. Coil springs are rated for specific vehicle applications.

NOTE :
Each component is serviced by removing the strut assembly from the vehicle and disassembling it. Coil springs are rated separately for each corner or side of the vehicle depending on optional equipment and type of vehicle service. If a coil spring requires replacement, be sure that it is replaced with a spring meeting the correct load rating for the vehicle and its specific options.

Removal & Installation

CAUTION:
At no time when servicing a vehicle can a sheet metal screw, bolt or other metal fastener be installed into the strut tower to take the place of an original plastic clip. Also, do not drill holes into the front strut tower for the installation of any metal fasteners into the strut tower area indicated.

1. Remove the rear strut assembly (See Rear Strut Removal & Installation in Section 10 Suspension).

WARNING!

Do not remove the strut rod nut before the coil spring is properly compressed. The coil spring is held under pressure. The coil spring must be compressed, removing spring tension from the upper mount and bearing, before the strut rod nut is removed.

2. Position the strut assembly in the strut coil spring compressor following the manufacturer's instructions and set the lower and upper hooks of the compressor on the coil spring.
3. Compress the coil spring until all coil spring tension is removed from the upper mount and bearing.
4. Once the spring is sufficiently compressed, install strut nut wrench on the strut rod nut.
5. Install a deep socket on the end of the strut rod.
6. While holding the strut rod from turning, remove the nut using the strut nut wrench.
7. Remove the lower spring isolator from the strut seat.
8. Remove the dust shield and jounce bumper.
9. Remove the upper mounting bracket.
10. Remove the upper spring seat and isolator.
11. Release the tension from the coil spring by backing off the compressor drive completely. Release the compressor hooks and remove the coil spring.
12. Assembly is in the reverse order of disassembly.

UNIT REPAIR

Rear Strut

Disassemble

NOTE :
The strut assembly must be removed from the vehicle for it to be disassembled and assembled. For the disassembly and assembly of the strut assembly, use a strut spring compressor, or the equivalent, to compress the coil spring. Follow the manufacturer's instructions closely.

WARNING!

Do not remove the strut rod nut before the coil spring is properly compressed. The coil spring is held under pressure. The coil spring must be compressed, removing spring tension from the upper mount and bearing, before the strut rod nut is removed.

1. If both struts are being serviced at the same time, mark both the coil springs and strut assemblies according to which side of the vehicle the strut is being removed from.
2. Position the strut assembly in the strut coil spring compressor following the manufacturer's instructions and set the lower and upper hooks of the compressor on the coil spring.
3. Compress the coil spring until all coil spring tension is removed from the upper mount and bearing.

CAUTION:
Never use impact or high speed tools to remove the strut rod nut. Damage to the strut internal bearings can occur.

4. Once the spring is sufficiently compressed, install the strut nut wrench on the strut rod nut.
5. Install a deep socket on the end of the strut rod. While holding the strut rod, remove the nut using the strut nut wrench.
6. Remove the lower spring isolator from the strut seat.
7. Remove the dust shield and jounce bumper.
8. Remove the upper mounting bracket.
9. Remove the upper spring seat and isolator.
10. Release the tension from the coil spring by backing off the compressor drive completely. Release the compressor hooks and remove the coil spring.

Inspection

Inspect the strut assembly for damage and evidence of fluid running from the upper end of the fluid reservoir (actual leakage will be a stream of fluid running down the side of the reservoir tube and dripping off lower end of unit).

Assemble

Assembly is in the reverse order of disassembly.

ALIGNMENT

GENERAL INFORMATION

Description

Vehicle wheel alignment is the positioning of all interrelated front and rear suspension angles. These angles affect the handling and steering of the vehicle when it is in motion. Proper wheel alignment is essential for efficient steering, good directional stability, and proper tire wear.

The method of checking a vehicle's front and rear wheel alignment varies depending on the manufacturer and type of equipment used. The manufacturer's instructions should always be followed to ensure accuracy of the alignment. On this vehicle, the suspension angles that can be adjusted are as follows:

Front

- Camber
- Toe

Rear

- Camber
- Toe

Check the wheel alignment and make all wheel alignment adjustments with the vehicle standing at its proper curb height specification. Curb height is the normal riding height of the vehicle. It is measured from a certain point on the vehicle to the ground or a designated area while the vehicle is sitting on a flat, level surface.

Operation

Curb Height Measurement

The wheel alignment is to be checked and all alignment adjustments made with the vehicle at its required curb height specification.

- Vehicle height is to be checked with the vehicle on a flat, level surface, preferably a vehicle alignment rack.
- The tires are to be inflated to the recommended pressure.
- All tires are to be the same size as standard equipment.
- Vehicle height is checked with the fuel tank full of fuel, and no passenger or luggage compartment load.
- Vehicle height is not adjustable.
- If the measurement is not within specifications, inspect the vehicle for bent or weak suspension components.
- Compare the parts tag on the suspect coil spring(s) to the parts book and the vehicle sales code, checking for a match.
- Once removed from the vehicle, compare the coil spring height to a new or known good coil spring. The heights should vary if the suspect spring is weak.

NOTE :

Prior to reading the curb height measurement, the front and rear of the vehicle must be jounced to settle the suspension. Induce jounce by pushing down on the center of the bumper (fascia), using care not to damage the vehicle, moving the vehicle up and down, gradually increasing the suspension travel with each stroke. Release the bumper at the bottom of each stroke, repeating this action several times. Perform this to both front and rear suspensions an equal amount of times.

Pre-Wheel Alignment Inspection

Before any attempt is made to change or correct the wheel alignment, the following inspection and necessary corrections must be made to the vehicle to ensure proper alignment.

9. Verify the fuel tank is full of fuel. If the fuel tank is not full, the reduction in weight will affect the curb height of the vehicle and the alignment specifications.
10. The passenger and luggage compartments of the vehicle should be free of any load that is not factory equipment.
11. Check the tires on the vehicle. The tires are to be inflated to the recommended air pressure. All tires must be the same size and in good condition with approximately the same tread wear.
12. Check the front tire and wheel assemblies for excessive radial runout.
13. Inspect all suspension component fasteners for looseness and proper torque.
14. Inspect all ball joints and all steering linkage for looseness and any sign of wear or damage.
15. Inspect the rubber bushings on all the suspension components for signs of wear or deterioration. If any bushings show signs of wear or deterioration, they should be replaced prior to aligning the vehicle.
16. Check vehicle curb height.

Wheel Alignment Setup

17. Position the vehicle on an alignment rack.
18. Install all required alignment equipment on the vehicle, per the alignment equipment manufacturer's instructions. On this vehicle, a four-wheel alignment is recommended.
19. Read the vehicle's current front and rear alignment settings. Compare the vehicle's current alignment settings to the vehicle specifications for camber, caster and toe-in.

NOTE :
Prior to reading the vehicle's alignment readouts, the front and rear of vehicle should be jounced. Induce jounce (rear first, then front) by grasping the center of the bumper and jouncing each end of vehicle an equal number of times. The bumper should always be released when vehicle is at the bottom of the jounce cycle.

Specifications

Torque Specifications

DESCRIPTION	TORQUE (N·m)
Camber Adjustment Bolts	110
Inner Tie Rod Adjuster Jam Nut	30
Rear Lower Control Arm Eccentric Cam Bolt	120
Rear Upper Control Arm Eccentric Cam Bolt	120
Wheel Mounting Nuts	110

Front Alignment Specifications

FRONT WHEEL ALIGNMENT	PREFERRED SETTING	ACCEPTABLE RANGE
Camber	0.00°	-30' to +30'
Caster	+2°40'	+2°10' to +2°70'
Toe-Individual	+3'	-3' to +9'

Rear Alignment Specifications

REAR WHEEL ALIGNMENT	PREFERRED SETTING	ACCEPTABLE RANGE
Camber	-1°30'	-1°30' to -1°40'
Toe-Individual	+9'	0' to 18'

DIAGNOSIS & TESTING

Vehicle Inspection

Inspect the following for damage:
- Inspect the tires.
- Inspect the rims.

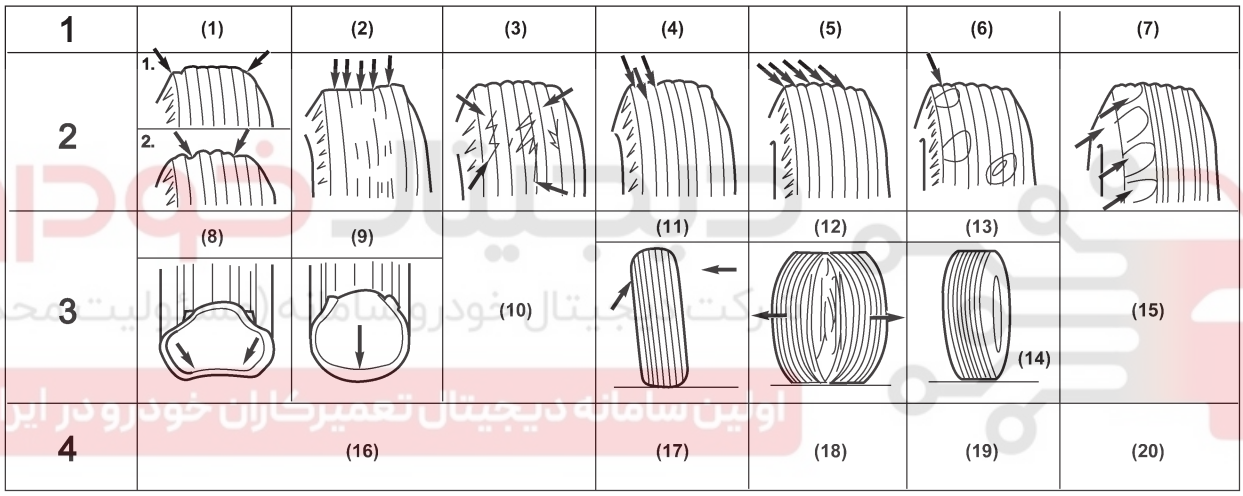
Replace any tire or rim that is found to be damaged.

Tire Wear

Inspect the following for accurate tire wear:
- Check the depth of tire remaining tread.
- Standard tire: not less than 1.6 mm.
- Snow tire: 50% tire tread.

If the tread is below the specifications, the tire should be replaced.

Tire Wear Chart



1 Condition:	(1) Rapid Wear At Shoulders	(2) Rapid Wear At Center	(3) Cracked Treads	(4) Wear On One Side	(5) Feathered Edge	(6) Bald Spots	(7) Scalloped Wear
2 Effect:	(1) Excessive Tire Wear	(2) Excessive Tire Wear	(3) Tire Damage	(4) Vehicle Pulls	(2) Excessive Tire Wear	(6) Poor Traction	(7) Excessive Tire Wear
3 Cause:	(8) Under Inflation Or Lack Of Rotation	(9) Over Inflation Or Lack Of Rotation	(10) Under Inflation Or Excessive Speed	(11) Excessive Camber	(12) Incorrect Toe	(13) Unbalanced Wheel	(15) Lack Of Rotation / Tires Worn / Alignment / Suspension
4 Correction:	(16) Adjust Tire Pressure To Specifications / Rotate Tires	(16) Adjust Tire Pressure To Specifications / Rotate Tires	(16) Replace Tire	(17) Adjust Camber To Specifications	(18) Adjust Toe-In To Specifications	(19) Balance Wheels	(20) Rotate Tires / Replace Tires / Check Alignment / Suspension

Alignment Troubleshooting Chart

CONDITION	POSSIBLE CAUSES	CORRECTIONS
Early Tire Wearing	· Incorrect tire pressure · Incorrect wheel alignment	· Adjust the tire pressure · Check the wheel alignment and then adjust.
Tire Noise	· Incorrect tire pressure · Tire wearing	· Adjust the tire pressure · Check the wheel alignment and then adjust.
Road Noise Or Vehicle Body Vibration	· Incorrect tire pressure · Unbalanced tire · Deformation of rim or tire · Tire wearing	· Adjust the tire pressure · Check the wheel alignment and then adjust. · Repair or install new suspension component as necessary
Up-Down Vibration Of The Steering Wheel	· Loose wheel nut or axle · Unbalanced tire · Crack or wearing of engine mounting rubber · Crack or wearing of transmission bracket rubber	· Fasten wheel nut · Check the wheel alignment and then adjust. · Repair or install new suspension component as necessary · Repair or install new engine or transmission mounting rubber as necessary
Circular Vibration Of The Steering Wheel	· Loose wheel nut or axle · Unbalanced tire · Deficient tire pressure · Damage or wearing of front wheel bearing · Failure of steering system	· Fasten wheel nut · Adjust the tire pressure · Check the wheel alignment and then adjust · Repair or install new suspension component as necessary
Steering Wheel Deflecting To Single Side	· Incorrect tire pressure · Excessive tire wearing · Failure of steering system · Failure of suspension system	· Adjust the tire pressure · Check steering system · Check the wheel alignment and then adjust · Repair or install new suspension component as necessary
Unstable Driving	· Loose wheel nut · Failure of steering system · Failure of suspension system	· Adjust the tire pressure · Check steering system · Check the wheel alignment and then adjust · Repair or install new suspension component as necessary
Heavy Steering Wheel	· Incorrect tire pressure · Failure of steering system · Failure of suspension system · Incorrect wheel alignment	· Adjust the tire pressure · Check steering system · Check the wheel alignment and then adjust · Repair or install new suspension component as necessary
Bad Alignment Return Of Steering Wheel	· Incorrect tire pressure · Failure of steering system · Failure of suspension system	· Adjust the tire pressure · Check steering system · Check the wheel alignment and then adjust · Repair or install new suspension component as necessary

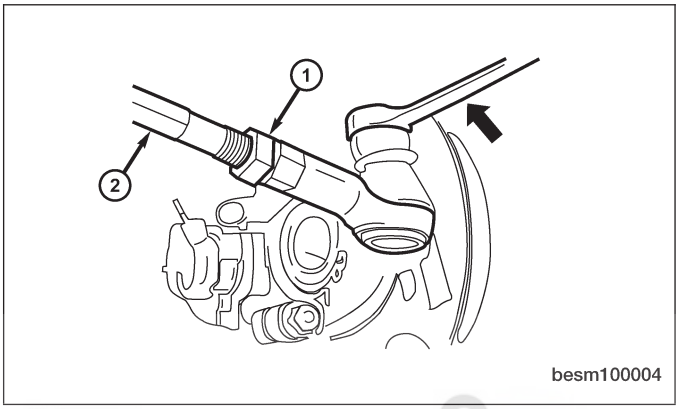
ON-VEHICLE SERVICE

Front Wheel Alignment

Front Toe Adjustment

CAUTION:
Do not twist the inner tie rod steering gear boot (bellows) while turning the inner tie rod during front toe adjustment. It may be necessary to remove the clamp where the boot meets the inner tie rod.

1. Loosen the tie rod adjusting jam nut (1).
   (Tighten: Tie rod adjusting jam nut to 30 N·m)
2. Grasp the inner tie rod shaft (2) and adjust the tie rod end until the front toe is set to specifications.

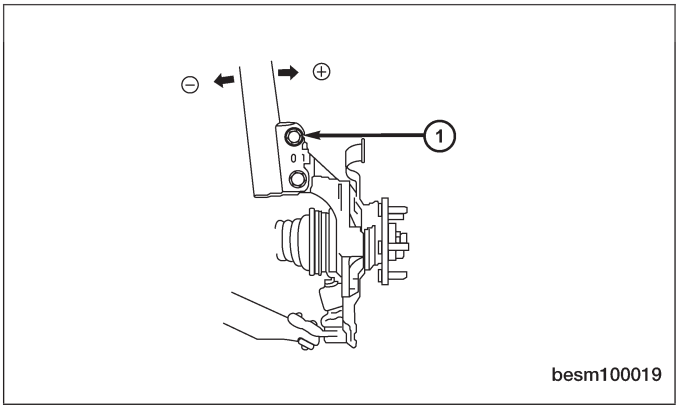


3. Make sure the inner tie rod steering gear boot is not twisted. If removed, reinstall the clamp where the boot meets the inner tie rod.
4. Remove the alignment equipment.
5. Lower vehicle and jounce the front and rear of the vehicle.

Front Camber Adjustment

1. Raise vehicle until its tires are not supporting the weight of the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.

Loosen the camber adjustment bolt (1) and adjust the camber angle to proper specifications.



3. Tighten each camber adjustment bolt to specified torque.
   (Tighten: Camber adjustment bolt to 110 N·m)
4. Install the tire and wheel assembly and install the wheel mounting nuts.
   (Tighten: Wheel mounting nuts to 110 N·m)
5. Once camber is within specifications, adjust toe to meet the preferred specification setting.

FRONT WHEEL ALIGNMENT		
Alignment Angle	Preferred Setting	Acceptable Range
Camber	0.00°	-30’ to +30’
Caster	+2°40’	+2°10’ to +2°70’
Toe-Individual	+3’	-3’ to +9’

Rear Wheel Alignment

Rear Toe Adjustment

1. While holding the rear lower control arm eccentric cam bolt stationary, loosen the rear lower control arm eccentric cam bolt.
2. Rotate the eccentric cam bolt left or right until the rear wheel toe for that rear wheel is set to the proper specification.
3. While holding the rear eccentric cam bolt stationary, tighten the rear eccentric cam bolt to the specified torque. (Tighten: Rear lower control arm eccentric cam bolt to 120 N·m)

Rear Camber Adjustment

1. While holding the rear upper control arm eccentric cam bolt stationary, loosen the rear upper control arm eccentric cam bolt.
2. Rotate the rear upper control arm eccentric cam bolt left or right until the rear wheel camber for that rear wheel is set to the proper specification.
3. While holding the rear upper control arm eccentric cam bolt stationary, tighten the rear upper control arm eccentric cam bolt to specified torque.
   (Tighten: Rear upper control arm eccentric cam bolt to 120 N·m)

REAR WHEEL ALIGNMENT		
Alignment Angle	Preferred Setting	Acceptable Range
Camber	0.00°	-30’ to +30’
Toe-Individual	+3’	-3’ to +9’

WHEELS AND TIRES

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GENERAL INFORMATION

Description

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

Operation

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain, in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe application of brakes
- High-speed driving
- Taking turns at excessive speeds
- Striking curbs and other obstacles
- Operating vehicle with over or under inflated tire pressures

Specifications

Torque Specifications

DESCRIPTION	TORQUE (N·m)
Wheel Mounting Nuts	110

Tire Pressure Specifications

DESCRIPTION	STANDARD COLD INFLATION PRESSURE (kPa)
Front Wheel	230
Rear Wheel	210
Spare Wheel	250

Wheel Out-Of-Round Specifications

DESCRIPTION	MAXIMUM RUN-OUT (mm)
Steel Rim	5
Aluminum Rim	3

DIAGNOSIS & TESTING

Vehicle Inspection

Visual inspection of the vehicle is recommended prior to road testing or performing any other procedure. Raise the vehicle on a suitable hoist.

Inspect the following:

- Inspect tires and wheels for damage, mud packing and unusual wear; correct as necessary.
- Check and adjust tire air pressure to the pressure listed on the label attached to the driver's door opening.

Tire and Wheel Vibration

Tire and wheel imbalance, runout and force variation can cause vehicles to exhibit steering wheel vibration.

NOTE :
Balance equipment must be calibrated and maintained per equipment manufacturer's specifications.

Tire Wear Patterns

Tire wear patterns can be traced to the following tire conditions:

- Under inflation will cause wear on the shoulders of tire.
- Over inflation will cause wear at the center of tire.
- Excessive camber causes the tire to run at an angle to the road. One side of tread is then worn more than the other.
- Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread.

NOTE :
Tread wear indicators are molded into the bottom of the tread grooves. When tread depth is 1.6 mm, the tread wear indicators will appear as a band. Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.

Wheel Out-Of-Round Inspection

- Raise vehicle and securely support it.
- Attach a dial indicator on the rim of the wheel and measure its unevenness.
- Replace the wheel if necessary.

NOTE :
On both edges of the wheel, the maximum allowed average value of the unevenness should not exceed the following:

MAXIMUM WHEEL OUT-OF-ROUND	
Steel Wheel	5 mm
Aluminum Wheel	3 mm

ON-VEHICLE SERVICE

Tire Repair

Description

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

WARNING!

Failure to equip the vehicle with tires having adequate speed capability can result in sudden tire failure. In order to maintain the speed capability of the vehicle, replacement tires must have speed ratings equal to or higher than those fitted to the vehicle as original equipment. If tires with lower speed ratings are fitted, the vehicle's handling may be affected and the speed capability of the vehicle may be lowered to the maximum speed capability of the replacement tires. To avoid an accident resulting in severe or fatal injury, consult the tire manufacturer in regards to maximum speed ratings.

Replacement Procedure

Note the following guidelines when replacing a tire:

- It is recommended that tires equivalent to the original equipment tires be used when replacement is needed.
- Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.
- The use of tires smaller than the minimum tire size approved for the vehicle can result in tire overloading and failure.
- Use tires that have the approved load rating for the vehicle and never overload them.
- Failure to equip the vehicle with tires having adequate speed capability can result in sudden tire failure and loss of vehicle control.
- The use of oversize tires may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

Perform the following when replacing a tire:

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
3. Deflate the tire completely before removing the tire from the wheel.
4. Use lubrication such as a mild soap solution when dismounting or mounting tire.
5. Replace the tire with a tire approved for the vehicle.
6. Use tools free of burrs or sharp edges which could damage the tire or wheel rim.
7. Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.
8. Install the tire and wheel assembly and install the wheel mounting nuts.
   (Tighten: Wheel mounting nuts to 110 N·m)

Repair Procedure

Note the following guidelines when performing a tire repair:

- For proper repairing, a radial tire must be removed from the wheel.
- Repairs should only be made if the defect, or puncture, is in the tread area.
- The tire should be replaced if the puncture is located in the sidewall.

Perform the following when repairing a tire:

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
3. Deflate the tire completely before removing the tire from the wheel.
4. Use lubrication such as a mild soap solution when dismounting or mounting tire.
5. Repair the tire only if the defect, or puncture, is in the tread area.
6. Use tools free of burrs or sharp edges which could damage the tire or wheel rim.
7. Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

8. Install the tire and wheel assembly and install the wheel mounting nuts.
   (Tighten: Wheel mounting nuts to 110 N·m)

Wheel Assembly

Description

Original equipment wheels are designed for operation up to the specified maximum vehicle capacity.

Inspect wheels for the following:

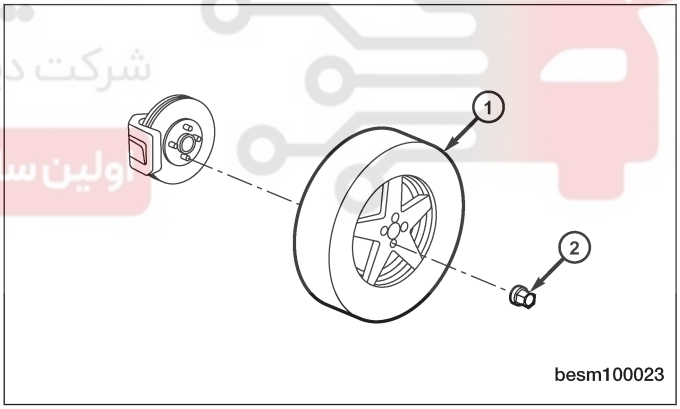
- Dents or cracks
- Damaged wheel bolt holes
- Air leaks from any area or surface of the wheel rim
- Excessive run out

NOTE :
Do not attempt to repair a wheel by hammering, heating or welding.

NOTE :
The wheel nuts are designed for specific applications. Do not use replacement bolts with a different design or lesser quality.

Removal & Installation

1. Raise and support the vehicle.
2. If the vehicle is equipped with wheel center caps that cover the wheel nuts, remove the cap with an appropriate removal tool utilizing the notch located between the wheel and the outer edge of the cap.
   NOTE: Use care not to damage the finish on the wheel.
3. Remove the wheel mounting nuts (2) with a suitable tool and remove the wheel assembly (1).
   (Tighten: Wheel mounting nuts to 110 N·m)
4. Installation is in the reverse order of removal.



Wheel Balance

Description

Balance the tire and wheel assembly as necessary following the wheel balancer manufacturer's instructions.

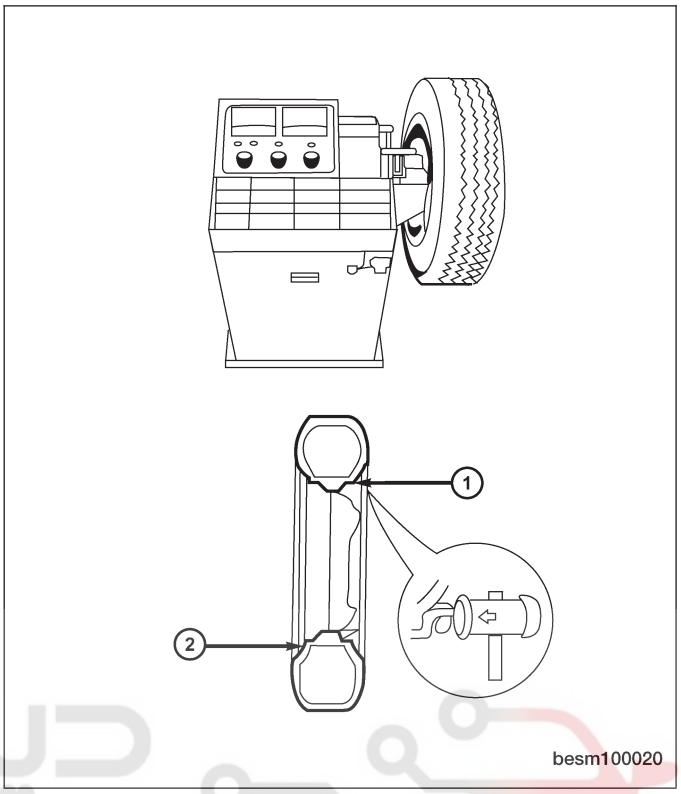
- Road test the vehicle for at least 5 miles.
- If the vibration persists, continue with Diagnosis & Testing procedure.

NOTE :

- Balance equipment must be calibrated and maintained per equipment manufacturer's specifications.
- Wheel weights must fit the rim properly.

Tire Balance Procedure

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
3. Perform a dynamic balance test, and install the appropriate wheel weights on the inner (2) and outer (1) edges of rim as necessary.
4. The final total weight difference should be less than 100g.
5. Not more than one wheel weight can be attached to each side of each wheel, with its maximum weight not exceeding 40g.



CAUTION:
Use caution not to damage wheel weights during tire and wheel installation.

6. Install the tire and wheel assembly and install the wheel mounting nuts.
   (Tighten: Wheel mounting nuts to 110 N·m)

Tire Rotation

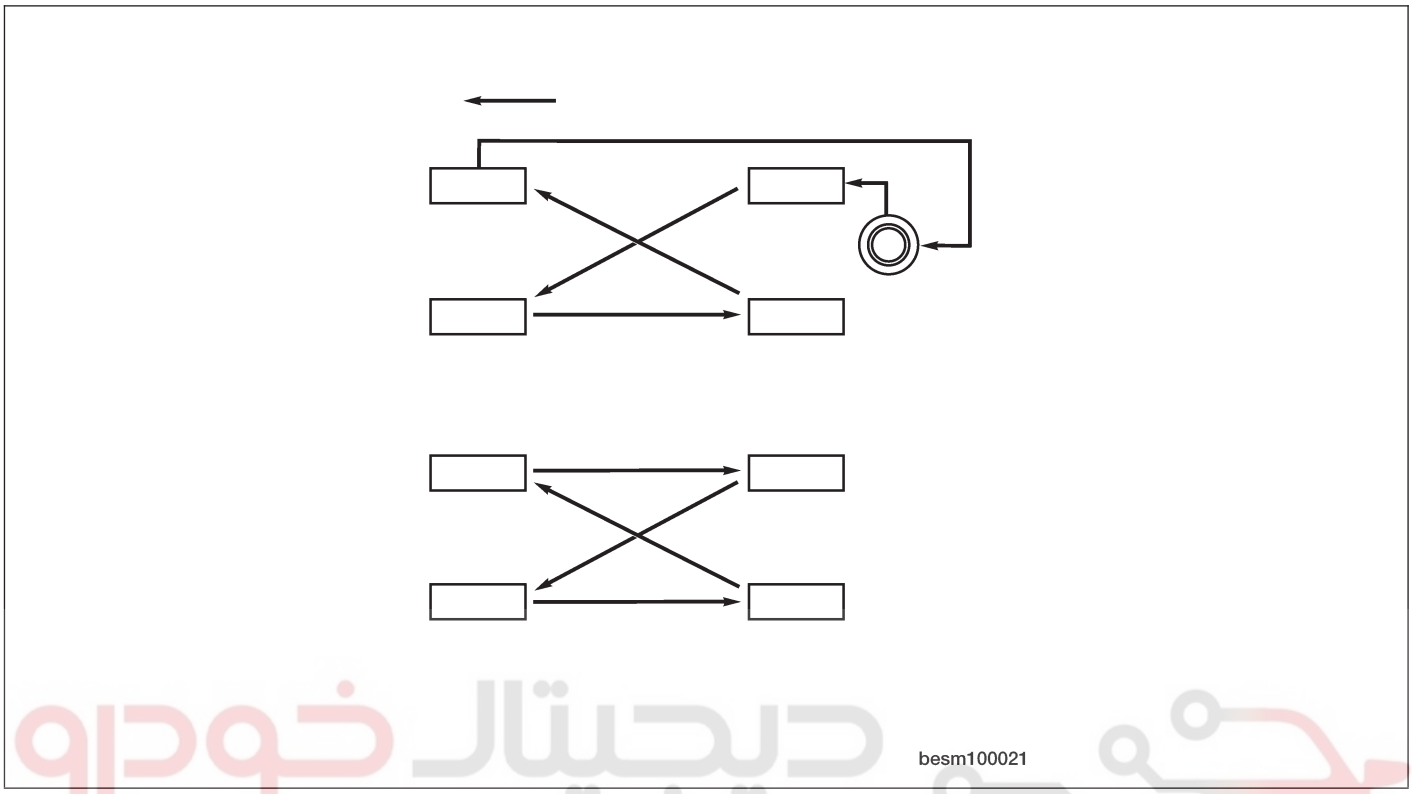
Description

Tires on the front and rear operate at different loads and perform different steering, driving, and braking functions. For these reasons they wear at unequal rates and tend to develop irregular wear patterns. These effects can be reduced by rotating the tires at regular intervals.

The benefits of tire rotation are:

- Increase tread life
- Maintain traction levels
- A smooth, quiet ride

Non-Directional Tires



The suggested method of tire rotation is shown. Other rotation methods can be used, but they will not provide all the tire longevity benefits.

NOTE :
Only the four-tire rotation method may be used if the vehicle is equipped with a compact or temporary spare tire.

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
3. Rotate the tire to the desired location.

CAUTION:
Use caution not to damage wheel weights during tire and wheel installation.

4. Install the tire and wheel assembly and install the wheel mounting nuts.
   (Tighten: Wheel mounting nuts to 110 N·m)

Directional Tires

Some vehicles may be fitted with special high-performance tires having a directional tread pattern. These tires are designed to improve traction on wet pavement. To obtain the full benefits of this design, the tires must be installed so that they rotate in the correct direction. This is indicated by arrows on the tire sidewalls. When being installed, extra care is needed to ensure that this direction of rotation is maintained.

1. Remove the wheel mounting nuts and the tire and wheel assembly.
2. Rotate the tire to the desired location.

CAUTION:
Use caution not to damage wheel weights during tire and wheel installation.

3. Install the tire and wheel assembly and install the wheel mounting nuts.
   (Tighten: Wheel mounting nuts to 110 N·m)