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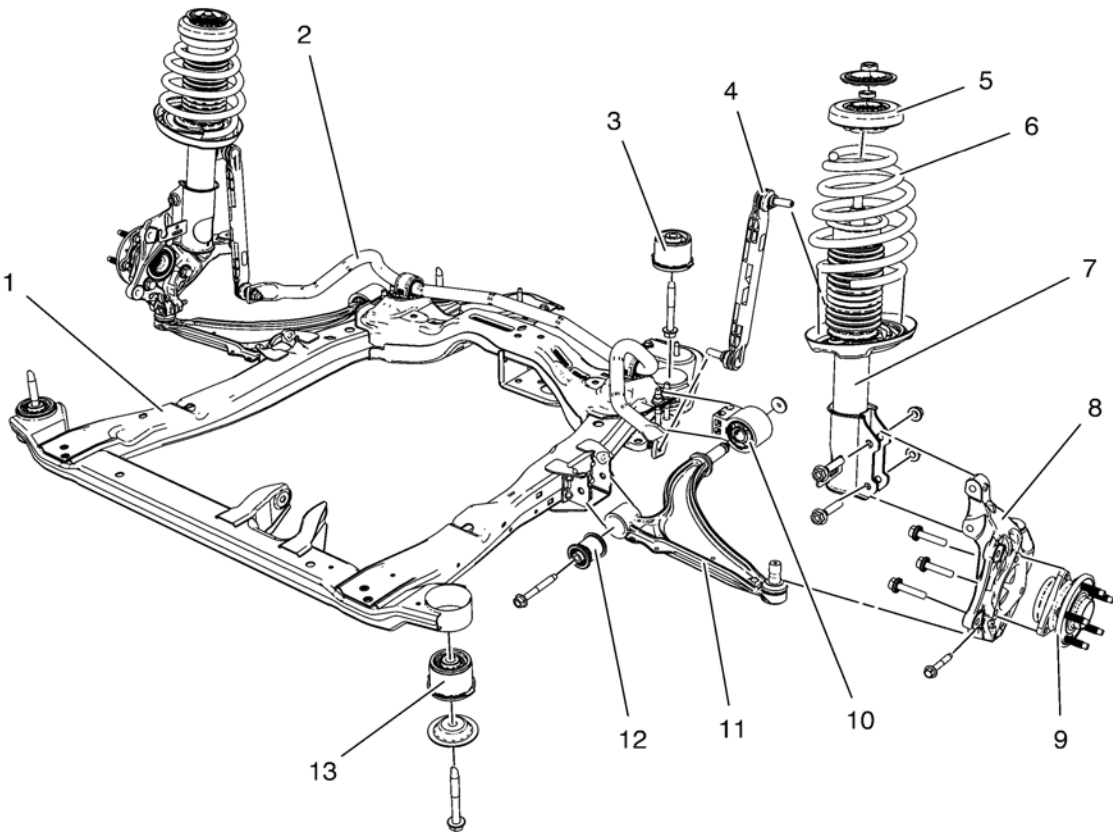


Fastener Tightening Specifications

Application	Specification	
	Metric	English
Control Arm to Steering Knuckle Bolt and Nut	30 N·m +60-75°	22 lb ft +60-75°
Control Arm to Subframe Bolt - Front	70 N·m+75-90°	52 lb ft+75-90°
Control Arm to Subframe Bolt - Rear	70 N·m+75-90°	52 lb ft+75-90°
Front Bearing to Steering Knuckle Bolt	90 N·m +60-75°	66 lb ft +60-75°
Front Stabilizer Shaft Insulator Clamp Bolt	22 N·m + 30°	17 lb in + 30°
Front Suspension Strut Lower Bolt and Nut	90 N·m+60°	66 lb ft+60°
Front Suspension Strut Mount Nut	45 N·m	34 lb ft
Front Suspension Support Bolt	60 N·m + 35°	45 lb ft + 35°
Rear Control Arm Bushing to Control Arm	55 N·m + 45-60°	41 lb ft + 45-60°
Stabilizer Shaft Link to Strut Nut	65 N·m	48 lb ft
Steering Gear Outer Tie Rod to Steering Knuckle Nut	35 N·m	26 lb ft
Steering Knuckle to Strut	90 N·m +60-75°	66 lb ft +60-75°
Strut Shaft Nut	70 N·m	52 lb ft

Front Suspension Components

Front Suspension Components



- (1) Drivetrain and Front Suspension Frame
- (2) Front Stabilizer Shaft
- (3) Drivetrain and Front Suspension Frame Rear Insulator
- (4) Front Stabilizer Shaft Link
- (5) Front Suspension Strut Insulator Assembly
- (6) Front Spring
- (7) Shock Absorber Assembly
- (8) Steering Knuckle
- (9) Front Wheel Bearing/Hub Assembly
- (10) Front Lower Control Arm Rear Bushing
- (11) Front Lower Control Arm
- (12) Front Lower Control Arm Bushing
- (13) Drivetrain and Front Suspension Frame Rear Insulator

Stabilizer Shaft Replacement

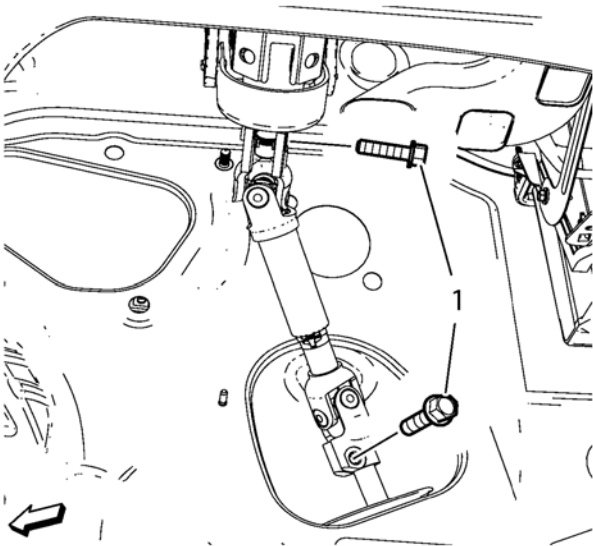
Special Tools

- CH 904 Underframe
- CH 49289 Centering Adapter
- EN 45059 Torque Angle Sensor Kit

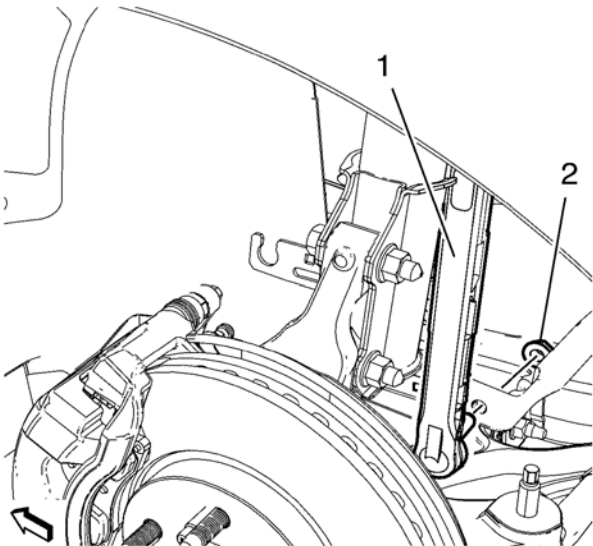
For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

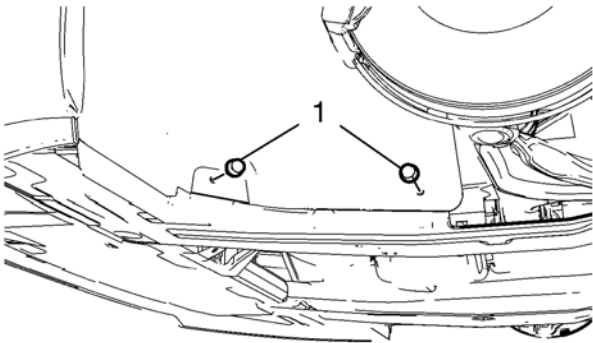
1. Turn the front wheels to the straight forward position and secure the steering wheel from moving.



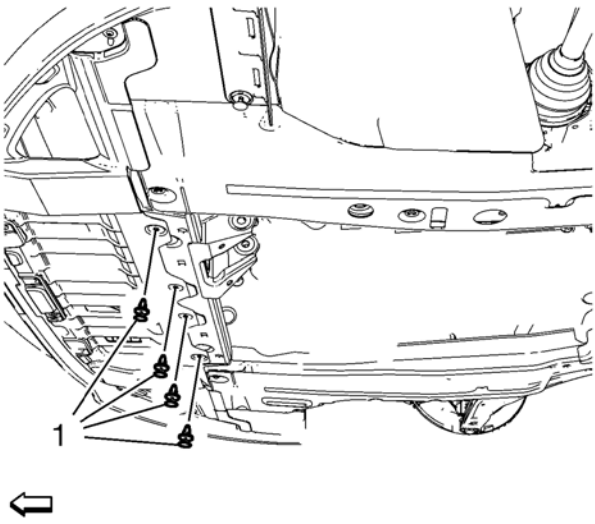
2. Remove the 2 lower steering intermediate shaft bolts (1).
3. Remove the steering intermediate shaft from the steering gear.
4. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
5. Remove the tire and wheel assemblies. Refer to [Tire and Wheel Removal and Installation](#).
6. Remove the front compartment insulator, if equipped. Refer to [Front Compartment Insulator Replacement](#).
7. Remove the exhaust flexible pipe. Refer to [Exhaust Flexible Pipe Replacement](#).



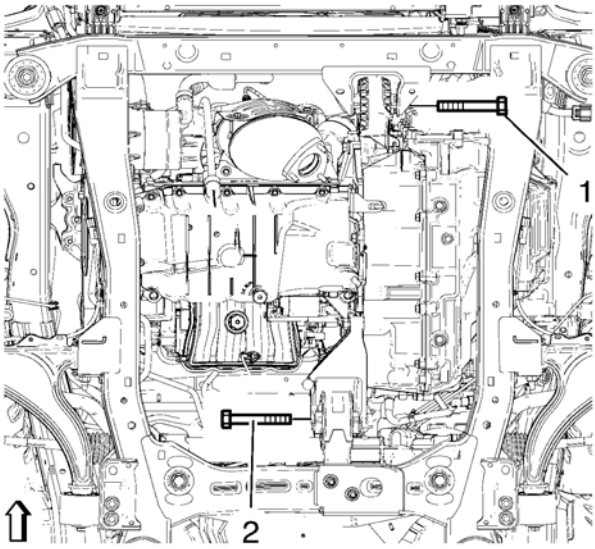
8. Remove lower stabilizer link shaft nut (2) on both sides.
9. Remove stabilizer link shaft (1) from stabilizer shaft.
10. Remove stabilizer link shaft (1) from stabilizer.



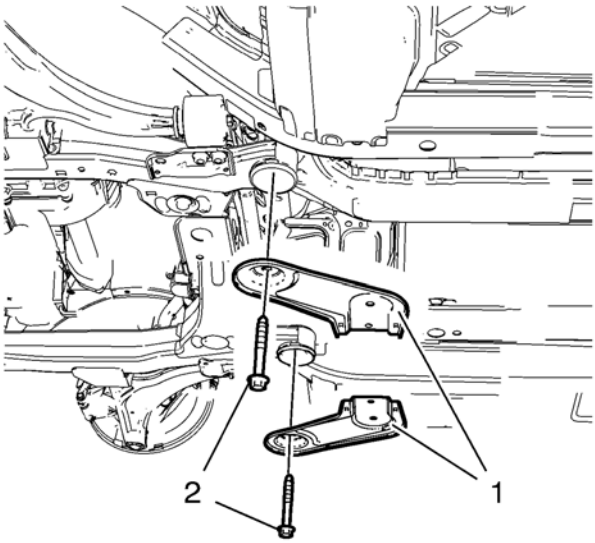
11. Remove 4 fasteners (1) of engine side cover on both sides.



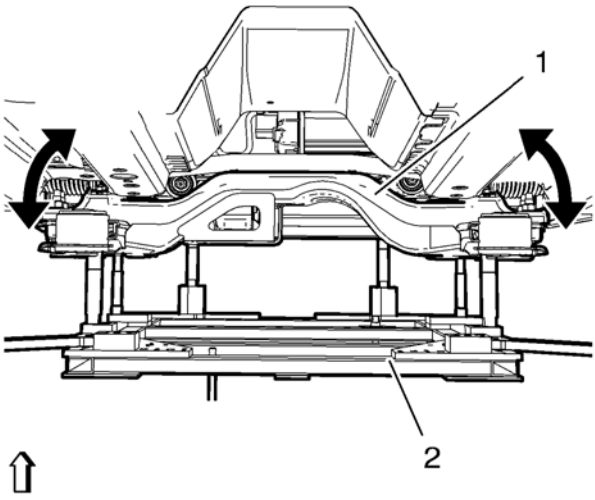
12. Remove 4 fasteners (1) of front engine compartment cover.



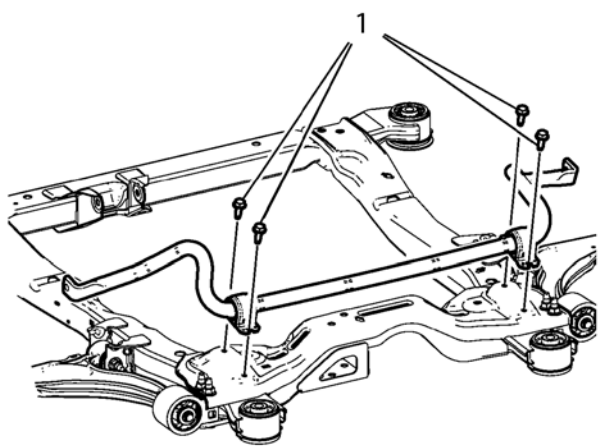
13. Remove the front (1) and the rear (2) transmission mount bracket bolts.



14. Remove and DISCARD 2 rear suspension frame bolts (2).
Remove rear frame reinforcements (1).

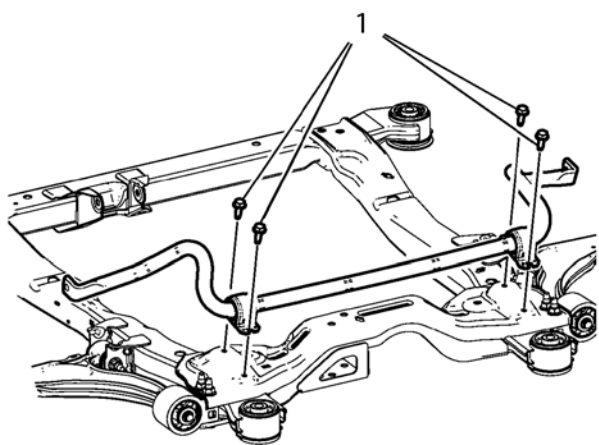


15. Position and set hydraulic lifter in connection with *CH-904* frame and *CH-49289-50* adapter (2) onto suspension frame (1). Pull away front engine compartment cover slightly..
16. Lower suspension frame max. **55 mm**.



17. Remove the 4 front stabilizer shaft insulator clam bolts (1).
18. Remove the stabilizer shaft.

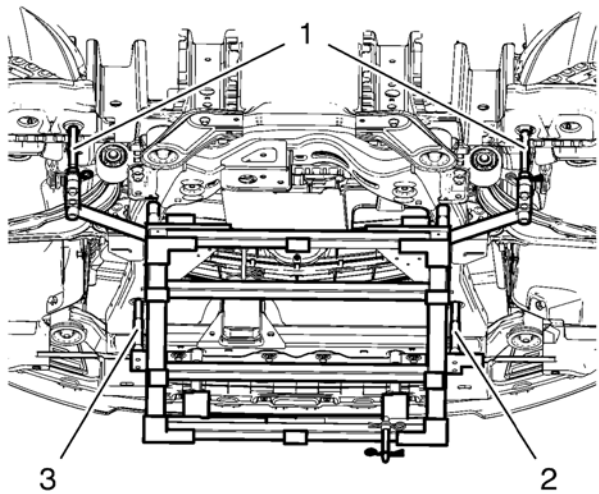
Installation Procedure



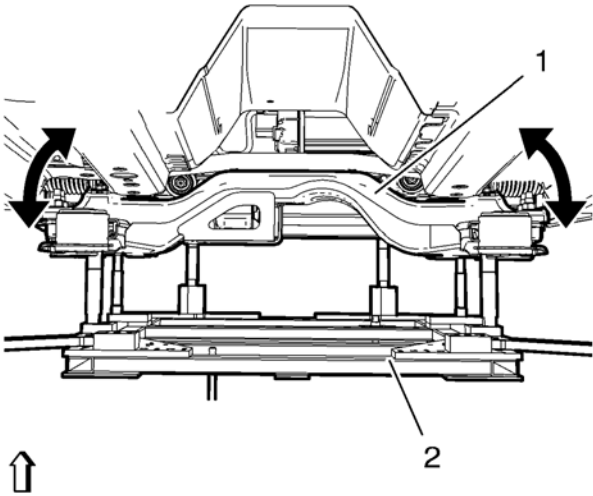
1. Install the stabilizer shaft.

Caution: Refer to [Fastener Caution](#) in the Preface section.

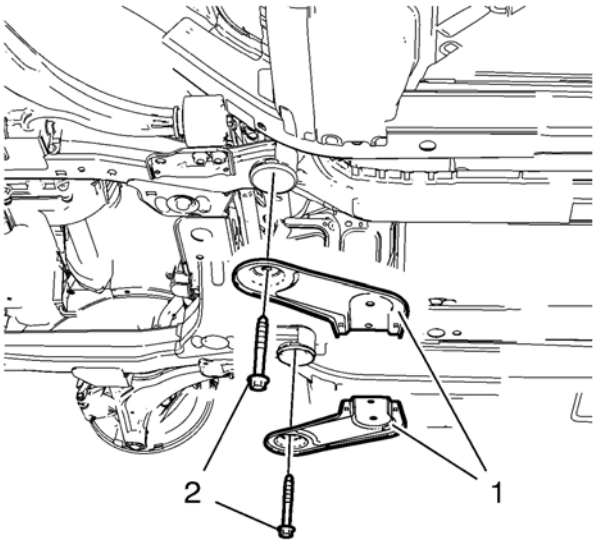
2. Install the 4 front stabilizer shaft insulator clam bolts (1) and tighten to **22 N·m (17 lb ft) plus 30 degrees**.



3. Move out the positioning pins (1) of *CH 49289* adapter .

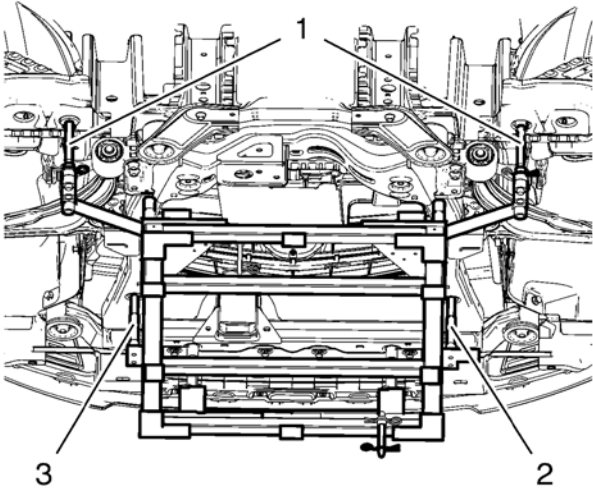


4. Raise the frame (1) carefully, using *CH 49289* adapter (2).

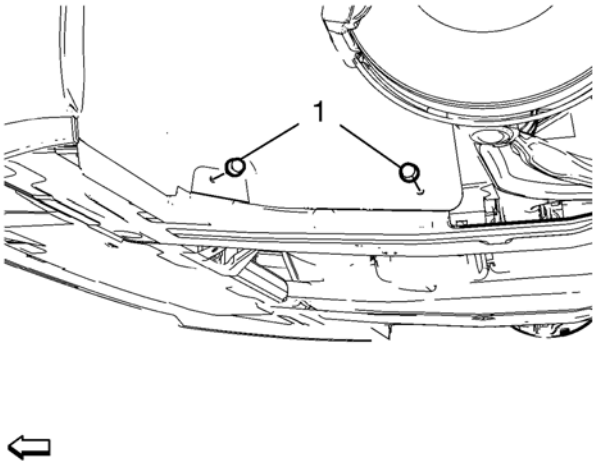


Note: Note: Do NOT reuse old bolts

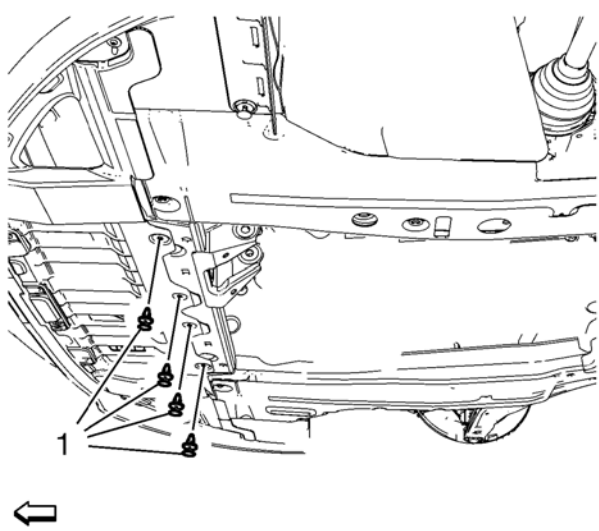
- 5. Install the 2 frame reinforcements (1).
- 6. Install the 2 NEW frame rear bolts (2) and tighten to **160 N·m (119 lb ft)**.



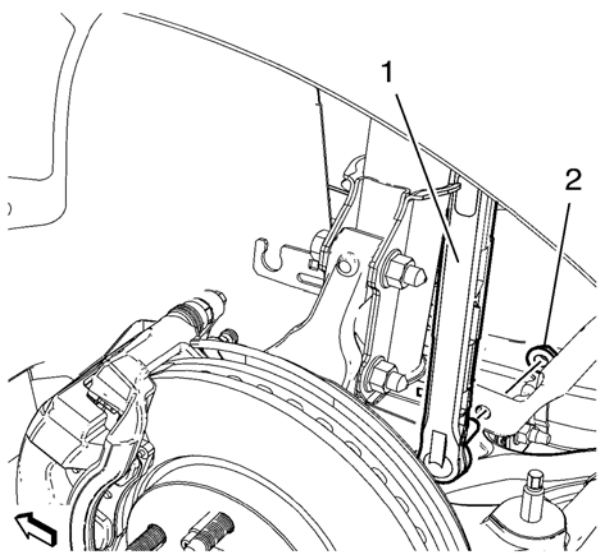
- 7. Install the front transmission mount bolt (1) and tighten to **58 N·m (43 lb ft)**.
- 8. Install the rear transmission mount bracket bolt (2) and tighten to **100 N·m (74 lb ft)**.



9. Install and tighten 4 fasteners (1) of engine side cover on both sides.

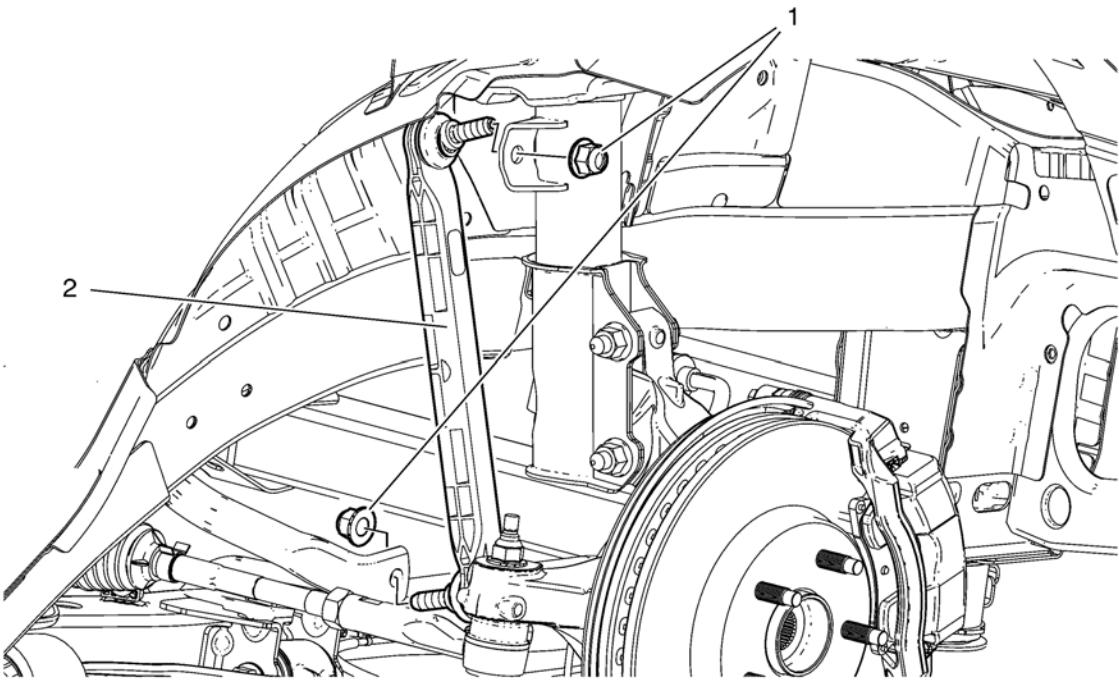


10. Install and tighten the 4 fasteners (1) of front engine compartment cover.
11. Install the front compartment insulator, if equipped [Front Compartment Insulator Replacement](#).
12. Install the exhaust flexible pipe. Refer to [Exhaust Flexible Pipe Replacement](#).



13. Install and tighten lower stabilizer link shaft nut (2) on both sides to **35 N·m (26 lb ft)**.
14. Lower the vehicle.
15. Install the tire and wheel assemblies. Refer to [Tire and Wheel Removal and Installation](#).

Stabilizer Shaft Link Replacement



Callout	Component Name
Preliminary Procedure 1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle. 2. Remove the front tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation.	
1	Stabilizer Shaft Link Nut (Qty: 2) Caution: Refer to Fastener Caution in the Preface section. Procedure Discard the old stabilizer shaft link nut and use NEW ONLY. Tighten 65 N·m (48 lb ft)
2	Stabilizer Shaft Link

Stabilizer Shaft Insulator Replacement

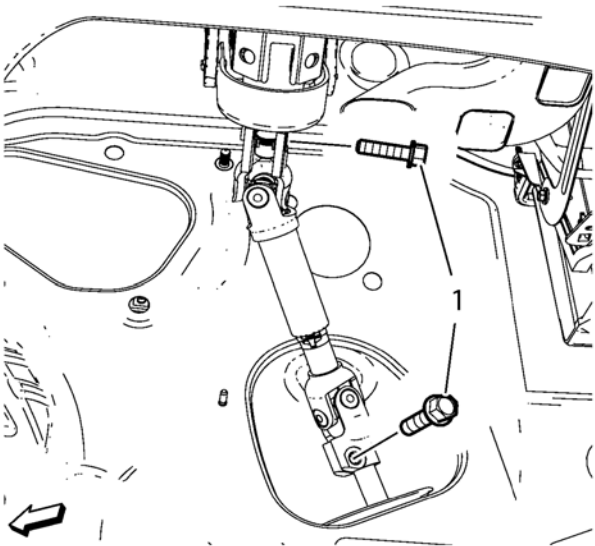
Special Tools

- CH 904 Underframe
- EN 45059 Torque Angle Sensor Kit
- CH 49289 Centering Adapter

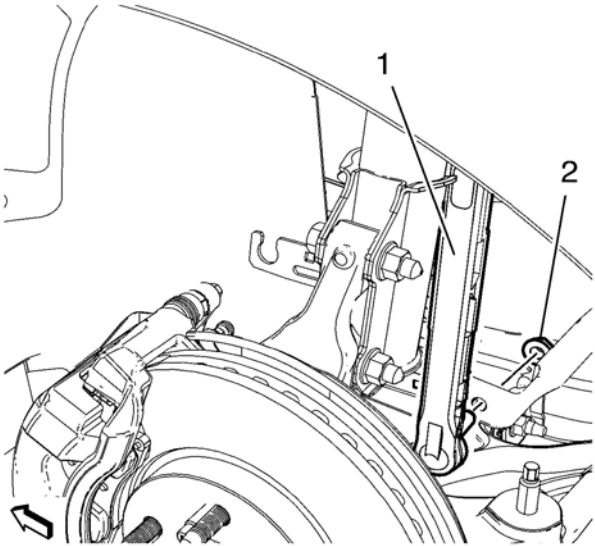
For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

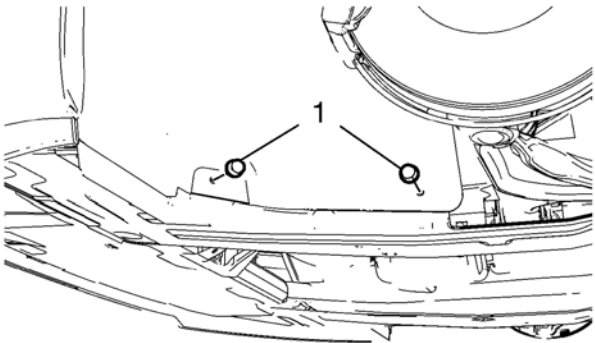
1. Turn the front wheels to the straight forward position and secure the steering wheel from moving.



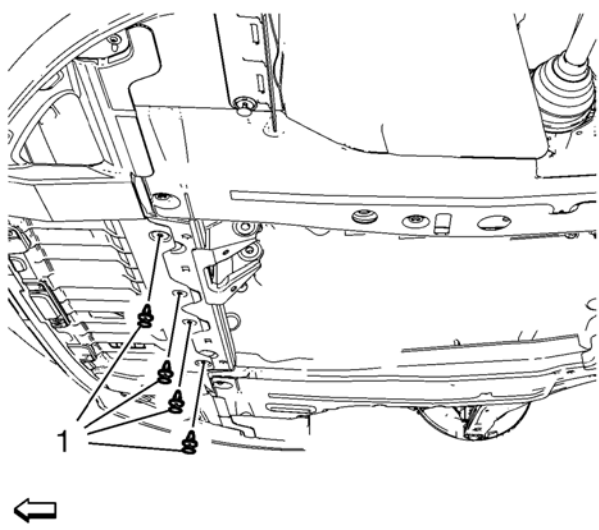
2. Remove the 2 lower steering intermediate shaft bolts (1).
3. Remove the steering intermediate shaft from the steering gear.
4. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#)
5. Remove the tire and wheel assemblies. Refer to [Tire and Wheel Removal and Installation](#)
6. Remove the front compartment insulator, if equipped.
7. Remove the engine shield, if equipped.
8. Remove the exhaust flexible pipe. Refer to [Exhaust Flexible Pipe Replacement](#).



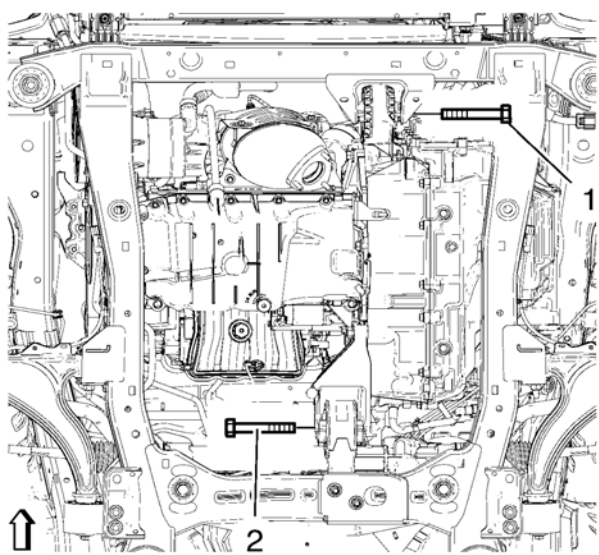
9. Remove lower stabilizer link shaft nut (2) on both sides.
10. Remove stabilizer link shaft (1) from stabilizer shaft.
11. Remove stabilizer link shaft (1) from stabilizer.



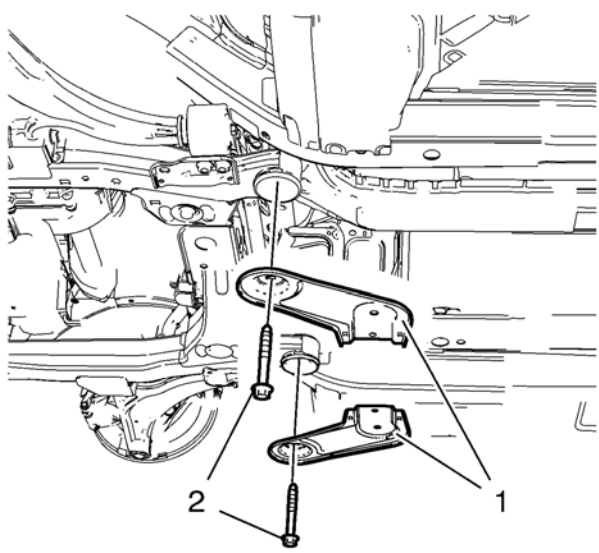
12. Remove 4 fasteners (1) for the engine side cover on both sides.



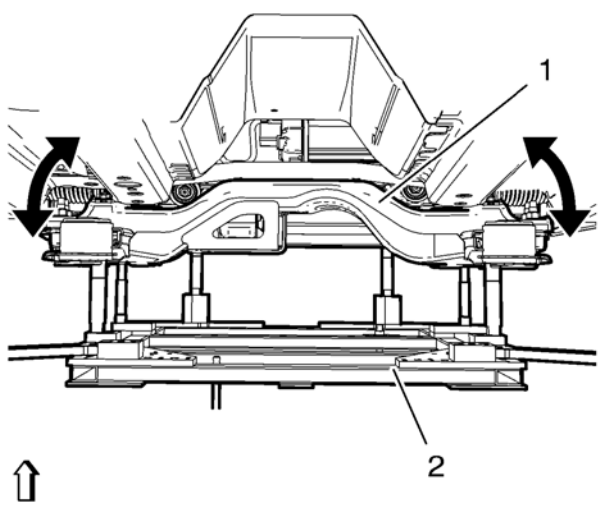
13. Remove 4 fasteners (1) for the front engine compartment cover.



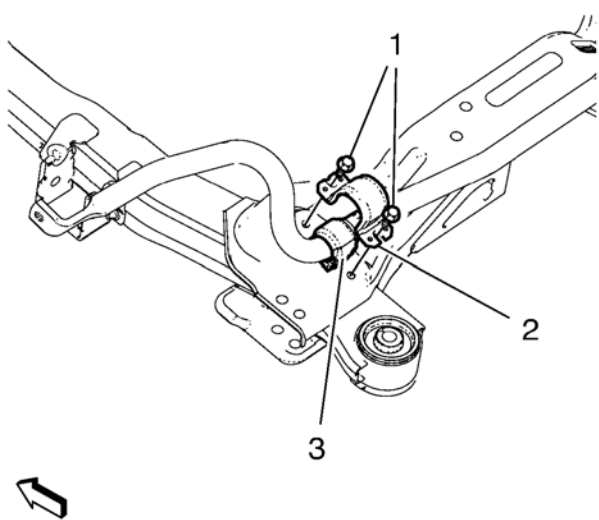
14. Remove the front and rear transmission mount bracket bolts (1, 2).



15. Remove and DISCARD 2 rear suspension frame bolts (2).
Remove rear frame reinforcements (1).



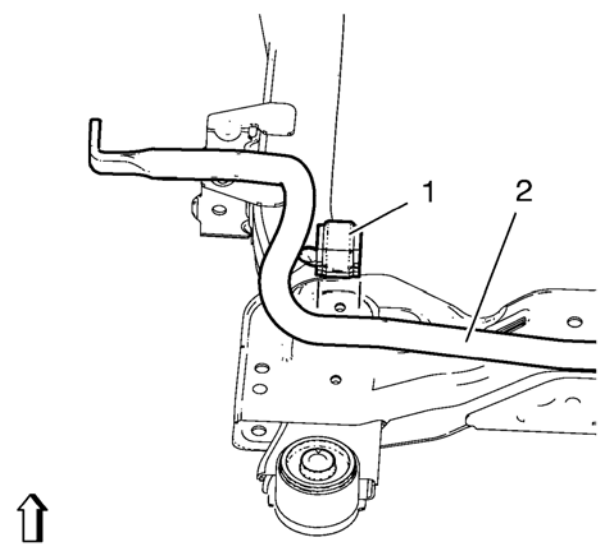
16. Position and set hydraulic lifter in connection with *CH 904* frame and *CH 49289-50* adapter (2) onto suspension frame (1). Bent from cover beside.
17. Lower suspension frame max. 55 mm.



Note: In order to assure a correct installation of the insulators **ONLY** remove and install the insulators side by side! Dismantled **MUST BE** discarded.

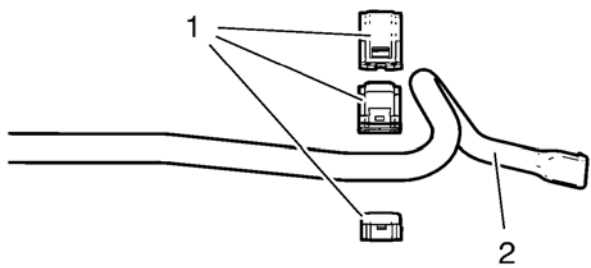
18. Remove and discard the two front stabilizer shaft insulator clamp bolts (1).
19. Remove the shaft insulator clamp (2).

Bend up clamp (2) slightly.

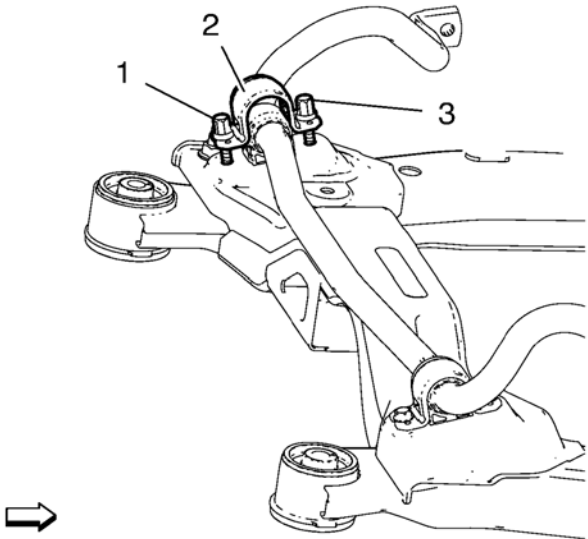


20. Mark the location of the insulator (1) to the stabilizer shaft (2).
21. Remove insulator (1) from stabilizer shaft (2).

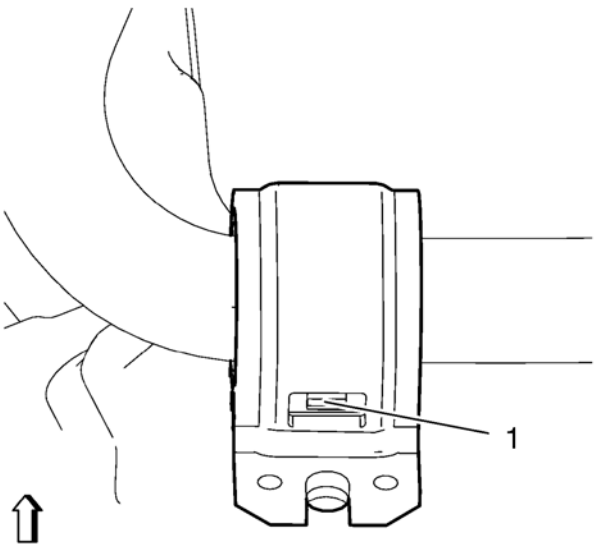
Installation Procedure



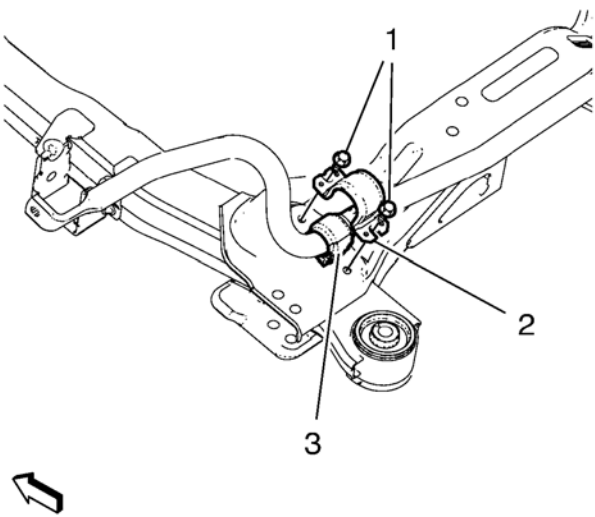
1. Install NEW stabilizer shaft insulators (1) to stabilizer shaft (2) so that the slit in the insulator is facing the rear of the vehicle.



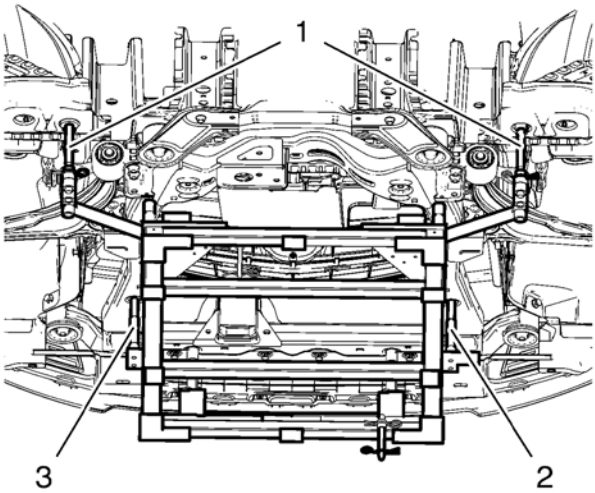
2. Install the insulator clamp to the insulator:
- 2.1. Position the clamp (2) over on the insulator.
 - 2.2. Use two M8 bolts (1, 3) with 40 mm (1.57 in) length.
 - 2.3. Tighten bolts (1, 3) by turns until clamp (2) slips over insulator.



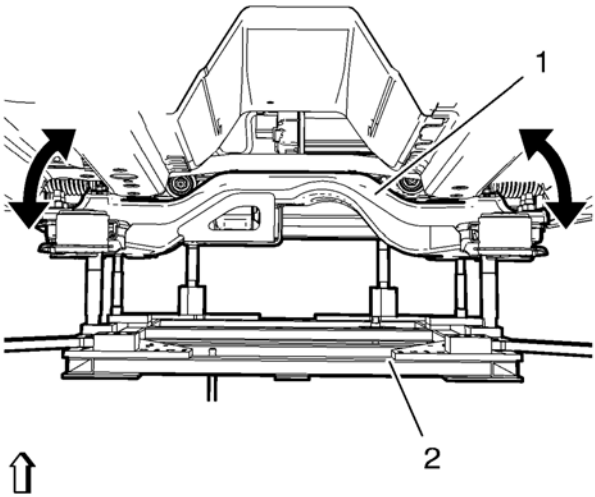
3. Check proper fitting of clamp and insulator.
- Retainer (1) MUST seat centrally in the hole of the clamp.
- Caution:** Refer to [Fastener Caution](#) in the Preface section.



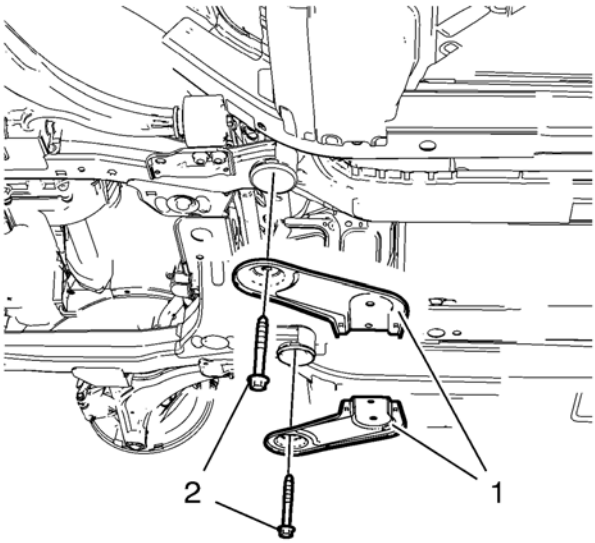
4. Install the NEW stabilizer shaft bolts (1) and tighten the NEW stabilizer shaft bolts to **22 N·m (17 lb ft) + 40°** using the *EN 45059* kit .



5. Move out positioning pins (1) of CH 49289 adapter .

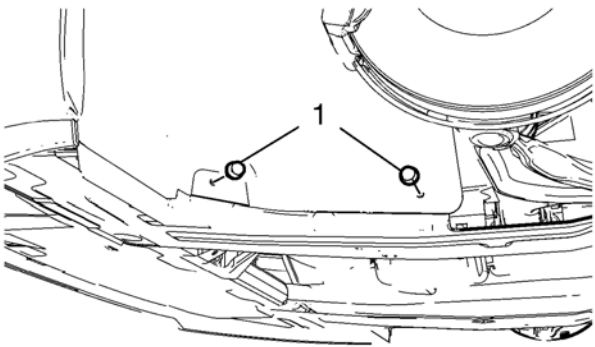


6. Carefully, raise the frame (1) using CH 49289 adapter (2).

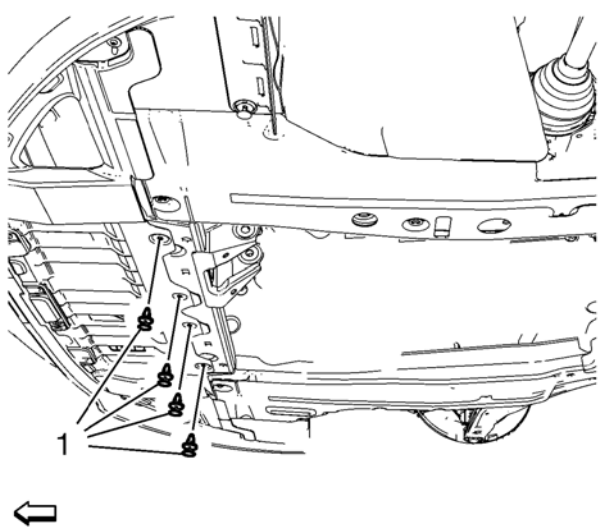


Note: Do NOT reuse old bolts.

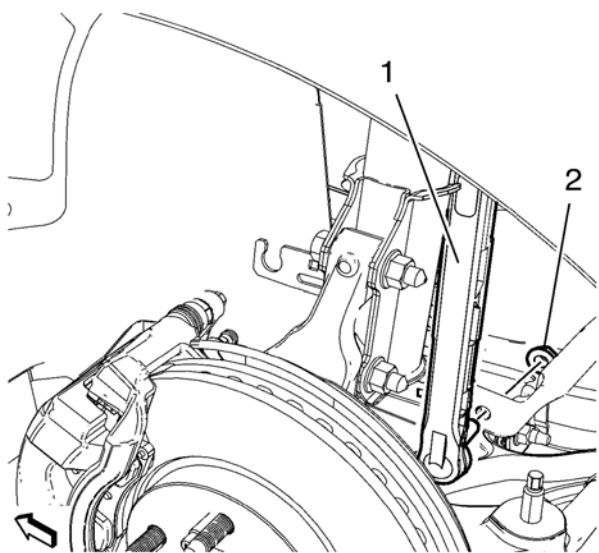
- 7. Install the 2 frame reinforcements (1).
- 8. Install the 2 NEW frame rear bolts (2) and tighten to **160 N·m (118 lb ft)**.
- 9. Install the front transmission mount bolt (1) and tighten to **58 N·m (43 lb ft)**.
- 10. Install the rear transmission mount bracket bolt (2) and tighten to **100 N·m (74 lb ft)**.



11. Install and tighten 4 fasteners (1) to the engine side cover on both sides.



12. Install and tighten 4 fasteners (1) to the front engine compartment cover.
13. Install the front compartment insulator, if equipped.
14. Install the engine shield, if equipped.
15. Install the exhaust flexible pipe. Refer to [Exhaust Flexible Pipe Replacement](#).



16. Install and tighten lower stabilizer link shaft nut (2) on both sides to **35 N·m (26 lb ft)**
17. Lower the vehicle.
18. Install the front tire and wheel assemblies. Refer to [Tire and Wheel Removal and Installation](#)

Front Wheel Bearing and Hub Replacement

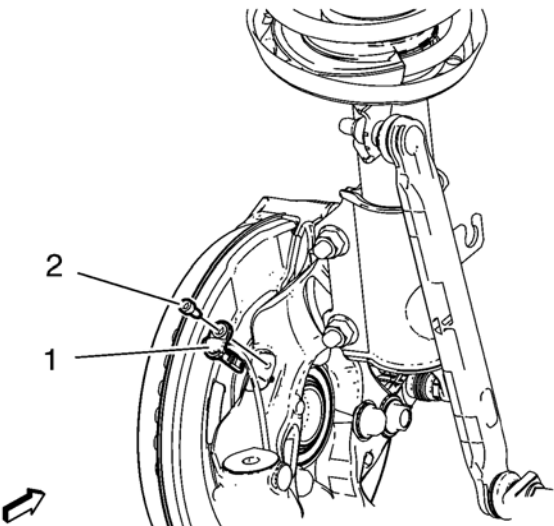
Special Tools

EN-45059 Torque Angle Sensor Kit

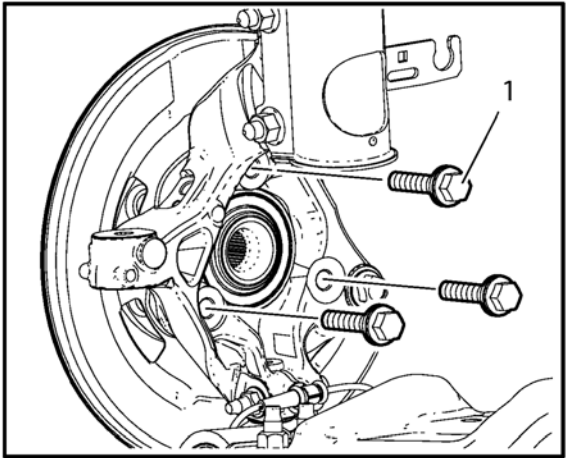
For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

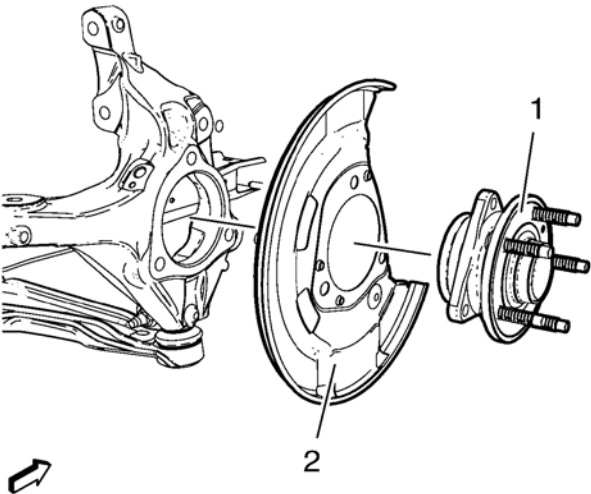
1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the brake rotor. Refer to [Front Brake Rotor Replacement](#).



3. Remove the wheel speed sensor screw (2).
4. Remove the wheel speed sensor (1) from the steering knuckle.
5. Remove the wheel drive shaft from the front wheel bearing/hub. Refer to front wheel drive shaft replacement [Front Wheel Drive Shaft Replacement - Left Side](#) and/or [Front Wheel Drive Shaft Replacement - Right Side](#).

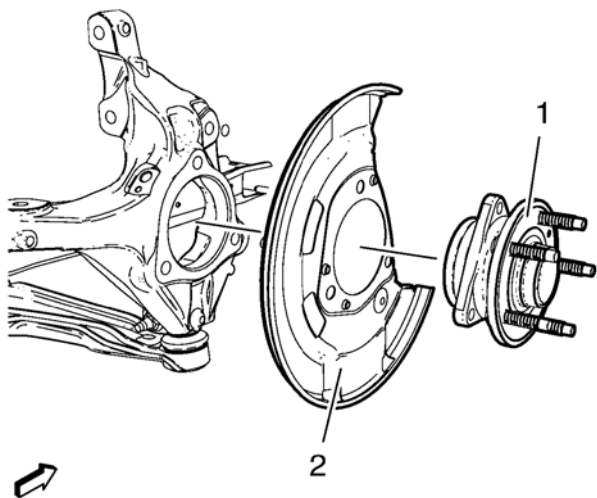


6. Remove and discard the front wheel bearing/hub bolts (1).



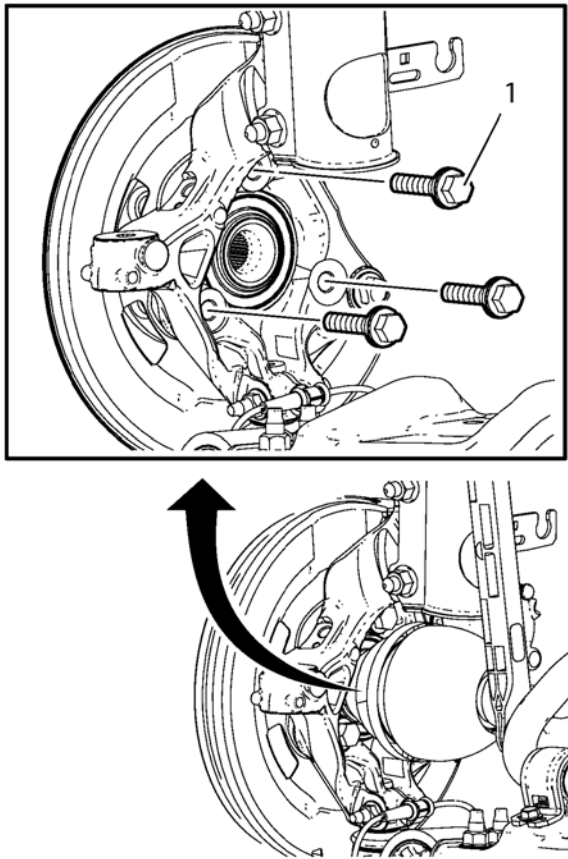
7. Remove the front wheel bearing/hub (1) and front brake shield (2) from the steering knuckle.

Installation Procedure

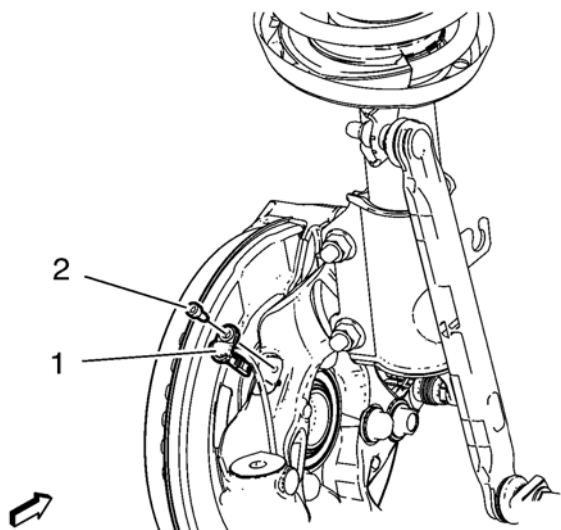


1. Position the front brake shield (2) and front wheel bearing/hub (1) assembly in the steering knuckle.

Caution: Refer to [Fastener Caution](#) in the Preface section.



2. Install the NEW front wheel bearing/hub bolts (1).
3. Tighten the bearing/hub bolts (1) in 3 passes. Use the *EN-45059* kit .
- First pass to **90 N·m (67 lb ft)**
 - Second pass to **60°**
 - Third pass to **15°**
4. Install the wheel drive shaft at the front wheel bearing/hub. Refer to [Front Wheel Drive Shaft Replacement - Left Side](#) or [Front Wheel Drive Shaft Replacement - Right Side](#).

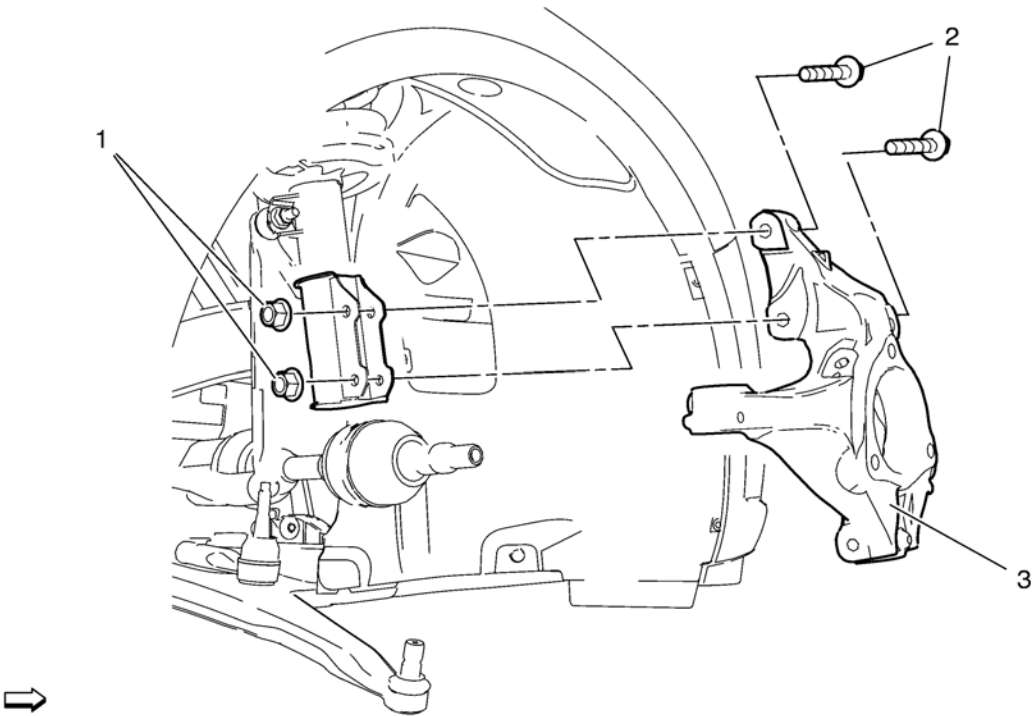




- 5. Install the wheel speed sensor (1) to the steering knuckle.
- 6. Install the wheel speed sensor screw (2) and tighten to **6 N·m (54 lb in)**.
- 7. Install the brake rotor. Refer to [Front Brake Rotor Replacement](#).
- 8. Remove the support and lower the vehicle.



Steering Knuckle Replacement



Callout	Component Name
Preliminary Procedure 1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle. 2. Remove the wheel bearing and hub assembly. Refer to Front Wheel Bearing and Hub Replacement. 3. Separate the outer tie rod end from the knuckle. Refer to Steering Linkage Outer Tie Rod Replacement. 4. Remove the wheel bearing/hub. Refer to Lower Control Arm Replacement.	
1	Steering Knuckle Bolt (Qty: 2)
2	Steering Knuckle Nut (Qty: 2) Caution: Refer to Fastener Caution in the Preface section. Tighten 90 N·m(66 lb ft) + 60-70 degrees
3	Steering Knuckle

Lower Control Arm Replacement

Special Tools

EN-45059 Torque Angle Sensor Kit

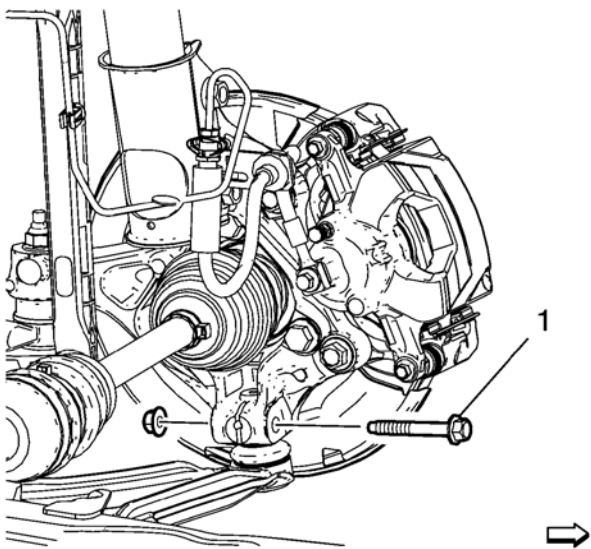
For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

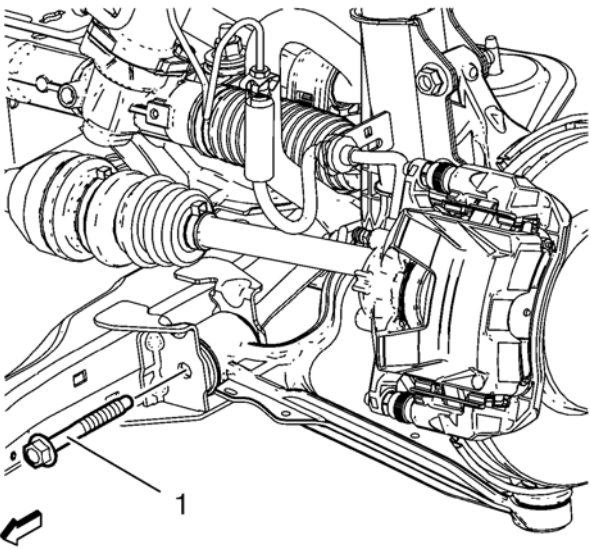
1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel. Refer to [Tire and Wheel Removal and Installation](#).

Note: DO NOT re-use the lower control arm bolts and nuts. Discard and use NEW only.

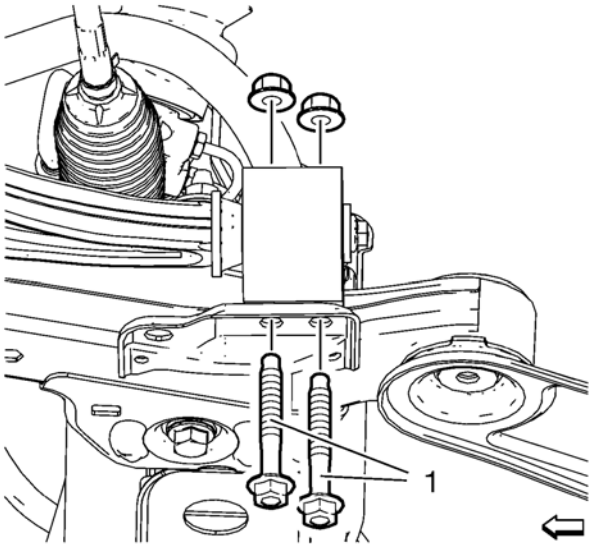
3. Remove wheel speed sensor wiring harness from control arm and steering knuckle.



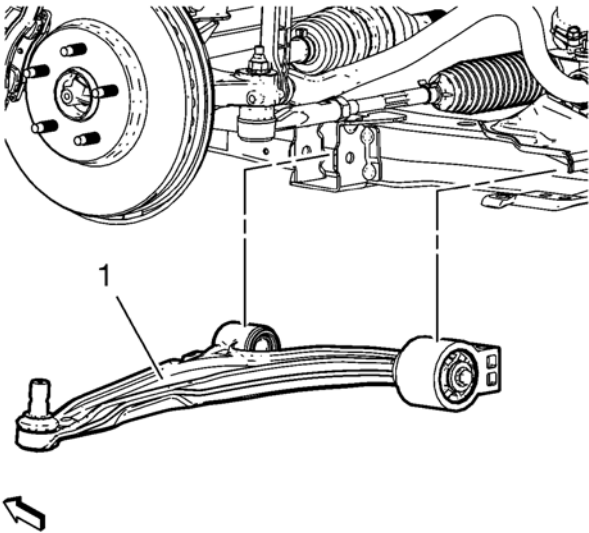
4. Remove and DISCARD the lower ball joint to knuckle nut and bolt (1).
5. Separate the lower control arm from the knuckle.



6. Remove and DISCARD the front lower control arm nut and bolt (1).

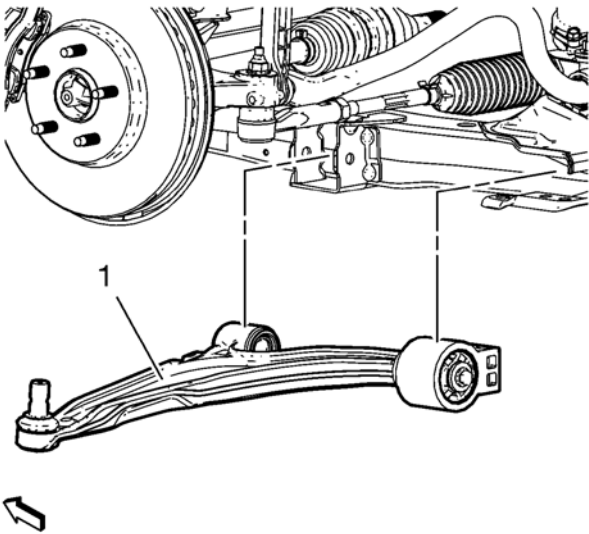


7. Remove and DISCARD the rear lower control arm bushing nuts and bolts (1).

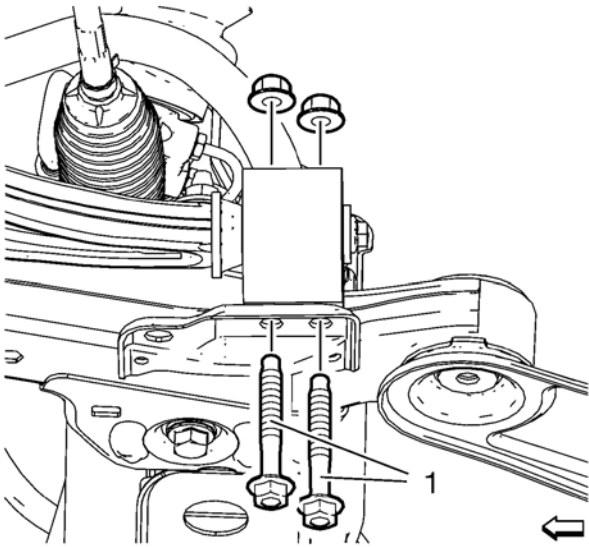


8. Remove the lower control (1) arm from the front frame.

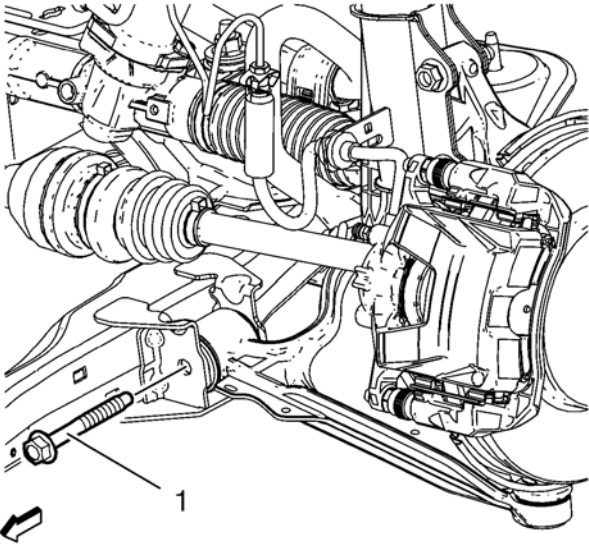
Installation Procedure



1. Position the lower control arm (1) in the cradle.

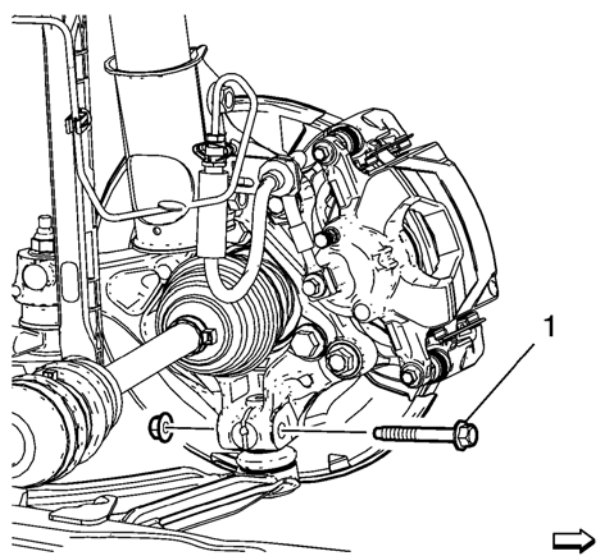


2. Install and hand tighten the NEW rear lower control arm bushing nuts and bolts (1).



3. Install and hand tighten the NEW front lower control arm nut and bolt (1).

Caution: Refer to [Fastener Caution](#) in the Preface section.

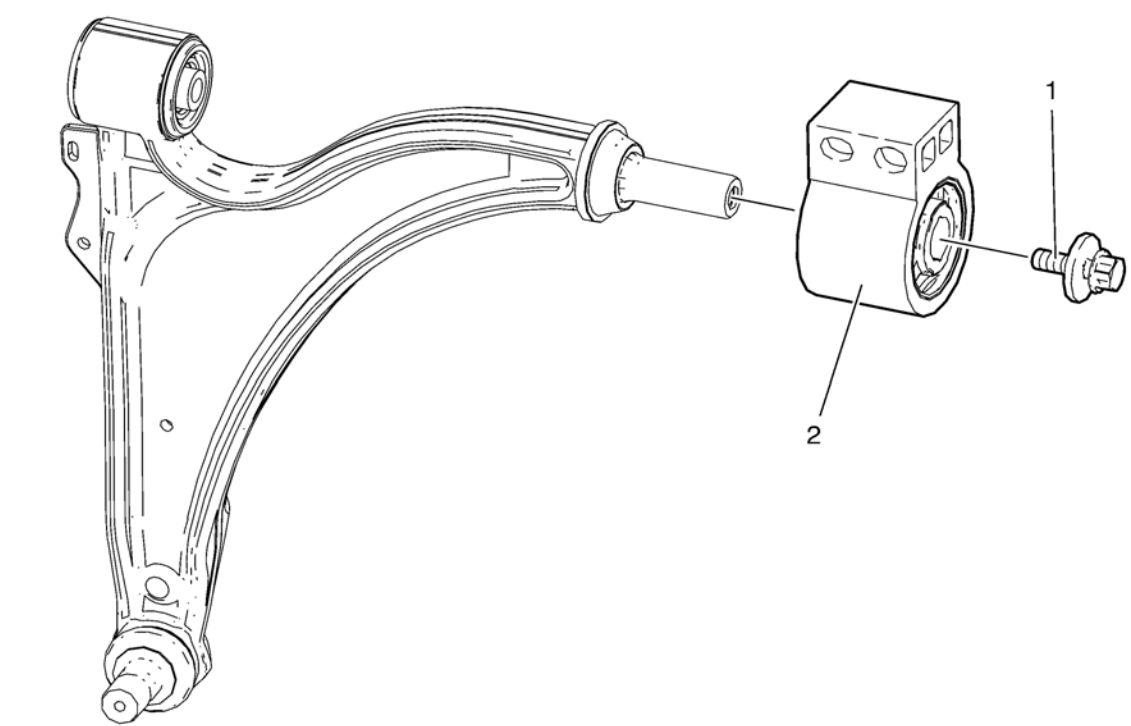


- 4. Support the lower control arm with a hydraulic jack and lift the control arm into the neutral position.
- 5. Tighten the front lower control arm bolt (1) to **70 N·m (52 lb ft) +75-90 degrees** , using *EN-45059* kit .
- 6. Tighten the rear bushing to frame bolts to **55 N·m (41 lb ft) +45-60 degrees** , using *EN-45059* kit .
- 7. Install the NEW ball joint to knuckle bolt and nut and tighten to **30 N·m (22 lb ft) +60-75 degrees** , using *EN-45059* kit .

Lower the vehicle to the ground in order to tighten the control arm fasteners correctly.

- 8. Remove the jack stand.
- 9. Install the tire and wheel. Refer to [Tire and Wheel Removal and Installation](#).
- 10. Lower the vehicle.

Front Lower Control Arm Bushing Replacement



Callout	Component Name
Preliminary Procedure 1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle. 2. Remove the tire and wheel. Refer to Tire and Wheel Removal and Installation. 3. Remove the lower control arm. Refer to Lower Control Arm Replacement.	
1	Lower Control Arm Rear Bushing Bolt
2	Lower Control Arm Rear Bushing Caution: Refer to Fastener Caution in the Preface section. Procedure 1. Discard Bushing Bolt and use NEW ONLY. 2. Tighten Bushing Bolt with vehicle standing on the ground. Tighten 55 N·m (41 lb ft) +45-60 degrees Special Tools EN-45059 Torque Angle Sensor Kit . Refer to Special Tools.

Wheel Stud Replacement

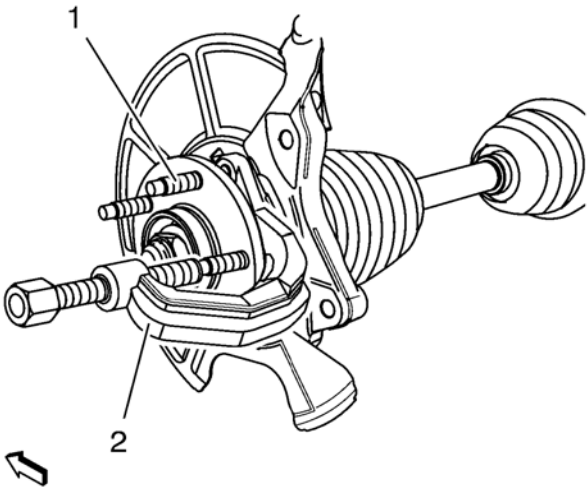
Special Tools

CH-43631 Ball Joint Remover

For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

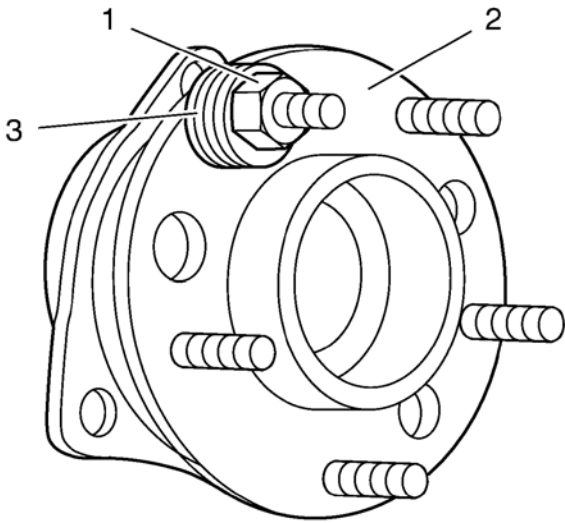
1. Raise and suitably support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
3. Remove and support the brake caliper and bracket as an assembly, and remove the brake rotor. Refer to [Front Brake Rotor Replacement](#).
4. Rotate the bearing hub to a position where the least amount of interference between the stud and the steering knuckle exists.



Caution: Support the brake caliper with heavy mechanic wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.

5. Using the CH-43631 remover (2) release the wheel stud (1) from the bearing hub and discard the stud (1).

Installation Procedure



1. Install a NEW stud into the bearing/hub assembly (2). Add enough washers (3) in order to draw the stud into the hub.
2. Install and tighten a wheel nut (1) until the head of the wheel stud is fully seated against the back of the bearing/hub flange (2).
3. Remove the wheel nut (1) and the washers (3).
4. Install the brake rotor, and install the brake caliper and bracket as an assembly. Refer to [Front Brake Rotor Replacement](#).
5. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
6. Lower the vehicle.

Strut Assembly Replacement

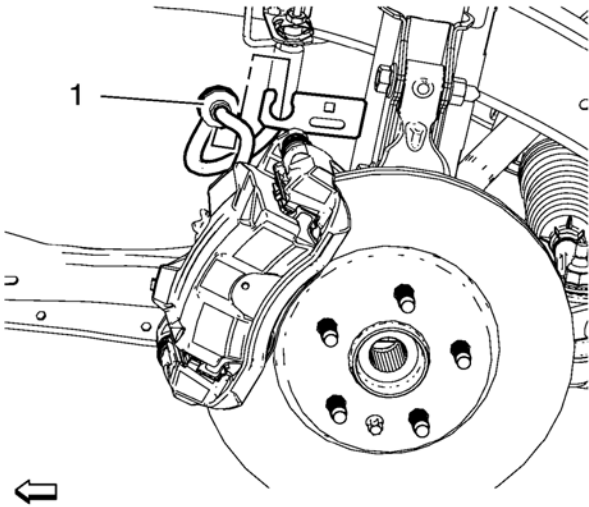
Special Tools

CH 49375 Wrench

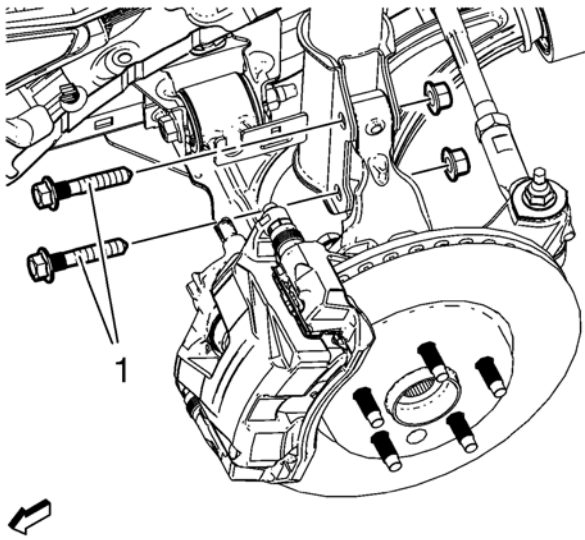
For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

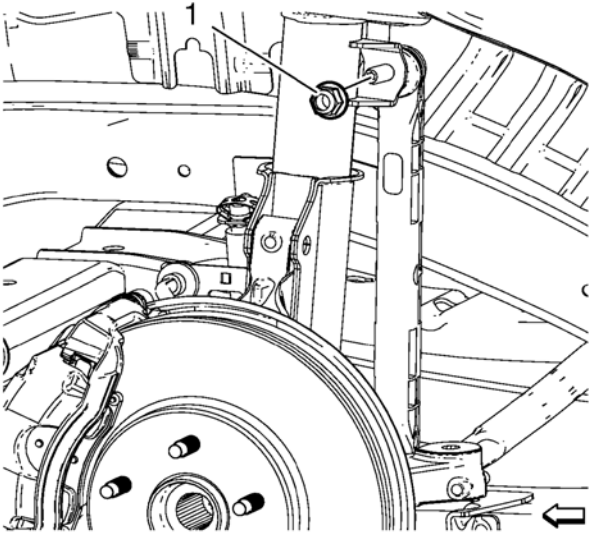
1. Raise and the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).



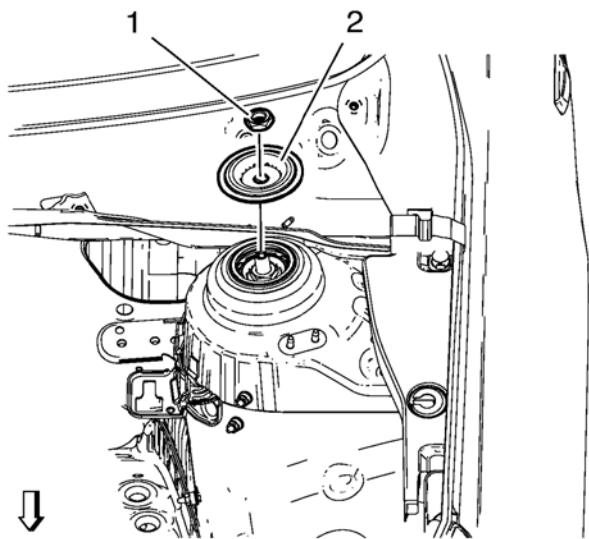
3. Separate the brake hose (1) from the shock absorber.



4. Remove the steering knuckle nuts and bolts (1).



5. Remove the stabilizer shaft link nut (1) from the front strut.
6. Lower the vehicle.
7. Open the hood.

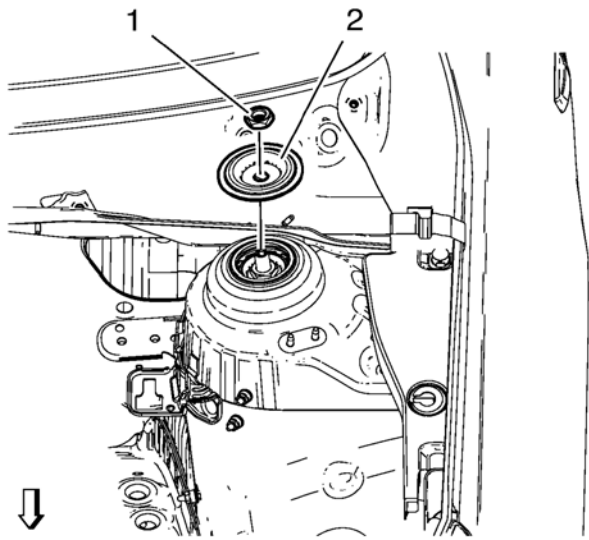


- 8. Remove the upper strut mount nut (1), use the *CH 49375* wrench .
- 9. Remove the strut mounting plate (2).
- 10. Separate the front strut from the knuckle.
- 11. Remove the front strut assembly from the vehicle.
- 12. For servicing the individual strut components, refer to [Strut, Strut Component, or Spring Replacement](#).

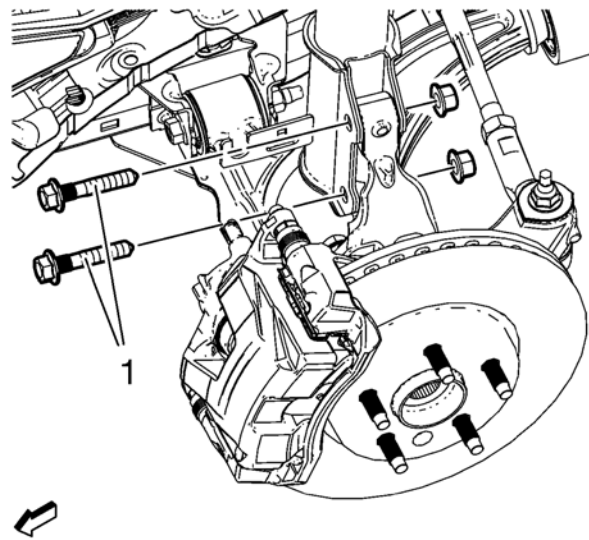
Installation Procedure

- 1. Install the front strut assembly.

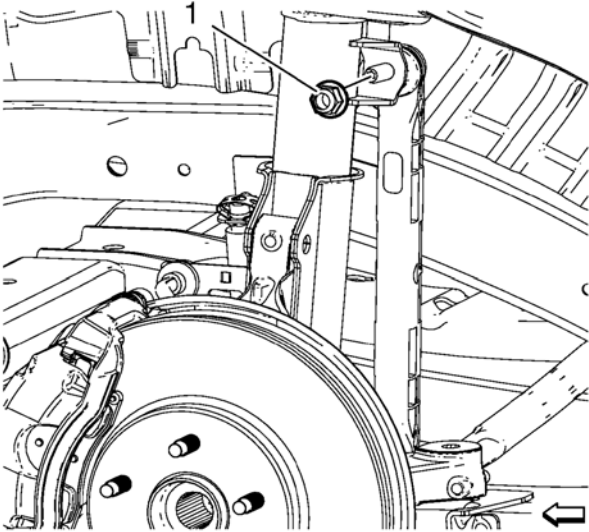
Caution: Refer to [Fastener Caution](#) in the Preface section.



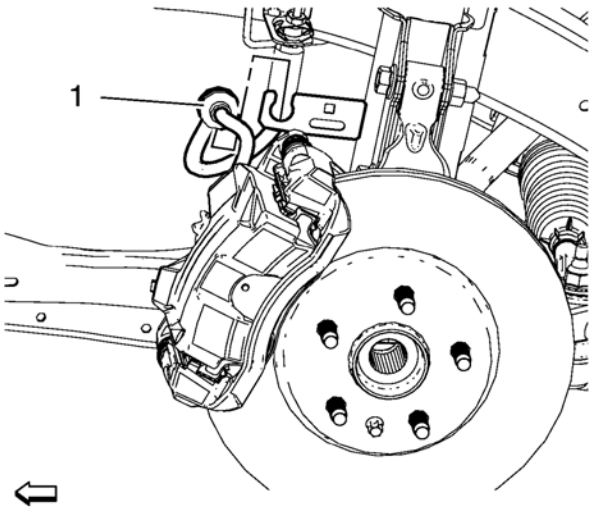
- 2. Install the strut mounting plate (2).
- 3. Install the upper strut mount nut (1), using the *CH 49375* wrench and tighten to **45 N·m (34 lb ft)**.



- 4. Insert the front strut in the knuckle.
- 5. Install the steering knuckle nuts and bolts (1) and tighten to **90 N·m (66 lb ft) +60-70 degrees**.



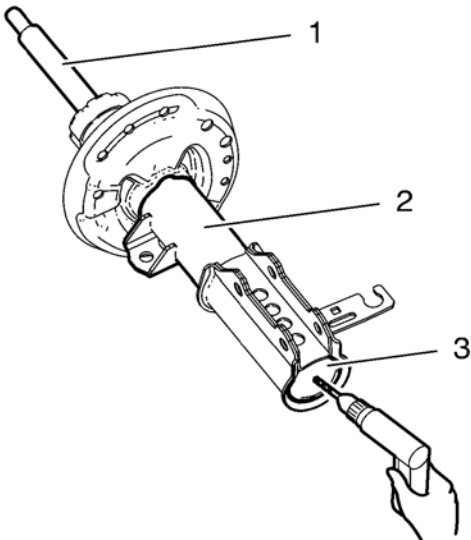
6. Install the stabilizer shaft link nut (1) and tighten to **65 N·m (48 lb ft)**.



7. Install the brake hose (1) to the strut.
8. Install the front tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
9. Lower the vehicle.
10. Check the front end alignment specifications. Refer to [Wheel Alignment Specifications](#).

Shock Absorber Disposal

Warning: Use the proper eye protection when drilling to prevent metal chips from causing physical injury.



1. Clamp the strut in a vise horizontally with the rod (1) completely extended.
2. Drill a hole in the strut at the center of the end cap (3) using a 5 mm (3/16 in) drill bit. Gas or a gas/oil mixture will exhaust when the drill bit penetrates the strut. Use shop towels in order to contain the escaping oil.
3. Remove the strut from the vise.
4. Hold the strut over a drain pan vertically with the hole down.
5. Move the rod (1) in and out of the tube (2) to completely drain the oil from the strut.

Strut, Strut Component, or Spring Replacement

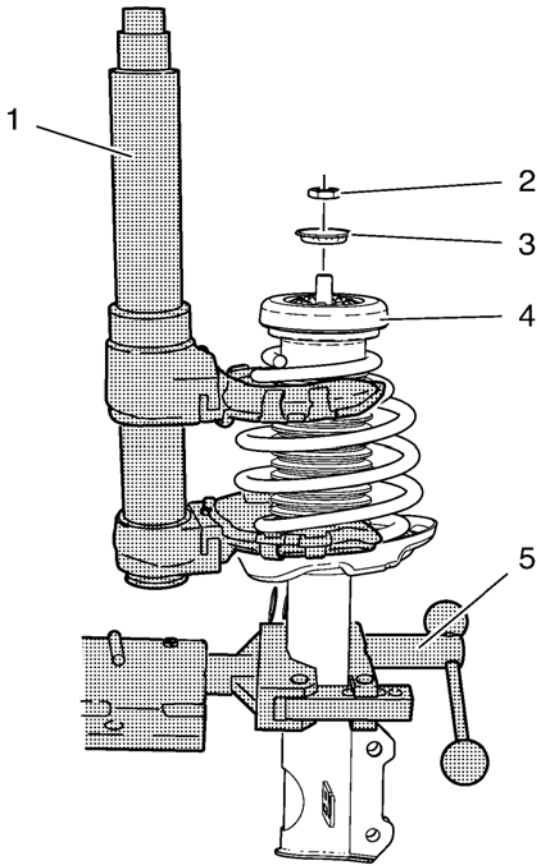
Special Tools

- CH-6068 Spring Tensioner Device
- CH-6066 Holding Device

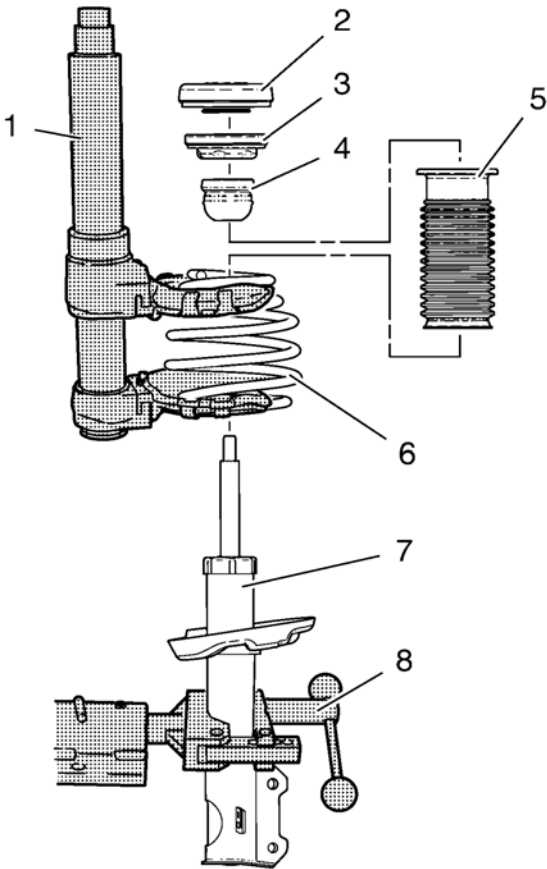
For equivalent regional tools, refer to [Special Tools](#).

Disassembly Procedure

1. Remove the strut assembly. Refer to [Strut Assembly Replacement](#).

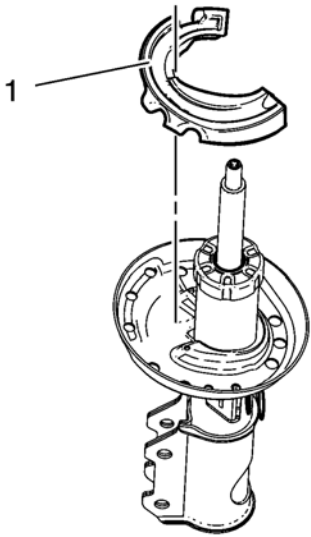


2. Install the strut to the CH-6066 holder (5).
3. Tension spring (4), using CH-6068 tensioner to remove the spring tension from the upper strut mount.
4. Remove the strut nut (2).
5. Remove the strut mount insulator washer (3).



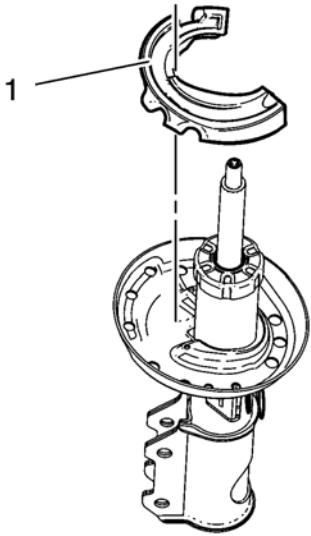
6. Remove the front spring strut components:
 - 6.1. Remove the strut mount insulator assembly (2). Inspect for damage and replace as necessary.
 - 6.2. Remove the strut mount bearing assembly (3). Inspect for damage and replace as necessary.
 - 6.3. Remove the bumper (4). Inspect for damage and replace as necessary.
 - 6.4. Remove the insulator (5). Inspect for damage and replace as necessary.
 - 6.5. Remove the spring (6) with CH-6068 tensioner (1).
 - 6.6. Remove the spring tension using the CH-6068 tensioner . Inspect for damage and replace as necessary.

6.7. Remove the strut (7) from *CH-6066* holder (8).

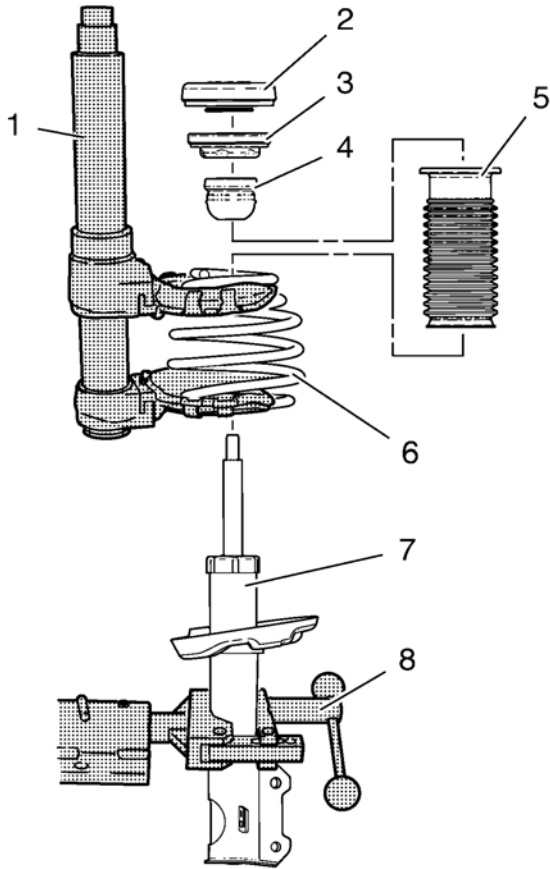


7. Remove the lower insulator (1). Inspect for damage and replace as necessary.

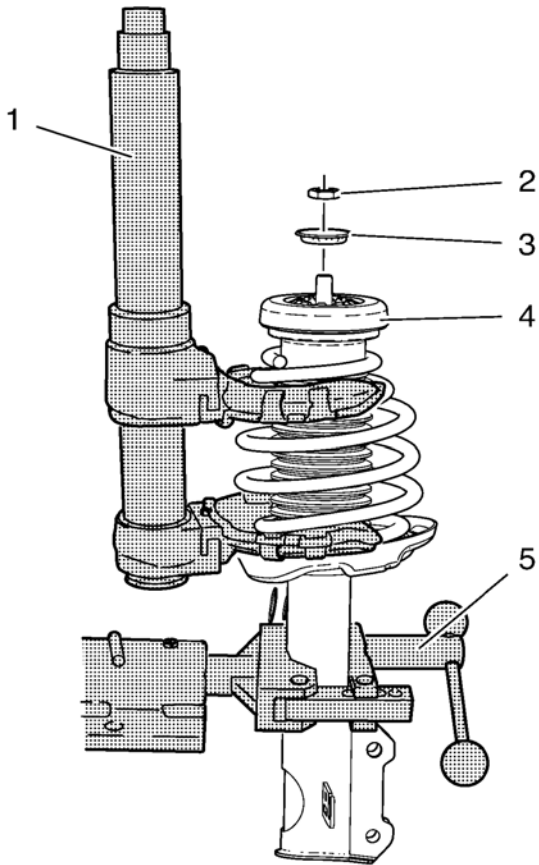
Assembly Procedure



1. Install the lower insulator (1).



2. Install the spring strut components:
- 2.1. Install the strut (7) to the *CH-6066* holder (8).
 - 2.2. Install the spring (6) to the *CH-6068* tensioner (1), compress spring to remove the spring tension.
 - 2.3. Install the spring (6) to the strut (7).
 - 2.4. Install the insulator (5) to the strut (7).
 - 2.5. Install the bumper (4) to the strut (7).
 - 2.6. Install the strut mount bearing (3) to the strut (7).
 - 2.7. Install the mount insulator assembly (2) to the strut (7).



3. Install the strut mount insulator washer (3).

Caution: Refer to [Fastener Caution](#) in the Preface section.

- 4. Install the strut nut (2) to the strut shaft and tighten to **70 N·m (52 lb ft)**.
- 5. Remove the *CH-6068* tensioner (1) from the spring (4).
- 6. Remove the front strut from *CH-6066* holder (5).
- 7. Install the strut assembly. Refer to [Strut Assembly Replacement](#).

Front Suspension Description and Operation

The front suspension has 2 primary purposes:

- Isolate the driver from irregularities in the road surface.
- Define the ride and handling characteristics of the vehicle.

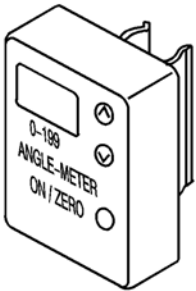
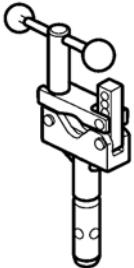
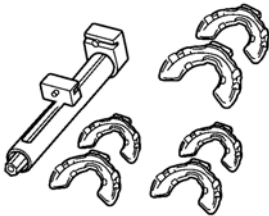
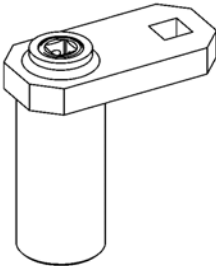
The front suspension absorbs the impact of the tires travelling over irregular road surfaces and dissipates this energy throughout the suspension system. This process isolates the vehicle occupants from the road surface. The rate at which the suspension dissipates the energy and the amount of energy that is absorbed is how the suspension defines the vehicles ride characteristics. Ride characteristics are designed into the suspension system and are not adjustable. The ride characteristics are mentioned in this description in order to aid in the understanding of the functions of the suspension system. The suspension system must allow for the vertical movement of the tire and wheel assembly as the vehicle travels over irregular road surfaces while maintaining the tire's horizontal relationship to the road.

This requires that the steering knuckle be suspended between a lower control arm and a strut assembly. The lower control arm attaches from the steering knuckle at the outermost point of the control arm. The attachment is through a ball and socket type joint. The innermost end of the control arm attached at 2 points to the vehicle frame through semi-rigid bushings. The upper portion of the steering knuckle is attached to a strut assembly. The strut assembly then connects to the vehicle body by way of an upper bearing. The steering knuckle is allowed to travel up and down independent of the vehicle body structure and frame.

This up and down motion of the steering knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. This spring is retained under tension over the strut assembly. A strut is used in conjunction with this system in order to dampen out the oscillations of the coil spring. A strut is a basic hydraulic cylinder. The strut is filled with oil and has a moveable shaft that connects to a piston inside the strut. Valves inside the shock absorber offer resistance to oil flow and consequently inhibit rapid movement of the piston and shaft. Each end of the shock absorber is connected in such a fashion to utilize this recoil action of a spring alone. Each end of the strut is designed as the connection point of the suspension system to the vehicle and acts as the coil spring seat. This allows the strut to utilize the dampening action to reduce the recoil of a spring alone. The lower control arm is allowed to pivot at the vehicle frame in a vertical fashion. The ball joint allows the steering knuckle to maintain the perpendicular relationship to the road surface.

Front suspensions systems utilize a stabilizer shaft. The stabilizer bar connects between the left and right lower control arm assemblies through the stabilizer link and stabilizer shaft insulators. This bar controls the amount of independent movement of the suspension when the vehicle turns. Limiting the independent movement defines the vehicles handling characteristics on turns.

Special Tools

Illustration	Tool Number / Description
	EN-45059 J-45059 Angle Meter
	CH-6066 KM-6066 Holding Device
	CH-6068 MKM-6068 88 18 791, 88 18 809, 88 18 817 Spring Tensioner Device
	CH-49375 Wrench



Select a Document:

-  [Specifications](#)
-  [Rear Suspension Components](#)
-  [Rear Wheel Bearing and Hub Replacement \(Disc Brake\)](#)
-  [Rear Wheel Bearing and Hub Replacement \(Drum Brake\)](#)
-  [Rear Axle Bushing Replacement](#)
-  [Shock Absorber Replacement](#)
-  [Shock Absorber Disposal](#)
-  [Rear Spring Insulator Replacement](#)
-  [Rear Spring Replacement](#)
-  [Rear Axle Replacement](#)
-  [Wheel Stud Replacement](#)
-  [Rear Suspension Description and Operation](#)
-  [Special Tools and Equipment](#)

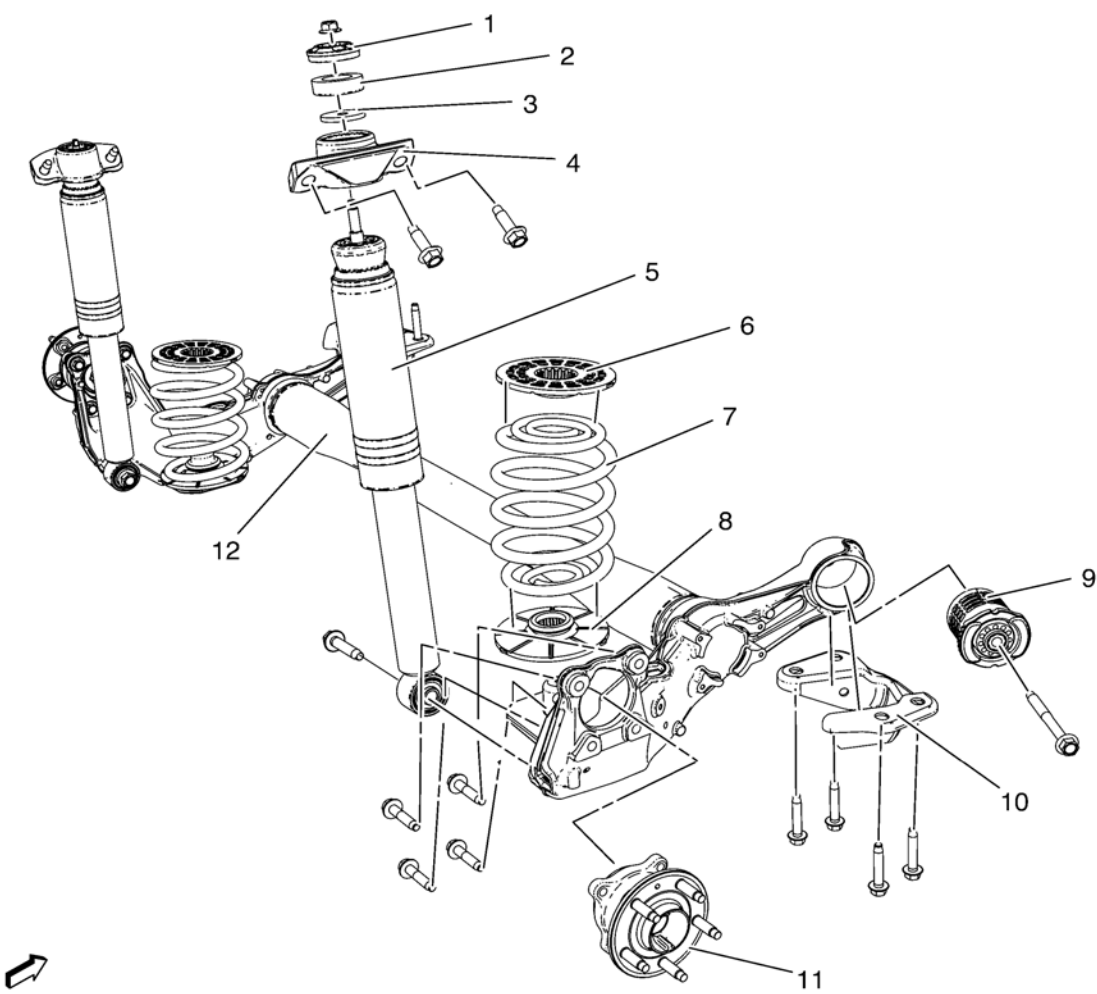


Fastener Tightening Specifications

Application	Specification	
	Metric	English
Axle Bushing Through Bolts And Nuts	70 N·m + 130°	37 lb ft + 130°
Rear Parking Brake Cable Bracket Bolts	10 N·m	89 lb in
Rear Suspension Trailing Arm Nut	70 N·m + 120°	52 lb ft + 120°
Shock Absorber Bolt Upper	100 N·m	74 lb ft
Shock Bolt Lower	150 N·m + 60°	111 lb ft + 60°
Wheel Bearing/Hub Assembly Mounting Bolts	50 N·m + 40°	37 lb ft + 40°
Wheel Speed Sensor Bolt	6 N·m	54 lb ft

Rear Suspension Components

Rear Suspension Components



- (1) Rear Shock Absorber Upper Mount
- (2) Rear Shock Absorber Upper Mount
- (3) Rear Shock Absorber Upper Mount
- (4) Rear Shock Absorber Upper Mount
- (5) Shock Absorber Assembly
- (6) Upper Dumping Ring
- (7) Rear Spring
- (8) Lower Dumping Ring
- (9) Rear Axle Bushing
- (10) Rear Axle Bracket
- (11) Rear Wheel Bearing
- (12) Rear Axle

Rear Wheel Bearing and Hub Replacement (Disc Brake)

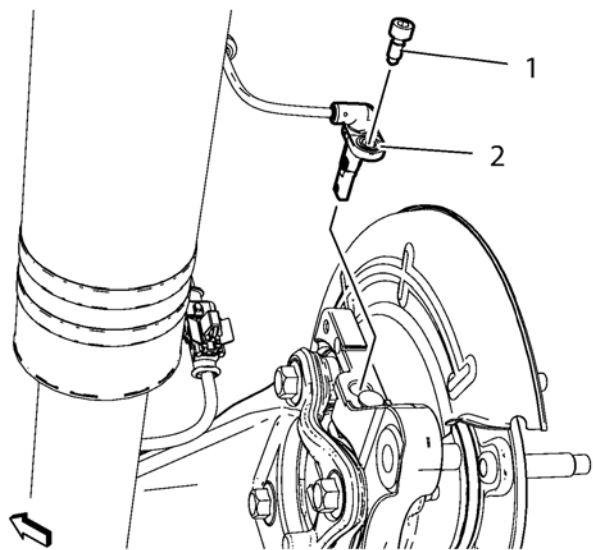
Special Tools

EN 45059 Torque Angle Sensor Kit

For equivalent regional tools, refer to [Special Tools](#).

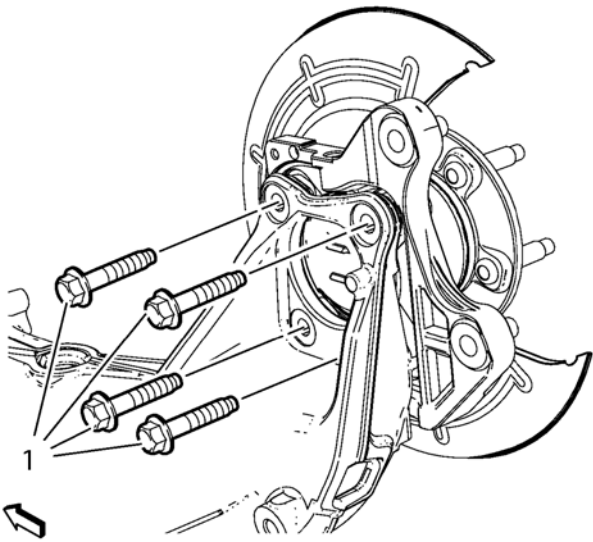
Removal Procedure

1. Raise and suitably support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
3. Without disconnecting the hydraulic brake flex hose, remove and support the rear brake caliper and bracket as an assembly, and remove the rear brake rotor. Refer to [Rear Brake Rotor Replacement](#).

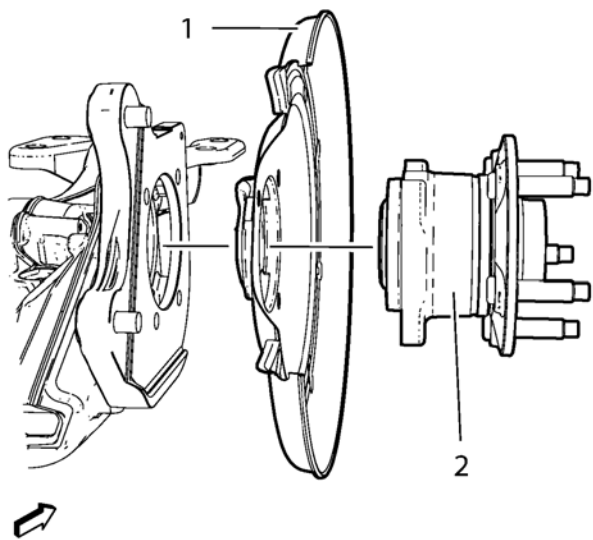


Caution: Support the brake caliper with heavy mechanic wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.

4. Remove the wheel speed sensor bolt (1).
5. Remove the wheel speed sensor (2).

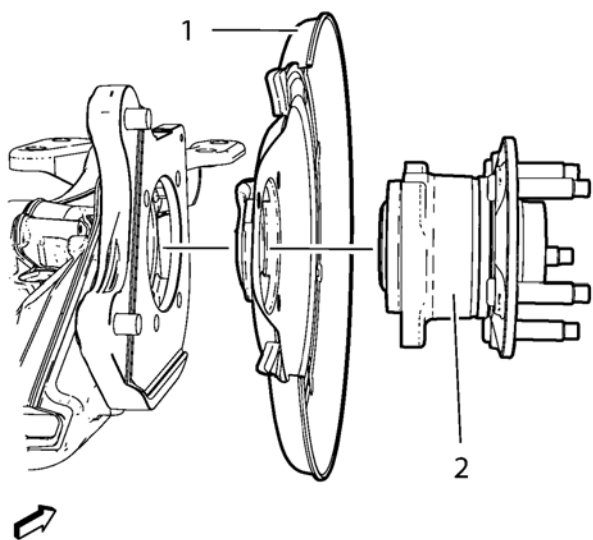


6. Remove and discard the wheel bearing/hub mounting bolts (1).



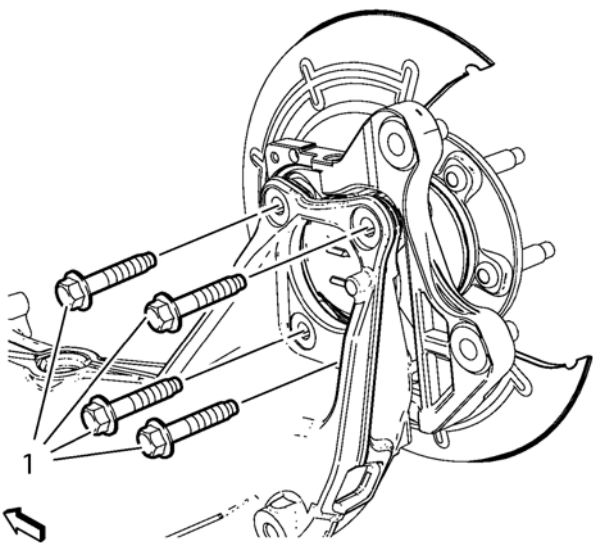
7. Remove the wheel bearing/hub assembly (1) and rear brake shield (2) from the rear axle.

Installation Procedure

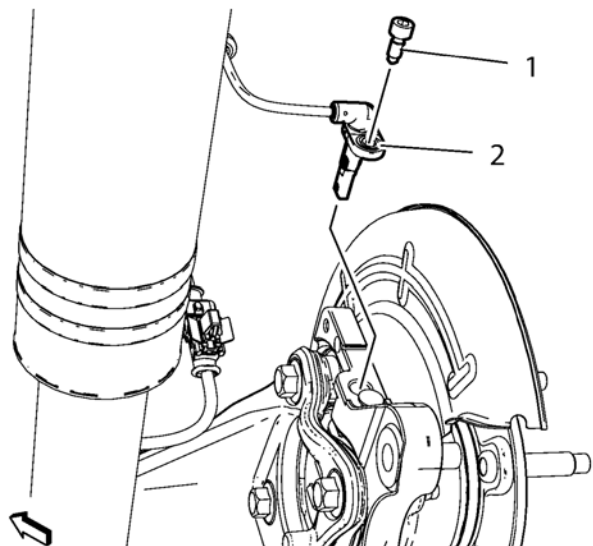


1. Position the rear brake shield (2) and wheel bearing/hub assembly (1) in the rear axle.

Caution: Refer to [Fastener Caution](#) in the Preface section.



2. Install the NEW wheel bearing/hub mounting bolts (1) and tighten to **50 N·m (37 lb in) + 40°** using the *EN 45059* kit .



3. Install the wheel speed sensor (2).
4. Install the wheel speed sensor screw (1) and tighten to **6 N·m (54 lb in)**. Tighten the bolts evenly, in a cross-pattern.
5. Install the brake rotor, and install the brake caliper and bracket as an assembly. Refer to [Rear Brake Rotor Replacement](#).
6. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
7. Remove the support and lower the vehicle.

Rear Wheel Bearing and Hub Replacement (Drum Brake)

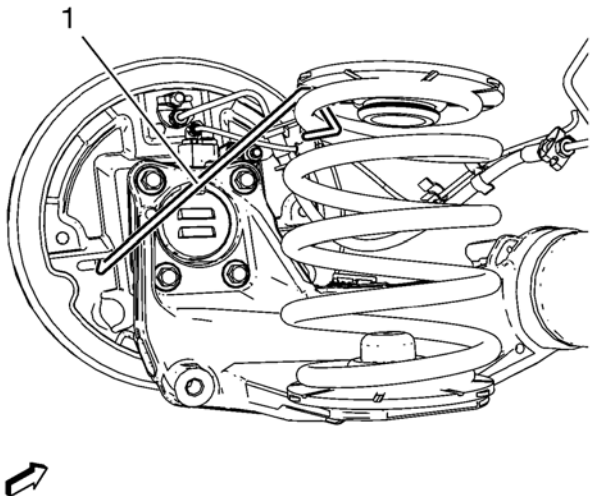
Special Tools

EN 45059 Torque Angle Sensor Kit

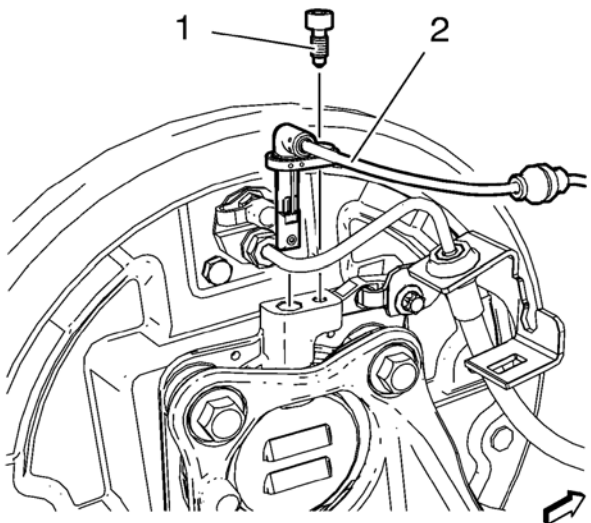
For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

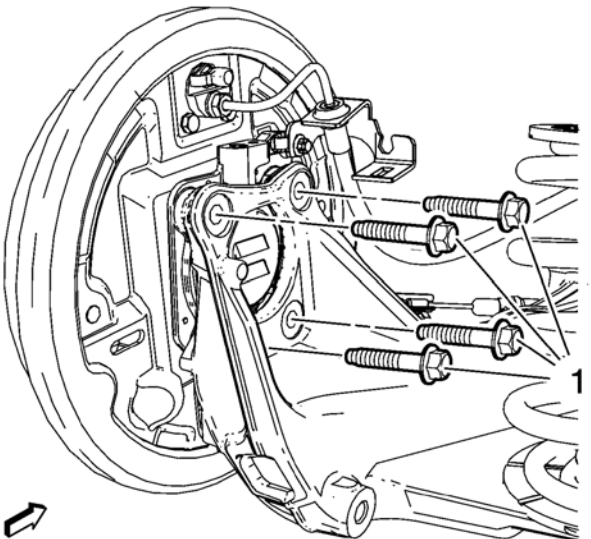
1. Raise and suitably support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
3. Remove the brake drum. Refer to [Brake Drum Replacement](#).



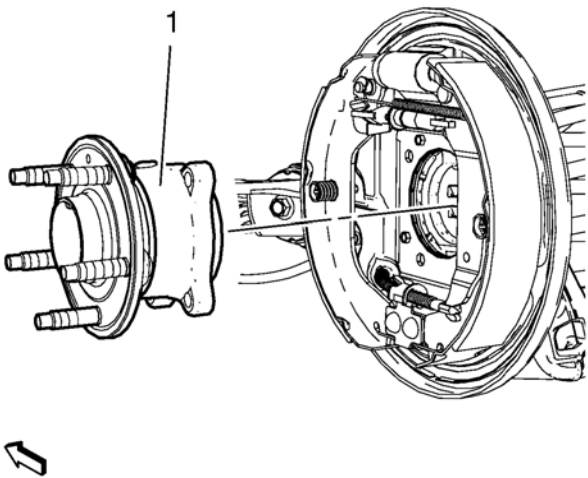
4. Remove the plug from the drum brake actuator access hole in the backing plate. Using the access hole, install a heavy mechanic wire (1) in order to support the brake backing plate.



5. Remove the wheel speed sensor bolt (2).
6. Remove the wheel speed sensor (1).

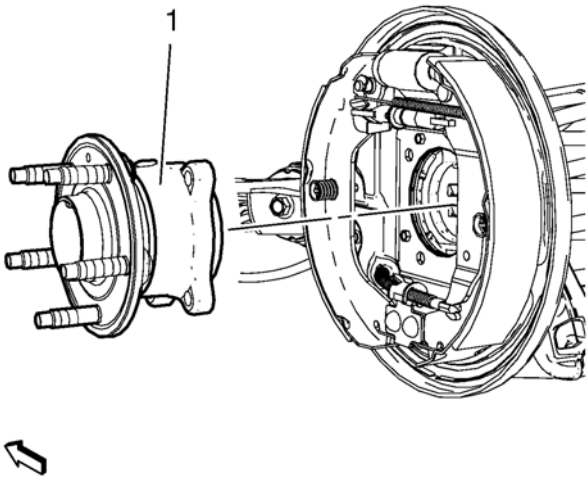


7. Remove the wheel bearing/hub mounting bolts (1).



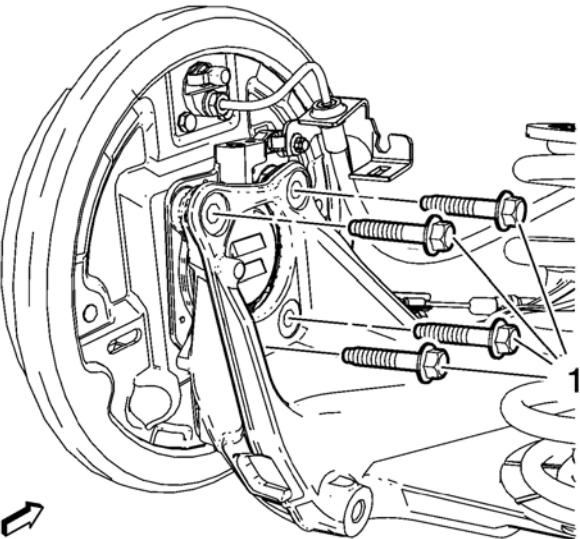
8. Remove the wheel bearing/hub assembly (1) from the rear axle assembly and brake backing plate.

Installation Procedure



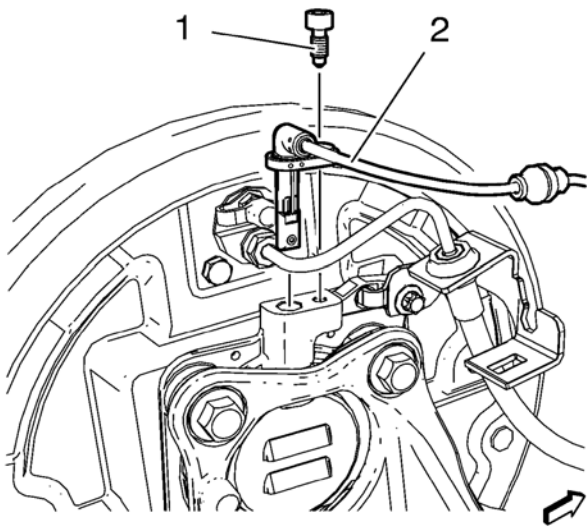
1. Install the wheel bearing/hub assembly (1) to the brake backing plate and the rear axle assembly.

Caution: Refer to [Fastener Caution](#) in the Preface section.



Note: Tighten the bolts evenly, in a cross-pattern.

2. Install the wheel bearing/hub mounting bolts (1) and tighten to **50 N·m (37 lb ft) + 40°** , using the EN 45059 kit.
Tighten the bolts evenly, in a cross-pattern.



- 3. Install the wheel speed sensor (1).
- 4. Install the wheel speed sensor bolt (2) and tighten to **6 N·m (54 lb in)**.
- 5. Remove the support (1) from the brake backing plate.
- 6. Install the plug to the drum brake actuator access hole in the backing plate.
- 7. Install the brake drum. Refer to [Brake Drum Replacement](#).
- 8. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
- 9. Remove the support and lower the vehicle.

Rear Axle Bushing Replacement

Special Tools

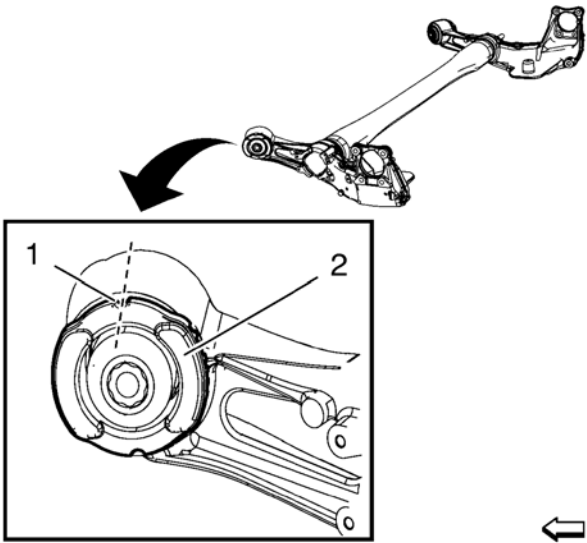
- CH 6616 Hydraulic Hand Pump
- CH 6615-10 Hydraulic Cylinder
- CH-48377-1 Chisel
- CH-49233 Adapter
- CH 906-42 Adapter

For equivalent regional tools. Refer to [Special Tools](#)

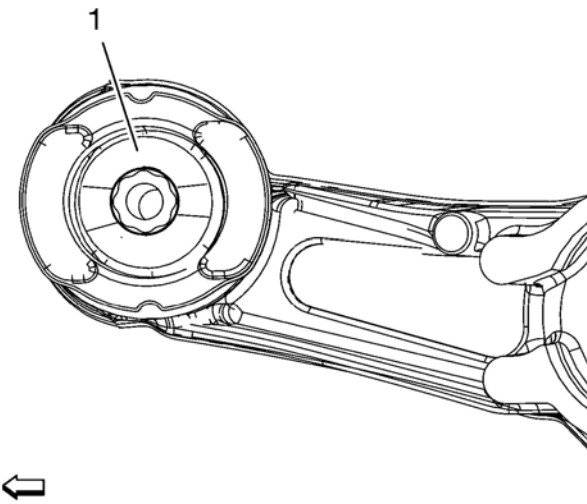
Removal Procedure

Warning: Use of eye goggles is necessary to prevent personal injury.

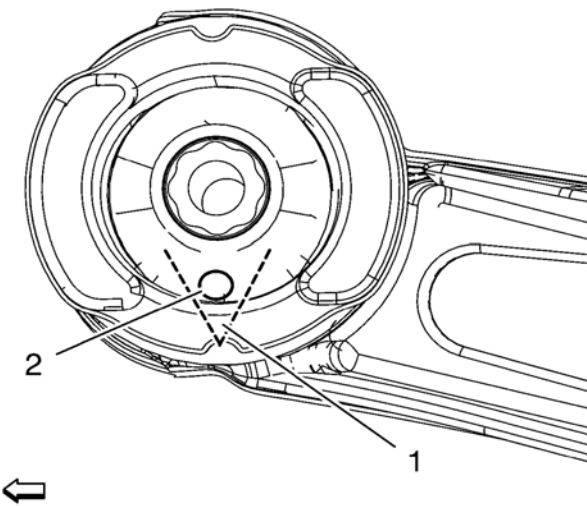
1. Remove the rear axle. Refer to [Rear Axle Replacement](#)
2. With the aid of second mechanic, place rear axle onto work bench.



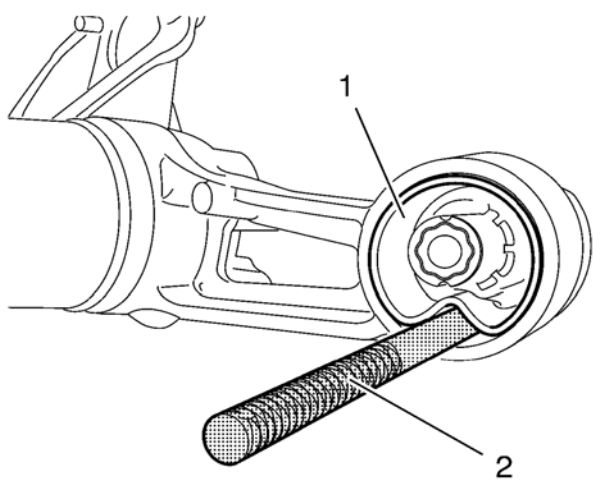
3. Mark installation position (dashed line) for rear axle bushing (2) on rear axle using a permanent marker.
Use upper gap (1) of bushing for alignment.



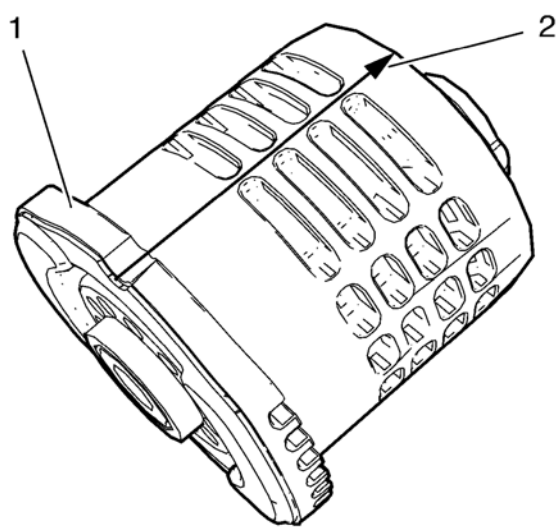
4. Drill 8 times all around through rubber (1) bushings with drill 10 mm (0.4 in)



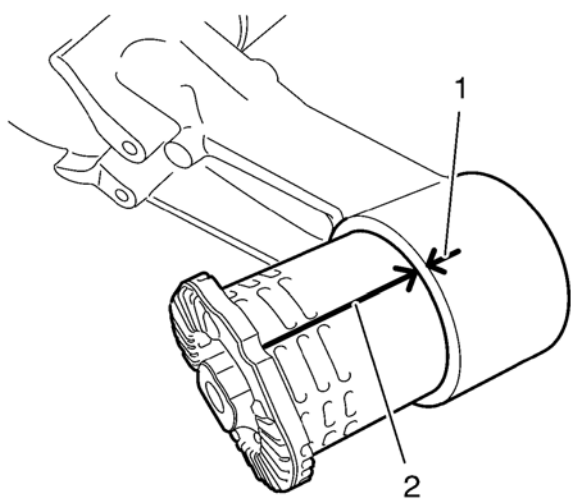
5. Jigsaw carefully a V-cut (dashed line) into lower side (1) of rear axle bushing. Use lowest bore (2) to insert saw.



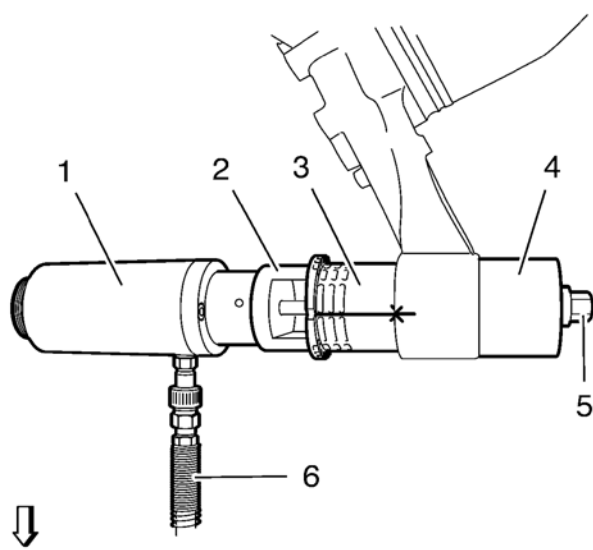
6. Remove bushing (1), using *CH-48377-1* chisel (2) and a hammer. Insert *CH-48377-1* chisel on place of V-cut.



7. Mark installation position (2) of NEW rear axle bushing (1) as shown in graphic above



8. Align bushing marking (2) to rear axle marking (1).



9. Install the following components onto rear axle bushing and rear axle:



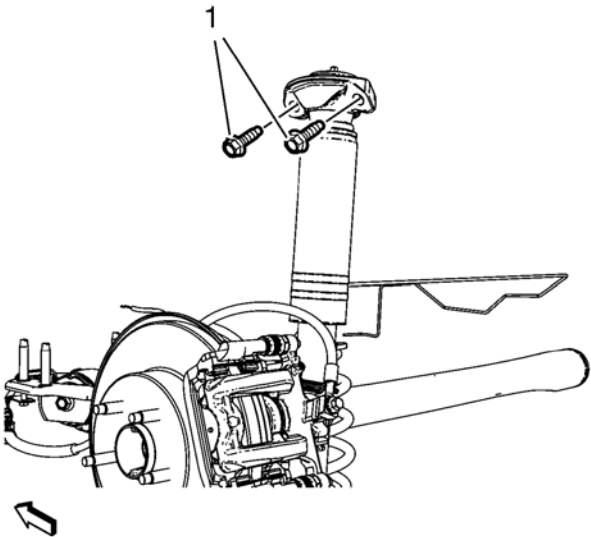
- *CH 6615-10* cylinder (1).
 - *CH-49233* adapter (2).
 - NEW rear axle bushing (3).
 - *CH 906-42* adapter (4)
 - Install and tighten counter nut (5) onto spindle of *CH 6615-10* cylinder (1)
10. Connect pressure hose (6) of *CH 6616* pump to *CH 6615-10* cylinder
 11. Press carefully the rear axle bushing in to rear axle, using *CH 6616* pump .
 12. When lift way of *CH 6615-10* cylinder reaches stop, release pressure on *CH 6616* pump , retighten counter nut (5) and press rear axle bushing in to rear axle until final installation position.
 13. Remove ALL special tools.
 14. Install rear axle. Refer to [Rear Axle Replacement](#)



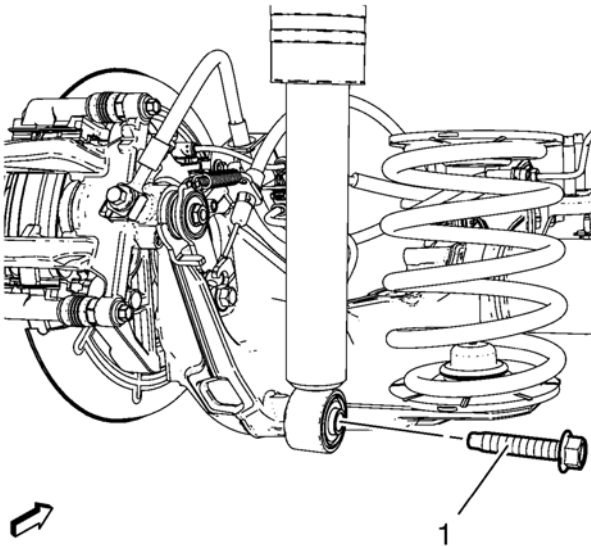
Shock Absorber Replacement

Removal Procedure

1. Raise and suitably support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
3. Support the rear axle with a tall jack stand near the shock absorber.



4. Remove the upper shock absorber bolts (1).

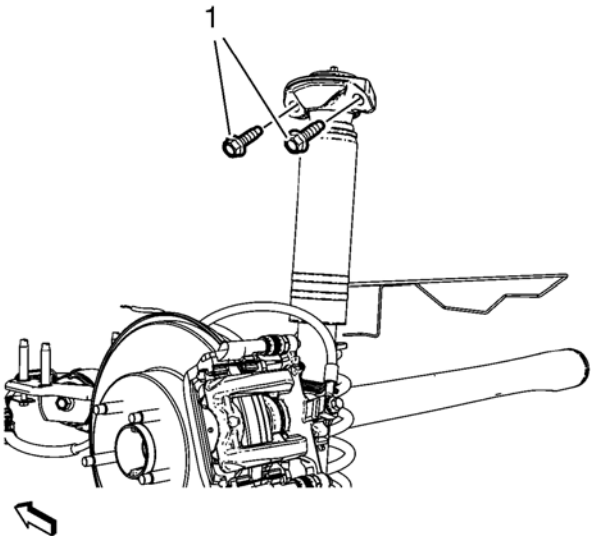


5. Remove the lower shock absorber bolt (1).

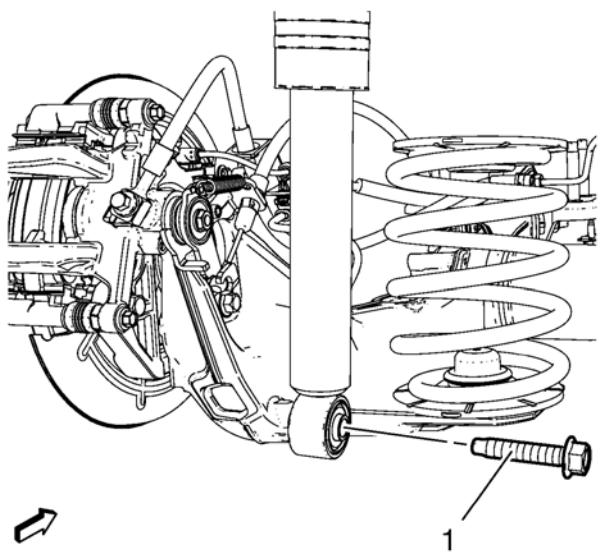
Installation Procedure

1. Position the shock absorber to the vehicle.

Caution: Refer to [Fastener Caution](#) in the Preface section.



2. Install NEW upper shock absorber bolts (1) and tighten to **100 N•m (74 lb in)**.

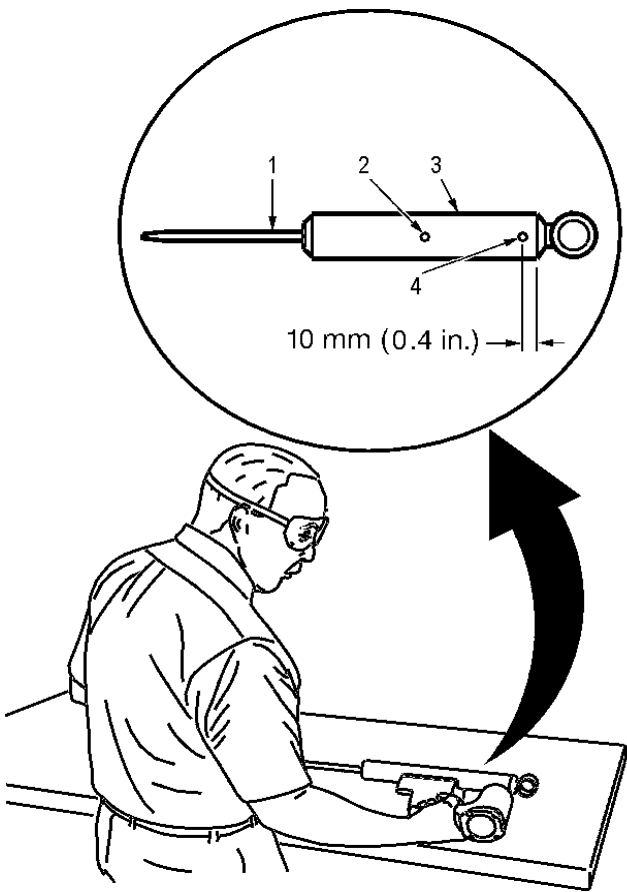


- 3. Install NEW lower shock absorber bolt (1) and tighten to **150 N·m (111 lb ft) + 60°**.
- 4. Remove the jack stand.
- 5. Install the rear tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
- 6. Lower the vehicle.

Shock Absorber Disposal

Warning: Gas charged shock absorbers contain high pressure gas. Do not remove the snap ring from inside the top of the tube. If the snap ring is removed, the contents of the shock absorber will come out with extreme force which may result in personal injury.

Warning: To prevent personal injury, wear safety glasses when centerpunching and drilling the shock absorber. Use care not to puncture the shock absorber tube with the centerpunch.

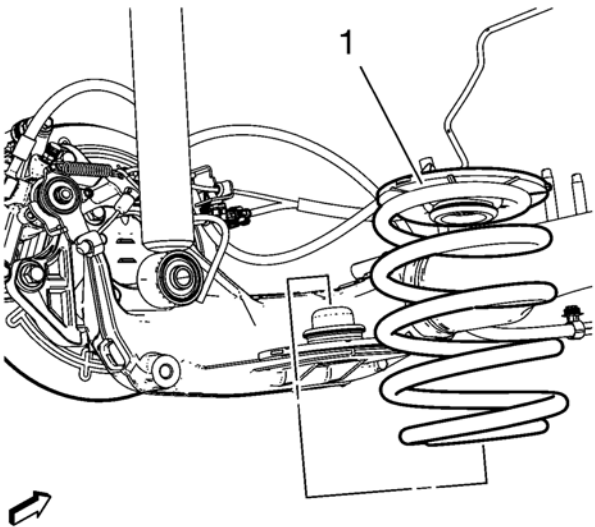


1. Make an indentation 10 mm (0.4 in) from the bottom (4) of the tube (3) using a centerpunch.
2. Clamp the shock absorber in a vise horizontally with the shock absorber rod (1) completely extended.
3. Drill a hole in the shock absorber at the centerpunch (4) using a 5 mm (3/16 in) drill bit. Gas or a gas/oil mixture will exhaust when the drill bit penetrates the shock absorber. Use shop towels in order to contain the escaping oil.
4. Make an indentation in the middle (2) of the tube (3) with a centerpunch.
5. Drill a second hole in the shock absorber at the centerpunch (2) using a 5 mm (3/16 in) drill bit. Oil will exhaust when the drill bit penetrates the shock absorber. Use shop towels in order to contain the escaping oil.
6. Remove the shock absorber from the vise. Hold the shock absorber over a drain pan horizontally with the holes down. Move the rod (1) in and out of the tube (3) to completely drain the oil from the shock absorber.

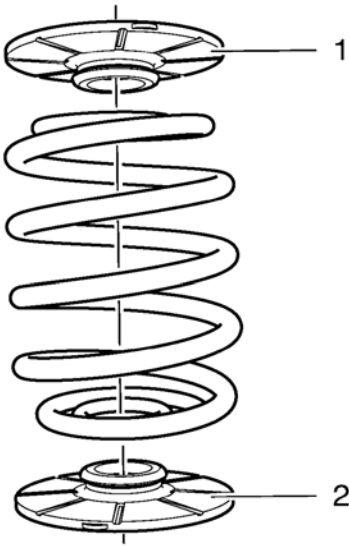
Rear Spring Insulator Replacement

Removal Procedure

1. Raise and suitably support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Support the rear axle with a tall jack stand near the shock absorber.
3. Remove the lower shock bolt. Refer to [Shock Absorber Replacement](#).
4. Using the tall jack stands, slowly lower the rear axle in order to remove tension from the rear springs.

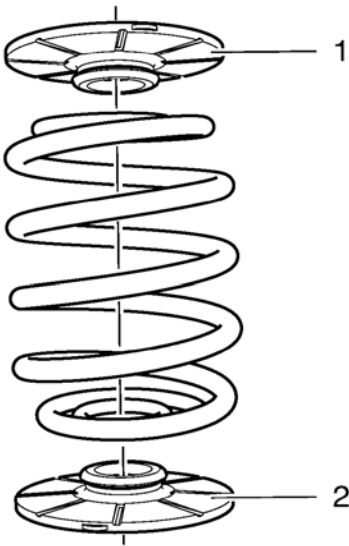


5. Remove the spring (1).



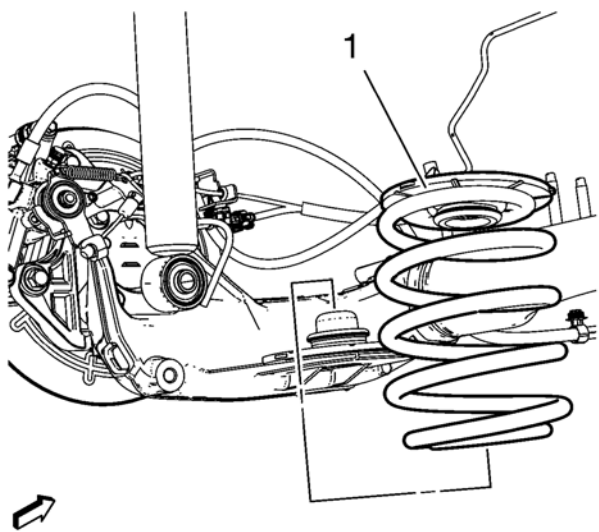
6. Remove the lower and upper rear spring insulators (1, 2).

Installation Procedure



Note: The rear springs are indexed with the colored tag toward the rear of the vehicle. No up/down or side to side orientation is required.

1. Install the lower and upper rear spring insulators (1, 2).

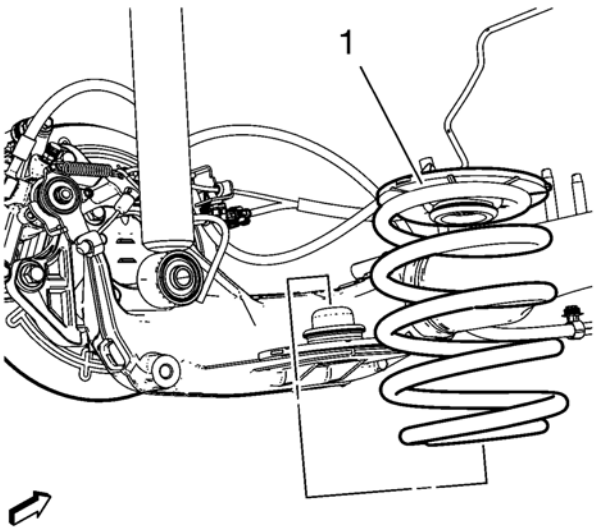


- 2. Install the spring (1) with the spring tag toward the rear of the vehicle, making sure the lower rear is seated into the lower spring seat.
- 3. Using the jack stands, raise the rear axle in order to compress the rear springs.
- 4. Install the lower shock absorber bolts. Refer to [Shock Absorber Replacement](#).
- 5. Lower the vehicle.

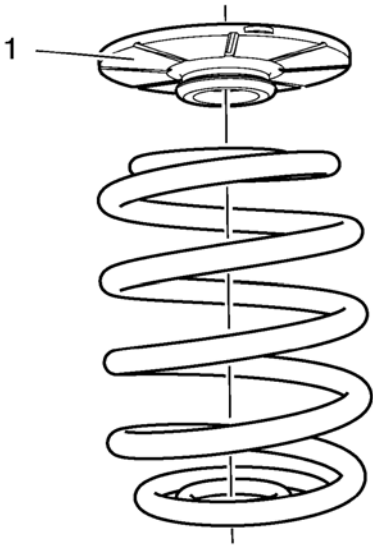
Rear Spring Replacement

Removal Procedure

1. Raise and suitably support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Support the rear axle with a tall jack stand near the shock absorber.
3. Remove the lower shock bolt. Refer to [Shock Absorber Replacement](#).
4. Using the tall jack stands, slowly lower the rear axle in order to remove tension from the rear springs.

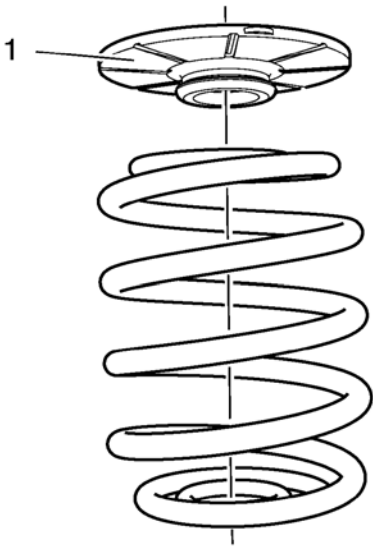


5. Remove the spring (1).

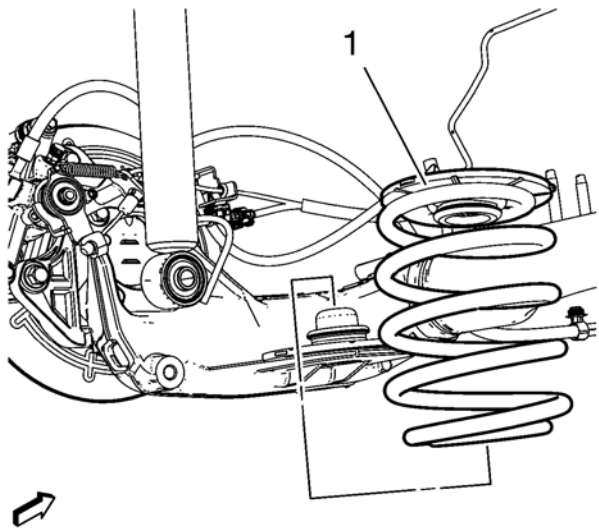


6. Remove the upper spring seat/jounce bumper (1) from the spring, while leaving the lower spring seat on the axle.

Installation Procedure



1. Install the upper spring seat/jounce bumper (1) on the spring.



- 2. Install the spring (1) making sure the lower coil is seated into the lower spring seat.
- 3. Using the jack stands, raise the rear axle in order to compress the rear springs.
- 4. Install the lower shock absorber bolts. Refer to [Shock Absorber Replacement](#).
- 5. Lower the vehicle.

Rear Axle Replacement

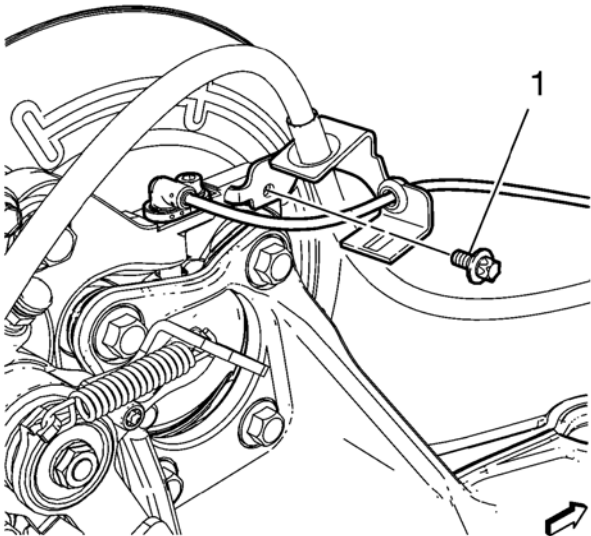
Special Tools

EN 45059 Torque Angle Sensor Kit

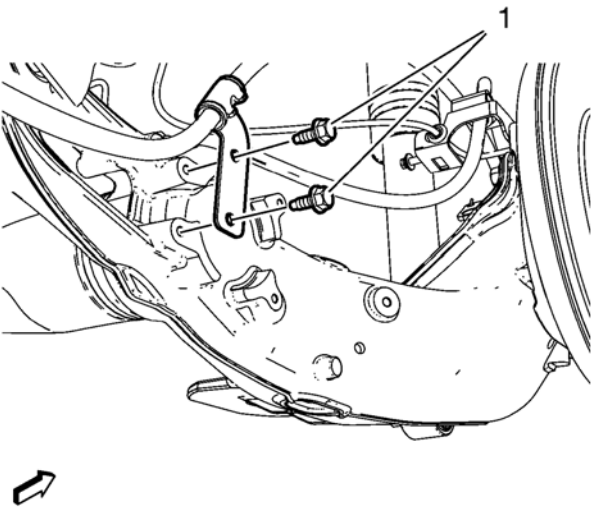
For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

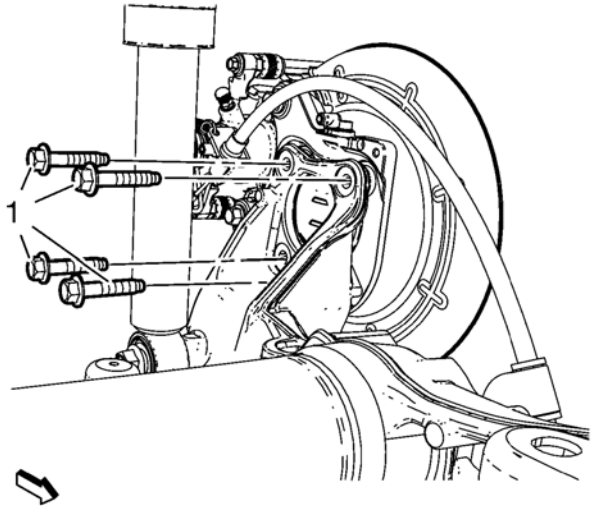
1. Raise and suitably support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).



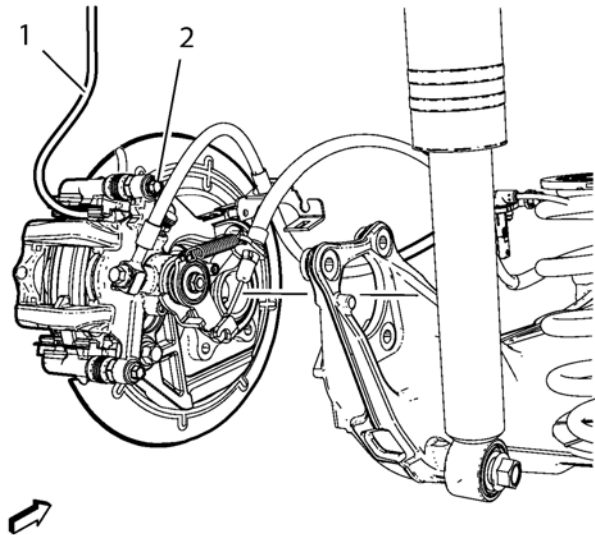
3. Remove the both brake hose bolts (1) attaching the hose to the rear brake caliper bracket.



4. Remove rear parking brake cable bracket bolts (1) from the rear axle.

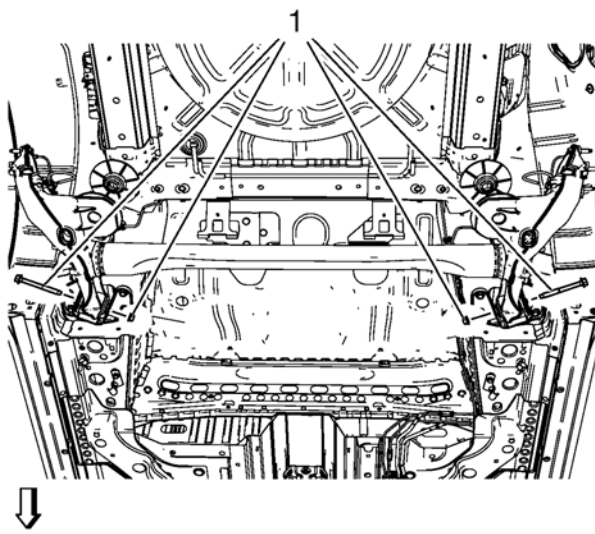


5. Remove the wheel bearing/hub mounting bolts (1).

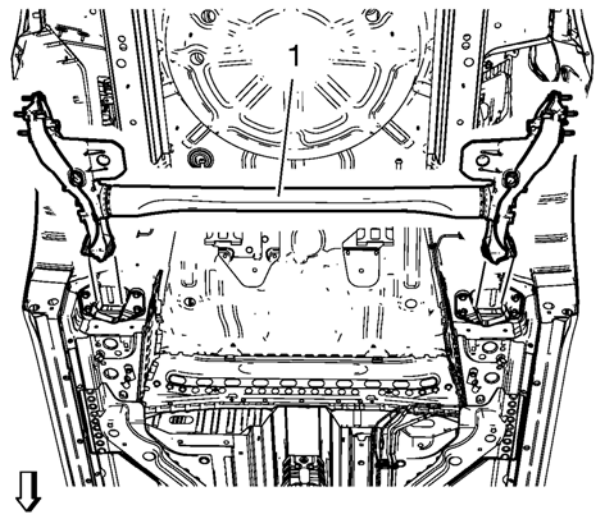


Caution: Support the brake caliper with heavy mechanic wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.

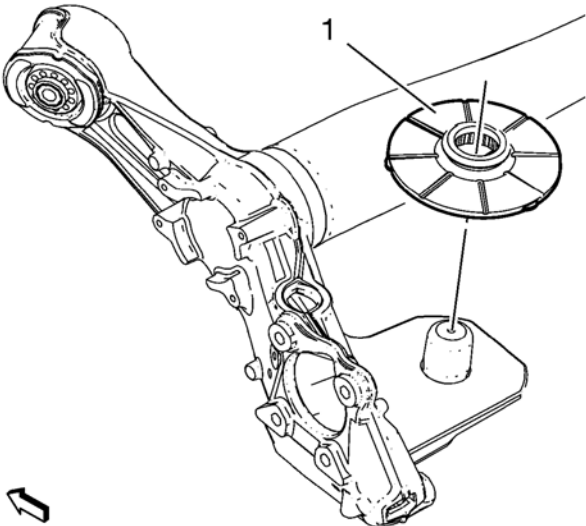
- 6. Without disconnecting the hydraulic brake flexible hose, remove wheel bearing/hub and brake assembly (2) upward and secure the wheel bearing/hub and brake assembly with heavy mechanics wire (1), or equivalent.
- 7. Support the rear axle with a hydraulic lift table.
- 8. Remove the lower shock bolts. Refer to [Shock Absorber Replacement](#).
- 9. Lower the hydraulic lift table and remove the rear coil springs. Refer to [Rear Spring Replacement](#).



- 10. Remove both rear axle bushing bolts (1) nuts.

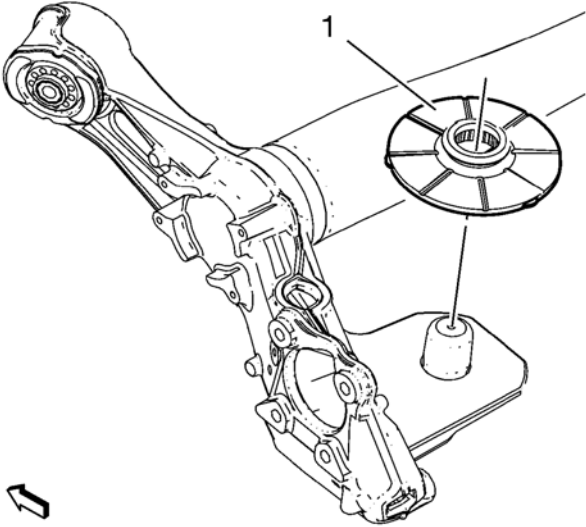


- 11. Use the hydraulic lift table to lower the rear axle (1) from the vehicle.

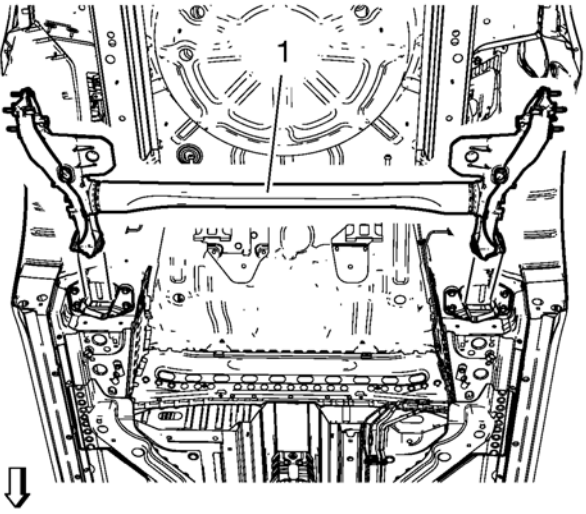


12. Remove the rear coil spring lower seat insulators (1) from the axle.

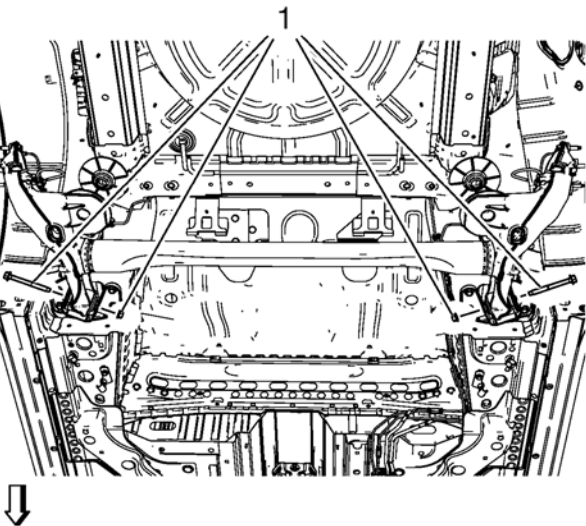
Installation Procedure



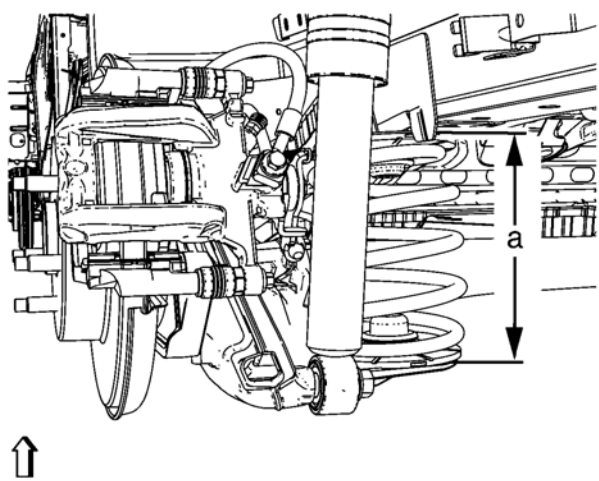
1. Install the rear coil spring lower seat insulators (1) to the axle.



2. Raise the axle (1) into position.



3. Loosely install the both axle bushing bolts (1) and nuts.



Note: The axle bushing bolts and nuts must be tightened with the axle at the correct trim height.

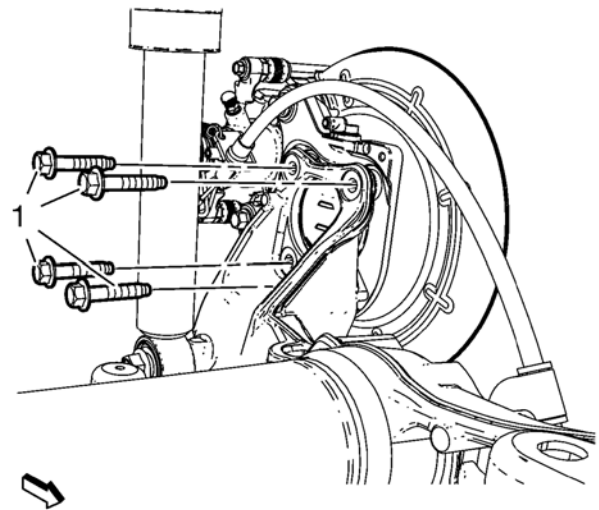
4. Using the lift table, raise the axle to the proper trim height specification by measuring the vertical distance between the bottom edge of the upper spring seat and the bottom of the notch in the lower spring seat specification:

Specification

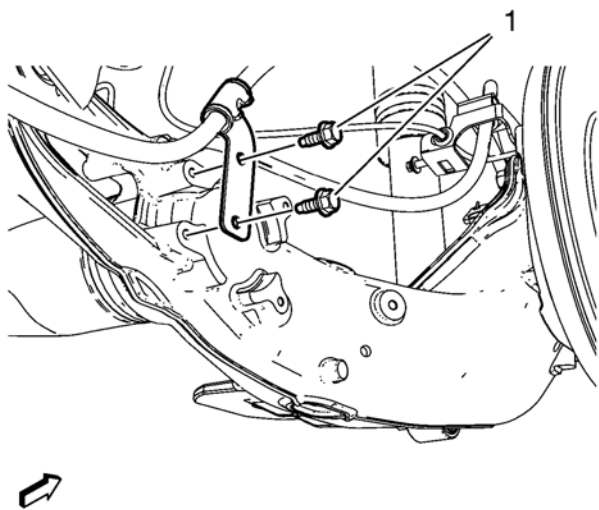
Dimension (a): 224 mm (8.81 in)

Caution: Refer to [Fastener Caution](#) in the Preface section.

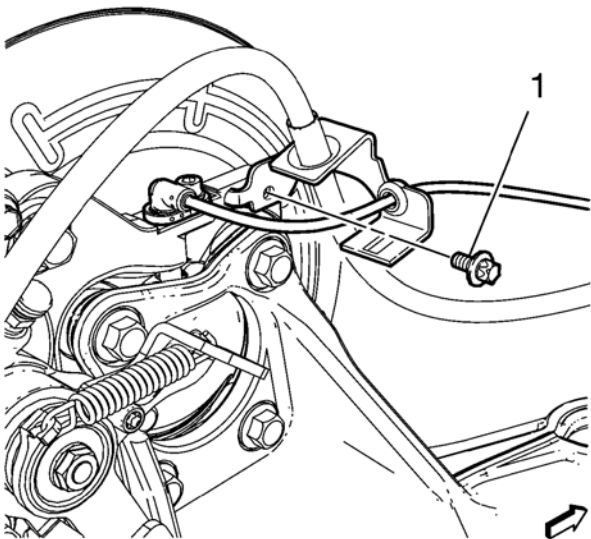
5. Tighten the NEW axle bushing through bolts and NEW nuts and tighten to **70 N·m (52 lb ft) + 130°** , using the *EN 45059* kit .
6. Install the rear coil springs. Refer to [Rear Spring Replacement](#).
7. Install the lower shock bolts. Refer to [Shock Absorber Replacement](#).
8. Remove the hydraulic lift table from the rear axle.
9. Install the wheel bearing/hub and brake assembly.



10. Install the NEW wheel bearing/hub mounting bolts (1) and tighten to **50 N·m (37 lb ft) + 40°** , using the *EN 45059* kit .



11. Install rear parking brake cable bracket bolts (1) at the rear axle and tighten to **10 N·m (89 lb in)**.

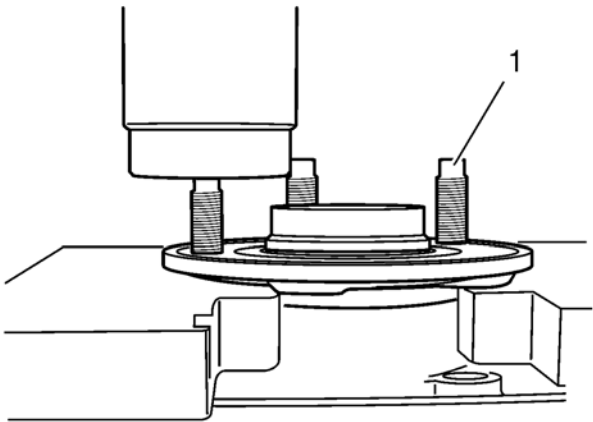


- 12. Install the both brake hose bolts (1) attaching the hose to the rear brake caliper bracket.
- 13. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
- 14. Remove the support and lower the vehicle.

Wheel Stud Replacement

Removal Procedure

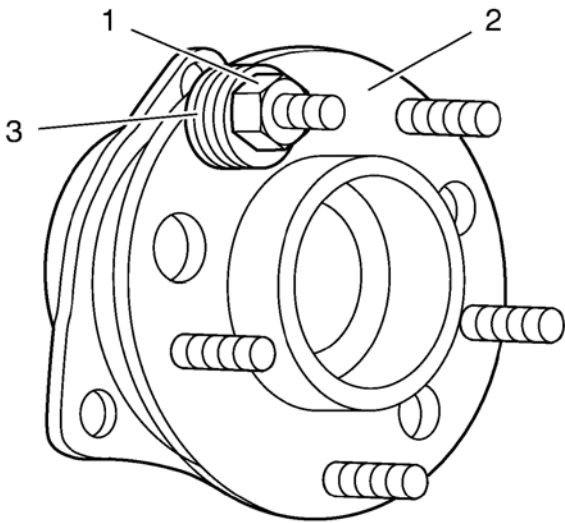
1. Raise and suitably support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
3. Remove the wheel bearing/hub. Refer to [Rear Wheel Bearing and Hub Replacement](#).



Caution: Support the brake caliper with heavy mechanic wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.

4. Release the wheel stud (1) from the bearing hub with the hydraulic press and discard the stud.

Installation Procedure



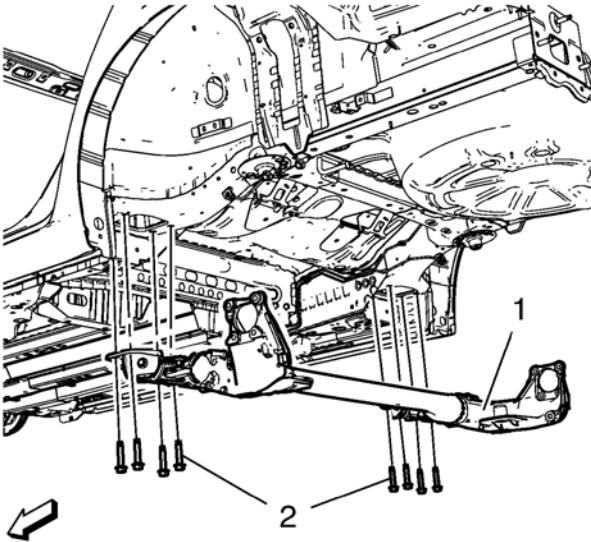
1. Install a NEW stud into the bearing/hub assembly (2). Add enough washers (3) in order to draw the stud into the hub.
2. Install and tighten a wheel nut (1) until the head of the wheel stud is fully seated against the back of the bearing/hub flange (2).
3. Remove the wheel nut (1) and the washers (3).
4. Install the wheel bearing/hub (2). Refer to [Rear Wheel Bearing and Hub Replacement](#).
5. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).
6. Remove the support and lower the vehicle.

Rear Suspension Description and Operation

This vehicle has a semi-independent twist-beam rear suspension system consisting of the following components:

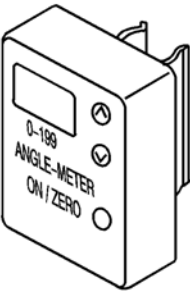
- An axle with integral trailing arms
- A V shaped twisting cross beam
- Two coil springs
- Two shock absorbers

Axle Assembly



The axle assembly (1) attaches to the underbody through a rubber bushing and bracket located at the front of each integral trailing arm. The brackets are attached to the underbody side rails with bolts (2). The axle structure itself maintains the geometrical relationship of the wheels relative to the centerline of the body.

Special Tools

Illustration	Tool Number / Description
	EN-45059 J-45059 Angle Meter



Select a Document:

-  [Specifications](#)
-  [Aluminum Wheel Porosity Repair](#)
-  [Aluminum Wheel Refinishing](#)
-  [Tyre and Wheel Removal and Installation](#)
-  [Tyre Repair](#)
-  [Tyre Dismounting and Mounting](#)



Fastener Tightening Specifications

Application	Specification	
	Metric	English
Wheel Nuts	140 N·m	103 lb ft

Adhesives, Fluids, Lubricants, and Sealers

Application	Type of Material	GM Part Number
Aluminum Wheels	Adhesive/Sealant	Refer to Electronic Parts Catalog
Wheels	Mounting Lubricant	Refer to Electronic Parts Catalog

Aluminum Wheel Porosity Repair

1. Remove the tire and wheel. Refer to [Tire and Wheel Removal and Installation](#).
2. Inflate the tire to the manufactures specified pressure as stated on the tire.
3. Submerge the tire/wheel into a water bath in order to locate the leak.
4. Inscribe a mark on the wheel in order to indicate the leak areas.
5. Inscribe a mark on the tire at the valve stem in order to indicate the orientation of the tire to the wheel.
6. Remove the tire from the wheel. Refer to [Tire Dismounting and Mounting](#).

Note: Do not damage the exterior surface of the wheel.

7. Use number 80 grit sandpaper to scuff the inside of the rim surface at the leak area.
8. Use general purpose cleaner to clean the leak area.
9. Apply 3 mm (0.12 in) thick layer of adhesive/sealant to the leak area. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).
10. Allow for the adhesive/sealant to dry.
11. Align the inscribed mark on the tire with the valve stem on the wheel.
12. Install the tire to the wheel. Refer to [Tire Dismounting and Mounting](#).
13. Pressurize the tire to 276 kPa (40 psi).
14. Submerge the tire/wheel into a water bath in order ensure the leak is sealed.
15. Inflate the tire to the specified pressure as stated on the tire placard.
16. Balance the tire and wheel. Refer to [Tire and Wheel Assembly Balancing - Off Vehicle](#).
17. Install the tire and wheel. Refer to [Tire and Wheel Removal and Installation](#).

Aluminum Wheel Refinishing

Finish Damage Evaluation Procedure

Note:

- If the wheels are chrome-plated, do not re-plate or refinish the wheels.
 - If the wheels are polished aluminum, do not refinish the wheels in the dealer environment. Utilize a refinisher that meets manufacturer guidelines.
1. Inspect the wheels for damage from uncoated wheel balance weights or from automatic car wash facilities.
 2. Inspect the wheels for the following conditions:
 - Corrosion
 - Scrapes
 - Gouges
 3. Verify the damage is not deeper than what sanding can remove.
 4. Inspect the wheels for cracks. If a wheel has cracks, discard the wheel.
 5. Inspect the wheels for bent rim flanges. If a rim flange is bent, discard the wheel.

Refinishing Procedure

Warning: To avoid serious personal injury when applying any two part component paint system, follow the specific precautions provided by the paint manufacturer. Failure to follow these precautions may cause lung irritation and allergic respiratory reaction.

1. Lift the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Remove the tire and wheel assembly from the vehicle. Refer to [Tire and Wheel Removal and Installation](#).
3. Remove the balance weights from the wheel.
4. Remove the tire from the wheel. Refer to [Tire Dismounting and Mounting](#).
5. Use a suitable cleaner in order to remove the following contaminants from the wheel:
 - Lubricants
 - Wax
 - Dirt

Note:

- Do not re-machine the wheel.
- Do not use chemicals in order to strip the paint from the wheel.

6. Use plastic media blasting in order to remove the paint from the wheel.
7. If the wheel had a machined aluminum finish, spin the wheel and use sand paper in order to restore the circular machined appearance.

Note: The wheel mounting surface and the wheel nut contact surface must remain free of paint.

8. Mask the wheel mounting surface and the wheel nut contact surface.
9. Follow the paint manufacturer's instructions for painting the wheel.
10. Unmask the wheel.
11. Install a new valve stem.

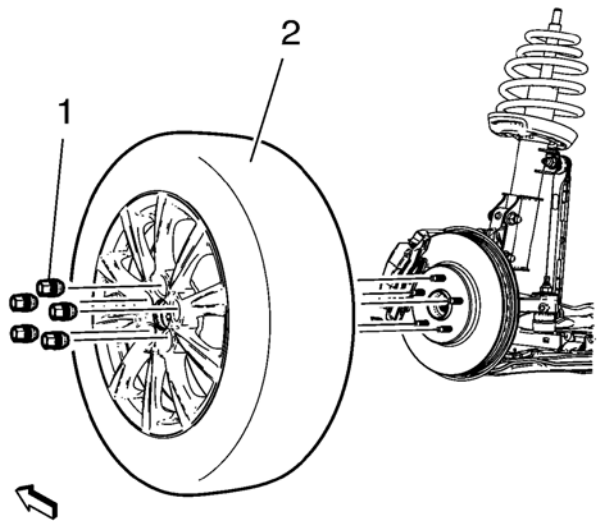
Note: Use new coated balance weights in order to balance the wheel.

12. Install the tire to the wheel. Refer to [Tire Dismounting and Mounting](#).
13. Use a suitable cleaner in order to remove the following contaminants from the wheel mounting surface:
 - Corrosion
 - Overspray
 - Dirt
14. Install the tire and wheel assembly to the vehicle. Refer to [Tire and Wheel Removal and Installation](#).
15. Lower the vehicle.

Tire and Wheel Removal and Installation

Removal Procedure

1. Raise and suitably support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).



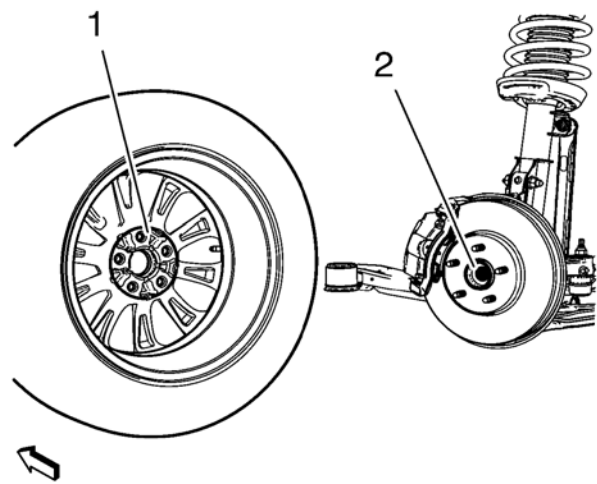
2. Remove the wheel center cap.
3. Mark the relationship of the wheel (2) to the hub.
4. Remove the wheel nuts (1).

Warning: If penetrating oil gets on the vertical surfaces between the wheel and the rotor or drum it could cause the wheel to work loose as the vehicle is driven, resulting in loss of control and an injury accident.

Caution: Removing the wheel may be difficult because of foreign materials or a tight fit between the wheel and the hub/rotor. Slightly tap the tire side wall with a rubber mallet in order to remove the wheel. Failure to follow these instructions may result in damage to the wheel.

5. Remove the tire and wheel assembly from the vehicle. If the tire and wheel assembly is difficult to remove, perform the following steps:
 - 5.1. Install and tighten all wheel nuts on the affected wheel.
 - 5.2. Loosen each wheel nut two turns.
 - 5.3. Lower the vehicle.
 - 5.4. Rock the vehicle from side to side.
 - 5.5. Repeat this procedure if necessary.
6. If the tire and wheel assembly still does not loosen, perform the following steps:
 - 6.1. Start the engine.
 - 6.2. Drive the vehicle forward and rearward slightly while applying quick, hard jabs of the brakes prior to changing direction.
 - 6.3. Repeat this procedure if necessary.

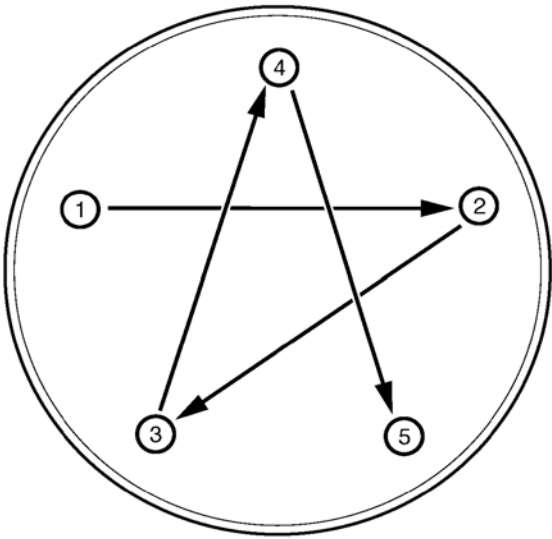
Installation Procedure



Warning: Before installing the wheels, remove any buildup of corrosion on the wheel mounting surface and brake drum or disc mounting surface by scraping and wire brushing. Installing wheels with poor metal-to-metal contact at the mounting surfaces can cause wheel nuts to loosen. This can cause a wheel to come off when the vehicle is moving, causing loss of control and possibly personal injury.

Note: Wheel nuts, studs, and mounting surfaces must be clean and dry.

1. Remove any corrosion or foreign material from the wheel (1) and the hub (2) mounting surfaces.
2. Clean the threads on the wheel studs and wheel nuts.
3. Install the tire and wheel assembly. Align the locating mark of the wheel to the hub.



4. Install the wheel nuts.

Caution: Refer to [Fastener Caution](#) in the Preface section.

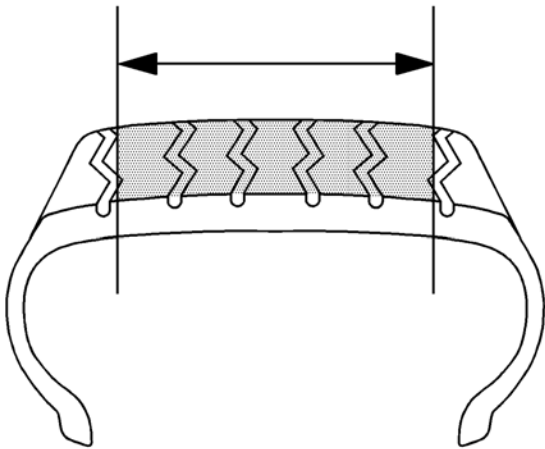
Note: Tighten the nuts evenly and alternately in the sequence shown, in order to avoid excessive runout.

5. Tighten the wheel nuts in the sequence shown tighten the nuts in sequence to **140 N·m (100 lb ft)**.
6. Install the wheel center cap.
7. Lower the vehicle.

Tire Repair

Warning:

- Tire changing can be dangerous and should be done by trained professionals using proper tools and procedures. Always read and understand any manufacturer's warnings contained in their customers literature or molded into the tire sidewall.
- Serious eye and ear injury may result from not wearing adequate eye and ear protection while repairing tires.
- NEVER inflate beyond 275 kPa (40 pounds) pressure to seat beads.
- NEVER stand, lean or reach over the assembly during inflation.



Repairable area on a radial tire.

Note:

- NEVER repair tires worn to the tread indicators 1.59 mm (2/32 in) remaining depth.
- NEVER repair tires with a tread puncture larger than 6.35 mm (1/4 in).
- NEVER substitute an inner tube for a permissible or non-permissible repair.
- NEVER perform an outside-in tire repair (plug only, on the wheel).
- Every tire must be removed from the wheel for proper inspection and repair.
- Regardless of the type of repair used, the repair must seal the inner liner and fill the injury.
- Consult with repair material supplier/manufacturer for repair unit application procedures and repair tools/repair material recommendations.

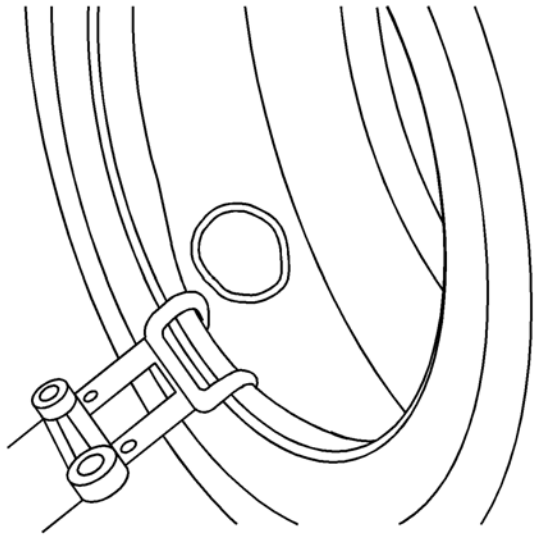
Three basic steps for tire puncture repair:

1. Remove the tire from the wheel for inspection and repair.
2. Fill the injury (puncture) to keep moisture out.
3. Seal the inner liner with a repair unit to prevent air loss.

External Inspection

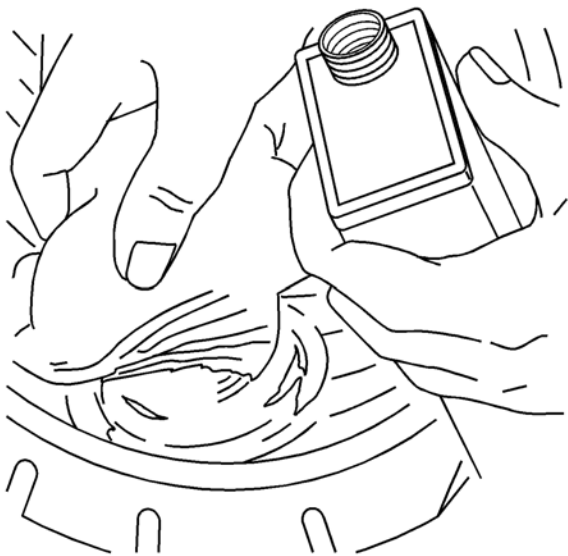
1. Prior to demounting, inspect the tire surface, the valve and the wheel for the source of the leak by using a water and soap solution. Mark the injured area and totally deflate the tire by removing the valve core.
2. Demount the tire from the wheel and place the tire on a well-lighted spreader.

Internal Inspection



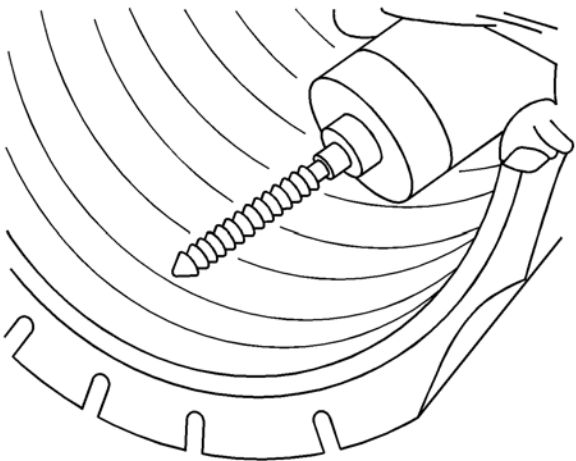
1. Spread the beads and mark the puncture with a tire crayon.
2. Inspect the inner tire for any signs of internal damage.
3. Remove the puncturing object, noting the direction of the penetration.
4. Probe the injury with a blunt awl in order to determine the extent and direction of the injury.
5. Remove any loose foreign material from the injury.
6. Punctures exceeding 6.35 mm (1/4 in) should not be repaired.

Cleaning



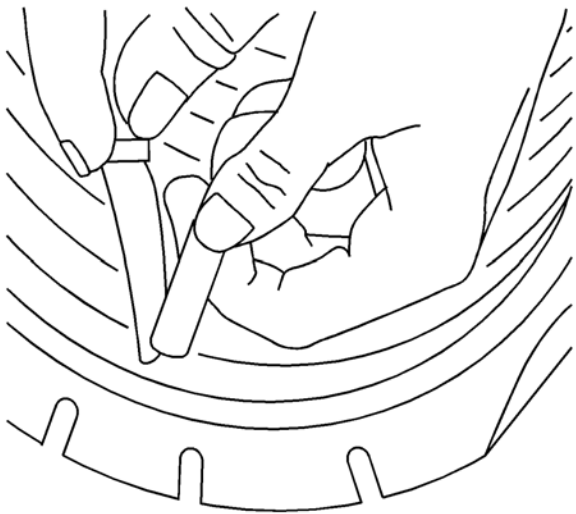
1. Clean the area around the puncture thoroughly with a proper liner cleaner, clean cloth and a scraper. This step serves to remove dirt and mold lubricants to insure proper adhesion and non-contamination of the buffing tool.
2. Refer to information on the product or manufacturer's Material Safety Data Sheet and follow guidelines for handling and disposal.

Clean the Injury Channel



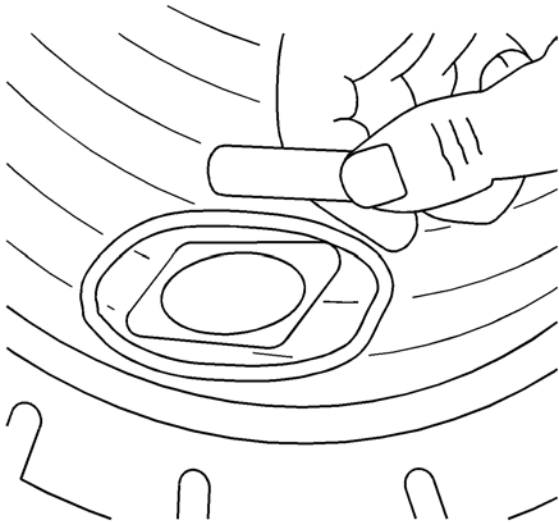
1. Use a proper hand reamer, carbide cutter or drill bit to ream the puncture channel from the inside of the tire in order to clean the injury.
2. Remove steel wires protruding above the liner surface to prevent damage to the repair unit.
3. Consult your repair material supplier for recommended reaming tool(s).

Fill the Injury



1. It is necessary to fill the injury channel to provide back up for the repair unit and to prevent moisture from entering the tire fabric and steel wires.
2. For combination repair/plug units skip this step. Cement the injured channel and fill the injury from the inside of the tire with the repair plug per repair material manufacturer's recommendations. Without stretching the plug, cut the plug off just above the inside tire surface.
3. Consult your repair material supplier for proper repair material selection.

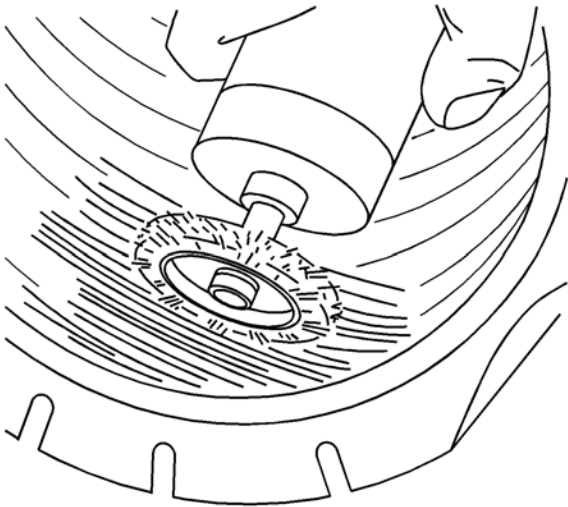
Repair Unit Selection



Note: Do not install the repair unit in this step.

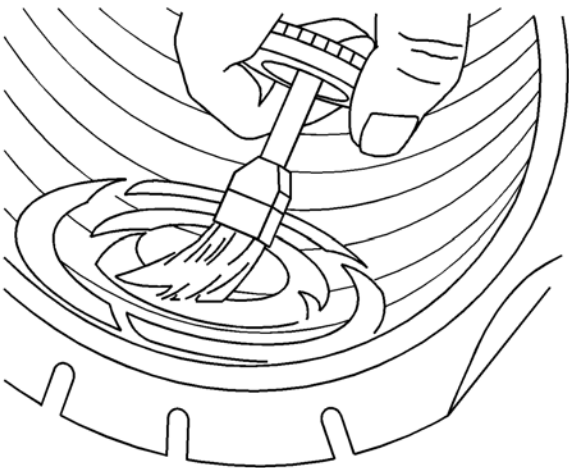
1. Center the repair unit over the injury as a reference and outline an area larger than the unit so that buffing will not remove the crayon marks.
2. Remove the repair unit.
3. DO NOT overlap previous or multiple repair units.
4. Consult your repair material supplier for proper repair unit selection.

Buffing



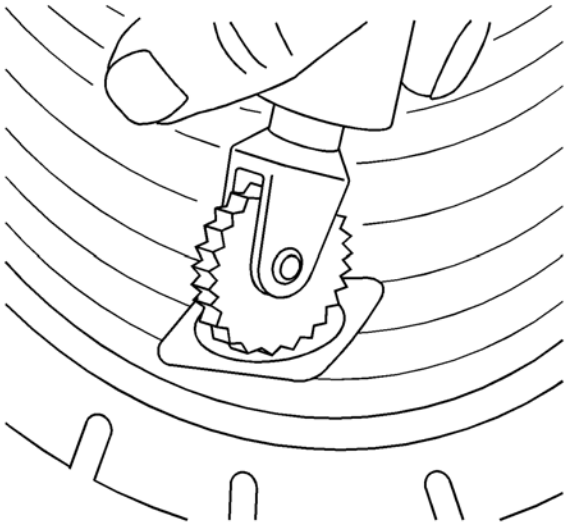
1. To prevent contamination and preserve the outline, buff within the marked area thoroughly and evenly with a low speed buffing tool using a fine wire brush or gritted rasp.
2. Buff to a smooth velvet surface (RMA #1 or #2 buffed texture).
3. Use caution not to gouge the inner liner or expose casing fabric.
4. Remove any buffing dust with a vacuum cleaner.
5. Consult your repair material supplier for a proper buffing tool.

Cementing



Apply chemical cement according to the repair material manufacturer's procedures.

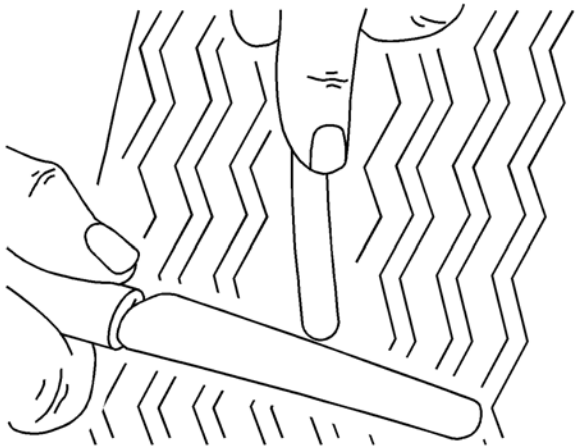
Repair Unit Application



The tire must be in the relaxed position when the repair unit is installed. Do not spread the beads excessively.

Two-Piece Plug and Repair Units

- 1. If applicable, install the repair unit so that the alignment is correct.
- 2. Center the repair unit over the injury and stitch down thoroughly with the stitching tool, working from the center out.



- 3. Being careful not to stretch the plug material, cut the plug flush with the outer tread.

Combination Repair / Plug Units

- 1. Pull the plug through the injury until the repair just reaches the liner. Stitch down thoroughly.
- 2. Follow the repair material manufacturer's recommendations for further installation instructions.

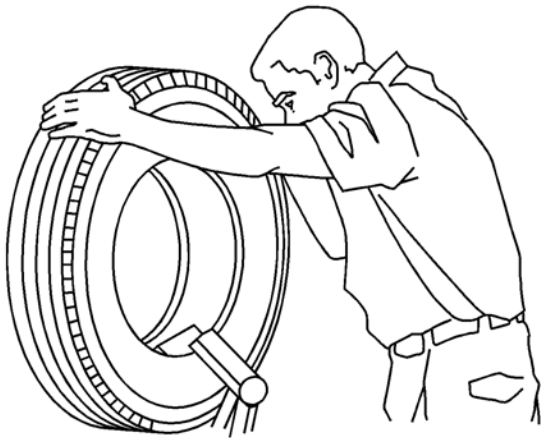
Consult your repair material supplier for the proper stitching tool.

Safety Cage



Some run flat tires may require more than 275 kPa (40 psi) to seat the bead. In such a case, a tire safety cage must be used. Consult the tire manufacturer for its individual repair policy.

Final Inspection



1. After remounting and inflating the tire, check both beads, the repair and the valve with a water and soap solution in order to detect leaks.
2. If the tire continues to lose air, the tire must be demounted and reinspected.
3. Balance the tire and wheel assembly. Refer to [Tire and Wheel Assembly Balancing - Off Vehicle](#).

For additional tire puncture repair information, contact:

Rubber Manufacturers Association (RMA)
1400 K Street, N.W., Suite 900
Washington, DC 20005-2403

Telephone: 202-682-4800

E-mail: info@rma.org

Website: www.rma.org

Tire Dismounting and Mounting

Caution: Use a tire changing machine in order to dismount tires. Do not use hand tools or tire irons alone in order to remove the tire from the wheel. Damage to the tire beads or the wheel rim could result.

Caution: Do not scratch or damage the clear coating on aluminum wheels with the tire changing equipment. Scratching the clear coating could cause the aluminum wheel to corrode and the clear coating to peel from the wheel.

Caution: Damage to either the tire bead or the wheel mounting holes can result from the use of improper wheel attachment or tire mounting procedures. It takes up to 70 seconds for all of the air to completely exhaust from a large tire. Failure to follow the proper procedures could cause the tire changer to put enough force on the tire to bend the wheel at the mounting surface. Such damage may result in vibration and/or shimmy, and under severe usage lead to wheel cracking.

1. Deflate the tire completely.

Note: Rim-clamp European-type tire changers are recommended.

2. Use the tire changer in order to remove the tire from the wheel.
3. Use a wire brush or coarse steel wool in order to remove any rubber, light rust or corrosion from the wheel bead seats.

Caution: When mounting the tires, use an approved tire mounting lubricant. DO NOT use silicon or corrosive base compounds to lubricate the tire bead and the wheel rim. A silicon base compound can cause the tire to slip on the rim. A corrosive type compound can cause tire or rim deterioration.

4. Apply an approved Lubricant to the tire bead and the wheel rim.
5. Use the tire changer in order to install the tire to the wheel.

Warning: To avoid serious personal injury, do not stand over tire when inflating. The bead may break when the bead snaps over the safety hump. Do not exceed 275 kPa (40 psi) pressure when inflating any tire if beads are not seated. If 275 kPa (40 psi) pressure will not seat the beads, deflate, relubricate the beads and reinflate. Overinflation may cause the bead to break and cause serious personal injury.

6. Inflate the tire to the proper air pressure.
7. Ensure that the locating rings are visible on both sides of the tire in order to verify that the tire bead is fully seated on the wheel.



Select a Document:

-  [Specifications](#)
-  [Wheel Alignment Measurement](#)
-  [Front Camber Adjustment](#)
-  [Front Caster and Camber Adjustment](#)
-  [Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment](#)
-  [Rear Caster and Camber Adjustment](#)
-  [Rear Camber Adjustment](#)
-  [Rear Toe Adjustment](#)



Wheel Alignment Specifications

Suspension	Camber	Cross Camber (L-R)	Caster	Cross Caster (L-R)	Steering Wheel Angle	Thrust Angle	Total Toe	Outer Wheel Deflection for 20° Inner Wheel Deflection
Front	-0.27° ± 0.75°	0.0° ± 1.00°	4.65° ± 0.75°	0.00° ± 1.00°	0.00° ± 1.50°	--	0.105° ± 0.167°	18.50° ± 0.75°
Rear	-1.25° ± 0.50°	0°00' ± 0.58°	--	--	--	0.00° ± 0.208°	0.15° ± 0.417°	--

Wheel Alignment Measurement

Steering and vibration complaints are not always the result of improper alignment. One possible cause is wheel and tire imbalance. Another possibility is tire lead due to worn or improperly manufactured tires. Lead/pull is defined as follows: At a constant highway speed on a typical straight road, lead/pull is the amount of effort required at the steering wheel to maintain the vehicle's straight path. Lead is the vehicle deviation from a straight path on a level road without pressure on the steering wheel.

Before performing any adjustment affecting wheel alignment, perform the following inspections and adjustments in order to ensure correct alignment readings:

- Inspect the tires for the proper inflation and irregular tire wear.
- Inspect the runout of the wheels and the tires.
- Inspect the wheel bearings for backlash and excessive play. Refer to [Suspension Strut and Shock Absorber Testing - On Vehicle](#)
- Inspect the ball joints for looseness or wear.
- Inspect the tie rod ends for looseness or wear.
- Inspect the control arms and stabilizer shaft for looseness or wear.
- Inspect the steering gear for looseness at the frame.
- Inspect the struts/shock absorbers for wear, leaks, and any noticeable noises. Refer to [Suspension Strut and Shock Absorber Testing - On Vehicle](#).
- Inspect the steering wheel for excessive drag or poor return due to stiff or rusted linkage or suspension components.
- Inspect the fuel level. The fuel tank should be full or the vehicle should have a compensating load added.

Give consideration to excess loads, such as tool boxes, sample cases, etc. If normally carried in the vehicle, these items should remain in the vehicle during alignment adjustments. Give consideration also to the condition of the equipment being used for the alignment. Follow the equipment manufacturer's instructions.

Satisfactory vehicle operation may occur over a wide range of alignment settings. However, if the setting exceeds the service allowable specifications, correct the alignment to the service preferred specifications. Refer to [Wheel Alignment Specifications](#)

Perform the following steps in order to measure the front and rear alignment angles:

1. Install the alignment equipment according to the manufacturer's instructions.
2. Jounce the front and the rear bumpers 3 times prior to checking the wheel alignment.
3. Measure the alignment angles and record the readings.

Note:

- Record the "Before" and "After" alignment measurements.
 - When performing adjustments to vehicles requiring a 4-wheel alignment, set the rear wheel alignment angles first in order to obtain proper front alignment angles.
4. Adjust alignment angles to vehicle specification, if necessary. Refer to [Wheel Alignment Specifications](#).



Front Camber Adjustment

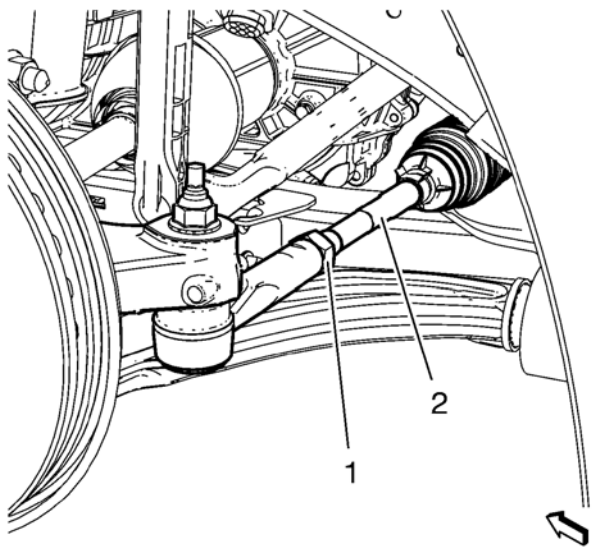
The front camber is not adjustable. If the front camber angle is not within specifications, inspect for suspension support misalignment or front suspension damage. Replace any damaged suspension components as necessary.



Front Caster and Camber Adjustment

The front caster and camber is not adjustable. If the front caster angle is not within specifications, inspect for suspension support misalignment or front suspension damage. Replace any damaged suspension components as necessary.

Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment



- 1. Ensure that the steering wheel is set in a straight ahead position.
- 2. Loosen the tie rod jam nut (1).
- 3. Adjust the toe to specification by turning the adjuster (2). Refer to [Wheel Alignment Specifications](#).

Caution: Refer to [Fastener Caution](#) in the Preface section.

- 4. Tighten the tie rod jam nut (1) to **35 N·m (26 lb ft)**.

Rear Caster and Camber Adjustment

The rear caster and camber is not adjustable. If the rear caster and camber angle is not within specifications, inspect for suspension support misalignment or rear suspension damage. Replace any damaged suspension components as necessary.

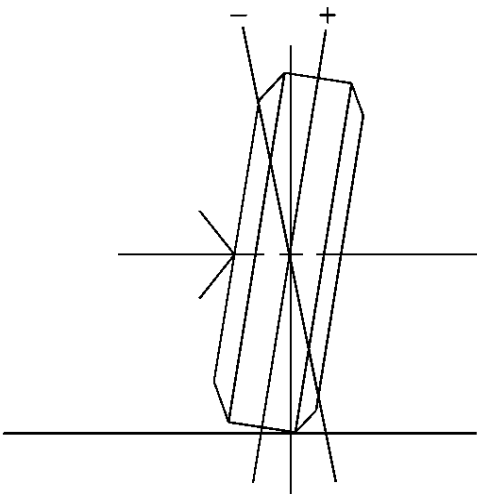
Rear Camber Adjustment

The rear camber is not adjustable. If the rear camber angle is not within specifications, inspect for suspension support misalignment or rear suspension damage. Replace any damaged suspension components as necessary.

Rear Toe Adjustment

The rear toe is not adjustable. If the rear toe angle is not within specifications, inspect for suspension support misalignment or rear suspension damage. Replace any damaged suspension components as necessary.

Camber Description



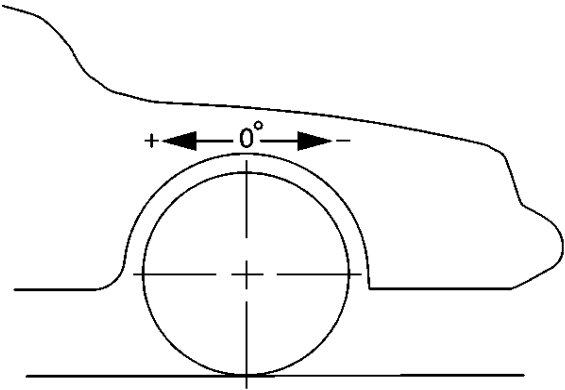
Camber is the tilting of the wheels from the vertical when viewed from the front of the vehicle. When the wheels tilt outward at the top, the camber is positive (+). When the wheel tilts inward at the top, the camber is negative (-). The amount of tilt is measured in degrees from the vertical. Camber settings influence the directional control and the tire wear.

Too much positive camber will result in premature wear on the outside of the tire and cause excessive wear on the suspension parts.

Too much negative camber will result in premature wear on the inside of the tire and cause excessive wear on the suspension parts.

Unequal side-to-side camber of one degree or more will cause the vehicle to pull or lead to the side with the most positive camber.

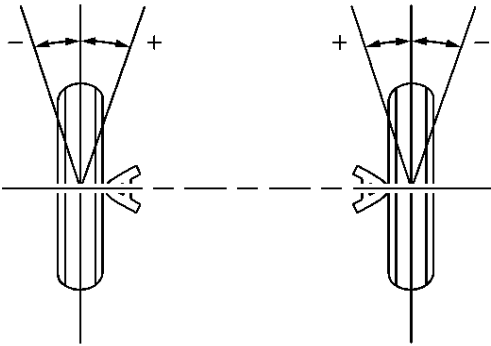
Caster Description



Caster is the tilting of the uppermost point of the steering axis either forward or backward, 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 the tire wear. Caster is affected by the vehicle height, therefore it is important to keep the body at its designed height. Overloading the vehicle or a weak or sagging rear spring will affect caster. When the rear of the vehicle is lower than its designated trim height, the front suspension moves to a more positive caster. If the rear of the vehicle is higher than its designated trim height, the front suspension moves to a less positive caster.

With too little positive caster, steering may be touchy at high speed and wheel returnability may be diminished when coming out of a turn. If one wheel has more positive caster than the other, that wheel will pull toward the center of the vehicle. This condition will cause the vehicle to pull or lead to the side with the least amount of positive caster.

Toe Description



Toe is a measurement of how much the front and/or rear wheels are turned in or out from a straight-ahead position. When the wheels are turned in, toe is positive (+). When the wheels are turned out, toe is negative (-). The actual amount of toe is normally only a fraction of a degree. The purpose of toe is to ensure that the wheels roll parallel.

Toe also offsets the small deflections of the wheel support system that occur when the vehicle is rolling forward. In other words, with the vehicle standing still and the wheels set with toe-in, the wheels tend to roll parallel on the road when the vehicle is moving.

Improper toe adjustment will cause premature tire wear and cause steering instability.