

Suspension

Front Suspension - CTS Sedan

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Front Lower Control Front Link Bolt (1)		
• First Pass	100 N.m	74 lb ft
• Final Pass	90-105 Degrees	
Front Lower Control Rear Link Bolt (1)		
• First Pass	100 N.m	74 lb ft
• Final Pass	90-105 Degrees	
Front Suspension Upper Strut Mount Nut	17 N.m	13 lb ft
Front Suspension Strut Nut (at Steering Knuckle)		
• First Pass	150 N.m	111 lb ft
• Final Pass	80-95 Degrees	
Front Suspension Strut Nut (with Electronic Suspension at Top of Front Suspension Strut Mount)	48 N.m	35 lb ft
Front Suspension Strut Nut (without Electronic Suspension at Top of Front Suspension Strut Mount)	60 N.m	44 lb ft
Front Wheel Bearing and Hub Assembly Bolt (AWD)	130 N.m	96 lb ft
Front Wheel Bearing and Hub Assembly Bolt (RWD)	118 N.m	87 lb ft
Lower Stabilizer Shaft Link Nut	100 N.m	74 lb ft
Stabilizer Shaft Clamp Nut	22 N.m	16 lb ft
Steering Knuckle Nut		
• First Pass	40 N.m	30 lb ft
• Final Pass	120-135 Degrees	
Upper Stabilizer Shaft Link Nut	100 N.m	74 lb ft
1. Torque-to-yield fastener in use, requires NEW bolt.		

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Adhesives, Fluids, Lubricants, and Sealers

Application	Type of Material	GM Part Number	
		United States	Canada
Wheel Bearing and Hub Bolt	Threadlocker	89021297	10953488

REPAIR INSTRUCTIONS

STABILIZER SHAFT REPLACEMENT (RWD)

Removal Procedure

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
2. Remove the tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation .
3. Remove the front compartment lower noise shield. Refer to Front Compartment Lower Noise Shield Replacement (RWD) .
4. Disconnect the stabilizer shaft links from the stabilizer shaft. Refer to Stabilizer Shaft Link Replacement.
5. Disconnect the steering gear electrical connectors.
6. If equipped, remove the engine mount vacuum tank. Refer to Engine Mount Vacuum Tank Replacement .

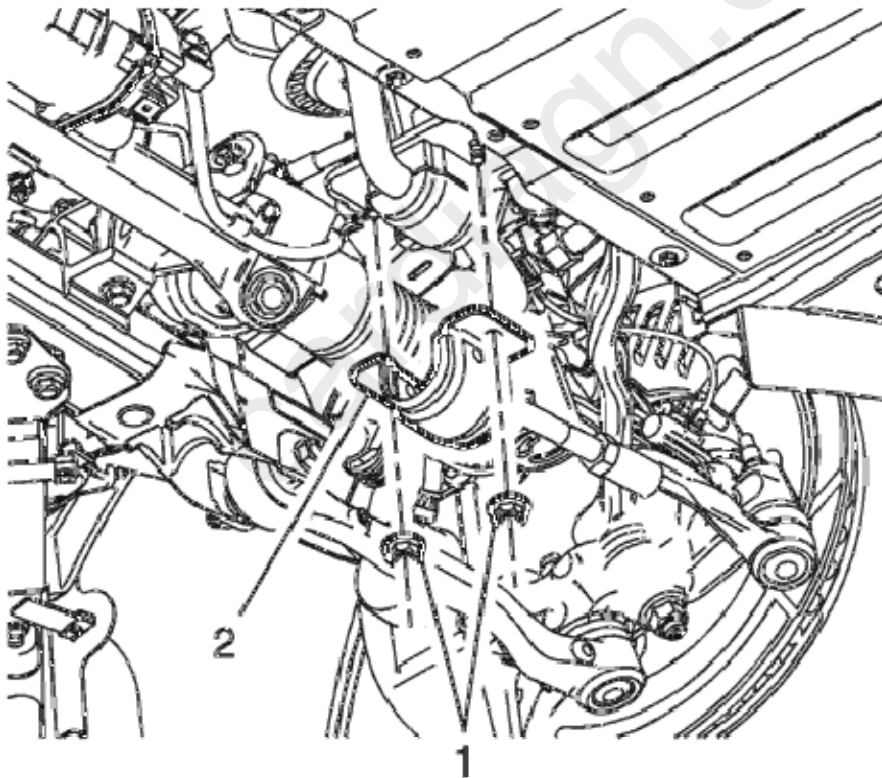


Fig. 1: Left Side Front Stabilizer Shaft Insulator Clamp
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Use caution when removing the front stabilizer insulator clamp nuts.

Avoid tool contact with the steering gear boot and clamps. Damage to the steering gear boot may lead to dirt and water contamination in the steering gear rack and components requiring a preventable replacement of the Steering Gear and its Components.

7. Using a swivel socket, remove the left side front stabilizer shaft insulator clamp nuts (1) and clamp (2).

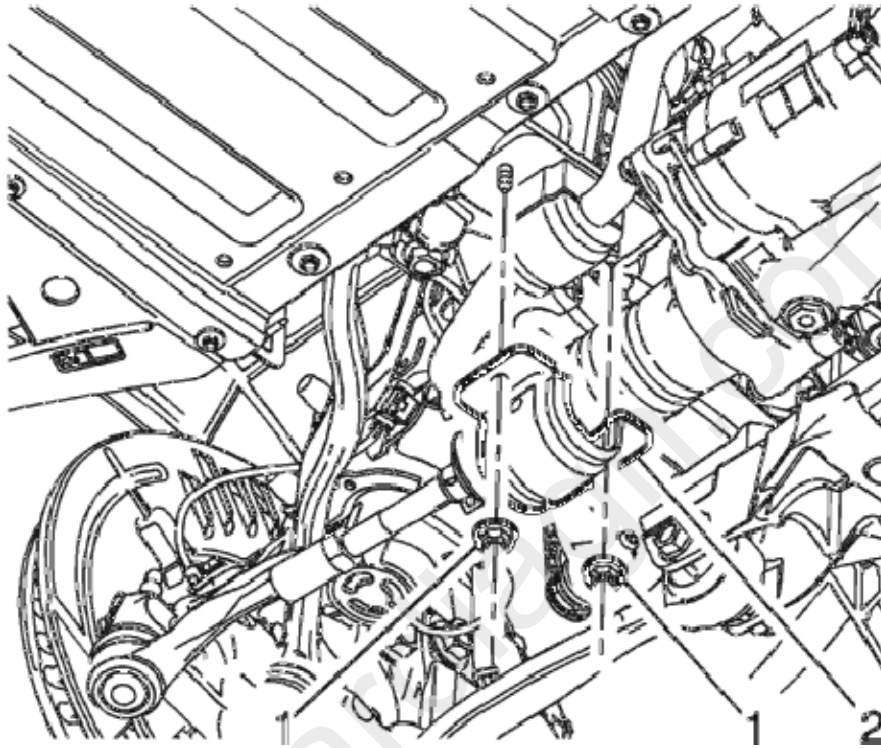


Fig. 2: Right Side Front Stabilizer Shaft Insulator Clamp
Courtesy of GENERAL MOTORS COMPANY

8. Using a swivel socket, remove the right side front stabilizer shaft insulator clamp nuts (1) and clamp (2).

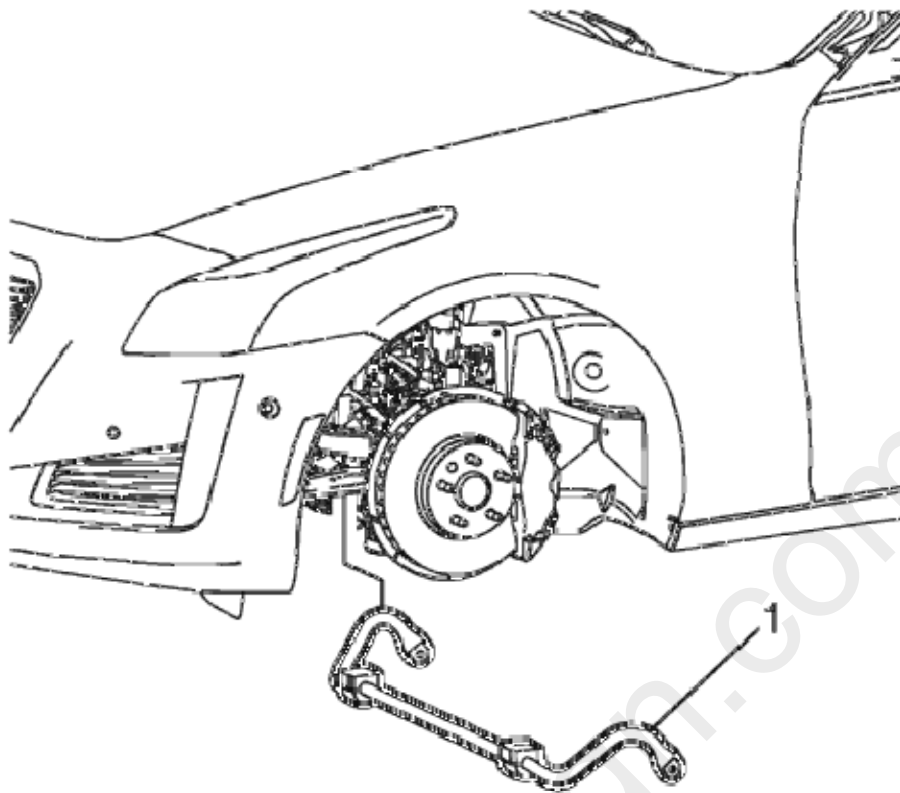


Fig. 3: Front Stabilizer Shaft

Courtesy of GENERAL MOTORS COMPANY

NOTE: On rear wheel drive vehicles, the front stabilizer shaft insulators are not serviceable. Do not transfer the insulators.

9. Remove the front stabilizer shaft (1) from the vehicle.

Installation Procedure

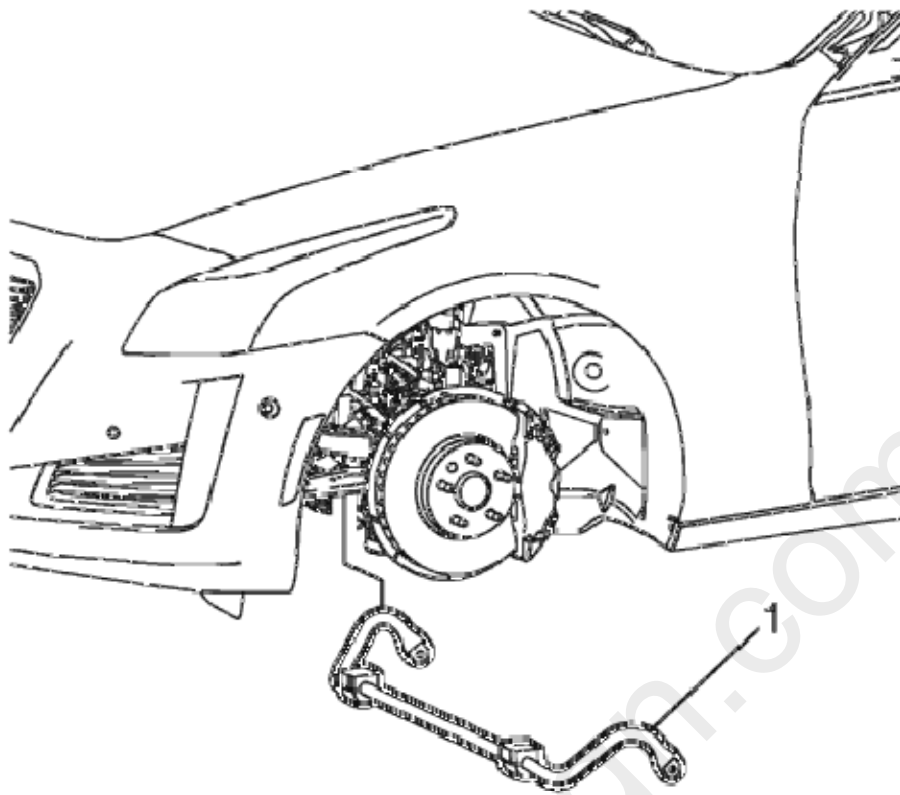


Fig. 4: Front Stabilizer Shaft

Courtesy of GENERAL MOTORS COMPANY

1. Position the front stabilizer shaft (1) on the vehicle.

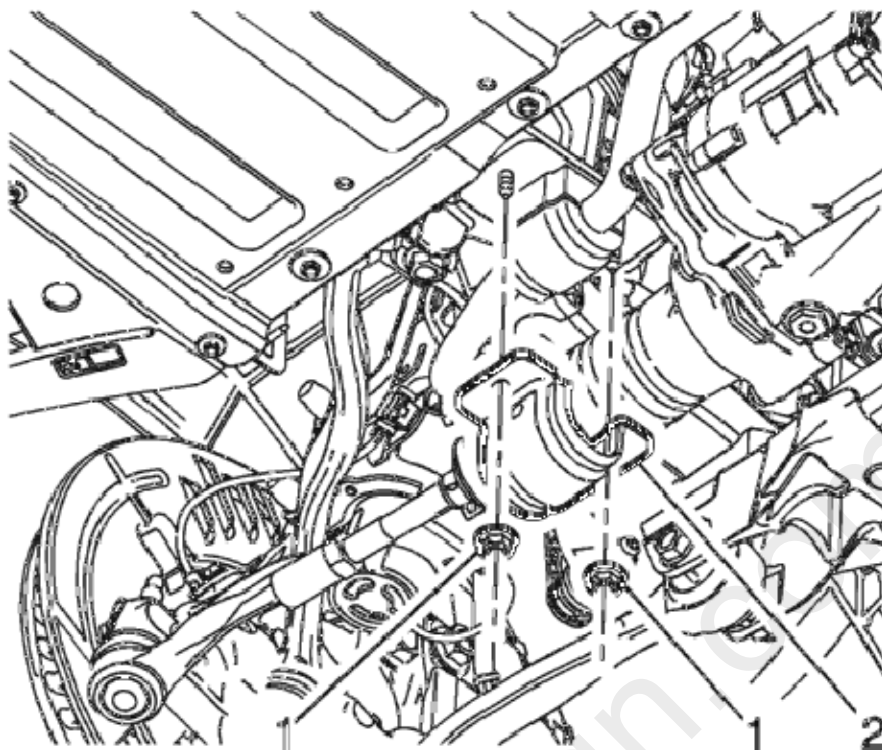


Fig. 5: Right Side Front Stabilizer Shaft Insulator Clamp
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

CAUTION: Use caution when removing the front stabilizer insulator clamp nuts. Avoid tool contact with the steering gear boot and clamps. Damage to the steering gear boot may lead to dirt and water contamination in the steering gear rack and components requiring a preventable replacement of the Steering Gear and its Components.

2. Using a swivel socket, install the right side front stabilizer shaft insulator clamp (2) and nuts (1) and tighten the nuts to 22 (16 lb ft).

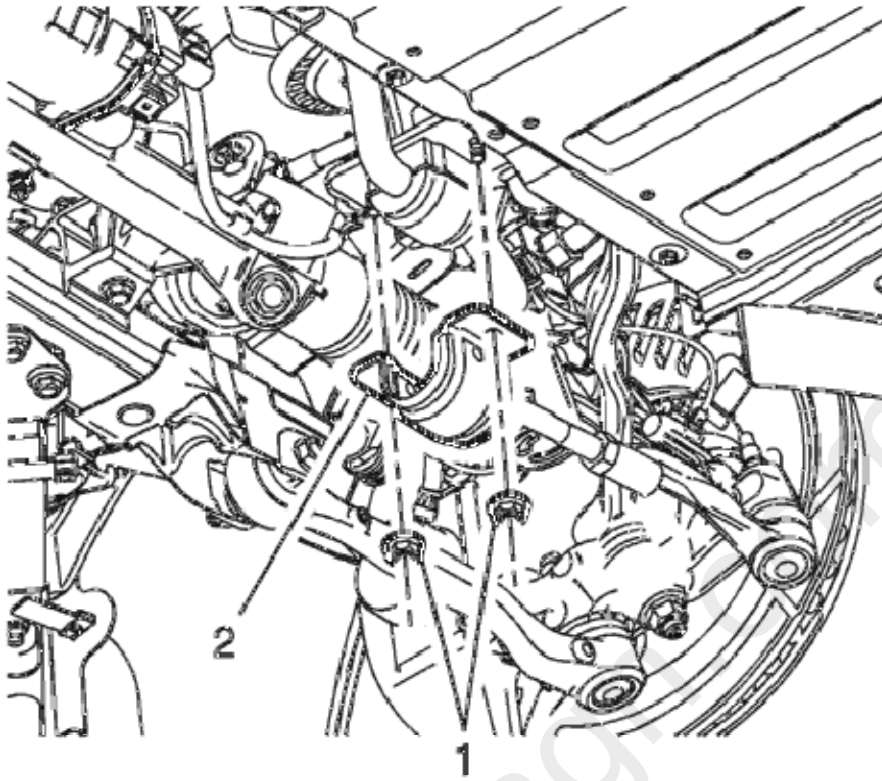


Fig. 6: Left Side Front Stabilizer Shaft Insulator Clamp
Courtesy of GENERAL MOTORS COMPANY

3. Using a swivel socket, install the left side front stabilizer shaft insulator clamp (2) and nuts (1) and tighten the nuts to 22 (16 lb ft).
4. If equipped, install the engine mount vacuum tank. Refer to **Engine Mount Vacuum Tank Replacement** .
5. Connect the steering gear electrical connectors.
6. Connect the stabilizer shaft links to the stabilizer shaft. Refer to **Stabilizer Shaft Link Replacement**.
7. Install the front compartment lower noise shield. Refer to **Front Compartment Lower Noise Shield Replacement (RWD)** .
8. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .

STABILIZER SHAFT REPLACEMENT (AWD)

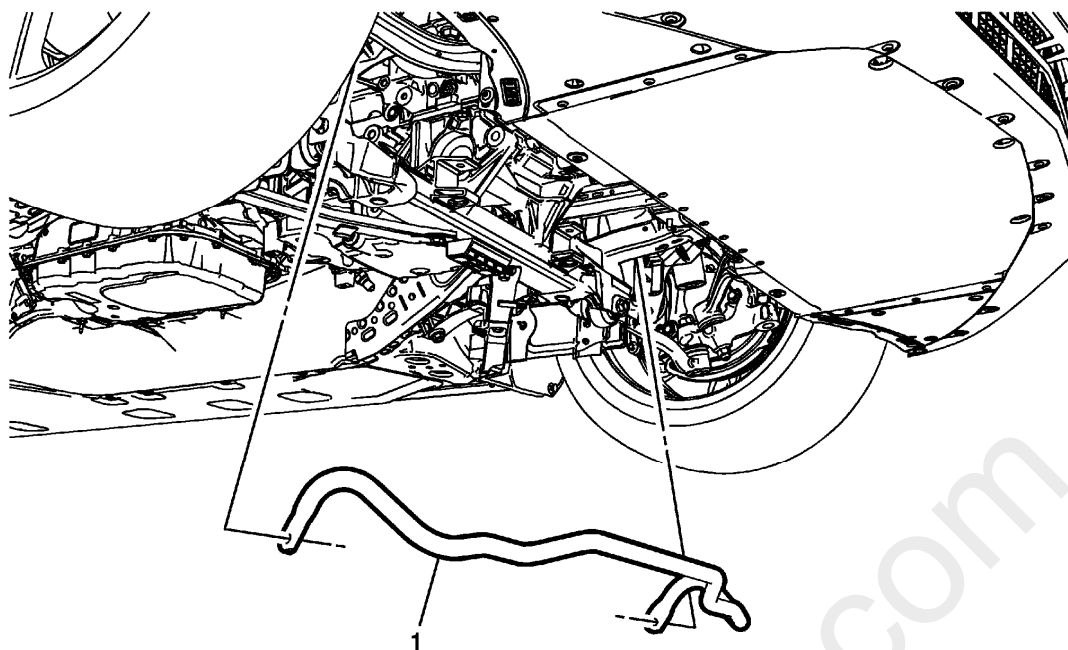


Fig. 7: Stabilizer Shaft (AWD)

Courtesy of GENERAL MOTORS COMPANY

Stabilizer Shaft Replacement (AWD)

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> 2. Remove the front compartment lower noise shield. Refer to <u>Front Compartment Lower Noise Shield Replacement (AWD)</u> . 3. Remove the center front bumper fascia air deflector. Refer to <u>Front Bumper Fascia Air Deflector Replacement - Center</u> . 4. Remove engine lower front splash shield. Refer to <u>Engine Lower Front Splash Shield Replacement</u> . 5. Disconnect the stabilizer shaft links from the stabilizer shaft. Refer to <u>Stabilizer Shaft Link Replacement</u>. 6. Remove the electric belt drive rack and pinion steering gear. <u>Electric Belt Drive Rack and Pinion Steering Gear Replacement (AWD)</u> . 7. Paint a reference mark on the stabilizer shaft where the stabilizer shaft insulators are located. Transfer the paint mark onto the new stabilizer shaft. 8. Remove the stabilizer shaft insulator clamps. Refer to <u>Stabilizer Shaft Insulator Replacement (AWD)</u>.	
1	Front Stabilizer Shaft

STABILIZER SHAFT LINK REPLACEMENT

Removal Procedure

1. Raise and 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. Use a jack stand to support the steering knuckle.

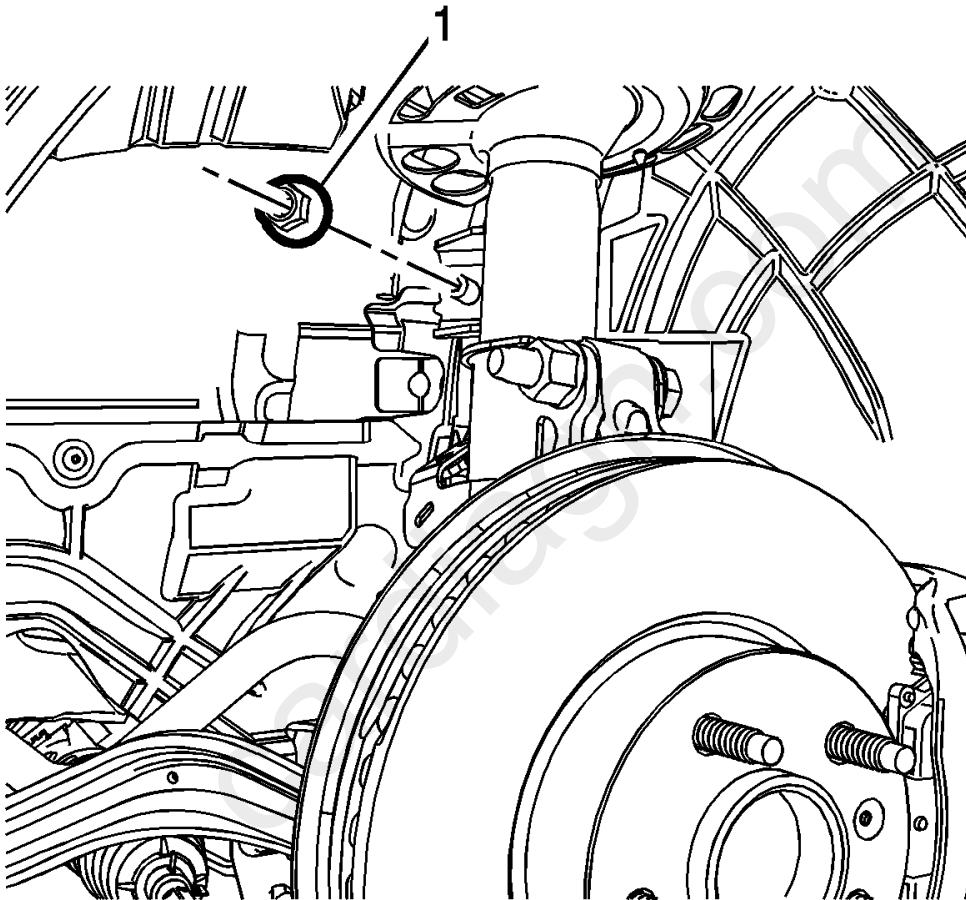


Fig. 8: Upper Stabilizer Shaft Link Nut
Courtesy of GENERAL MOTORS COMPANY

NOTE: Use the proper tool to prevent the stabilizer shaft link ball stud from turning while loosening the stabilizer shaft nut.

4. Remove the upper stabilizer shaft link nut (1).

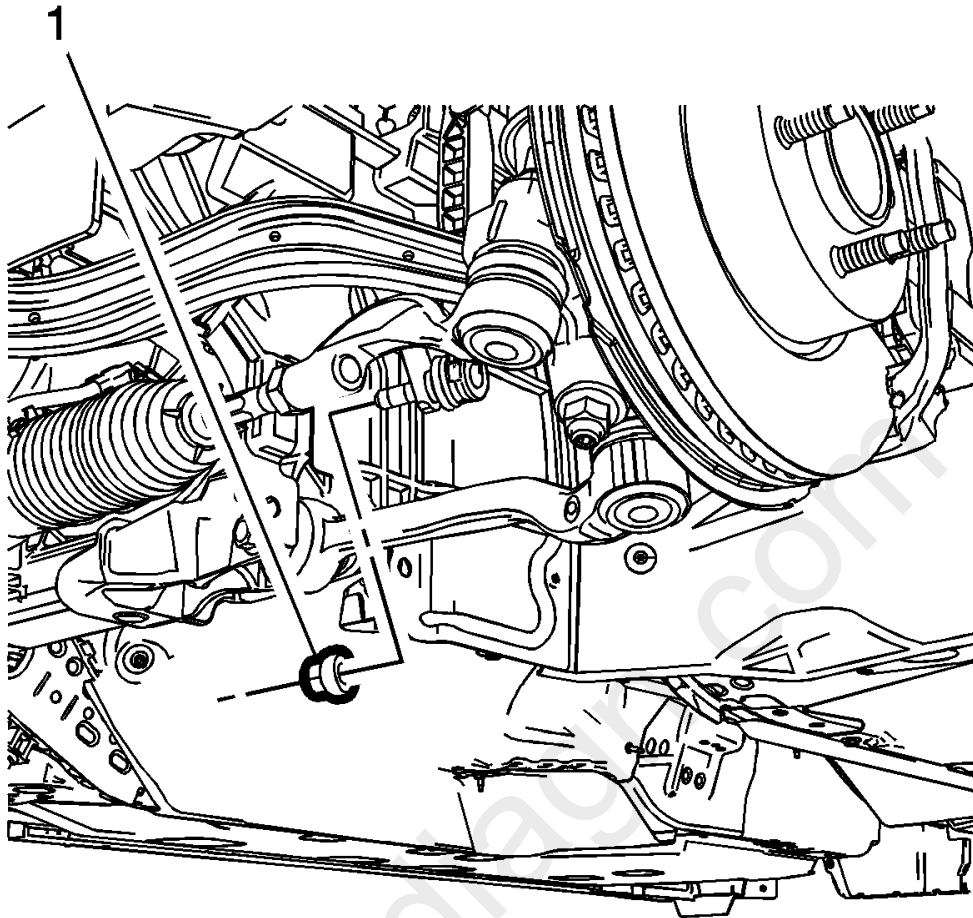


Fig. 9: Lower Stabilizer Shaft Link Nut
Courtesy of GENERAL MOTORS COMPANY

NOTE: Use the proper tool to prevent the stabilizer shaft link ball stud from turning while loosening the stabilizer shaft nut.

5. Remove the lower stabilizer shaft link nut (1).

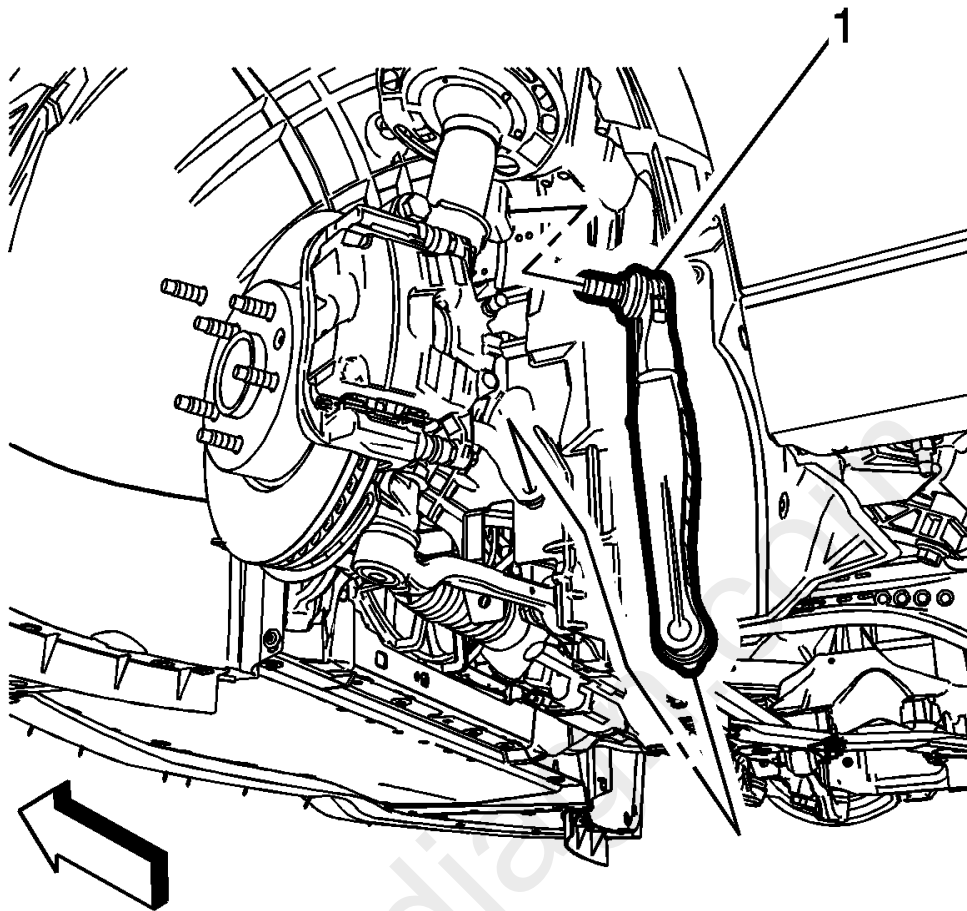


Fig. 10: Stabilizer Shaft Link
Courtesy of GENERAL MOTORS COMPANY

6. Remove the stabilizer shaft link (1) from the vehicle.

Installation Procedure

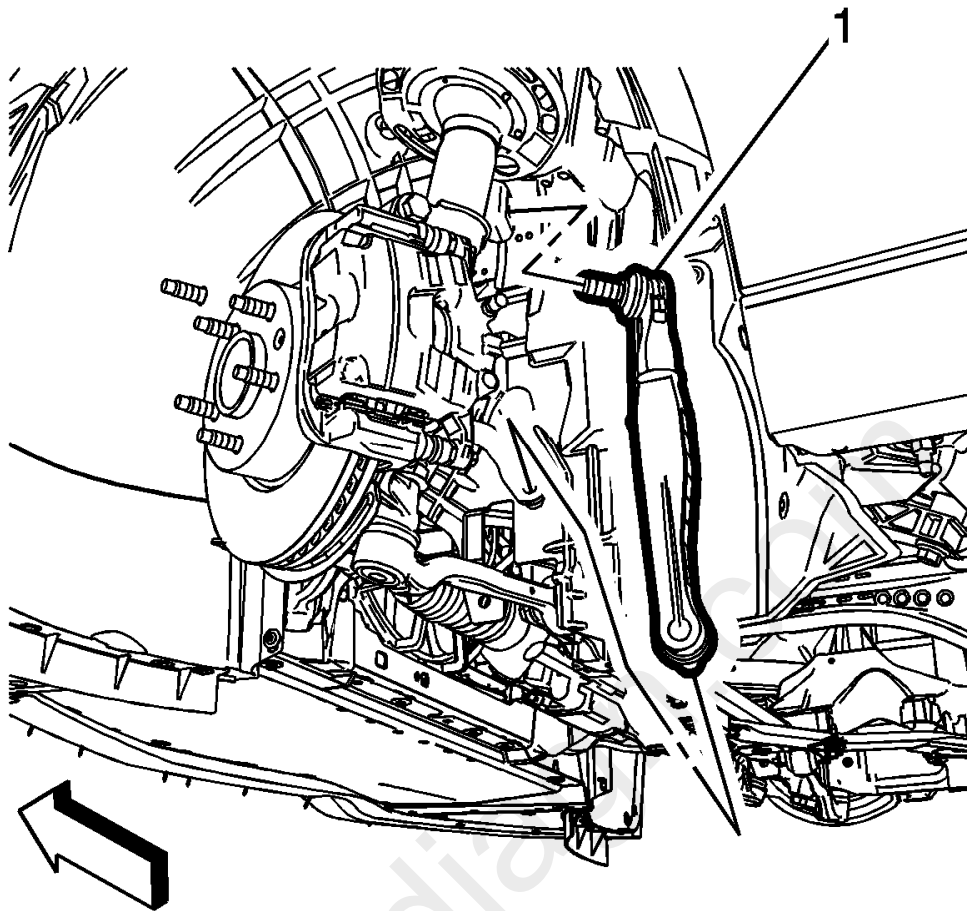


Fig. 11: Stabilizer Shaft Link
Courtesy of GENERAL MOTORS COMPANY

1. Position the stabilizer shaft link (1) on the vehicle.

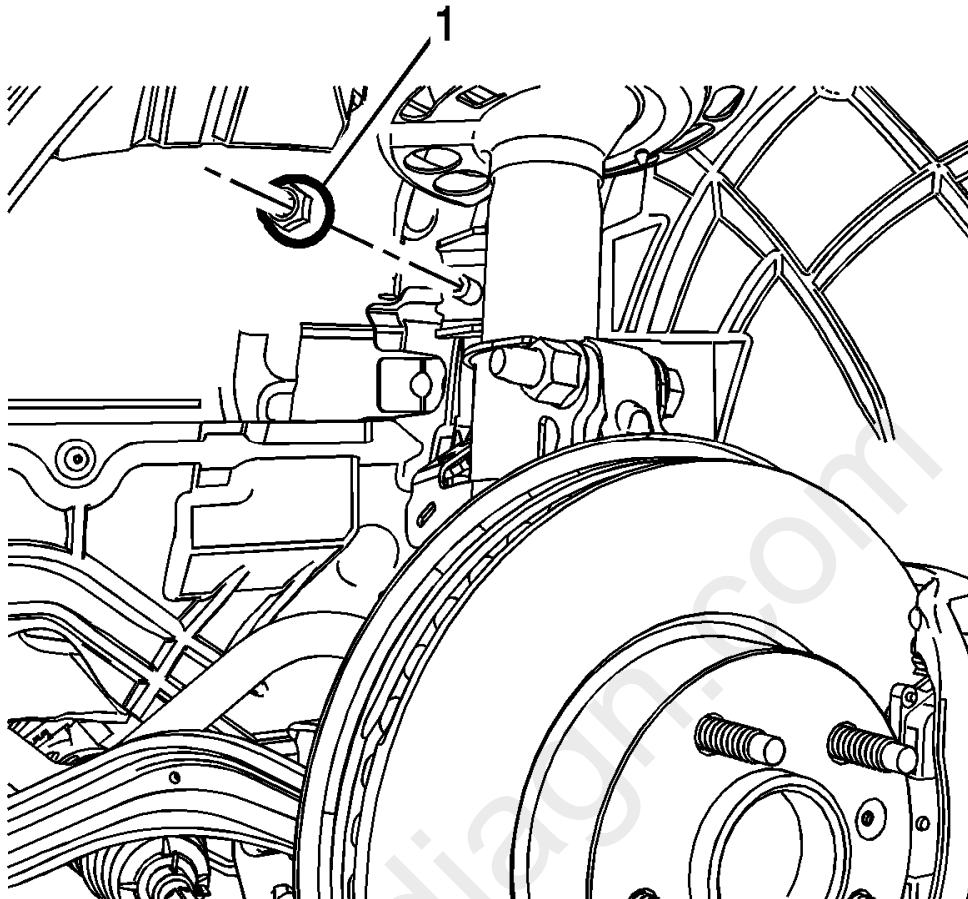


Fig. 12: Upper Stabilizer Shaft Link Nut
Courtesy of GENERAL MOTORS COMPANY

NOTE: Use the proper tool to prevent the stabilizer shaft link ball stud from turning while tightening the stabilizer shaft nut.

2. Install the upper stabilizer shaft link nut (1) and tighten to 100 (74 lb ft).

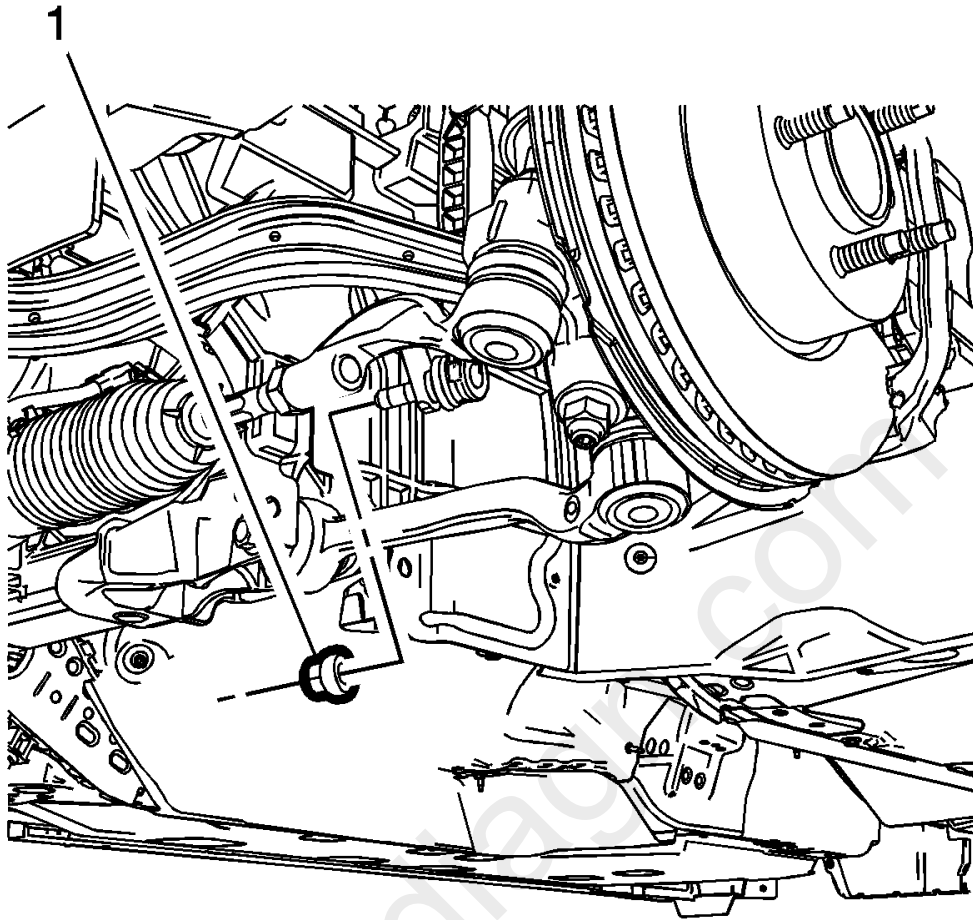


Fig. 13: Lower Stabilizer Shaft Link Nut
Courtesy of GENERAL MOTORS COMPANY

NOTE: Use the proper tool to prevent the stabilizer shaft link ball stud from turning while tightening the stabilizer shaft nut.

3. Install the lower stabilizer shaft link nut (1) and tighten to 100 (74 lb ft).
4. Remove the jack stand from the steering knuckle.
5. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .

STABILIZER SHAFT INSULATOR REPLACEMENT (AWD)

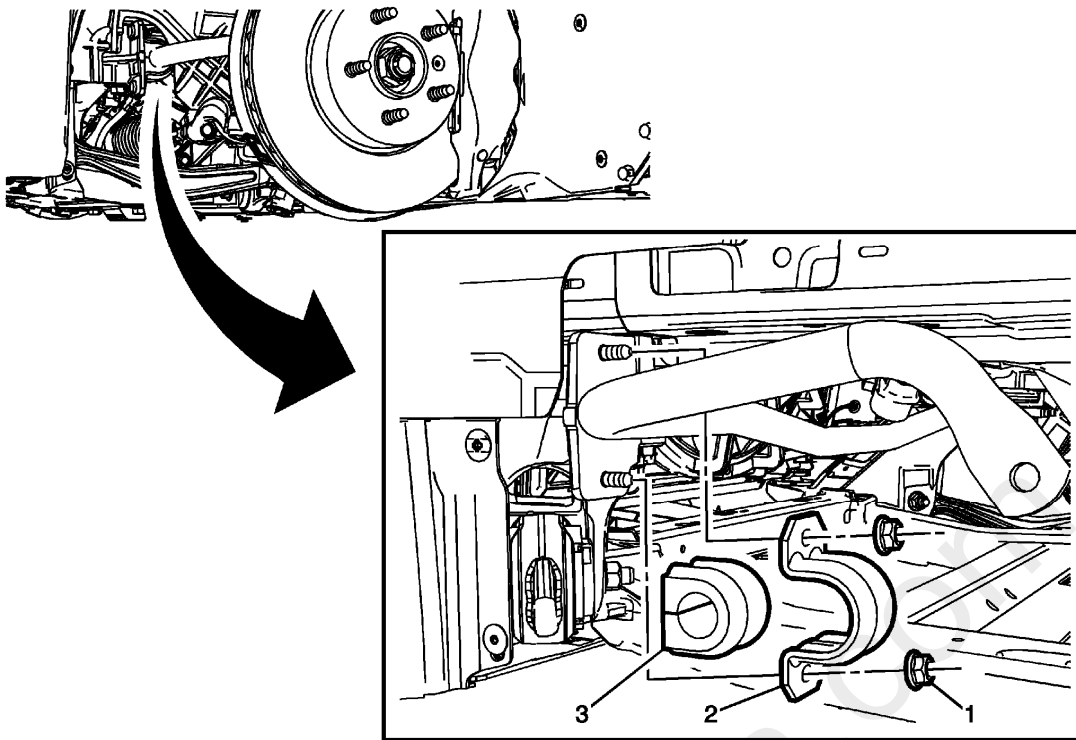


Fig. 14: Stabilizer Shaft Insulator (AWD)
 Courtesy of GENERAL MOTORS COMPANY

Stabilizer Shaft Insulator Replacement (AWD)

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the front compartment lower noise shield. Refer to <u>Front Compartment Lower Noise Shield Replacement (AWD)</u> . 3. Remove the engine lower front splash shield. Refer to <u>Engine Lower Front Splash Shield Replacement</u> . 4. Disconnect the stabilizer shaft links from the front stabilizer shaft. Refer to <u>Stabilizer Shaft Link Replacement</u>.	
1	Front Stabilizer Shaft Insulator Clamp Nut (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 22 (16 lb ft)
2	Front Stabilizer Shaft Insulator Clamp
	Front Stabilizer Shaft Insulator

3

NOTE:

Ensure the NEW front stabilizer shaft insulator is aligned the same way as the OLD insulator before installing.

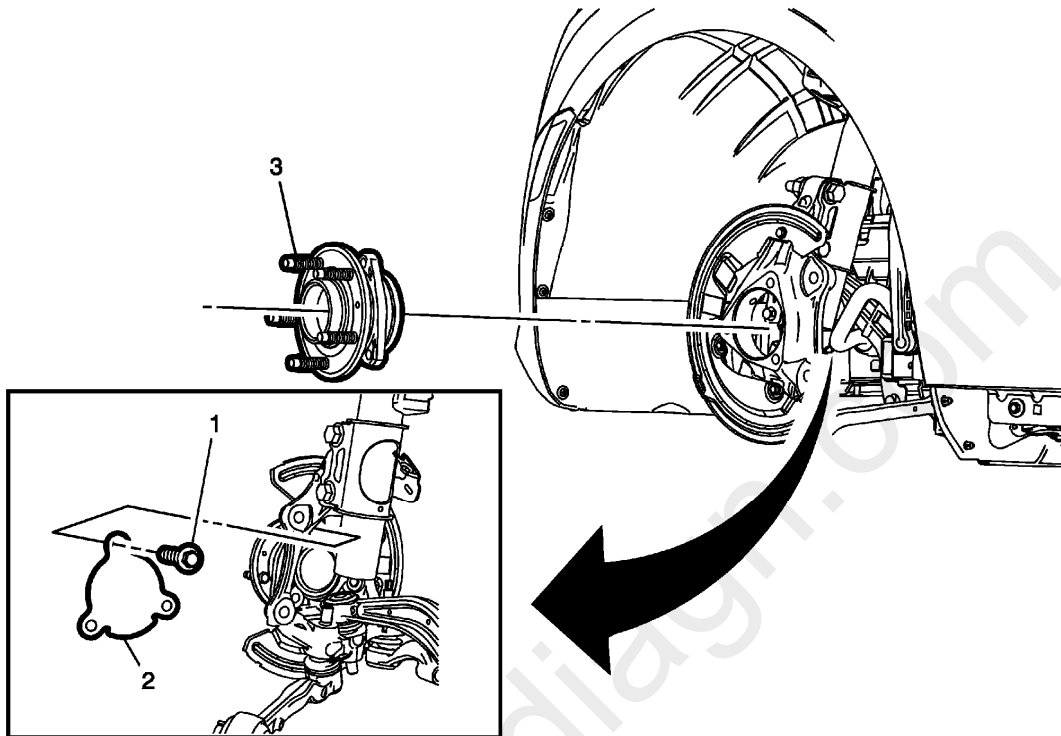
FRONT WHEEL BEARING AND HUB REPLACEMENT (RWD)

Fig. 15: Front Wheel Bearing and Hub (RWD)

Courtesy of GENERAL MOTORS COMPANY

Front Wheel Bearing and Hub Replacement (RWD)

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .	
2. Remove the tire and wheel assembly. Refer to <u>Tire and Wheel Removal and Installation</u> .	
3. Remove the front brake rotor. Refer to <u>Front Brake Rotor Replacement</u> .	
4. Remove the front wheel speed sensor from the steering knuckle only and position aside. Refer to <u>Front Wheel Speed Sensor Replacement</u> .	
	Front Wheel Bearing and Hub Assembly Bolt (Qty: 3)
	CAUTION: Refer to <u>Fastener Caution</u> .

Procedure

1

1. Thoroughly clean the old threadlocker residue from the threads of each front wheel bearing and hub assembly bolt with an approved solvent and allow to dry.
2. Thoroughly clean the old threadlocker residue from each front wheel bearing and hub assembly bolt hole with an approved solvent and allow to dry.
3. Apply threadlocker to 2/3 of the threaded length of the front wheel bearing and hub assembly bolts and the front wheel bearing and hub assembly bolt holes. Refer to **Adhesives, Fluids, Lubricants, and Sealers**.
4. Ensure there are no gaps in the threadlocker along the filled area of the front wheel bearing and hub assembly bolts and the front wheel bearing and hub assembly bolt holes.
5. Allow the threadlocker to cure approximately 10 minutes before installing the front wheel bearing and hub assembly bolts.

Tighten

118 (87 lb ft)

2

Front Wheel Bearing and Hub Assembly Debris Shield

3

Front Wheel Bearing and Hub Assembly

FRONT WHEEL BEARING AND HUB REPLACEMENT (AWD)

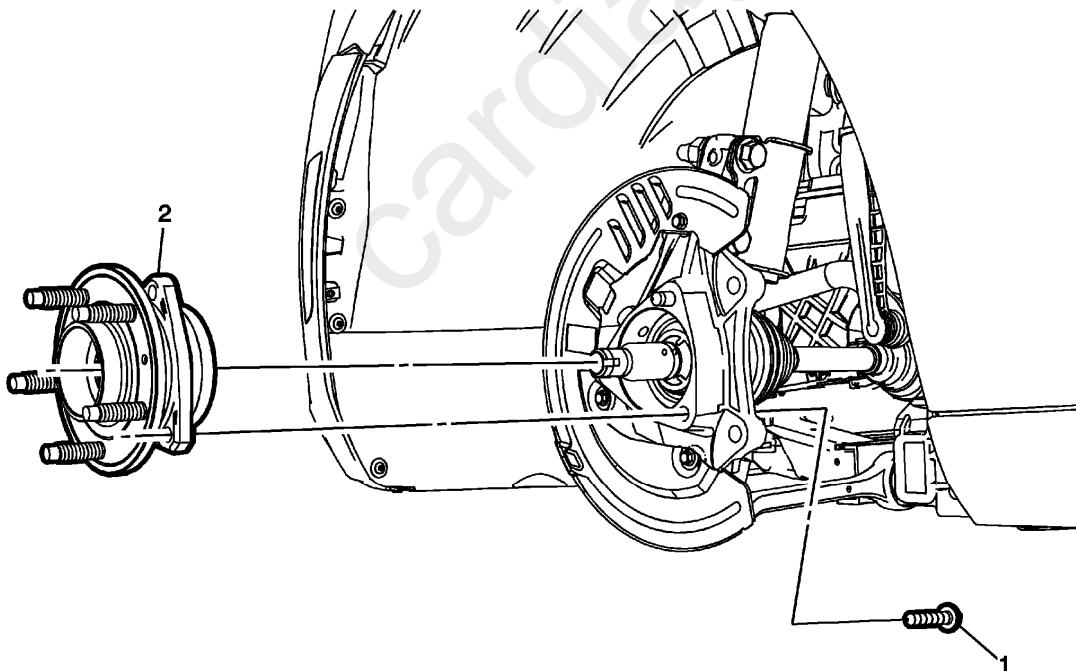


Fig. 16: Front Wheel Bearing and Hub (AWD)

Courtesy of GENERAL MOTORS COMPANY

Front Wheel Bearing and Hub Replacement (AWD)

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the tire and wheel assembly. Refer to <u>Tire and Wheel Removal and Installation</u> . 3. Remove the front brake rotor. Refer to <u>Front Brake Rotor Replacement</u> . 4. Remove the front wheel speed sensor from the steering knuckle only and position aside. Refer to <u>Front Wheel Speed Sensor Replacement</u> . 5. Remove the front wheel drive shaft nut and disengage the shaft from the hub only. It is not necessary to remove the shaft completely from the vehicle. Refer to <u>Front Wheel Drive Shaft Replacement - Left Side</u> , or <u>Front Wheel Drive Shaft Replacement - Right Side</u> .	
1	Front Wheel Bearing and Hub Assembly Bolt (Qty: 3) CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Thoroughly clean the old threadlocker residue from the threads of each front wheel bearing and hub assembly bolt with an approved solvent and allow to dry. 2. Thoroughly clean the old threadlocker residue from each front wheel bearing and hub assembly bolt hole with an approved solvent and allow to dry. 3. Apply threadlocker to 2/3 of the threaded length of the front wheel bearing and hub assembly bolts and the front wheel bearing and hub assembly bolt holes. Refer to <u>Adhesives, Fluids, Lubricants, and Sealers</u>. 4. Ensure there are no gaps in the threadlocker along the filled area of the front wheel bearing and hub assembly bolts and the front wheel bearing and hub assembly bolt holes. 5. Allow the threadlocker to cure approximately 10 minutes before installing the front wheel bearing and hub assembly bolts. Tighten 130 (96 lb ft)
2	Front Wheel Bearing and Hub Assembly

STEERING KNUCKLE REPLACEMENT (RWD)

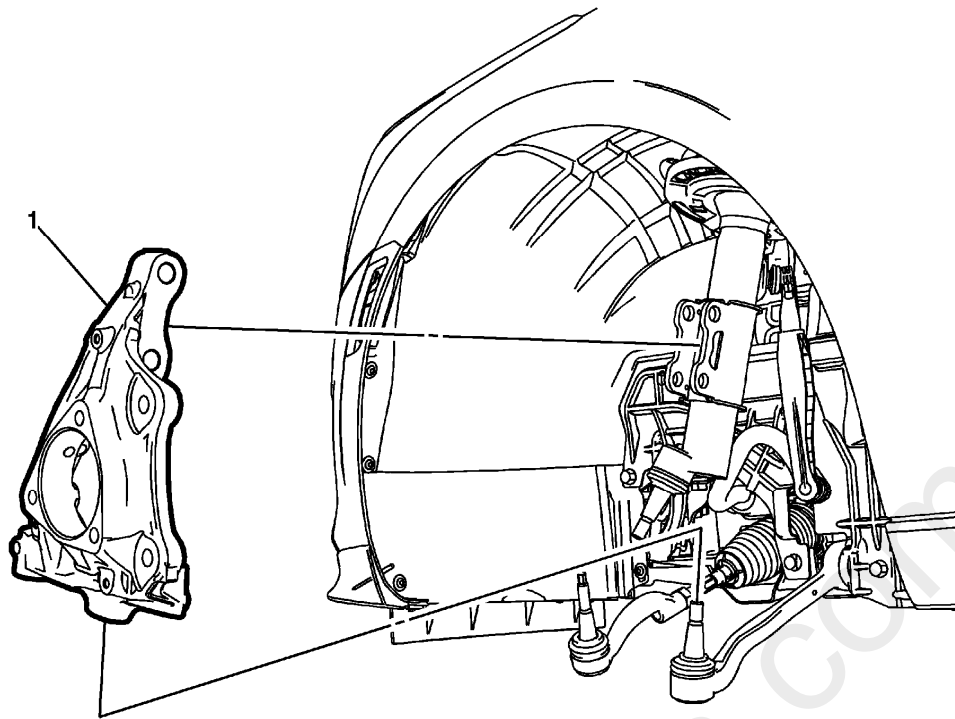


Fig. 17: Steering Knuckle (RWD)
 Courtesy of GENERAL MOTORS COMPANY

Steering Knuckle Replacement (RWD)

Callout	Component Name
Preliminary Procedure	
1. Remove the front wheel bearing and hub assembly. Refer to <u>Front Wheel Bearing and Hub Replacement (RWD)</u>. 2. Remove the front brake shield. Refer to <u>Front Brake Shield Replacement</u>. 3. Disconnect the steering linkage outer tie rod from the steering knuckle. Refer to <u>Steering Linkage Outer Tie Rod Replacement (RWD)</u>. 4. Disconnect the front lower control front link from the steering knuckle. Refer to <u>Front Lower Control Front Link Replacement (RWD)</u>. 5. Disconnect the front lower control rear link from the steering knuckle. Refer to <u>Front Lower Control Rear Link Replacement</u>. 6. Disconnect the strut assembly from the steering knuckle. Refer to <u>Strut Assembly Removal and Installation (FE2 Base)</u>, <u>Strut Assembly Removal and Installation (FE2 or FE3 With F55 Magnetic Ride Suspension)</u>.	
1	Steering Knuckle Procedure Check and adjust the front wheel alignment specifications. Refer to <u>Wheel Alignment Specifications</u> .

STEERING KNUCKLE REPLACEMENT (AWD)

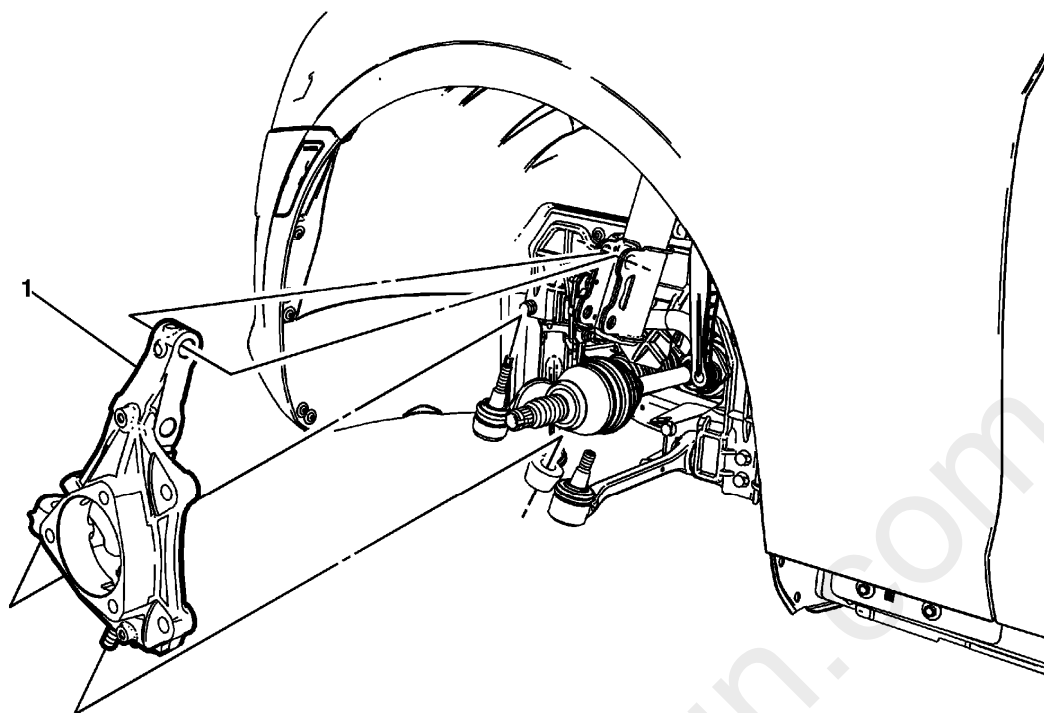


Fig. 18: Steering Knuckle (AWD)

Courtesy of GENERAL MOTORS COMPANY

Steering Knuckle Replacement (AWD)

Callout	Component Name
Preliminary Procedure	
1. Remove the front wheel bearing and hub assembly. Refer to <u>Front Wheel Bearing and Hub Replacement (AWD)</u>. 2. Remove the front brake shield. Refer to <u>Front Brake Shield Replacement</u>. 3. Disconnect the steering linkage outer tie rod from the steering knuckle. Refer to <u>Steering Linkage Outer Tie Rod Replacement (AWD)</u>. 4. Disconnect the front lower control front link from the steering knuckle. Refer to <u>Front Lower Control Front Link Replacement (AWD)</u>. 5. Disconnect the front lower control rear link from the steering knuckle. Refer to <u>Front Lower Control Rear Link Replacement</u>. 6. Disconnect the strut assembly from the steering knuckle. Refer to <u>Strut Assembly Removal and Installation (FE2 Base)</u>, <u>Strut Assembly Removal and Installation (FE2 or FE3 With F55 Magnetic Ride Suspension)</u>.	
1	Steering Knuckle Procedure Check and adjust the front wheel alignment specifications. Refer to <u>Wheel Alignment</u>

Specifications .

FRONT LOWER CONTROL FRONT LINK REPLACEMENT (RWD)

Special Tools

J-42188-B Ball Joint Separator

For regional equivalent 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 assembly. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the center front bumper fascia air deflector. Refer to **Front Bumper Fascia Air Deflector Replacement - Center** .
4. Remove the front compartment lower noise shield. Refer to **Front Compartment Lower Noise Shield Replacement (RWD)** .
5. Disconnect any harnesses or retainers secured to the lower control arm. Note any attaching points to aid in installation.

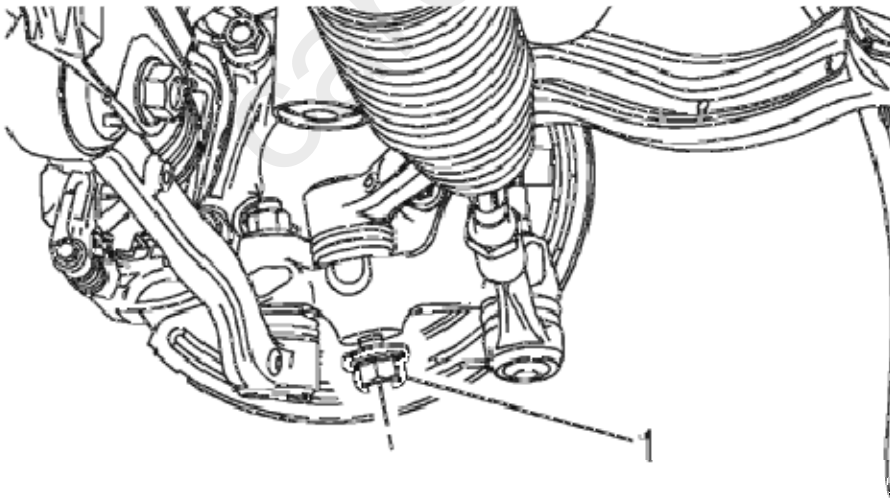


Fig. 19: Steering Knuckle Nut

Courtesy of GENERAL MOTORS COMPANY

NOTE: DO NOT allow the ball stud to rotate while loosening the nut.

6. Loosen but DO NOT remove the steering knuckle nut (1).

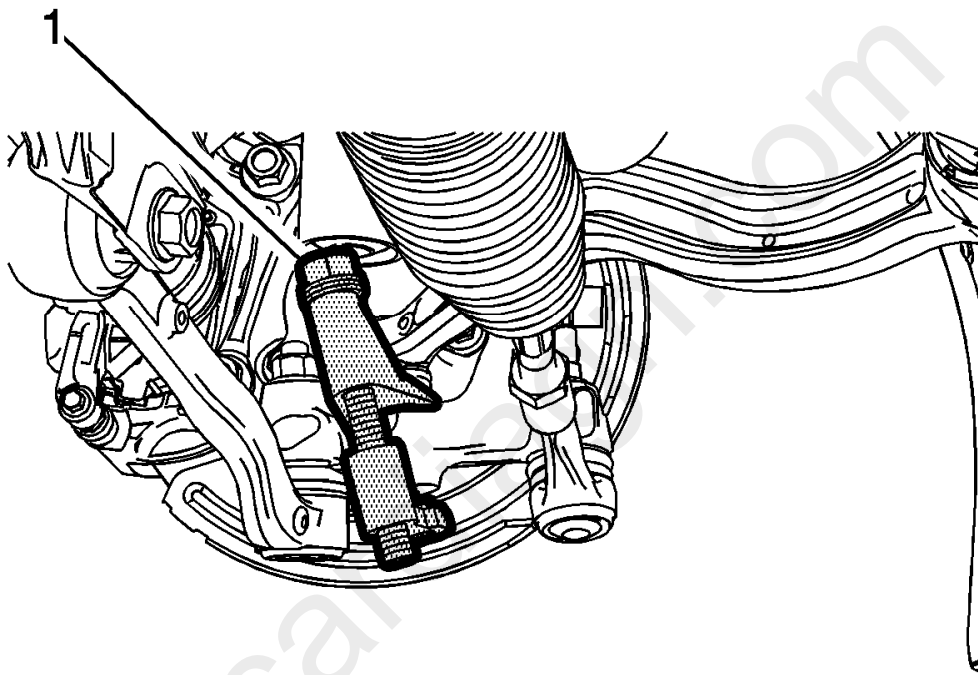


Fig. 20: Separating Front Lower Control Front Link From Steering Knuckle

Courtesy of GENERAL MOTORS COMPANY

7. Use the J-42188-B separator (1) to separate the front lower control front link from the steering knuckle.

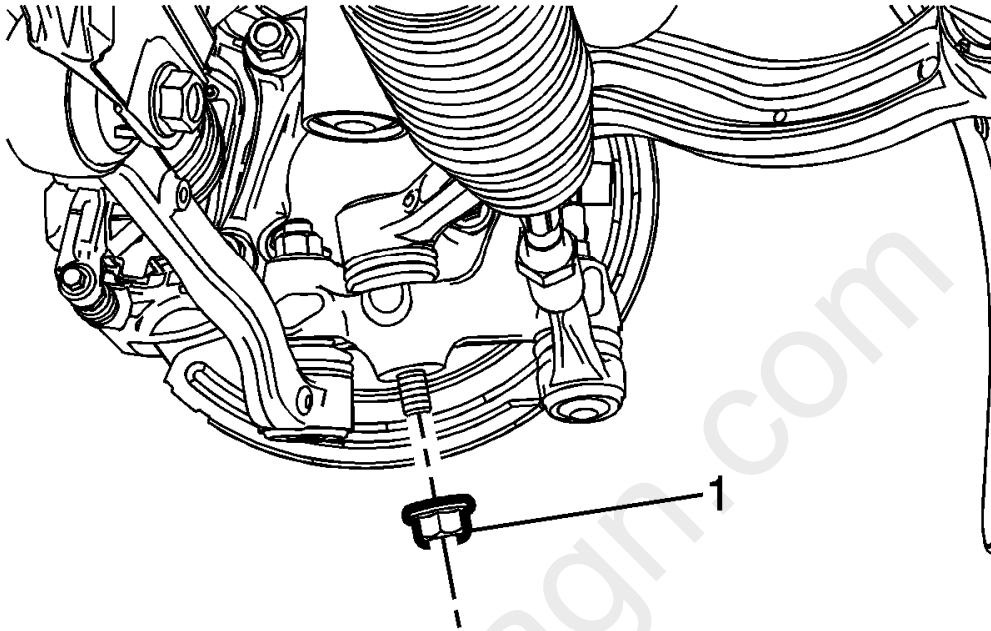


Fig. 21: Steering Knuckle Nut
Courtesy of GENERAL MOTORS COMPANY

8. Remove the steering knuckle nut (1).

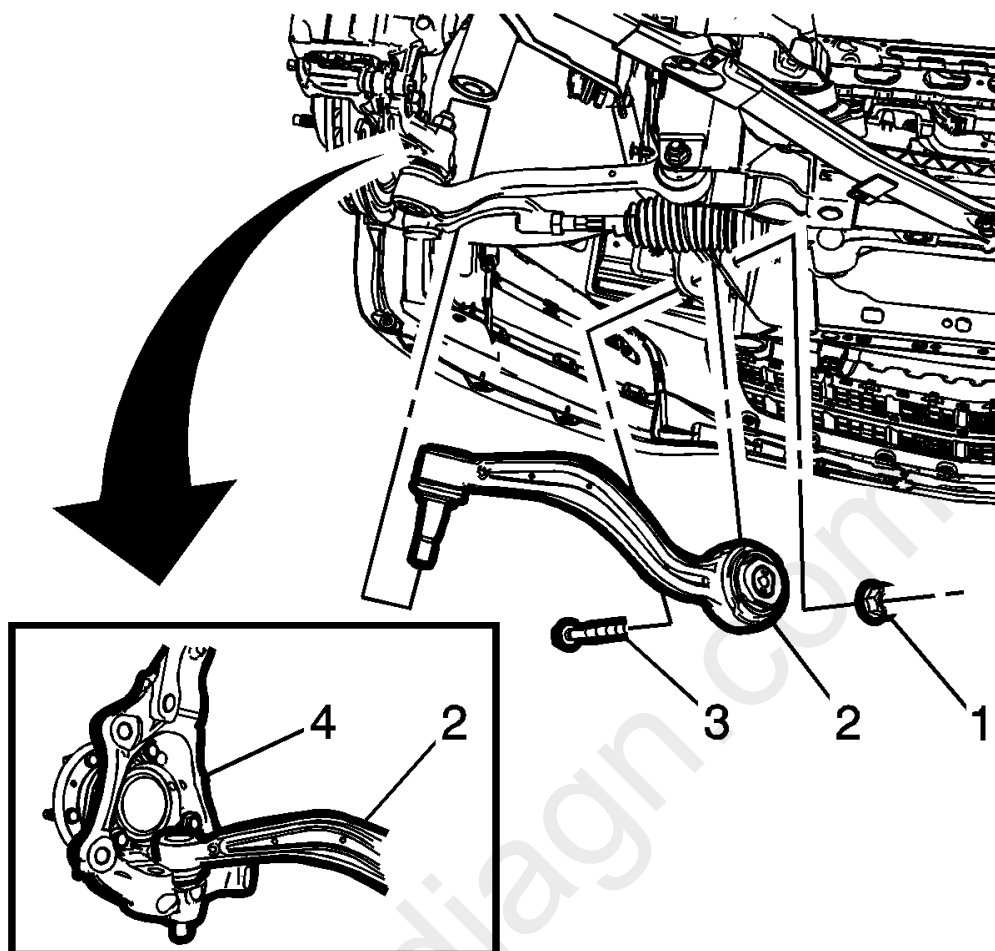


Fig. 22: Front Lower Control Front Link
Courtesy of GENERAL MOTORS COMPANY

9. Remove the front lower control front link nut (1).
10. Remove and DISCARD the front lower control front link bolt (3).
11. Remove the front lower control front link (2) from the steering knuckle (4).

Installation Procedure

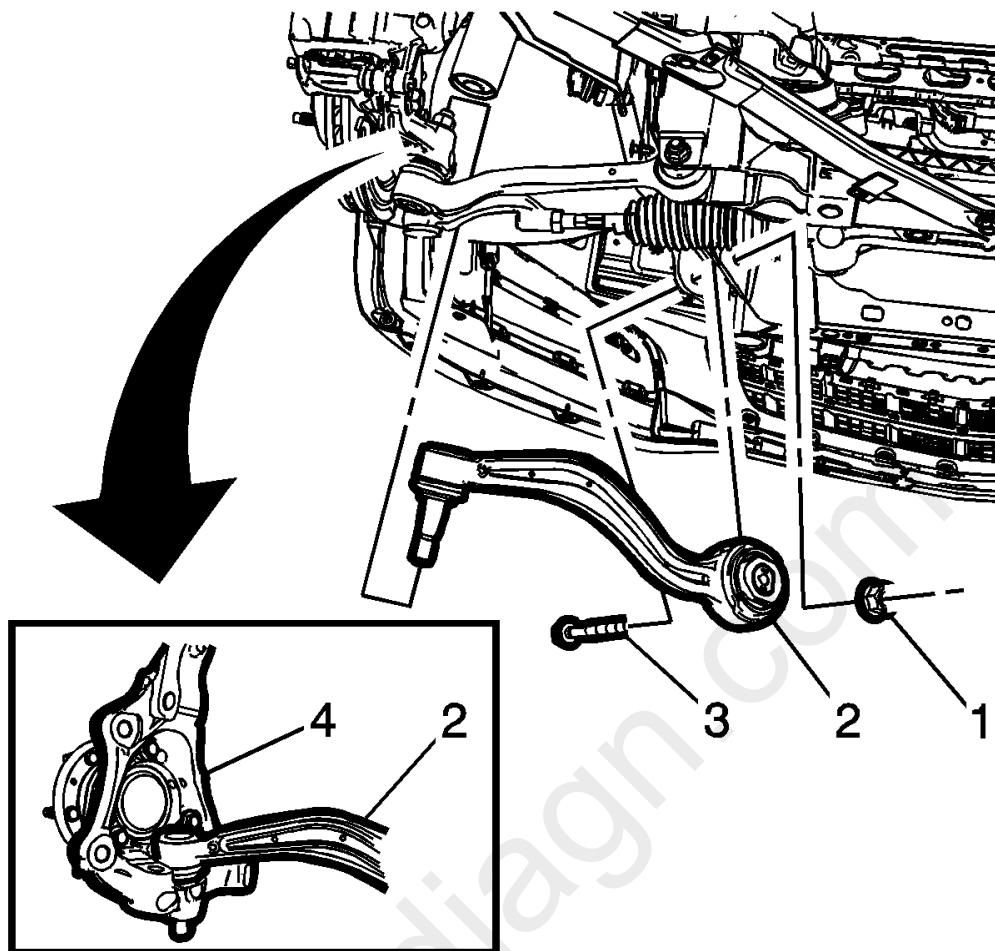


Fig. 23: Front Lower Control Front Link
 Courtesy of GENERAL MOTORS COMPANY

1. Position the front lower control front link (2) in the steering knuckle (4).
2. Position the front lower control front link (2) in the frame.

CAUTION: Refer to Fastener Caution .

3. Install the NEW front lower control front link bolt (3) and OLD nut (1).

CAUTION: This vehicle is equipped with torque-to-yield or single use fasteners. Install a NEW torque-to-yield or single use fastener when installing this component. Failure to replace the torque-to-yield or single use fastener could cause damage to the vehicle or component.

4. Tighten the NEW front lower control front link bolt (3) to 100 (74 lb ft) + (90-105 degrees).

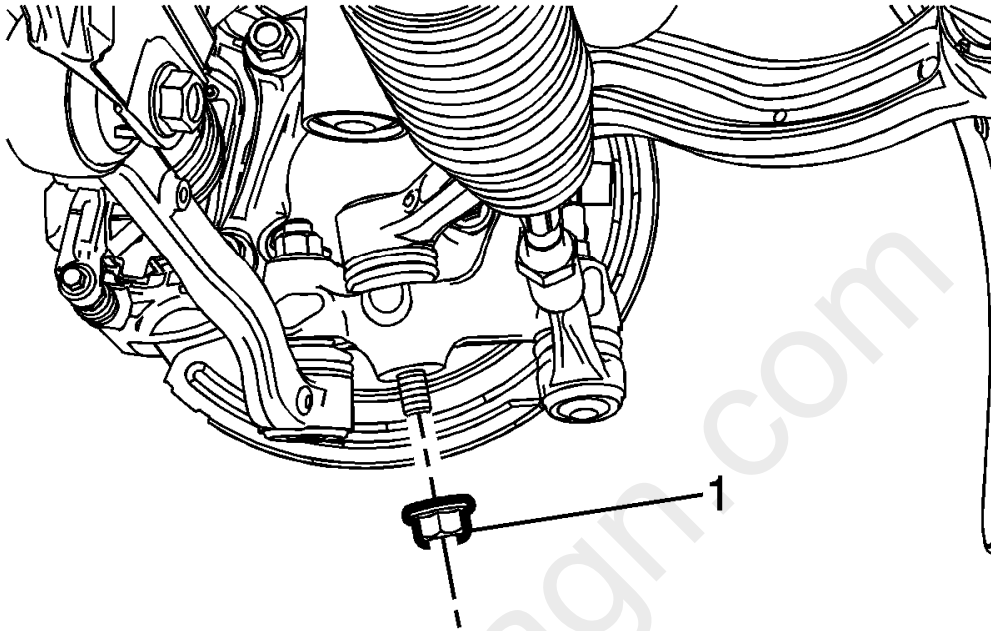


Fig. 24: Steering Knuckle Nut
Courtesy of GENERAL MOTORS COMPANY

5. Install the steering knuckle nut (1) and tighten to 40 (30 lb ft) + (120-135 degrees).
6. Connect any harnesses or retainers previously disconnected from the lower control arm.
7. Install the front compartment lower noise shield. Refer to **Front Compartment Lower Noise Shield Replacement (RWD)** .
8. Install the center front bumper fascia air deflector. Refer to **Front Bumper Fascia Air Deflector Replacement - Center** .
9. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
10. Check and adjust the front wheel alignment specifications. Refer to **Wheel Alignment Specifications** .

FRONT LOWER CONTROL FRONT LINK REPLACEMENT (AWD)

Special Tools

J-43631 Ball Joint Separator

For regional equivalent 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 assembly. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the front compartment lower noise shield. Refer to **Front Compartment Lower Noise Shield Replacement (AWD)** .
4. Remove the underbody front air deflector.
 - For the left side, refer to **Underbody Front Air Deflector Replacement - Left Side** .
 - For the right side, refer to **Underbody Front Air Deflector Replacement - Right Side** .
5. Remove the front wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
6. Disconnect any harnesses or retainers secured to the lower control arm. Note any attaching points to aid in installation.

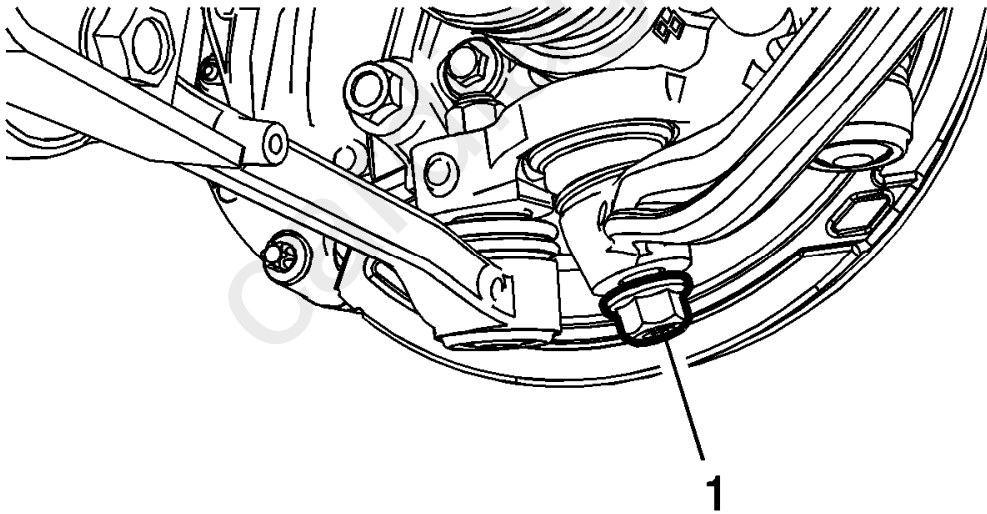


Fig. 25: Steering Knuckle Nut
Courtesy of GENERAL MOTORS COMPANY

NOTE: **DO NOT** allow the ball stud to rotate while loosening the nut.

7. Loosen but **DO NOT** remove the steering knuckle nut (1).

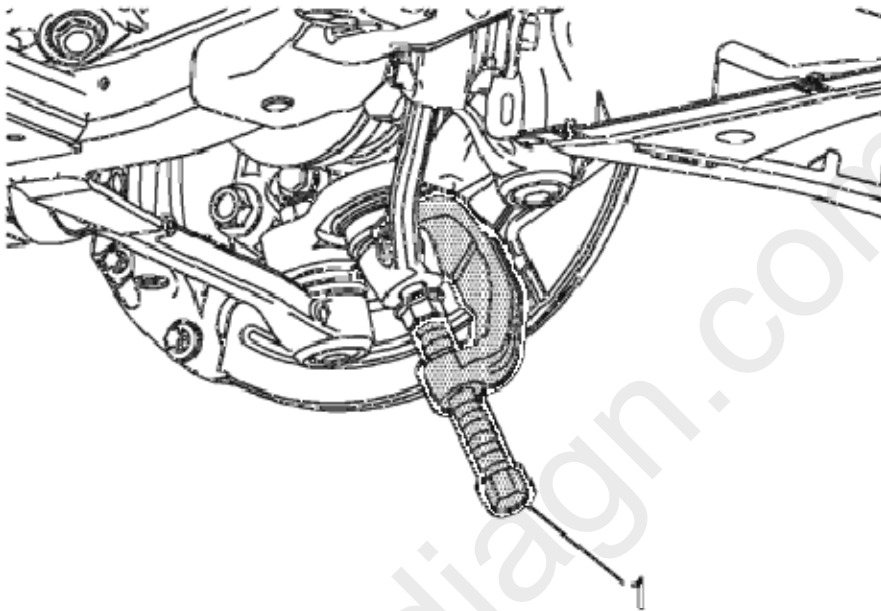


Fig. 26: Separating Front Lower Control Front Link From Steering Knuckle
Courtesy of GENERAL MOTORS COMPANY

8. Use the **J-43631** separator (1) to separate the front lower control front link from the steering knuckle.

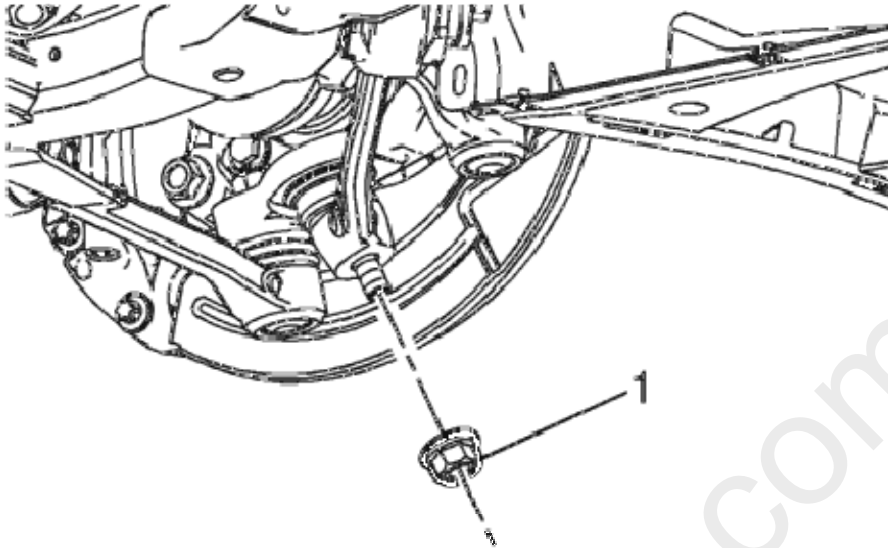


Fig. 27: Steering Knuckle Nut

Courtesy of GENERAL MOTORS COMPANY

9. Remove the steering knuckle nut (1).

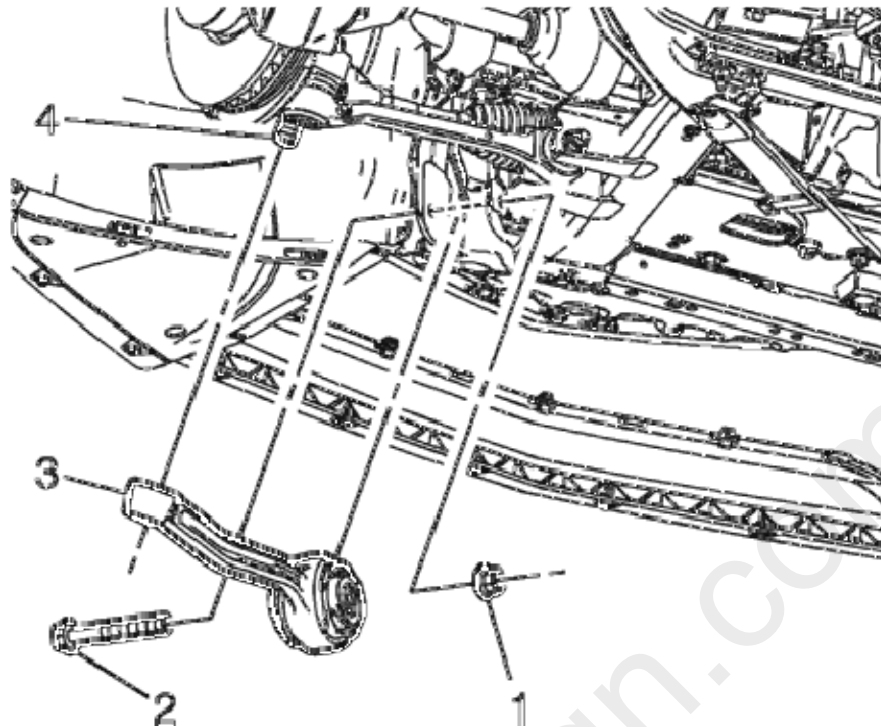


Fig. 28: Front Lower Control Front Link Nut
Courtesy of GENERAL MOTORS COMPANY

10. Remove the front lower control front link nut (1).
11. Remove and DISCARD the front lower control front link bolt (3).
12. Remove the front lower control front link (2) from the steering knuckle ball joint (4).

Installation Procedure

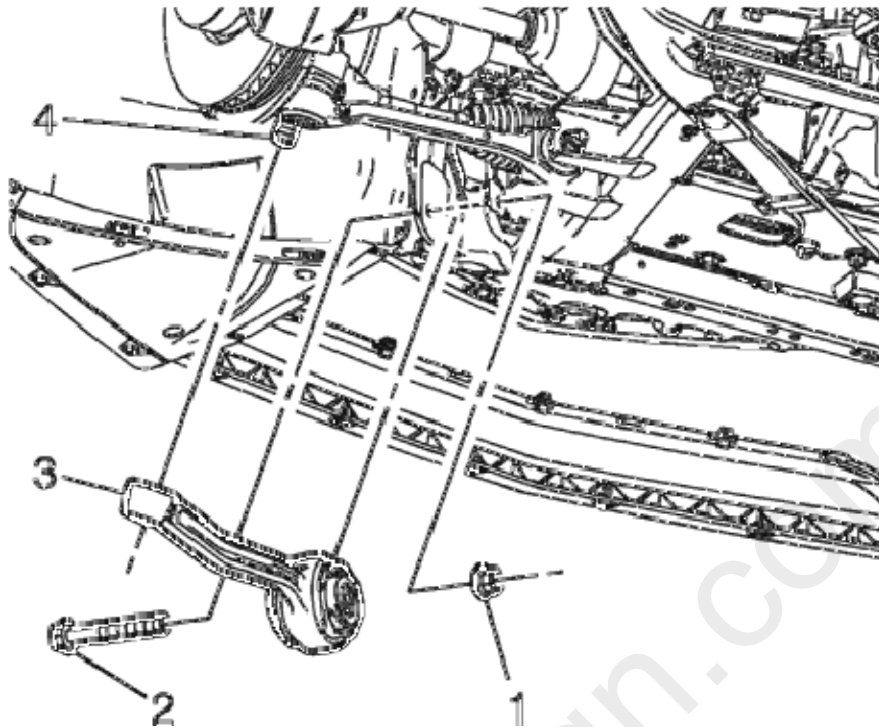


Fig. 29: Front Lower Control Front Link Nut
Courtesy of GENERAL MOTORS COMPANY

1. Position the front lower control front link (2) on the steering knuckle ball joint (4).
2. Position the front lower control front link (2) in the frame.

CAUTION: Refer to Fastener Caution .

3. Install the NEW front lower control front link bolt (3) and OLD nut (1).

CAUTION: This vehicle is equipped with torque-to-yield or single use fasteners. Install a NEW torque-to-yield or single use fastener when installing this component. Failure to replace the torque-to-yield or single use fastener could cause damage to the vehicle or component.

4. Tighten the NEW front lower control front link bolt (3) to 100 (74 lb ft) + (90-105 degrees).

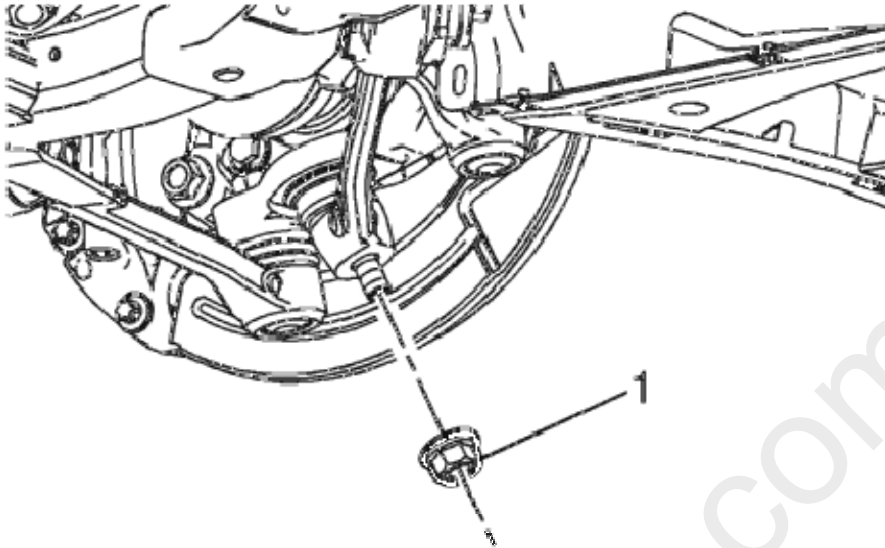


Fig. 30: Steering Knuckle Nut
Courtesy of GENERAL MOTORS COMPANY

5. Install the steering knuckle nut (1) and tighten to 40 (30 lb ft) + (120-135 degrees).
6. Connect any harnesses or retainers previously disconnected from the lower control arm.
7. Install the front wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
8. Install the underbody front air deflector.
 - For the left side, refer to **Underbody Front Air Deflector Replacement - Left Side** .
 - For the right side, refer to **Underbody Front Air Deflector Replacement - Right Side** .
9. Install the front compartment lower noise shield. Refer to **Front Compartment Lower Noise Shield Replacement (AWD)** .
10. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
11. Check and adjust the front wheel alignment specifications. Refer to **Wheel Alignment Specifications** .

FRONT LOWER CONTROL REAR LINK REPLACEMENT

Special Tools

J-42188-B Ball Joint Separator

For regional equivalent 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 assembly. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the front compartment lower noise shield. Refer to **Front Compartment Lower Noise Shield Replacement (AWD)** , **Front Compartment Lower Noise Shield Replacement (RWD)** .
4. Remove the engine lower front splash shield. Refer to **Engine Lower Front Splash Shield Replacement** .
5. Disconnect the electronic suspension front position sensor from the front lower control arm. Refer to **Electronic Suspension Front Position Sensor Replacement** .

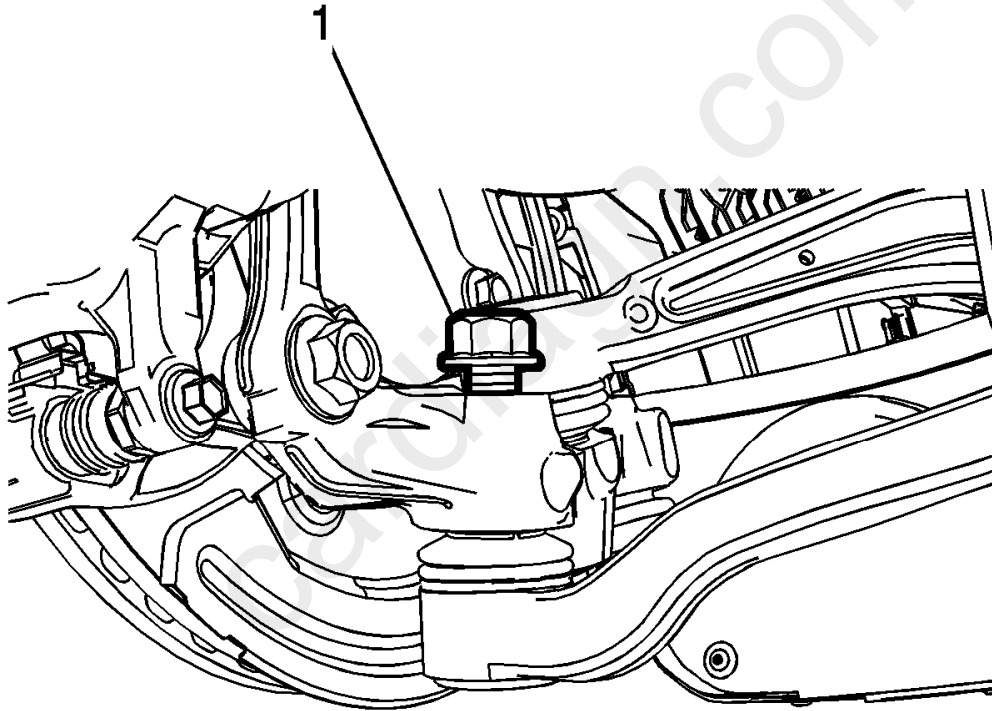


Fig. 31: Steering Knuckle Nut

Courtesy of GENERAL MOTORS COMPANY

NOTE: DO NOT allow the ball stud to rotate while loosening the nut.

6. Loosen but DO NOT remove the steering knuckle nut (1).

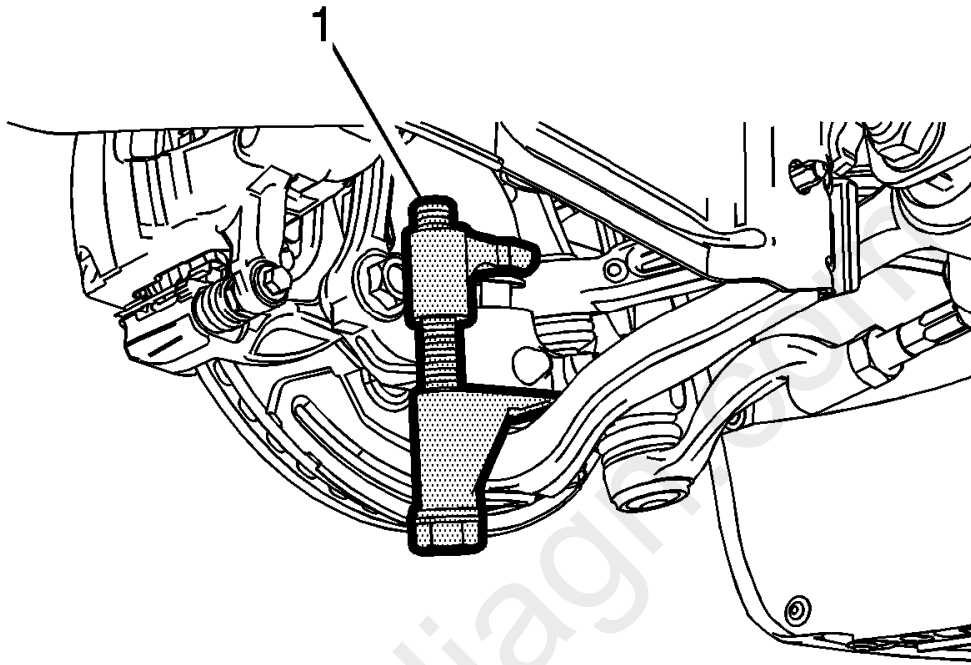


Fig. 32: Separate Front Lower Control Rear Link From Steering Knuckle
Courtesy of GENERAL MOTORS COMPANY

7. Use the J-42188-B separator (1) to separate the front lower control rear link from the steering knuckle.

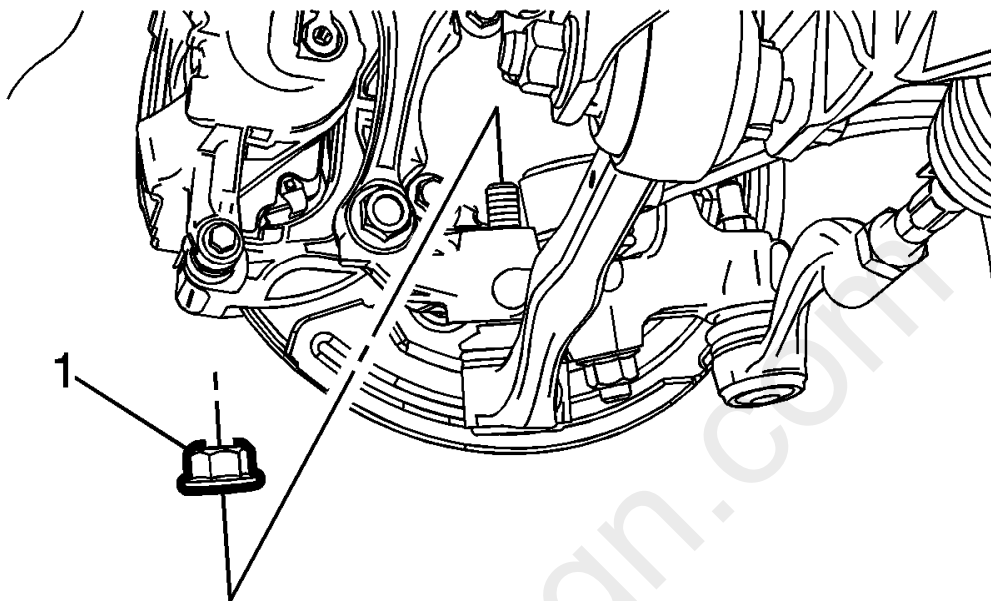


Fig. 33: Steering Knuckle Nut
Courtesy of GENERAL MOTORS COMPANY

8. Remove the steering knuckle nut (1).

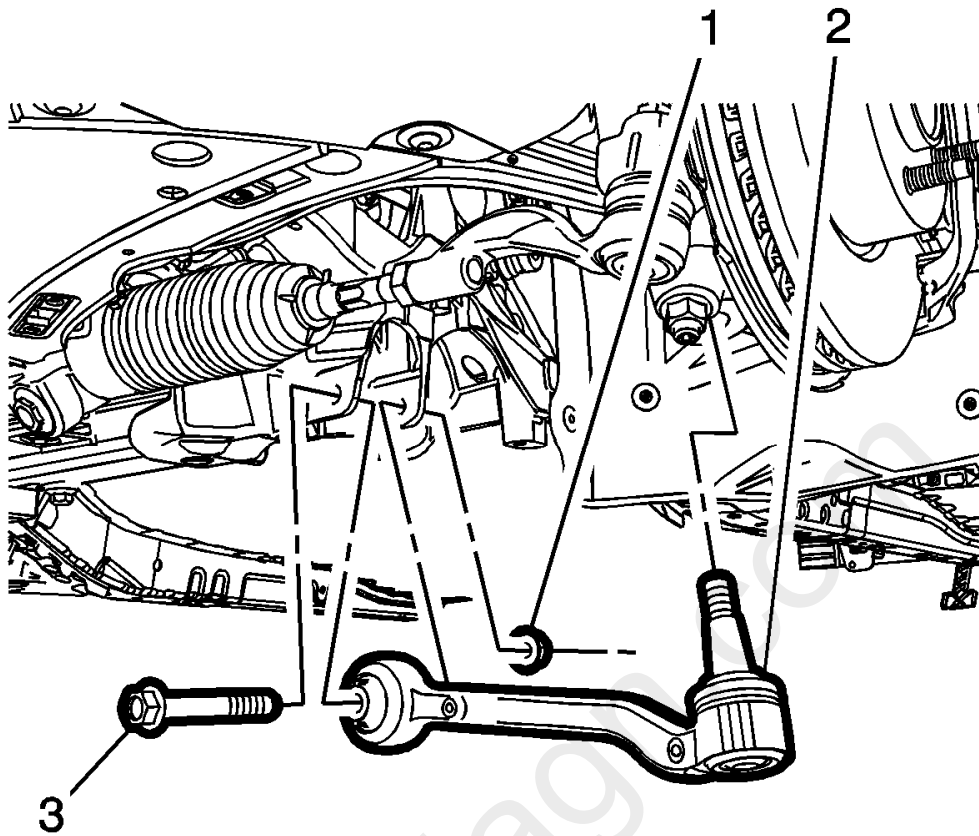


Fig. 34: Front Lower Control Rear Link Nut
Courtesy of GENERAL MOTORS COMPANY

9. Remove the front lower control rear link nut (1).
10. Remove and DISCARD the front lower control rear link bolt (3).
11. Remove the front lower control rear link (2) from the steering knuckle.
12. Transfer components as necessary.

Installation Procedure

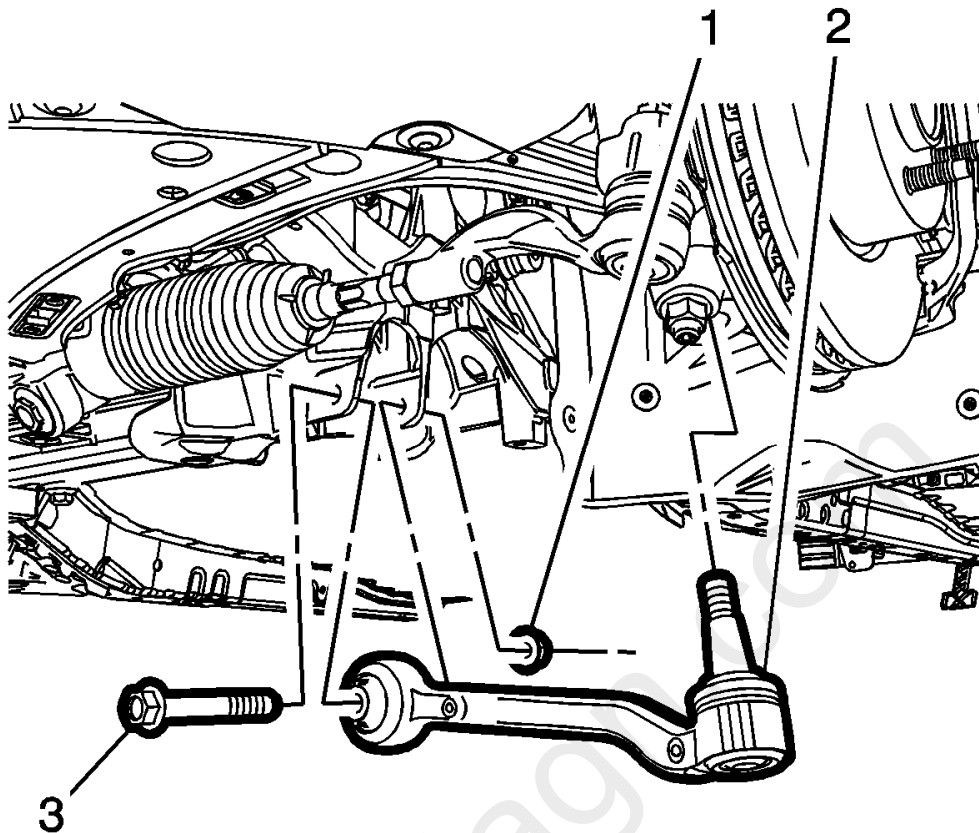


Fig. 35: Front Lower Control Rear Link Nut
Courtesy of GENERAL MOTORS COMPANY

1. Position the front lower control rear link (2) in the steering knuckle.
2. Position the front lower control rear link (2) in the frame.

CAUTION: Refer to Fastener Caution .

3. Install the NEW front lower control rear link bolt (3) and OLD nut (1).

CAUTION: This vehicle is equipped with torque-to-yield or single use fasteners. Install a NEW torque-to-yield or single use fastener when installing this component. Failure to replace the torque-to-yield or single use fastener could cause damage to the vehicle or component.

4. Tighten the NEW front lower control rear link bolt (3) to 100 (74 lb ft) + (90-105 degrees).

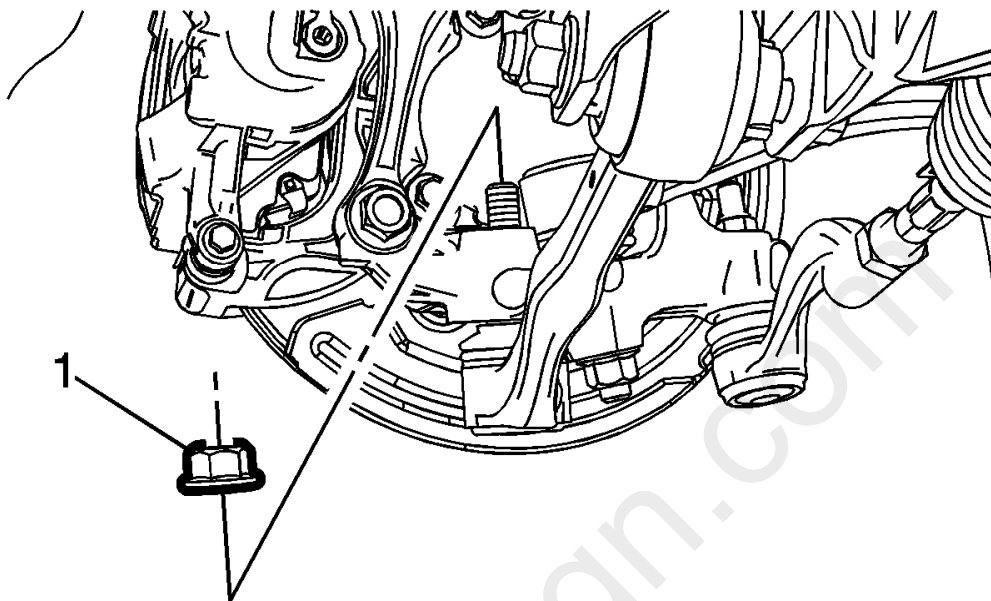


Fig. 36: Steering Knuckle Nut

Courtesy of GENERAL MOTORS COMPANY

5. Install the steering knuckle nut (1) and tighten to 40 (30 lb ft) + (120-135 degrees).
6. Connect the electronic suspension front position sensor to the front lower control arm. Refer to **Electronic Suspension Front Position Sensor Replacement** .
7. Install the engine lower front splash shield. Refer to **Engine Lower Front Splash Shield Replacement** .
8. Install the front compartment lower noise shield. Refer to **Front Compartment Lower Noise Shield Replacement (AWD)** , **Front Compartment Lower Noise Shield Replacement (RWD)** .
9. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
10. Check and adjust the front wheel alignment specifications. Refer to **Wheel Alignment Specifications** .

WHEEL STUD REPLACEMENT

Special Tools

J-43631 Ball Joint Separator

For regional equivalent 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 assembly. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the front brake rotor. Refer to **Front Brake Rotor Replacement** .

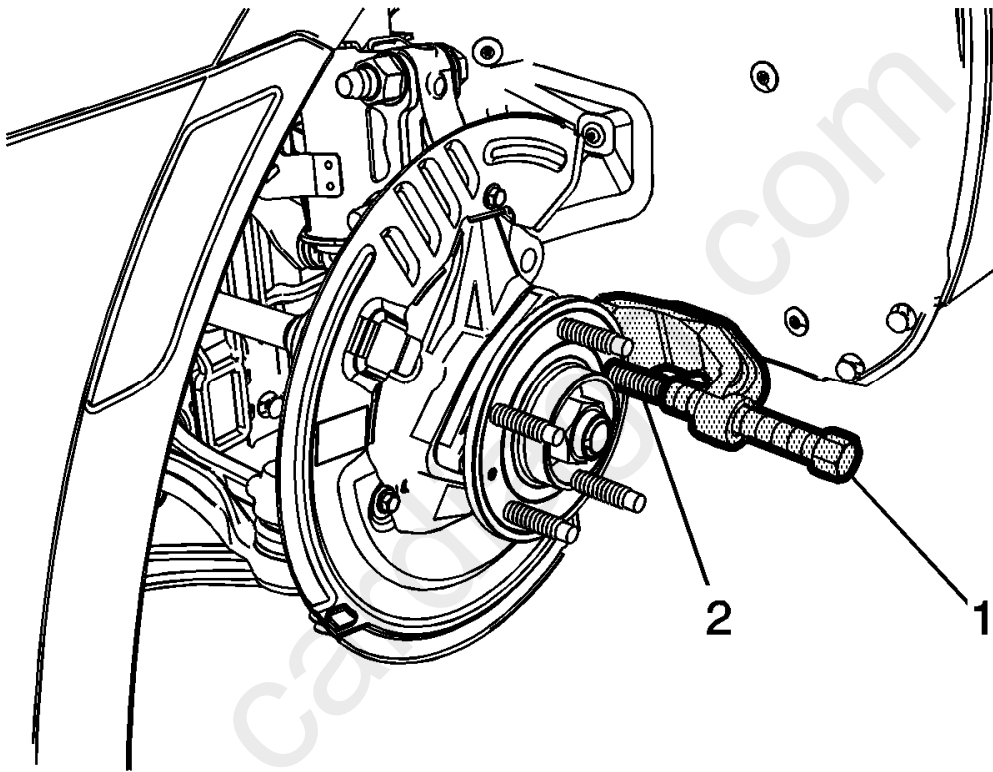


Fig. 37: Removing Wheel Stud

Courtesy of GENERAL MOTORS COMPANY

4. Use the **J-43631** separator (1) to separate the wheel stud (2) from the front wheel bearing and hub assembly.

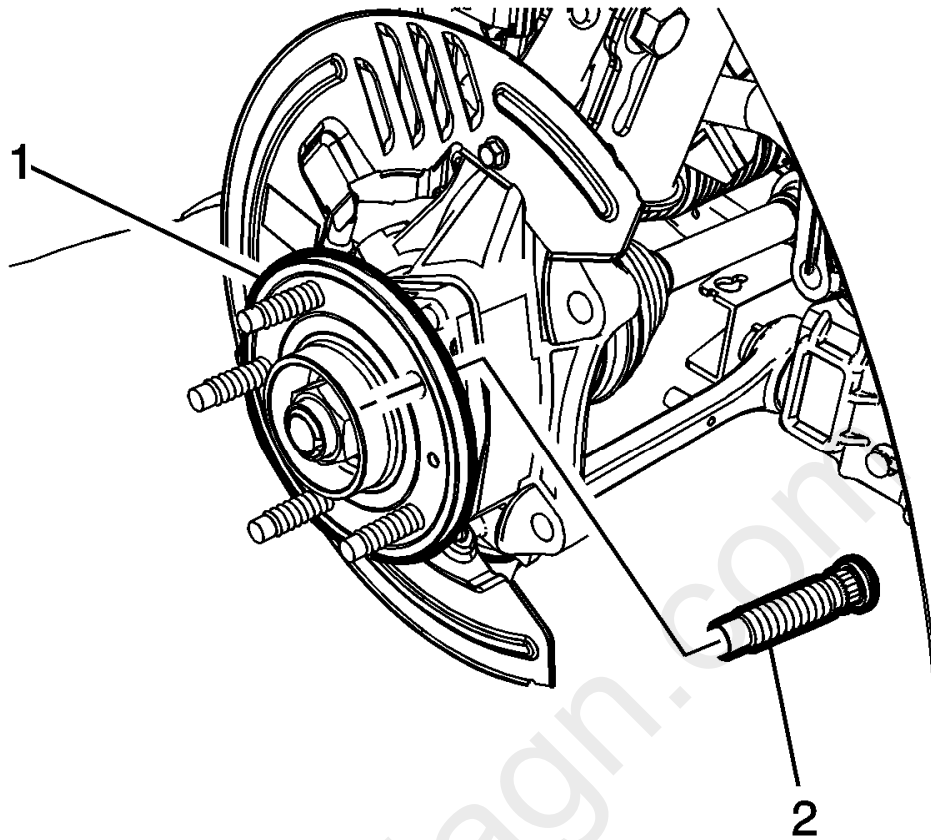


Fig. 38: Wheel Stud

Courtesy of GENERAL MOTORS COMPANY

5. Remove the wheel stud (2) from the front wheel bearing and hub assembly (1) and discard it.

Installation

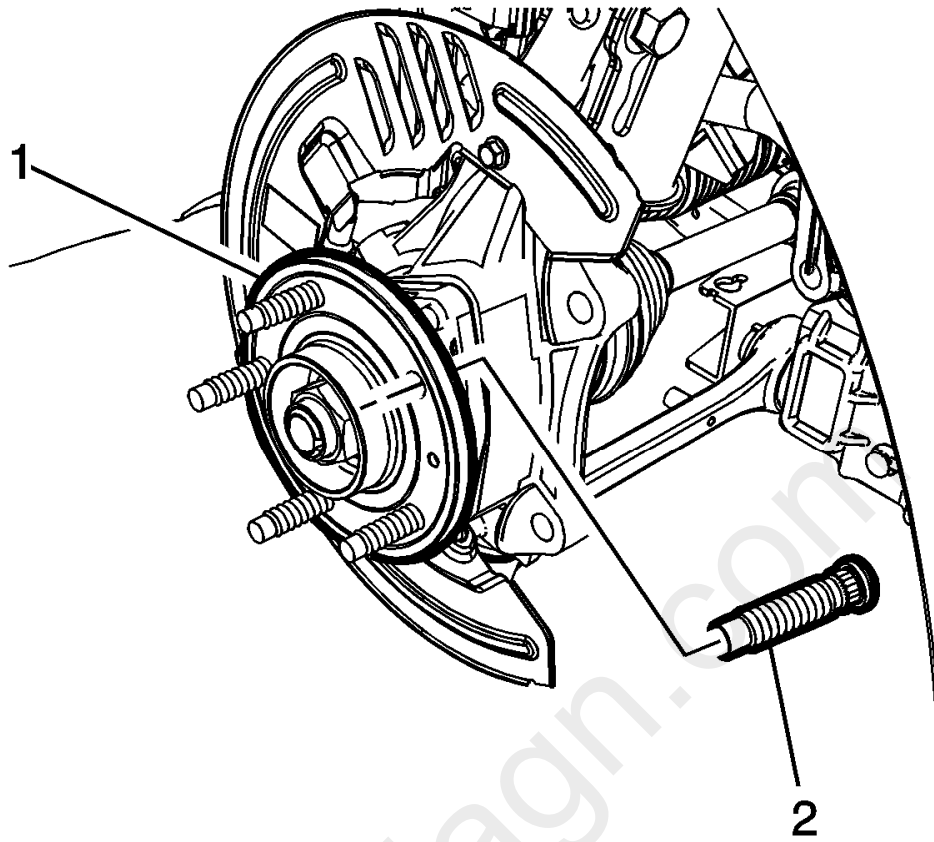


Fig. 39: Wheel Stud

Courtesy of GENERAL MOTORS COMPANY

1. Position the NEW wheel stud (2) in the front wheel bearing and hub assembly (1).

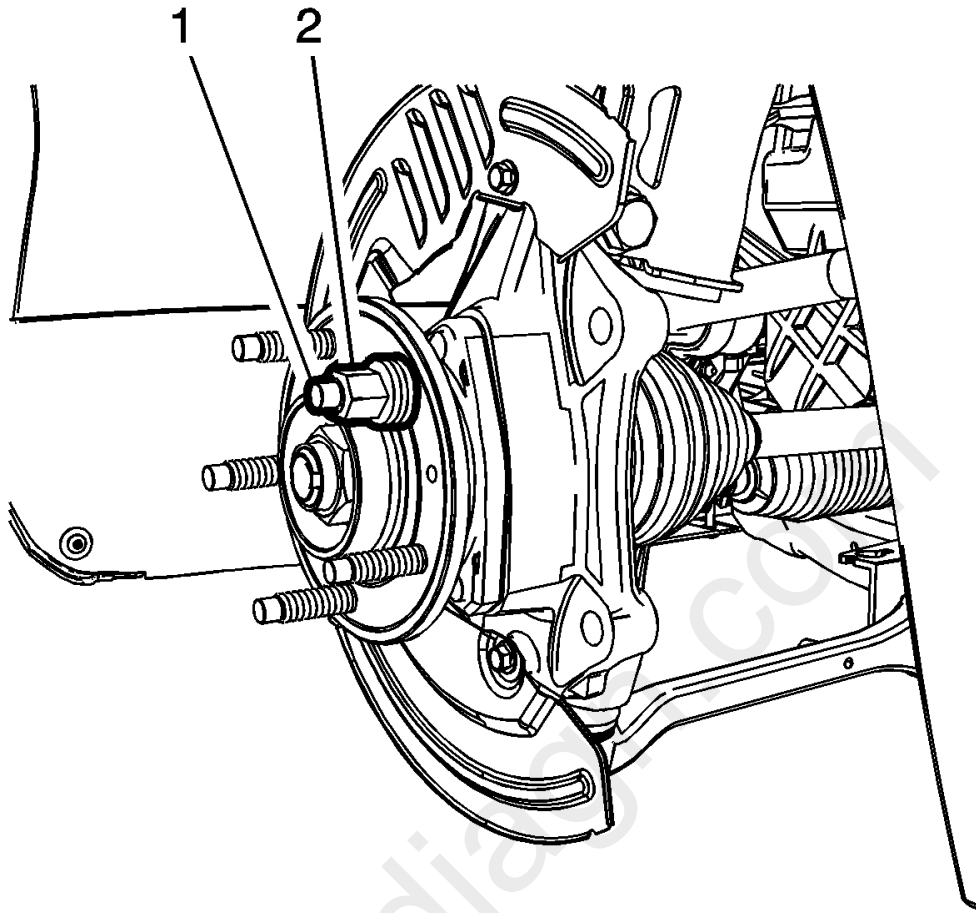


Fig. 40: Flat Washers And Old Wheel Nut On Wheel Stud
Courtesy of GENERAL MOTORS COMPANY

2. Install flat washers and an old wheel nut (2) on the wheel stud (1).
3. Use a suitable tool to prevent the flange on the front wheel bearing and hub assembly from turning.
4. Tighten the wheel nut (2) until the wheel stud (1) is firmly seated.
5. Remove the wheel nut (2) and flat washers.
6. Install the front brake rotor. Refer to **Front Brake Rotor Replacement** .
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .

STRUT ASSEMBLY REMOVAL AND INSTALLATION (FE2 BASE)

Removal Procedure

1. Raise and 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. Disconnect the stabilizer shaft link from the strut assembly. Refer to **Stabilizer Shaft Link**

Replacement.

4. Disconnect the front wheel speed sensor from the steering knuckle and strut assemblies. Refer to **Front Wheel Speed Sensor Replacement** .
5. Disconnect the front brake hose from the strut assembly. Refer to **Front Brake Hose Replacement** .

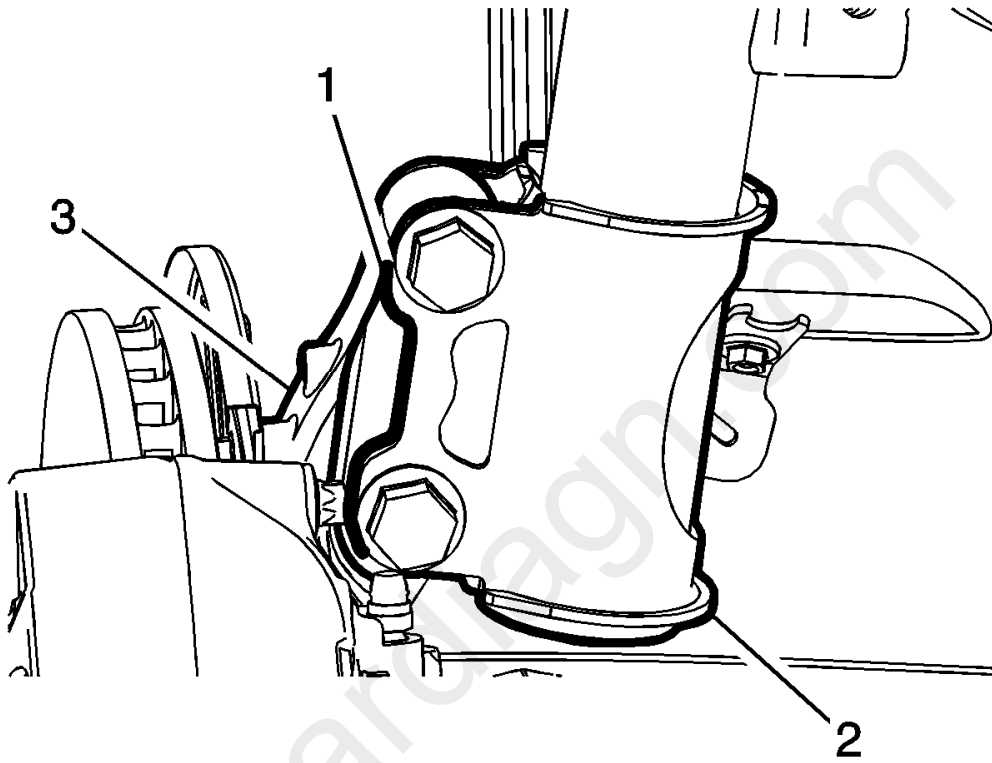


Fig. 41: Strut Assembly And Steering Knuckle
Courtesy of GENERAL MOTORS COMPANY

6. Place a reference mark (1) where the strut assembly (2) sits on the steering knuckle (3).

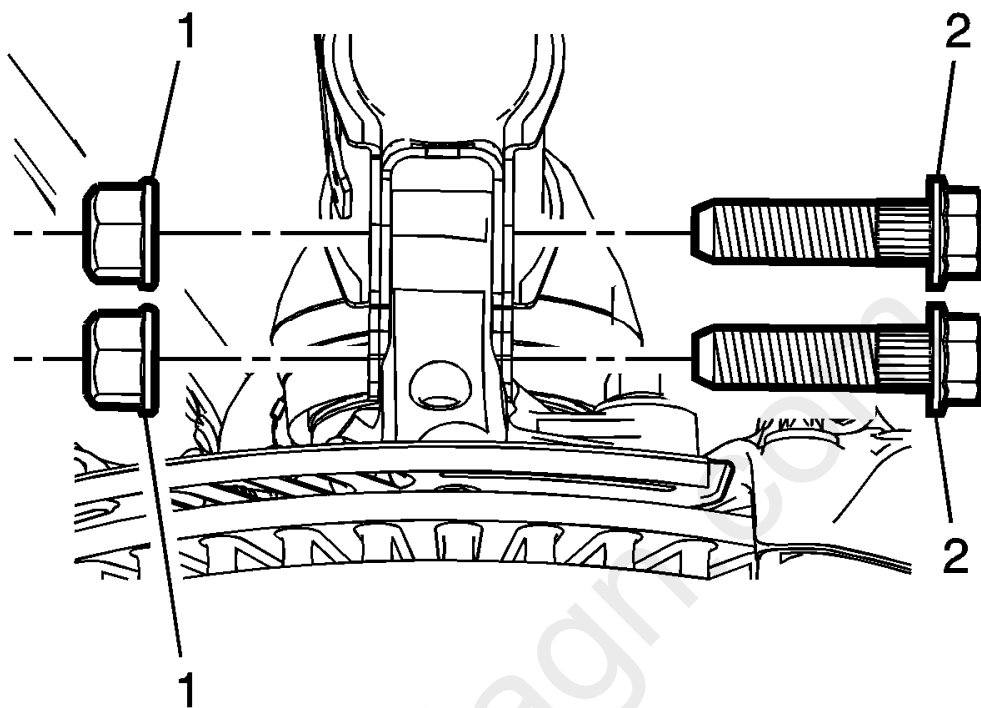


Fig. 42: Front Suspension Strut Nuts And Bolts
Courtesy of GENERAL MOTORS COMPANY

7. Remove the front suspension strut nuts (1) and bolts (2).

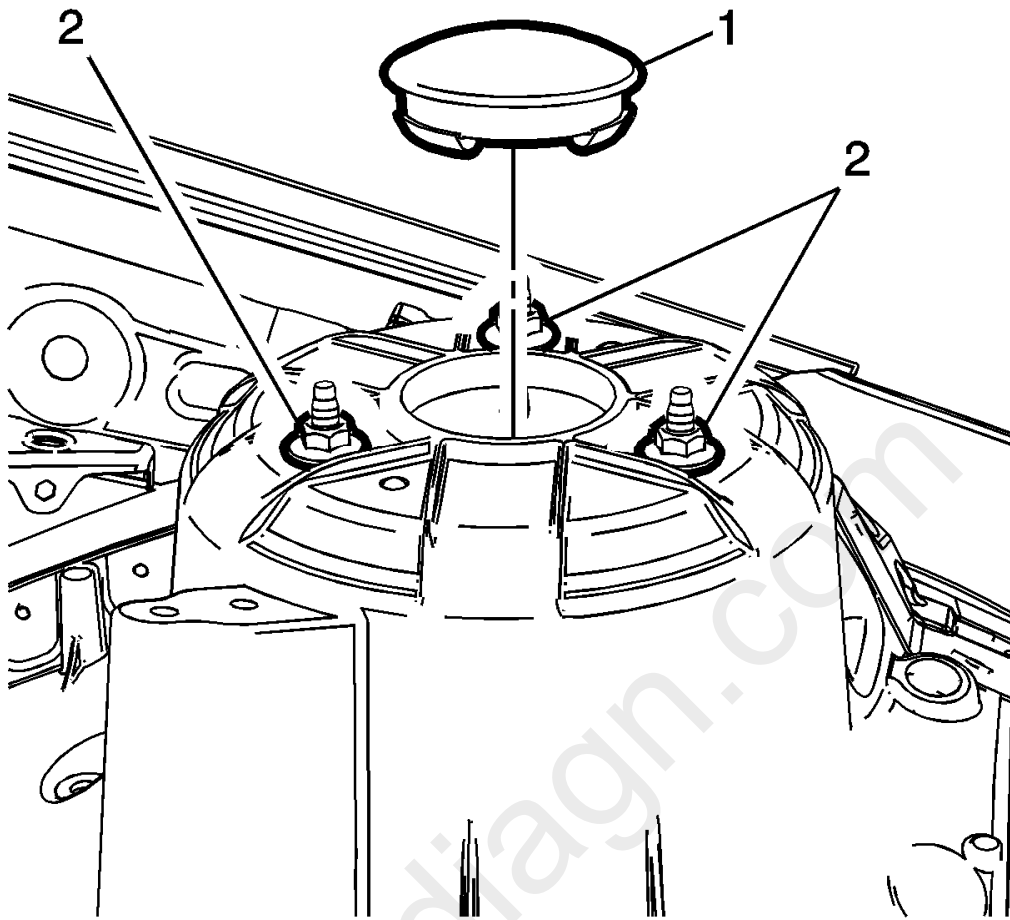


Fig. 43: Front Suspension Strut Access Hole Plug
Courtesy of GENERAL MOTORS COMPANY

8. Remove the front suspension strut access hole plug (1).
9. Remove the front suspension upper strut mount nuts (2).

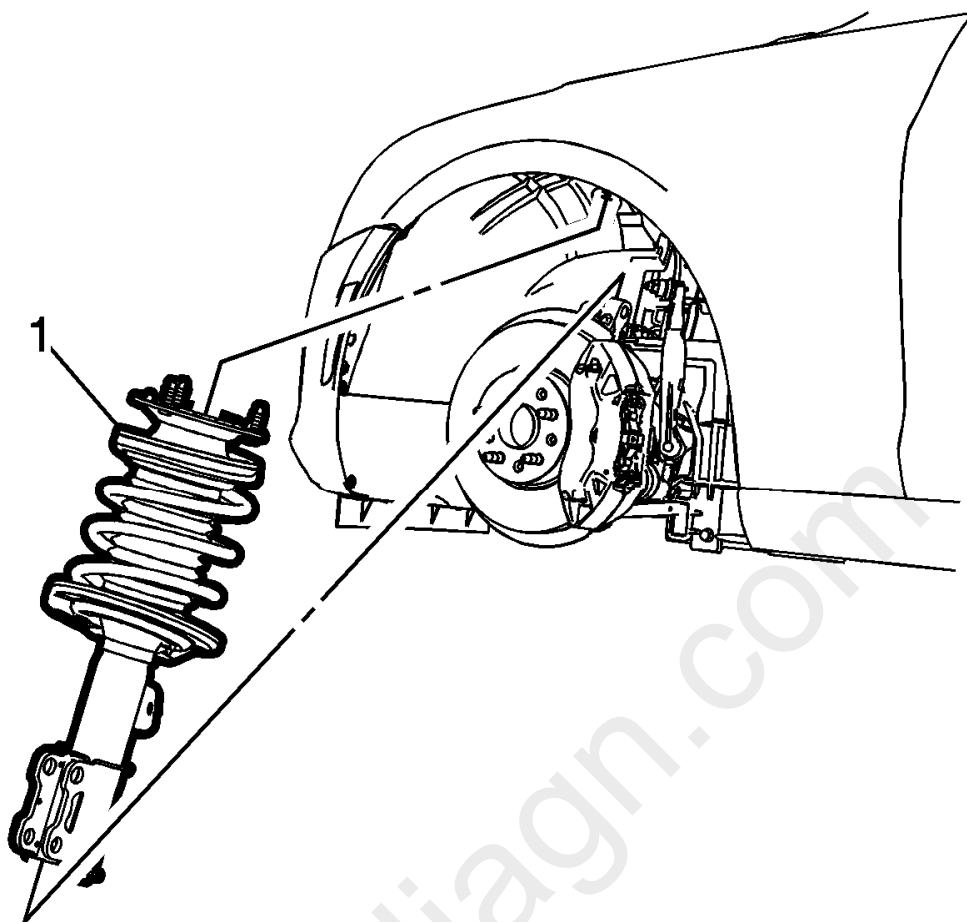


Fig. 44: Strut Assembly
Courtesy of GENERAL MOTORS COMPANY

10. Remove the strut assembly (1) from the vehicle.

Installation Procedure

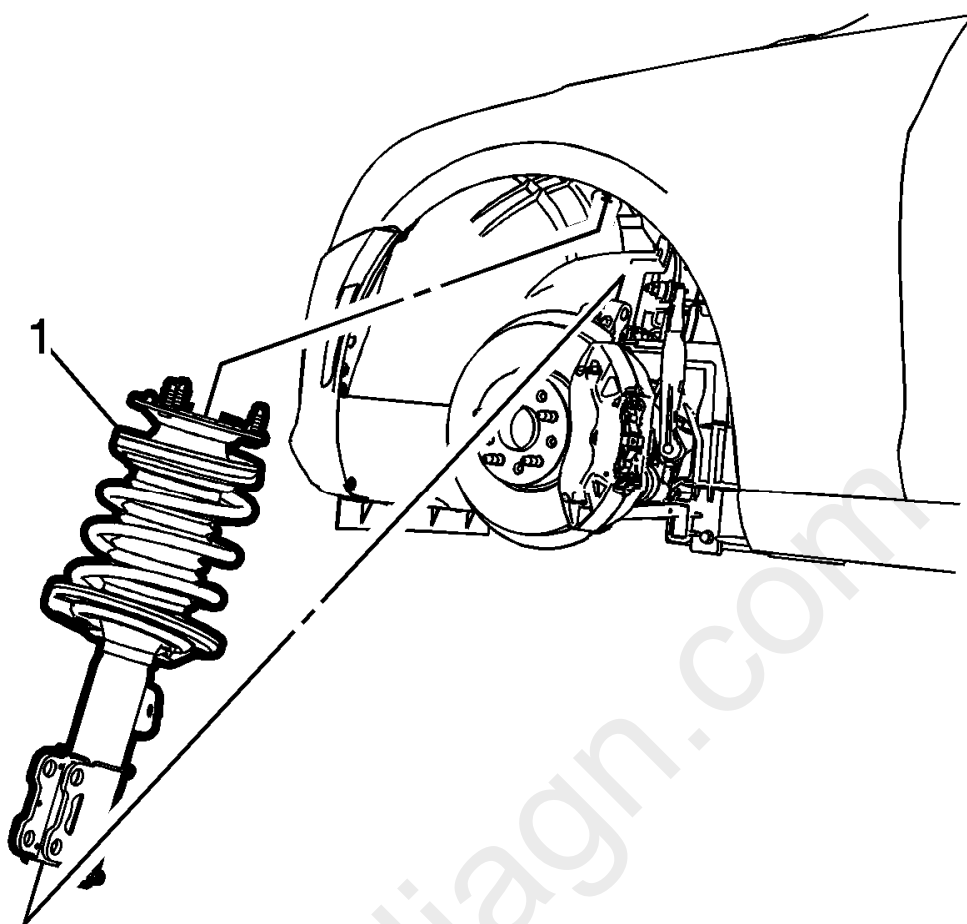


Fig. 45: Strut Assembly

Courtesy of GENERAL MOTORS COMPANY

1. Position the front strut assembly (1) in the vehicle.

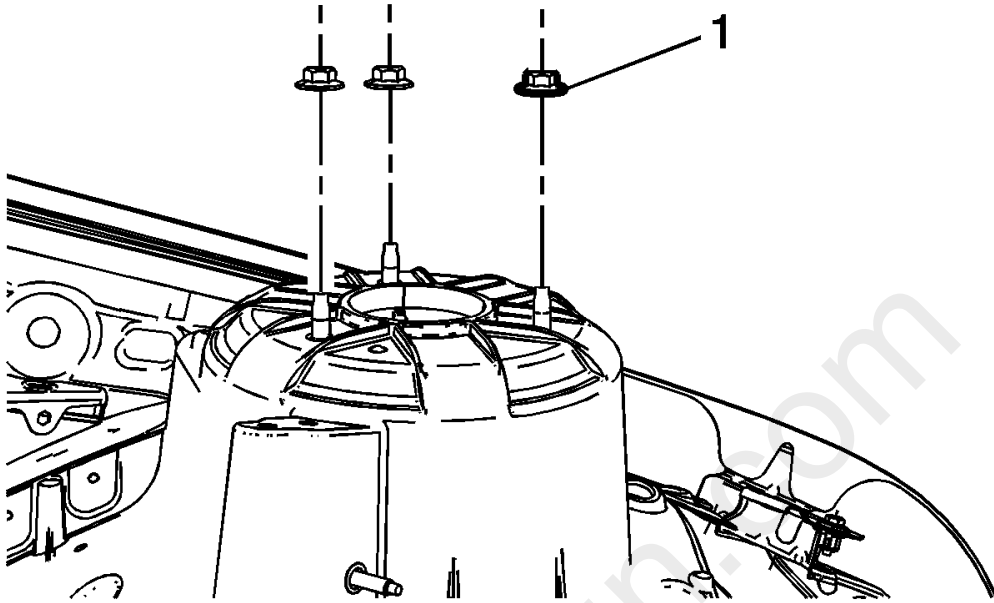


Fig. 46: Front Suspension Upper Strut Mount Nuts
Courtesy of GENERAL MOTORS COMPANY

2. Start the front suspension upper strut mount nuts (1) by hand but do not tighten.

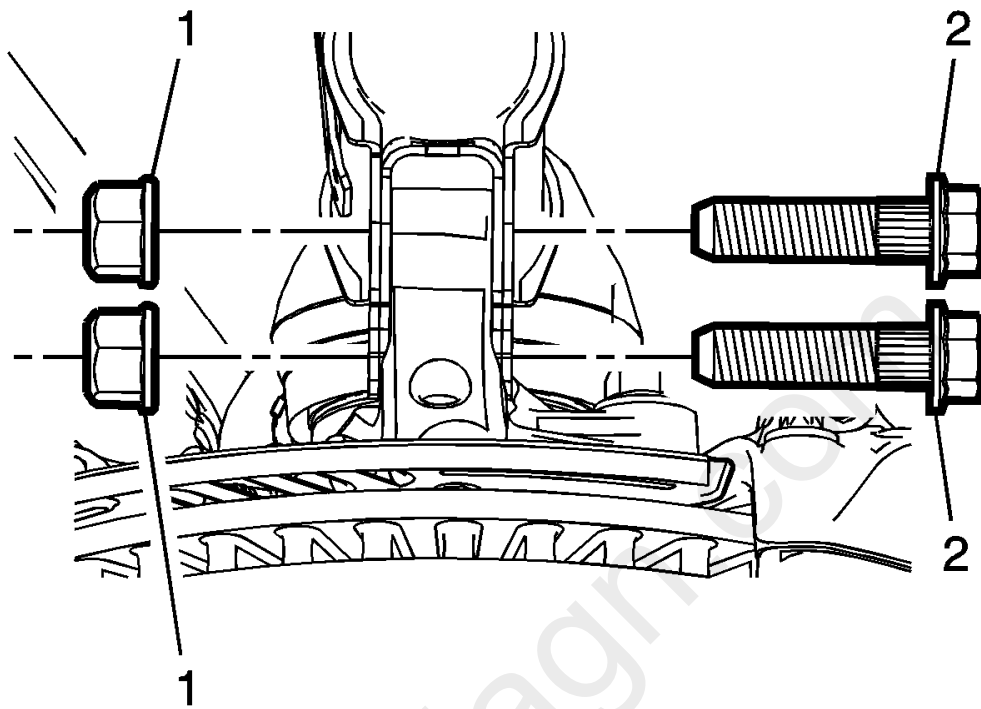


Fig. 47: Front Suspension Strut Nuts And Bolts
Courtesy of GENERAL MOTORS COMPANY

3. Start the front suspension strut bolts (2) and nuts (1) by hand but do not tighten.

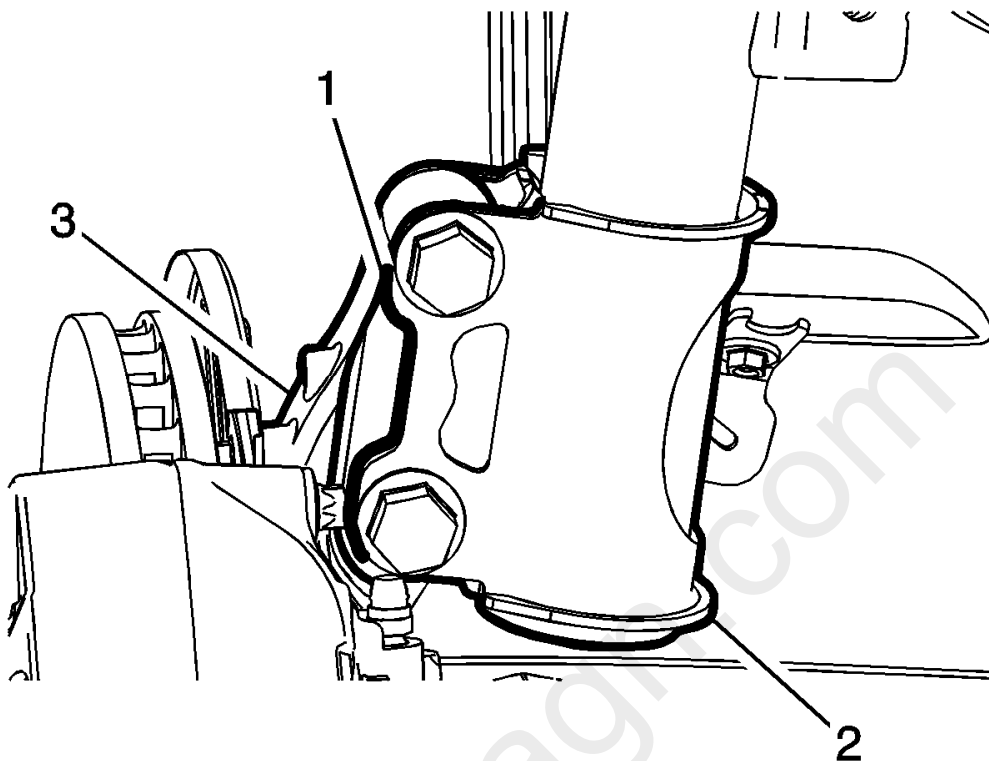


Fig. 48: Strut Assembly And Steering Knuckle
Courtesy of GENERAL MOTORS COMPANY

4. Align the strut assembly (2) with the previously made alignment mark (1).

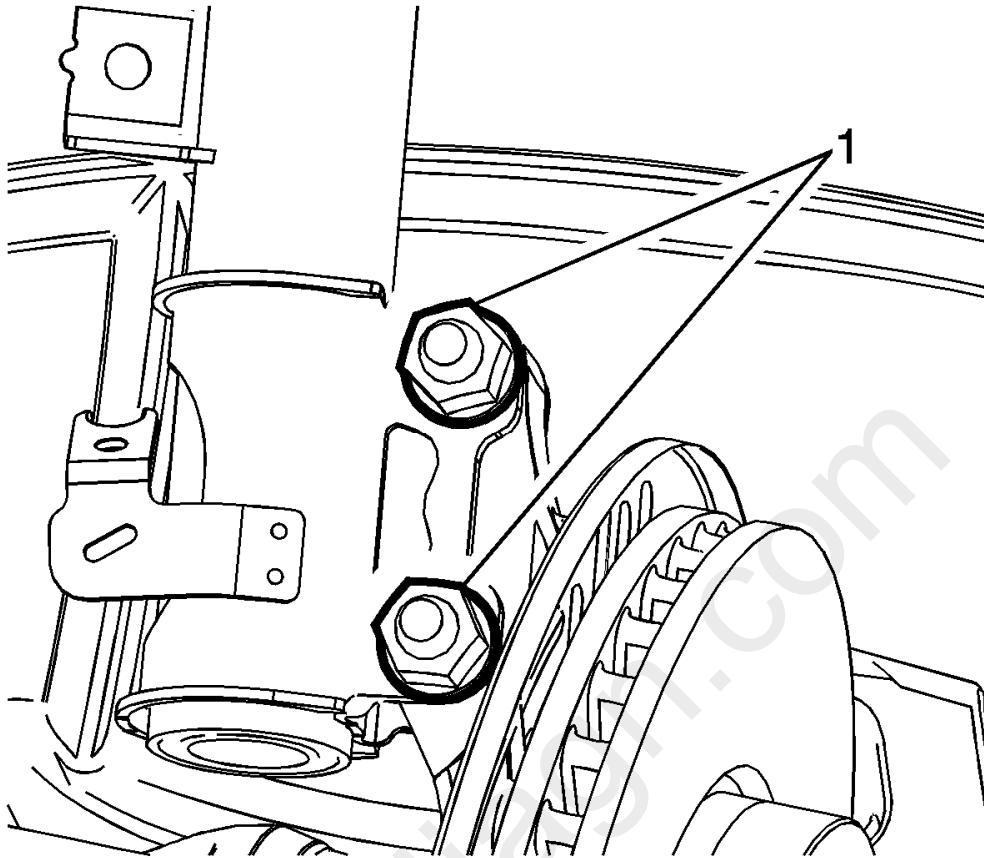


Fig. 49: Front Suspension Strut Nuts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

5. Tighten the front suspension strut nuts (1) to 150 (111 lb ft) + (80-95 degrees).
6. Ensure the splines on the strut bolts are fully seated.
7. Connect the stabilizer shaft link to the strut assembly. Refer to Stabilizer Shaft Link Replacement.
8. Connect the front wheel speed sensor to the steering knuckle and strut assemblies. Refer to Front Wheel Speed Sensor Replacement .
9. Connect the front brake hose to the strut assembly. Refer to Front Brake Hose Replacement .
10. Install the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation .
11. Lower the vehicle completely.

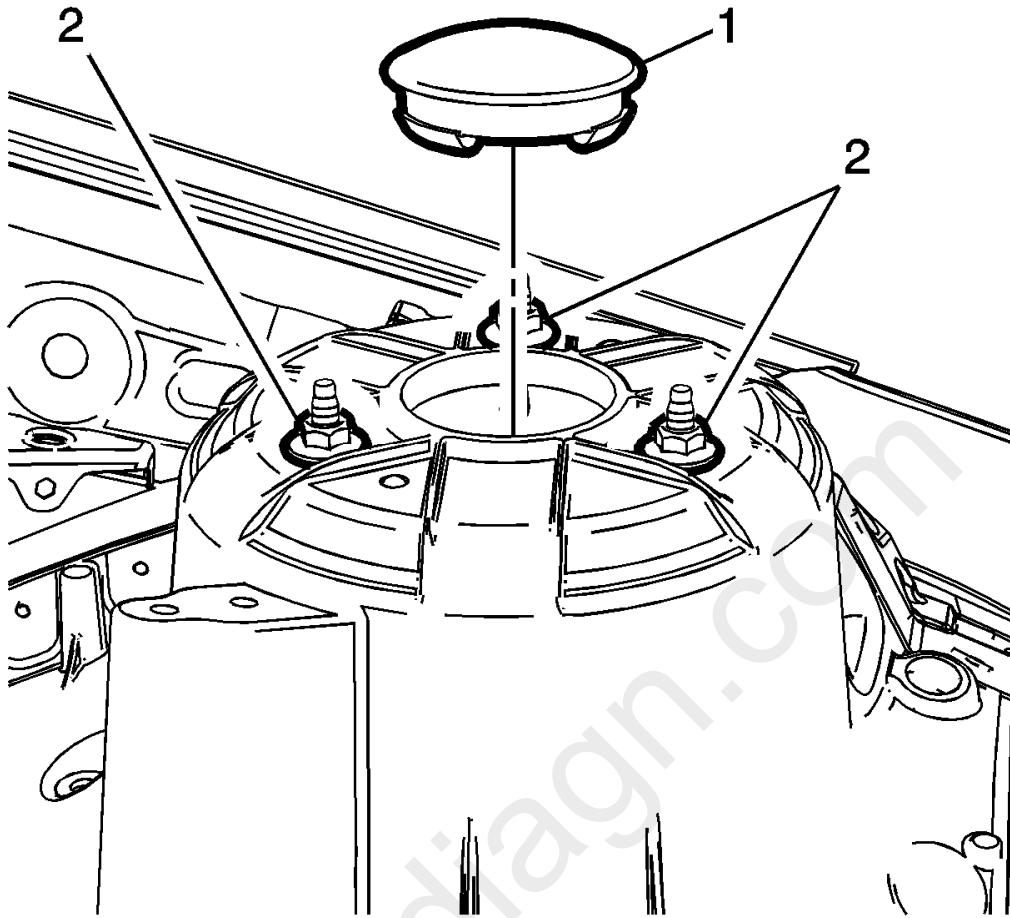


Fig. 50: Front Suspension Strut Access Hole Plug
Courtesy of GENERAL MOTORS COMPANY

12. Tighten the front suspension upper strut mount nuts (2) to 17 (13 lb ft).
13. Install the front suspension strut access hole plug (1).
14. Check and adjust the front wheel alignment. Refer to **Wheel Alignment Specifications** .

STRUT ASSEMBLY REMOVAL AND INSTALLATION (FE2 OR FE3 WITH F55 MAGNETIC RIDE SUSPENSION)

Removal Procedure

1. Raise and 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. Disconnect the stabilizer shaft link from the strut assembly. Refer to **Stabilizer Shaft Link Replacement**.
4. Disconnect the front wheel speed sensor from the steering knuckle and strut assemblies. Refer to **Front Wheel Speed Sensor Replacement** .

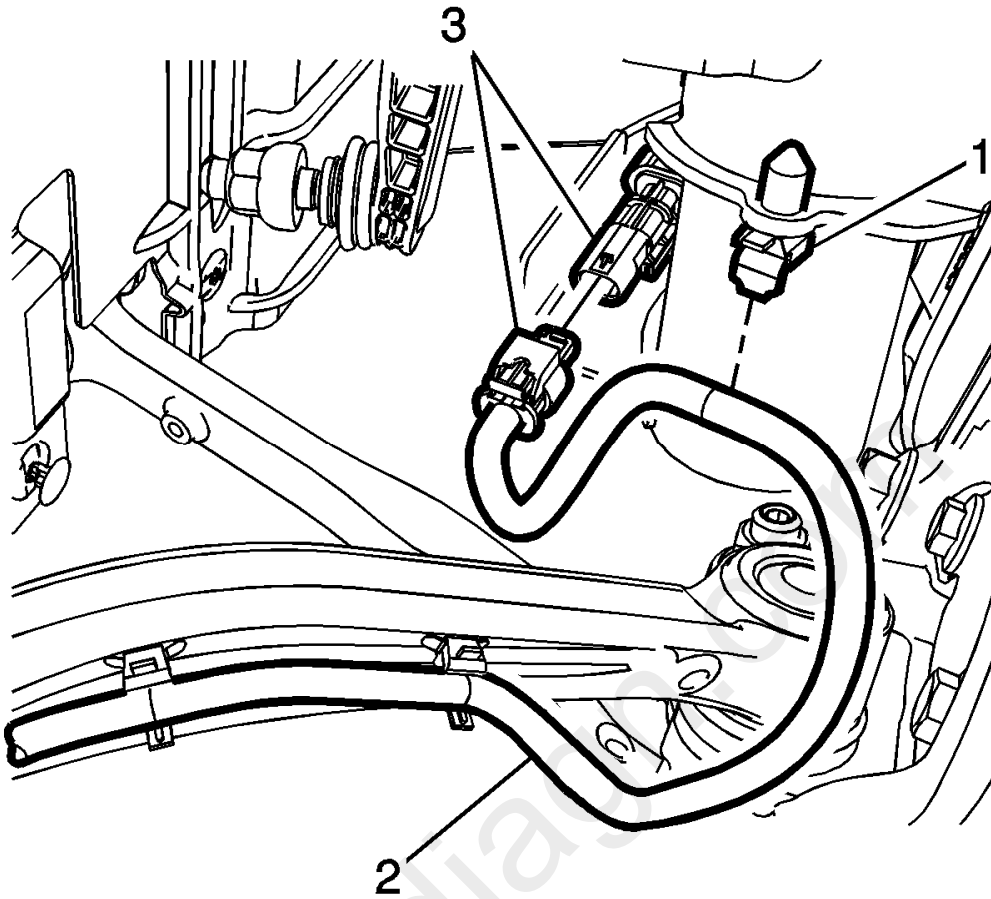


Fig. 51: Strut Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the wiring harness (2) from the retainer (1) on the side of the strut assembly.
6. Disconnect the electrical connector (3) for the electronic suspension.
7. Disconnect the front brake hose from the strut assembly. Refer to **Front Brake Hose Replacement** .

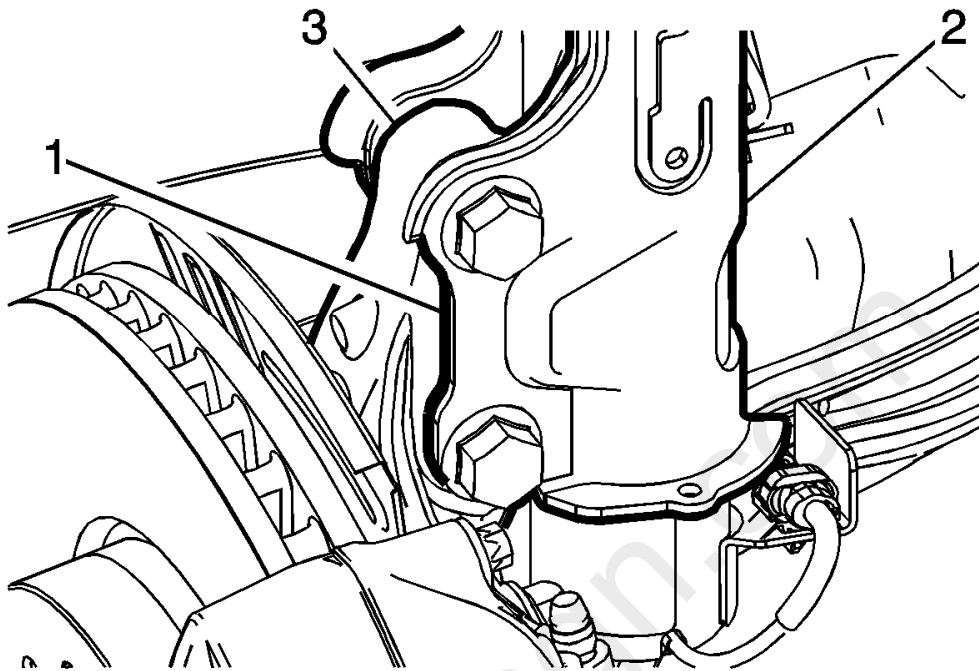


Fig. 52: Strut Assembly And Steering Knuckle
Courtesy of GENERAL MOTORS COMPANY

8. Place a reference mark (1) where the strut assembly (2) sits on the steering knuckle (3).

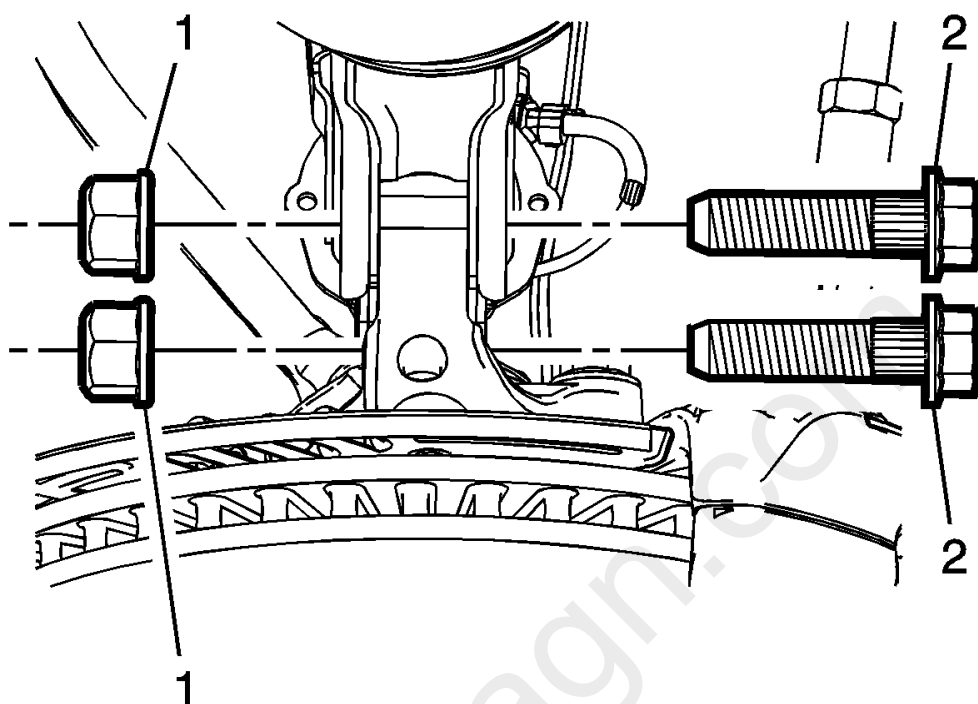


Fig. 53: Front Suspension Strut Mounting Components
Courtesy of GENERAL MOTORS COMPANY

9. Remove the front suspension strut nuts (1) and bolts (2).

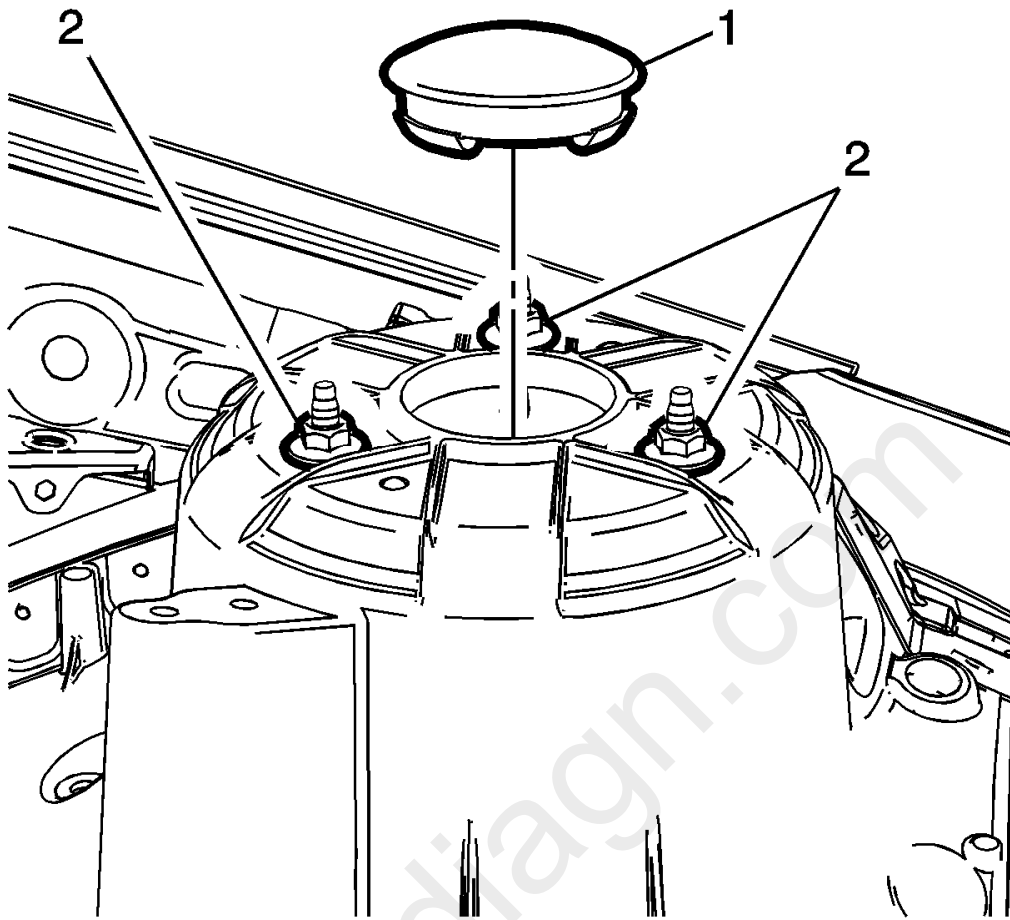


Fig. 54: Front Suspension Strut Access Hole Plug
Courtesy of GENERAL MOTORS COMPANY

10. Remove the front suspension strut access hole plug (1).
11. Remove the front suspension upper strut mount nuts (2).

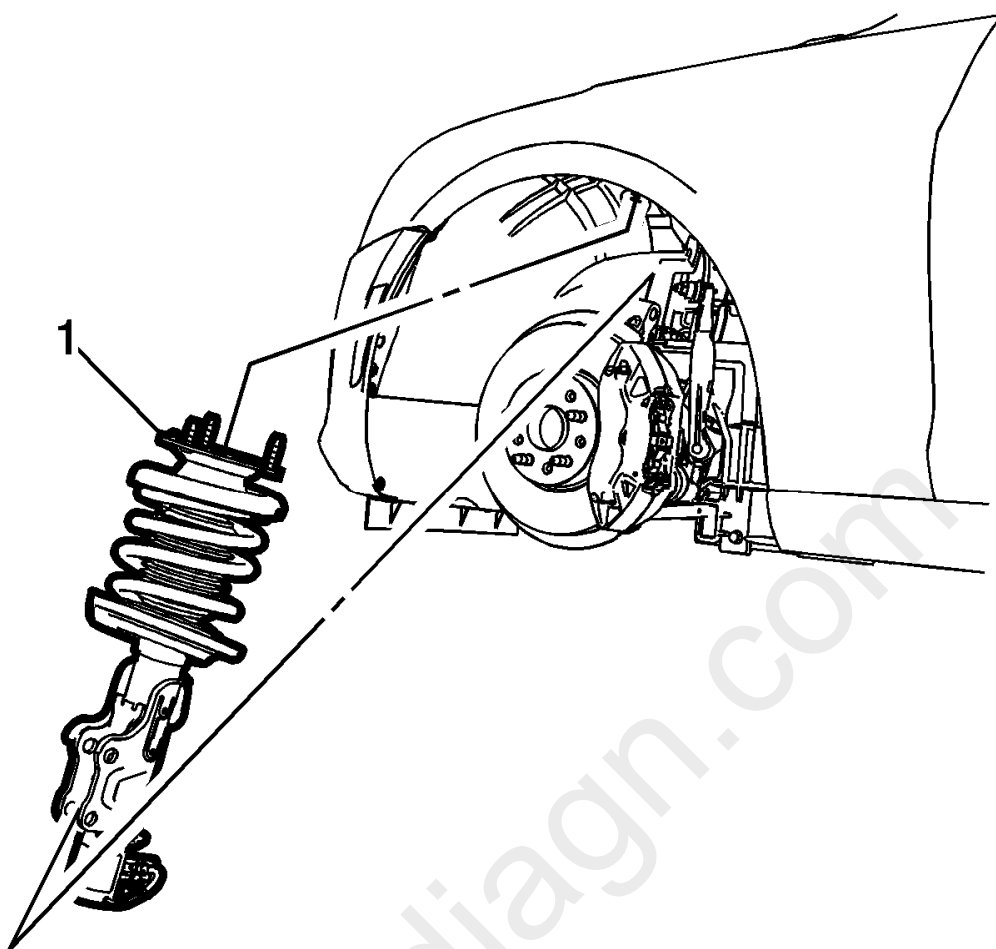


Fig. 55: Strut Assembly
Courtesy of GENERAL MOTORS COMPANY

12. Remove the strut assembly (1) from the vehicle.

Installation Procedure

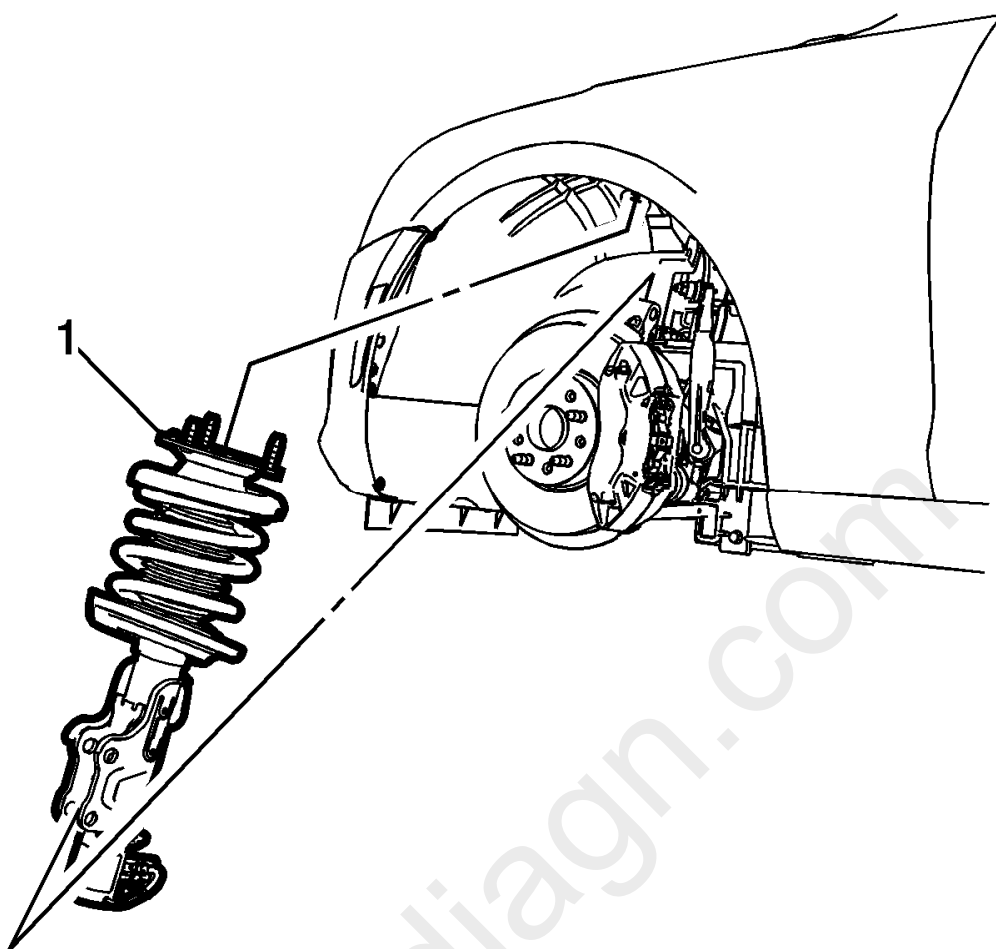


Fig. 56: Strut Assembly

Courtesy of GENERAL MOTORS COMPANY

1. Position the front strut assembly (1) in the vehicle.

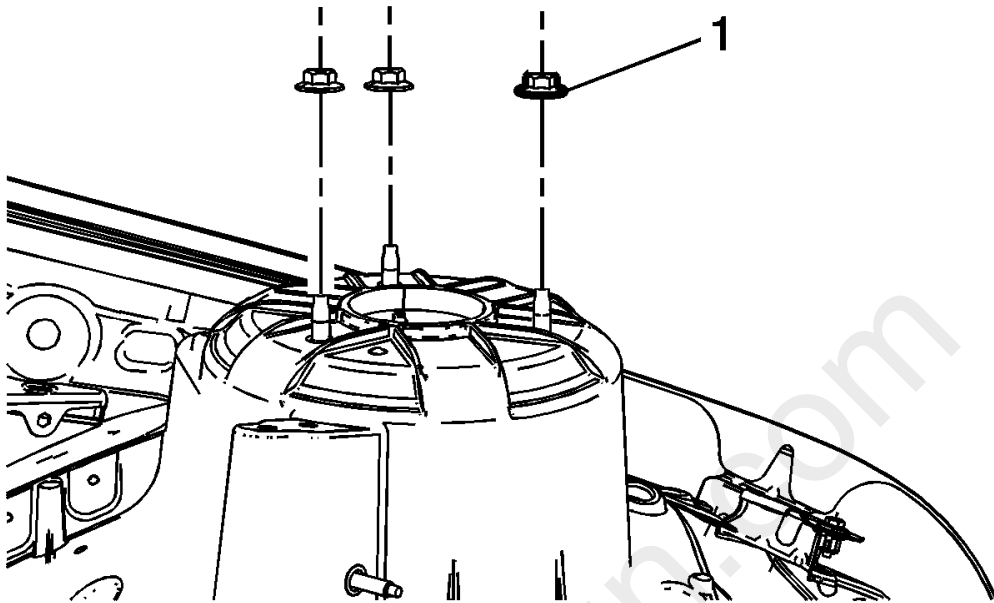


Fig. 57: Front Suspension Upper Strut Mount Nuts
Courtesy of GENERAL MOTORS COMPANY

2. Start the front suspension upper strut mount nuts (1) by hand but do not tighten.

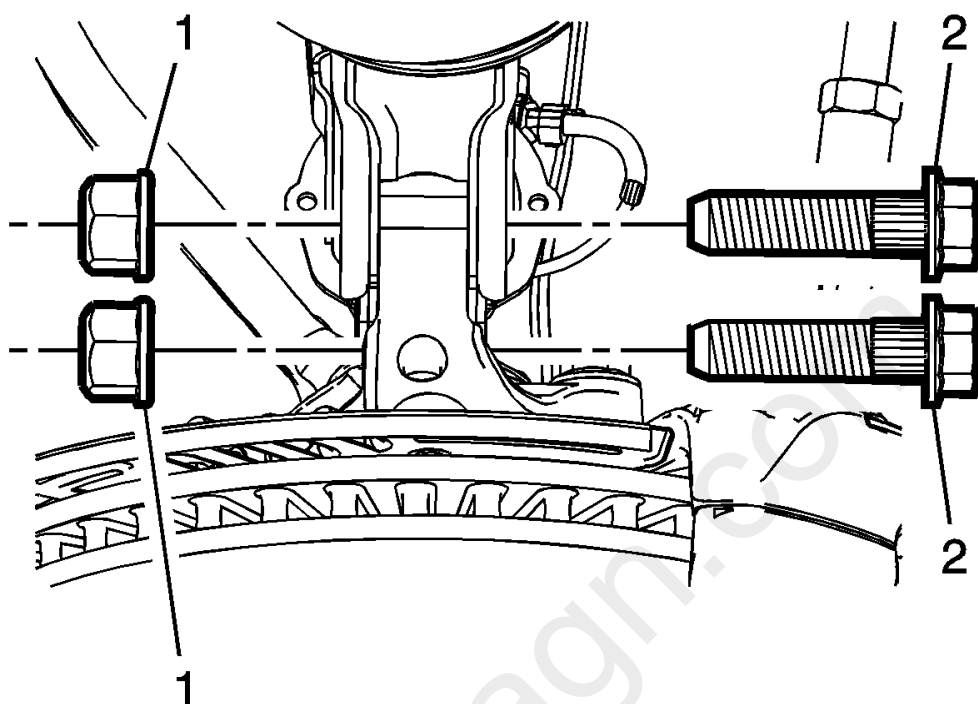


Fig. 58: Front Suspension Strut Mounting Components
Courtesy of GENERAL MOTORS COMPANY

3. Start the front suspension strut bolts (2) and nuts (1) by hand but do not tighten.

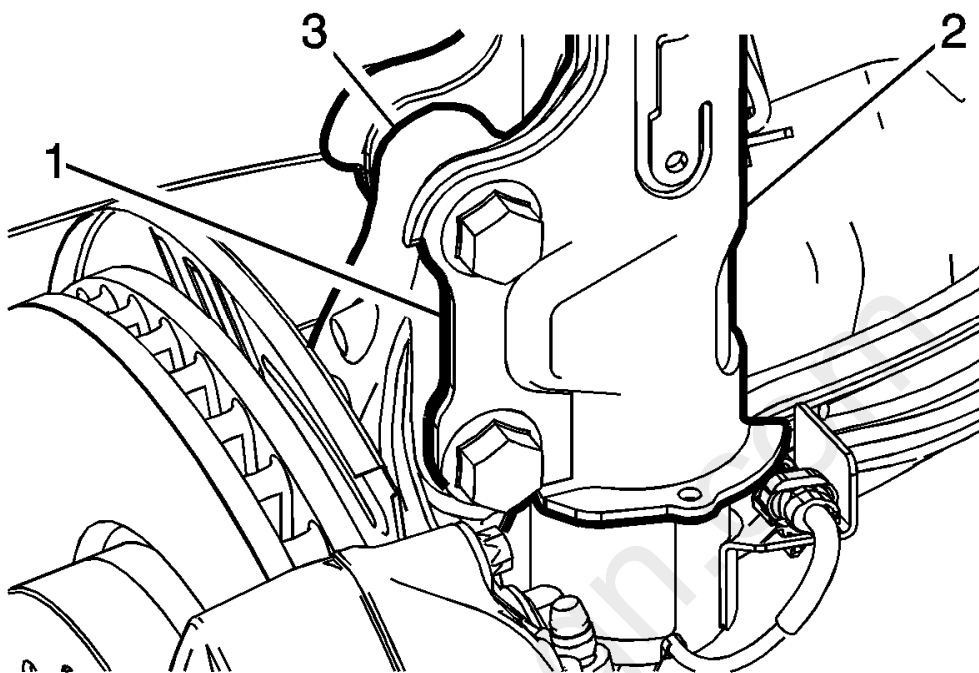


Fig. 59: Strut Assembly And Steering Knuckle
Courtesy of GENERAL MOTORS COMPANY

4. Align the strut assembly (2) with the previously made alignment mark (1).

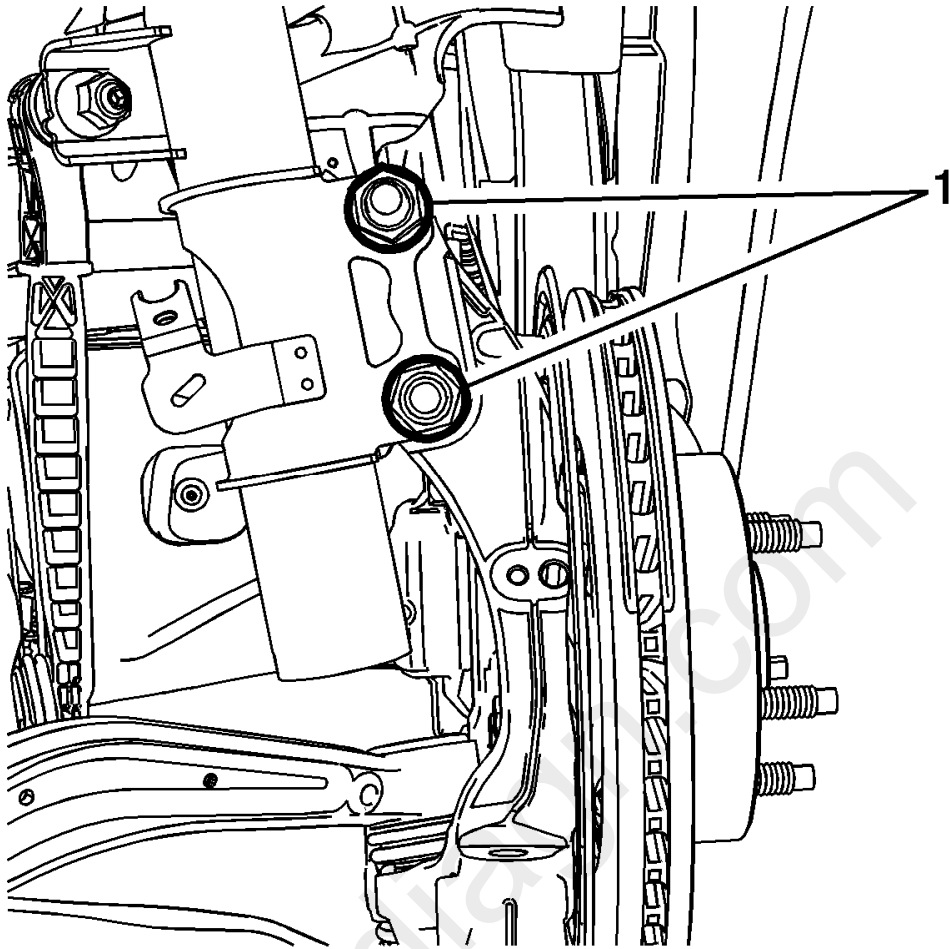


Fig. 60: Front Suspension Strut Nuts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

5. Tighten the front suspension strut nuts (1) to 150 (111 lb ft) + (90-105 degrees).
6. Ensure the splines on the strut bolts are fully seated.
7. Connect the stabilizer shaft link to the strut assembly. Refer to Stabilizer Shaft Link Replacement.
8. Connect the front wheel speed sensor to the steering knuckle and strut assemblies. Refer to Front Wheel Speed Sensor Replacement .

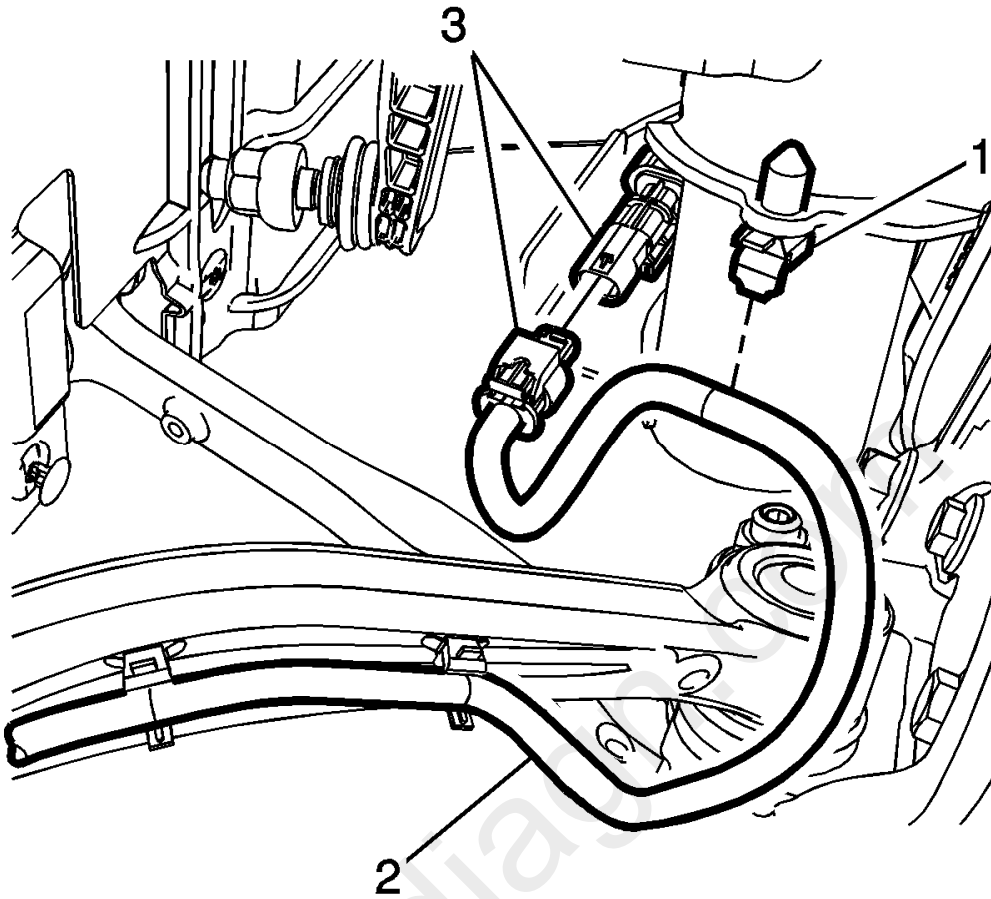


Fig. 61: Strut Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

9. Install the wiring harness (2) in the retainer (1) on the side of the strut assembly.
10. Connect the electrical connector (3) for the electronic suspension.
11. Connect the front brake hose to the strut assembly. Refer to **Front Brake Hose Replacement** .
12. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
13. Lower the vehicle completely.

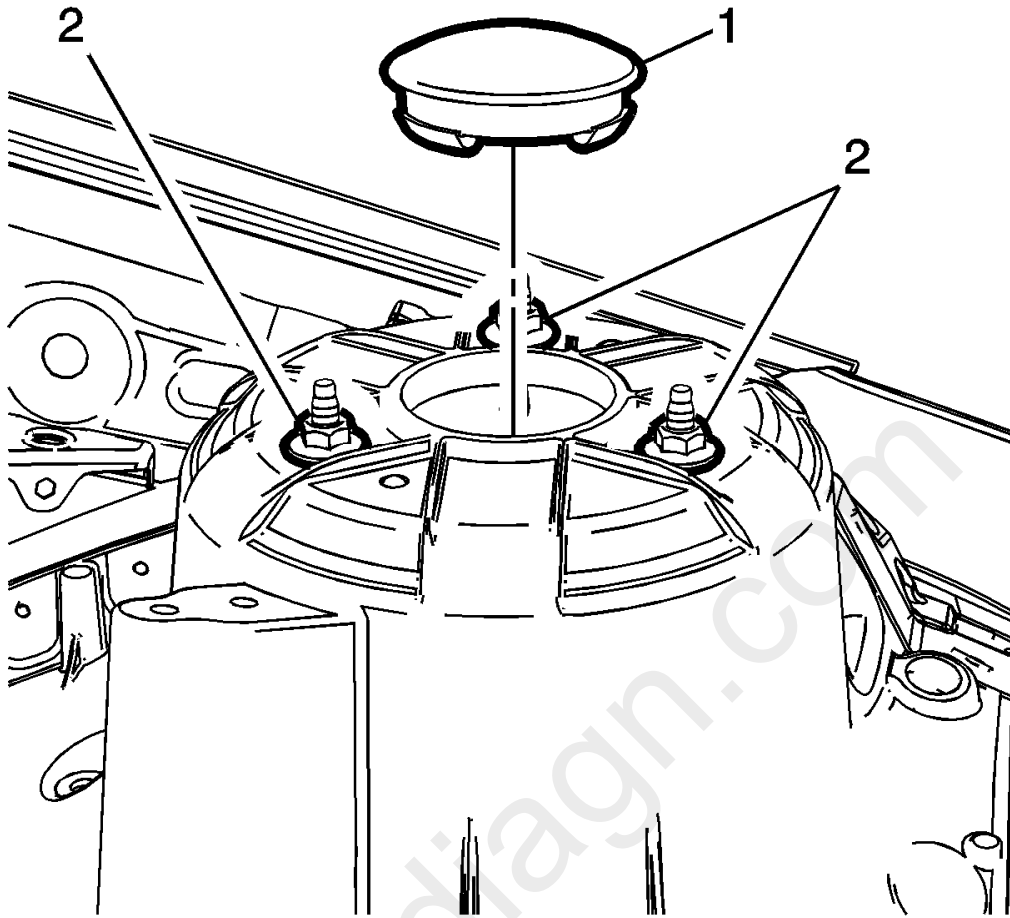


Fig. 62: Front Suspension Strut Access Hole Plug
Courtesy of GENERAL MOTORS COMPANY

14. Tighten the front suspension upper strut mount nuts (2) to 17 (13 lb ft).
15. Install the front suspension strut access hole plug (1).
16. Check and adjust the front wheel alignment. Refer to **Wheel Alignment Specifications** .

SUSPENSION STRUT DISPOSAL

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

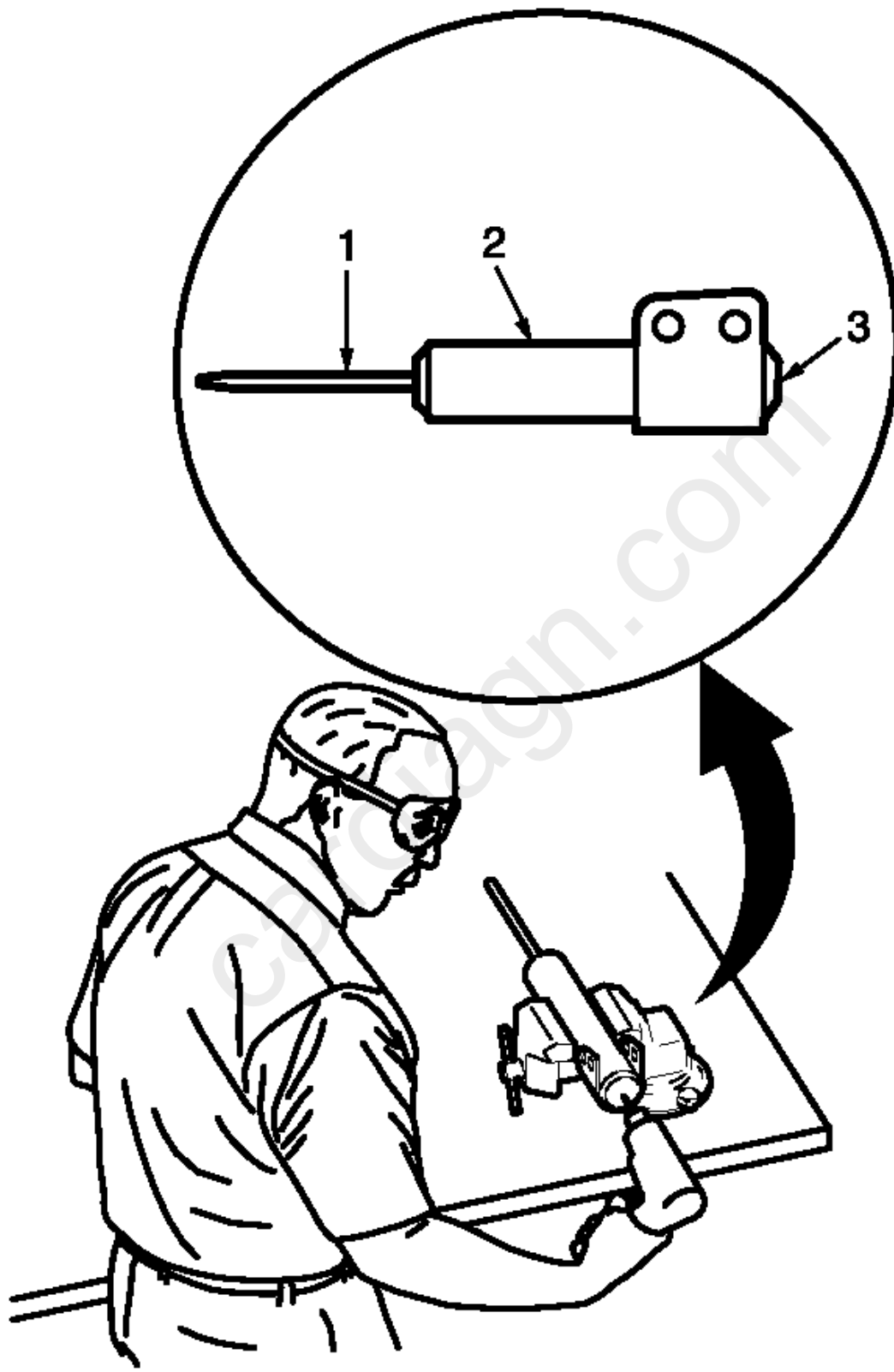


Fig. 63: Drilling Hole In Strut At Center Of End Cap

Courtesy of GENERAL MOTORS COMPANY

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 (WITH ELECTRONIC SUSPENSION)

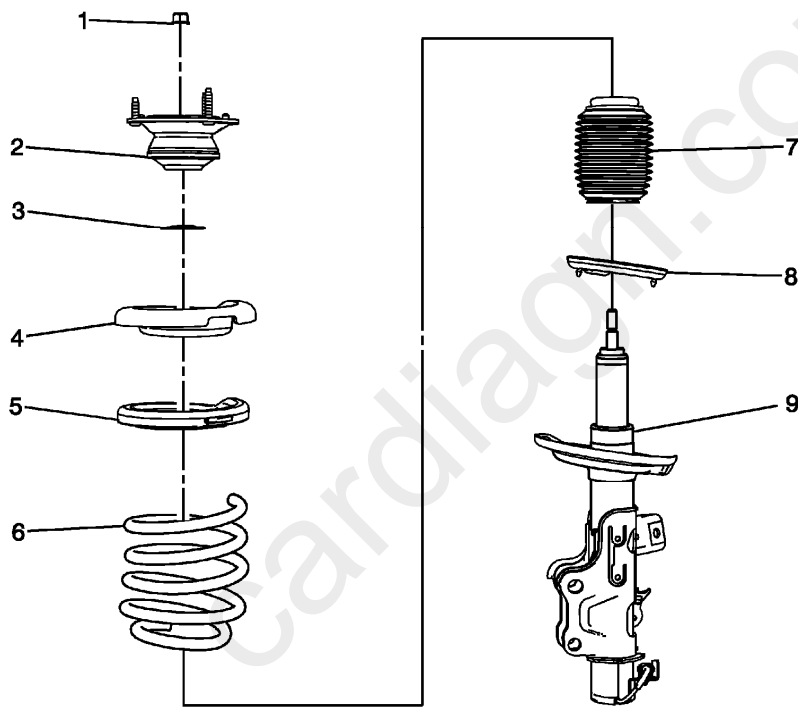


Fig. 64: Strut, Strut Component, or Spring (With Electronic Suspension)
Courtesy of GENERAL MOTORS COMPANY

Strut, Strut Component, or Spring Replacement (With Electronic Suspension)

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .	
2. Remove the strut assembly. Refer to <u>Strut Assembly Removal and Installation (FE2 or FE3 With F55 Magnetic Ride Suspension)</u> .	
	Front Suspension Strut Nut

CAUTION:
Refer to Fastener Caution .

Procedure

1. Use the **J-45400-A** compressor to compress the strut assembly components.
2. Use the **CH-50732** socket to remove the front suspension strut nut.

1 **Tighten**
48 (35 lb ft)

Special Tools

- **CH-50732** Strut Rod Nut Socket, 18 mm
- **J-45400-A** Strut Spring Compressor

For regional equivalent tools, refer to Special Tools.

2 Front Suspension Strut Mount

Front Suspension Strut Mount Washer

3 **NOTE:**
Ensure that the smaller diameter of the front suspension strut mount washer goes up against the front suspension strut mount and the larger diameter is against the front coil spring upper seat.

4 Front Coil Spring Upper Seat

5 Front Coil Spring Upper Insulator

6 Front Coil Spring
NOTE:
Do not blemish or modify the coating on the front coil spring in any manner.

7 Front Suspension Strut Dust Shield

8 Front Coil Spring Lower Insulator

9 Front Suspension Strut

STRUT, STRUT COMPONENT, OR SPRING REPLACEMENT (WITHOUT ELECTRONIC SUSPENSION)

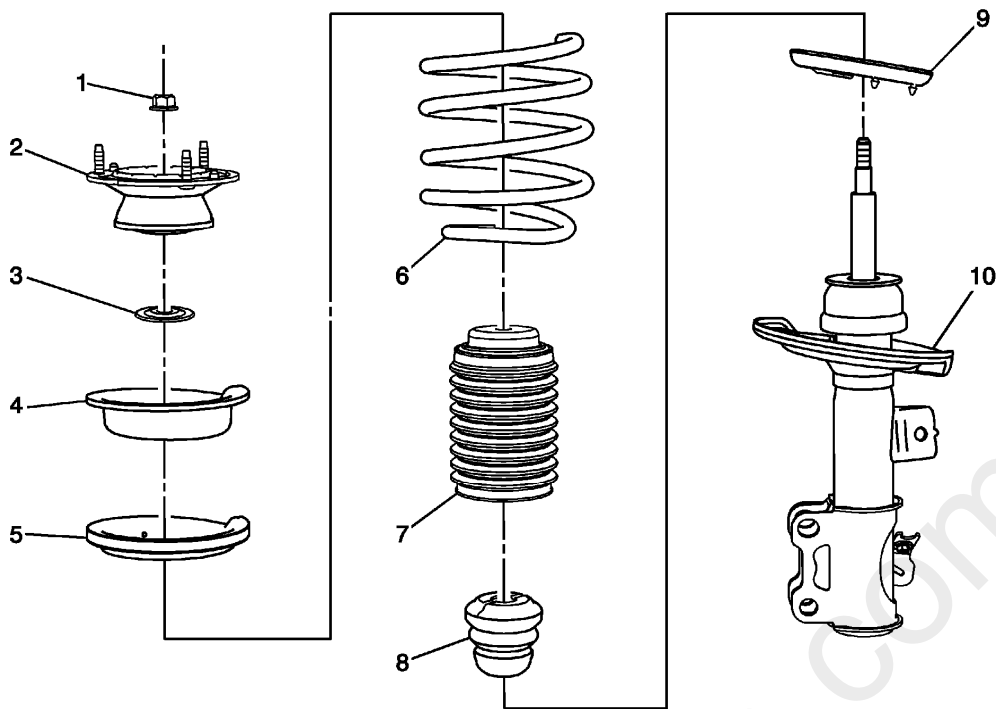


Fig. 65: Strut, Strut Component, or Spring (Without Electronic Suspension)
 Courtesy of GENERAL MOTORS COMPANY

Strut, Strut Component, or Spring Replacement (Without Electronic Suspension)

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the strut assembly. Refer to <u>Strut Assembly Removal and Installation (FE2 Base)</u> .	
1	Front Suspension Strut Nut CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Use the J-45400-A compressor to compress the strut assembly components. 2. Use the CH-50732 socket to remove the front suspension strut nut. Tighten 60 (44 lb ft) Special Tools

	• CH-50732 Strut Rod Nut Socket, 18 mm • J-45400-A Strut Spring Compressor For regional equivalent tools, refer to <u>Special Tools</u>.
2	Front Suspension Strut Mount
3	Front Suspension Strut Mount Washer NOTE: Ensure that the smaller diameter of the front suspension strut mount washer goes up against the front suspension strut mount and the larger diameter is against the front coil spring upper seat.
4	Front Coil Spring Upper Seat
5	Front Coil Spring Upper Insulator
6	Front Coil Spring NOTE: Do not blemish or modify the coating on the front coil spring in any manner.
7	Front Suspension Strut Dust Shield
8	Front Suspension Strut Bumper
9	Front Coil Spring Lower Insulator
10	Front Suspension Strut

DESCRIPTION AND OPERATION

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.

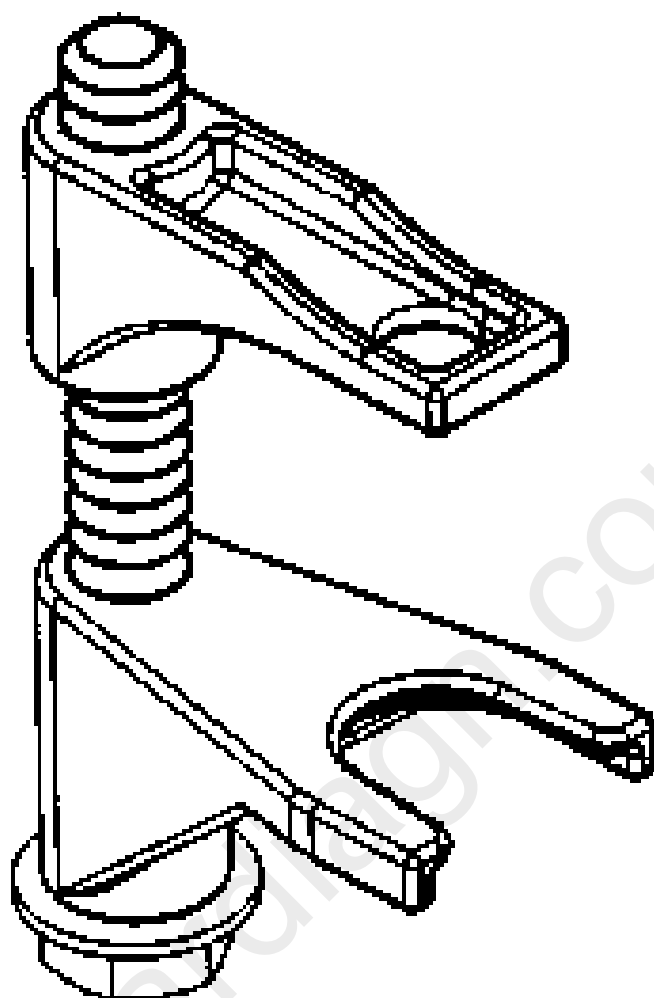
Front suspensions systems utilize a stabilizer shaft. The stabilizer bar connects between the left and right lower control arm assemblies through the stabilizer link and stabilizer shaft insulators. This bar controls the amount of independent movement of the suspension when the vehicle turns. Limiting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

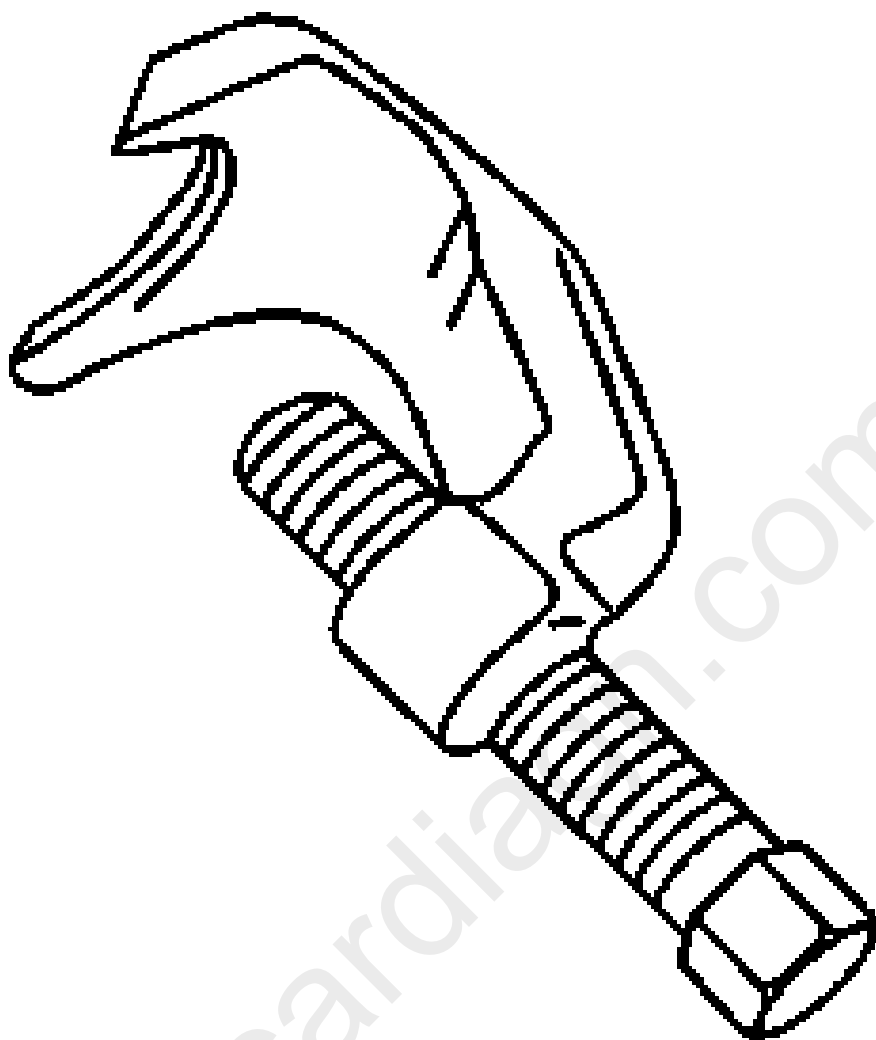
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

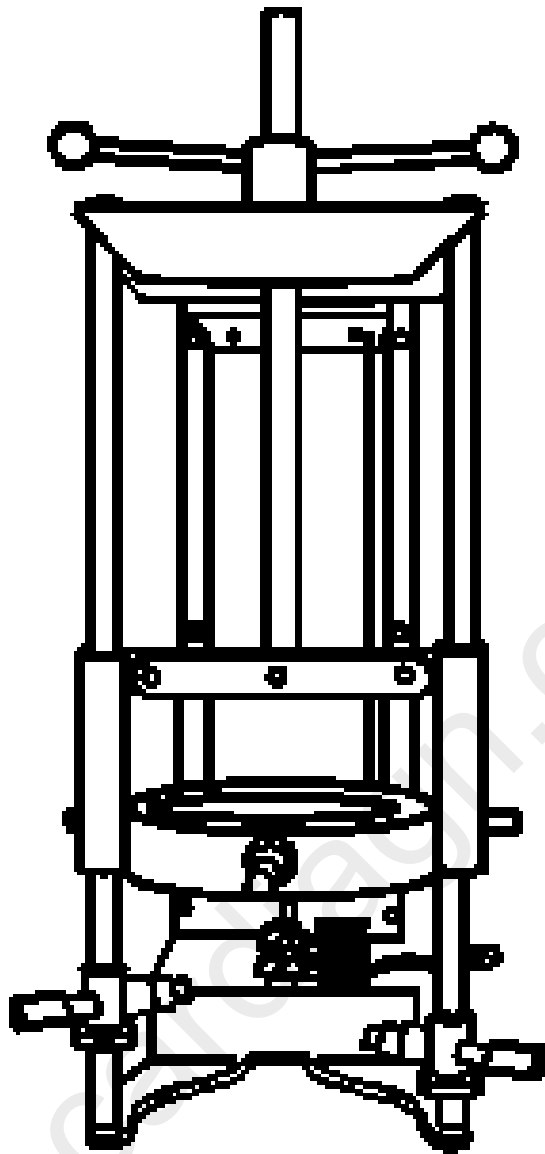
Illustration	Tool Number/ Description
	CH-42188-B J-42188-B Ball Joint

Separator

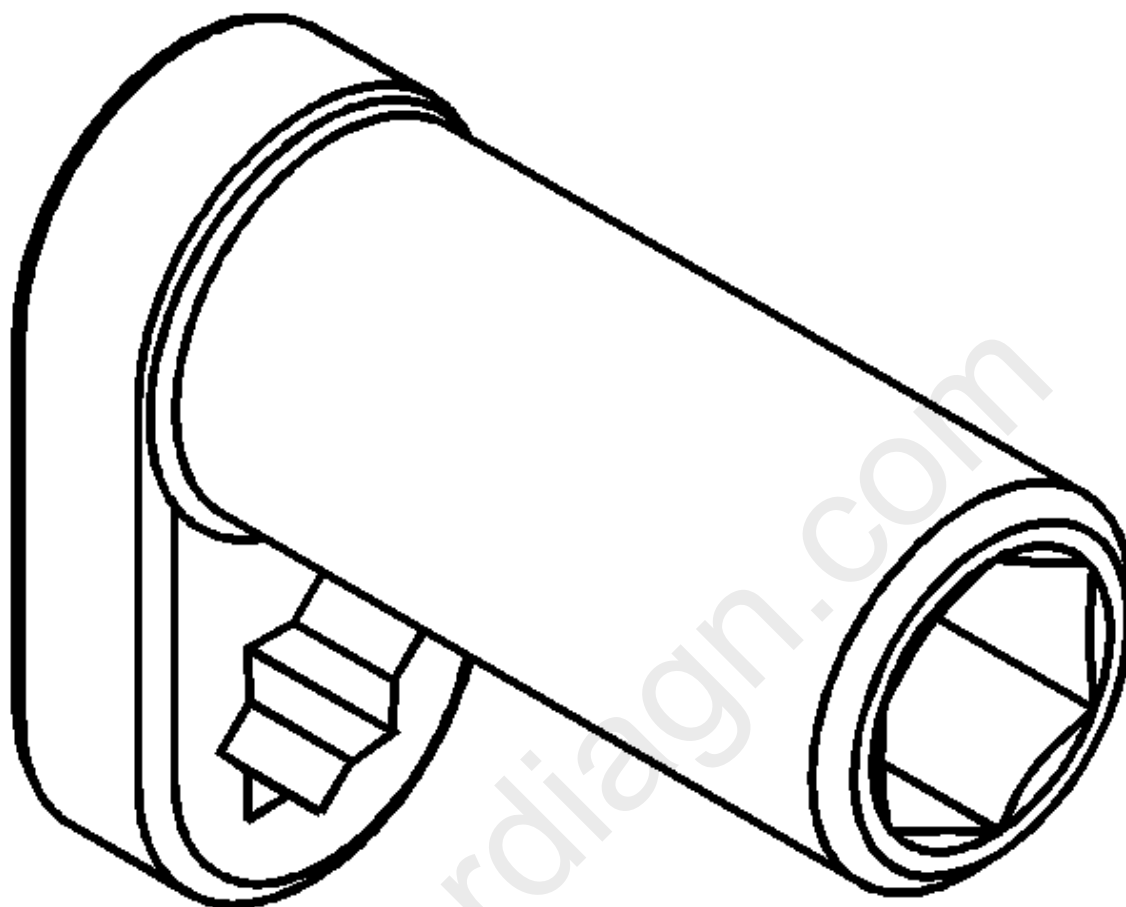




CH-43631
CH-49455
J-43631
Ball Joint
Separator



CH-45400-
A
DW320-
010
J-45400-A
Strut Spring
Compressor



CH-50732
MLR-9362
Strut Rod
Nut Socket,
18 mm