

2013 SUSPENSION

Front Suspension - Malibu

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Front Lower Control Arm Front Bolt (1)		
• First Pass	100 N.m	74 lb ft
• Final Pass	plus 90 Degrees	
Front Lower Control Arm Rear Bolt (1)		
• First Pass	100 N.m	74 lb ft
• Final Pass	plus 90 Degrees	
Front Lower Control Arm Rear Bushing Bolt (1)		
• First Pass	55 N.m	41 lb ft
• Final Pass	plus 100 Degrees	
Front Suspension Strut Mount Nut	55 N.m	41 lb ft
Front Suspension Strut Nut	70 N.m	52 lb ft
Front Wheel Bearing and Hub Assembly Bolt (1)		
• First Pass	100 N.m	74 lb ft
• Final Pass	plus 75 Degrees	
Stabilizer Shaft Insulator Clamp Bolt (1)		
• First Pass	22 N.m	16 lb ft
• Final Pass	plus 30 Degrees	
Stabilizer Shaft Link Nut	65 N.m	48 lb ft
Steering Knuckle Nut (at Lower Control Arm)		
• First Pass	50 N.m	37 lb ft
• Second Pass	loosen 120 Degrees	
• Third Pass	50 N.m	37 lb ft
• Final Pass	plus 45 Degrees	
Steering Knuckle Nut (at Strut Assembly)		
• First Pass	85 N.m	63 lb ft
• Final Pass	plus 60 Degrees	
1. Use NEW Fastener.		

REPAIR INSTRUCTIONS

STABILIZER SHAFT REPLACEMENT

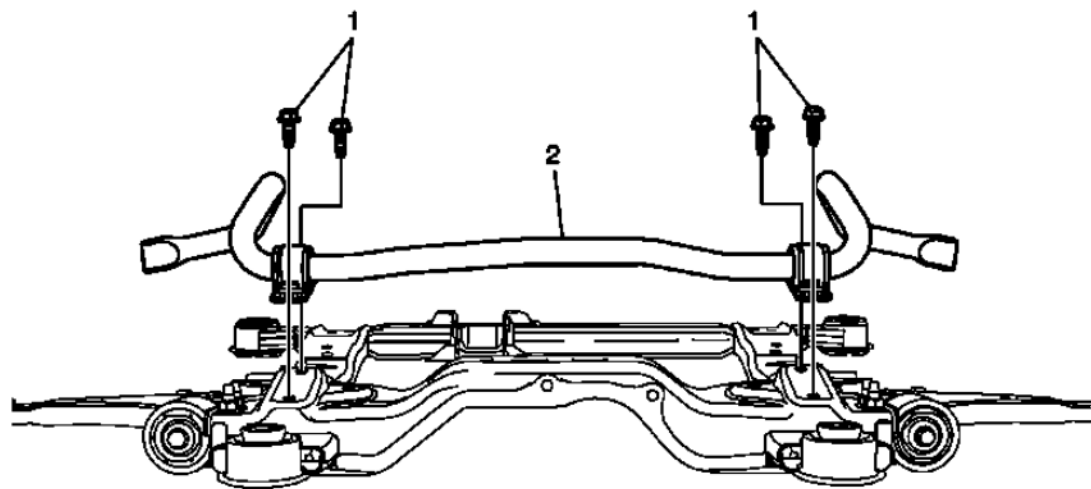


Fig. 1: Stabilizer Shaft & Clamp Bolts
Courtesy of GENERAL MOTORS COMPANY

Stabilizer Shaft Replacement

Callout	Component Name
Preliminary Procedure 1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the tire and wheel assemblies. Refer to <u>Tire and Wheel Removal and Installation</u> . 3. Disconnect the stabilizer shaft links from the stabilizer shaft. Refer to <u>Stabilizer Shaft Link Replacement</u> . 4. Lower the rear of the drivetrain and front suspension frame to gain enough clearance to remove the stabilizer shaft. Refer to <u>Drivetrain and Front Suspension Frame Replacement</u> .	
	Stabilizer Shaft Insulator Clamp Bolt (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> . CAUTION: This vehicle is equipped with torque-to-yield or single use

1	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. Procedure Remove and discard the bolts. DO NOT reuse, replace with NEW only. Tighten 22 N.m (16 lb ft) + 30 degrees
2	Stabilizer Shaft

STABILIZER SHAFT LINK REPLACEMENT

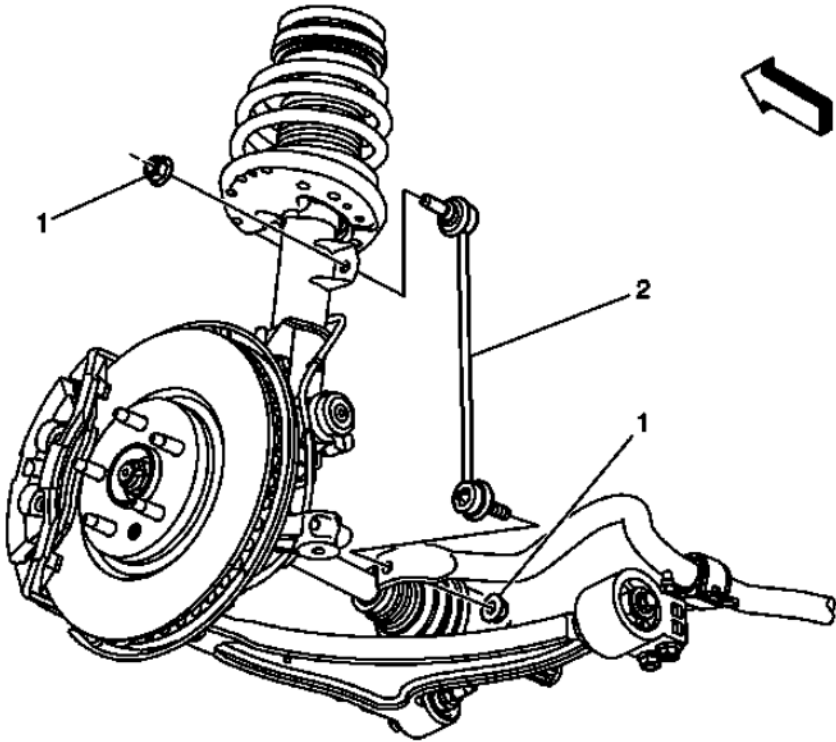


Fig. 2: Stabilizer Shaft Link And Nuts
Courtesy of GENERAL MOTORS COMPANY

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 tire and wheel assembly. Refer to Tire and Wheel Removal and Installation . 3. Disconnect any harnesses or retainers secured to the stabilizer shaft link. Note any attaching points	

to aid in installation.

1	Stabilizer Shaft Link Nut (Qty: 2)
	CAUTION: Refer to <u>Fastener Caution</u> .
	Tighten 65 N.m (48 lb ft)
2	Stabilizer Shaft Link

STABILIZER SHAFT INSULATOR REPLACEMENT

The stabilizer shaft insulator is not serviced separately, but with the stabilizer shaft. For the stabilizer shaft replacement, refer to Stabilizer Shaft Replacement.

FRONT WHEEL BEARING AND HUB REPLACEMENT

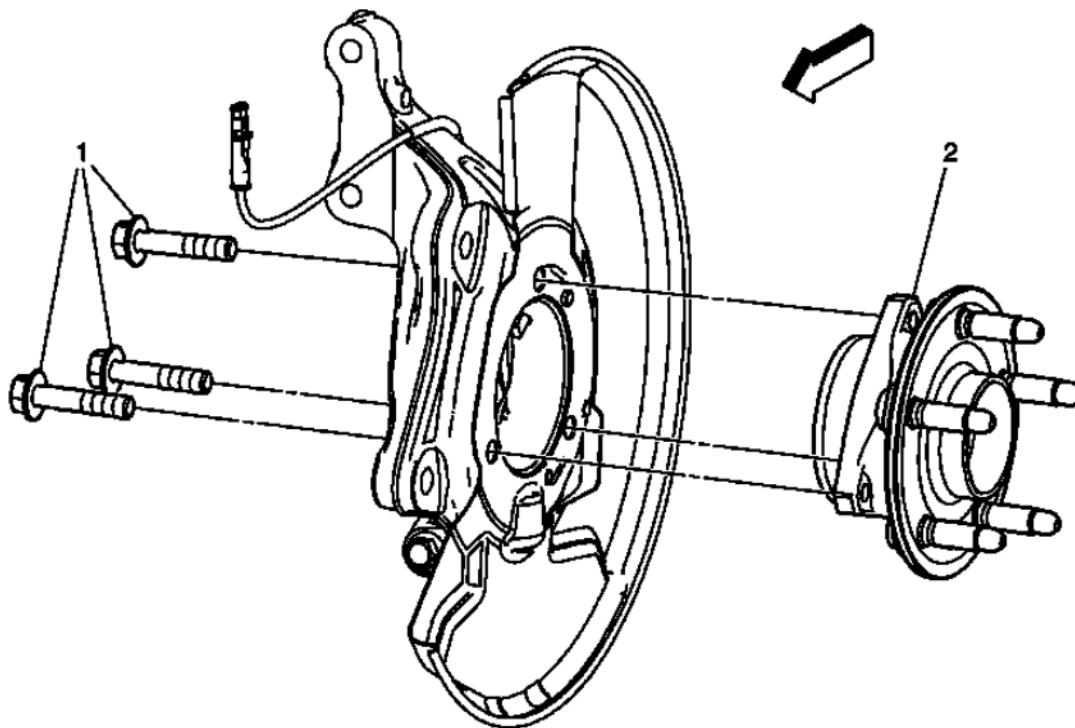


Fig. 3: Identifying Front Wheel Bearing, Hub & Bolts
Courtesy of GENERAL MOTORS COMPANY

Front Wheel Bearing and Hub Replacement

Callous	Component Name
Preliminary Procedures	

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** .
4. Disconnect the front wheel drive shaft from the front wheel bearing and hub assembly. Refer to **Front Wheel Drive Shaft Replacement - Left Side** , or **Front Wheel Drive Shaft Replacement - Right Side** .

1	Front Wheel Bearing and Hub Assembly Bolt (Qty: 3) CAUTION: Refer to <u>Fastener Caution</u> . 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. Procedure Remove and discard the bolts. DO NOT re-use, replace with NEW only. Tighten 100 N.m (74 lb ft) + 75 degrees
2	Front Wheel Bearing and Hub Assembly

STEERING KNUCKLE REPLACEMENT

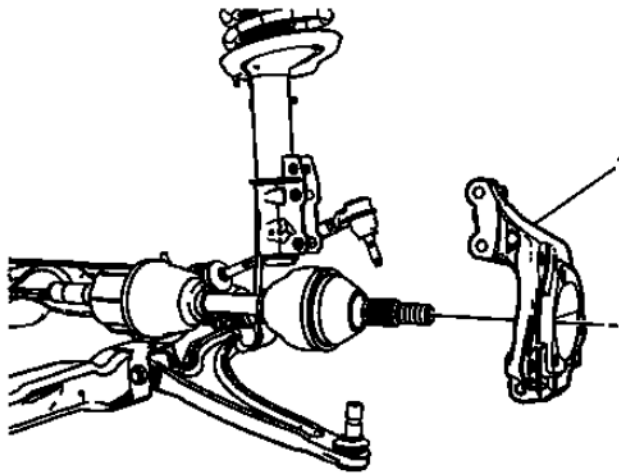


Fig. 4: View Of Steering Knuckle
Courtesy of GENERAL MOTORS COMPANY

Steering Knuckle Replacement

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 wheel bearing and hub assembly. Refer to <u>Front Wheel Bearing and Hub Replacement</u>.	
1	Steering Knuckle CAUTION: Do not pry in such a way that the ball joint seal is contacted. Damage to the seal may result. Procedure 1. Disconnect the steering linkage outer tie rod from the steering knuckle. Refer to <u>Steering Linkage Outer Tie Rod Replacement</u> . 2. Disconnect the strut assembly from the steering knuckle. Refer to <u>Strut Assembly Removal and Installation</u>. 3. Disconnect the lower control arm from the steering knuckle. Refer to <u>Lower Control Arm Replacement</u>.

LOWER CONTROL ARM REPLACEMENT

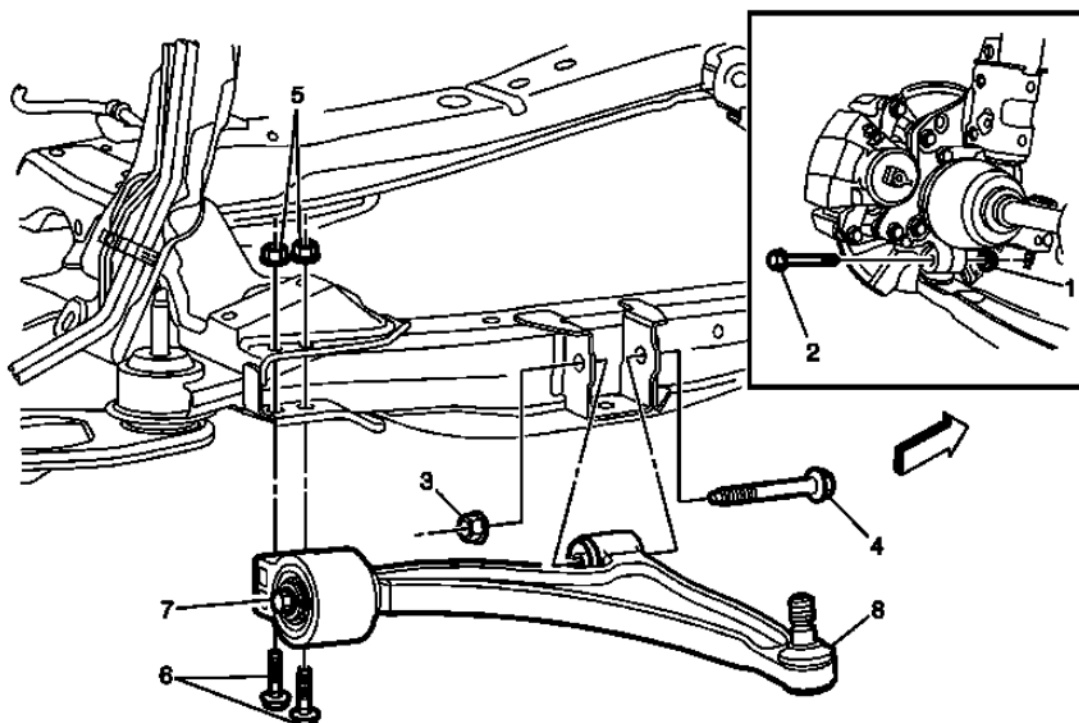


Fig. 5: Lower Control Arm (GNA)
 Courtesy of GENERAL MOTORS COMPANY

Lower Control Arm Replacement

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> .	
1	Steering Knuckle Nut CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Support the knuckle with the proper jack stand. 2. Using a suitable tool, open the pinch joint on the steering knuckle and disconnect the lower control arm ball joint from the knuckle. Tighten 1. Tighten the nut to 50 N.m (37 lb ft). 2. Loosen the nut to 120 degrees. 3. Tighten the nut to 50 N.m (37 lb ft) + 45 degrees.
2	Steering Knuckle Bolt 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. Procedure Discard the bolt. DO NOT re-use, replace with NEW.
3	Front Lower Control Arm Front Nut 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.

	Procedure Discard the nut. DO NOT re-use, replace with NEW.
4	Front Lower Control Arm Front Bolt 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. Procedure Discard the bolt. DO NOT re-use, replace with NEW. Tighten 100 N.m (74 lb ft) + 90 degrees
5	Front Lower Control Arm Rear Nut (Qty: 2)
6	Front Lower Control Arm Rear Bolt (Qty: 2) 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. Procedure Discard the bolt. DO NOT re-use, replace with NEW. Tighten 100 N.m (74 lb ft) + 90 degrees
7	Front Lower Control Arm Rear Bushing Bolt 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. Procedure 1. Discard the bolt. DO NOT re-use, replace with NEW. 2. Load the front suspension with the proper jackstand before tightening the bolt to specification. 3. Use the GE-6600-2 wrench to tighten the NEW bolt to specification.

	Tighten 55 N.m (41 lb ft) + 100 degrees Special Tools GE-6600-2 Torque Wrench For equivalent regional tools. Refer to Special Tools .
8	Front Lower Control Arm Procedure Verify the wheel alignment. Refer to Wheel Alignment Specifications .

FRONT LOWER CONTROL ARM REAR BUSHING REPLACEMENT

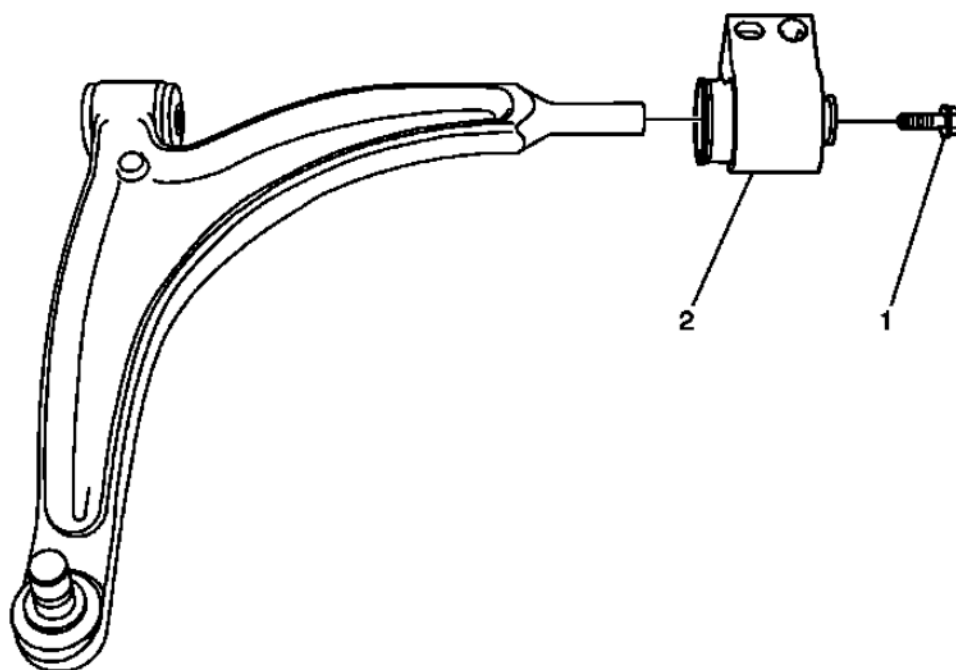


Fig. 6: Front Lower Control Arm Rear Bushing & Bolt
Courtesy of GENERAL MOTORS COMPANY

Front Lower Control Arm Rear 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 assembly. Refer to Tire and Wheel Removal and Installation . 3. Remove the lower control arm. Refer to Lower Control Arm Replacement .	
	Front Lower Control Arm Rear Bushing Bolt

1	CAUTION: Refer to <u>Fastener Caution</u> . 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. Procedure Discard the bolt. DO NOT re-use, replace with NEW. NOTE: Tighten the bolt with the vehicle at ride height. Tighten 55 N.m (41 lb ft) + 100 degrees
2	Front Lower Control Arm Rear Bushing

WHEEL STUD REPLACEMENT

Special Tools

CH-43631 Ball Joint Remover

For equivalent regional tools, refer to Special Tools.

Removal Procedure

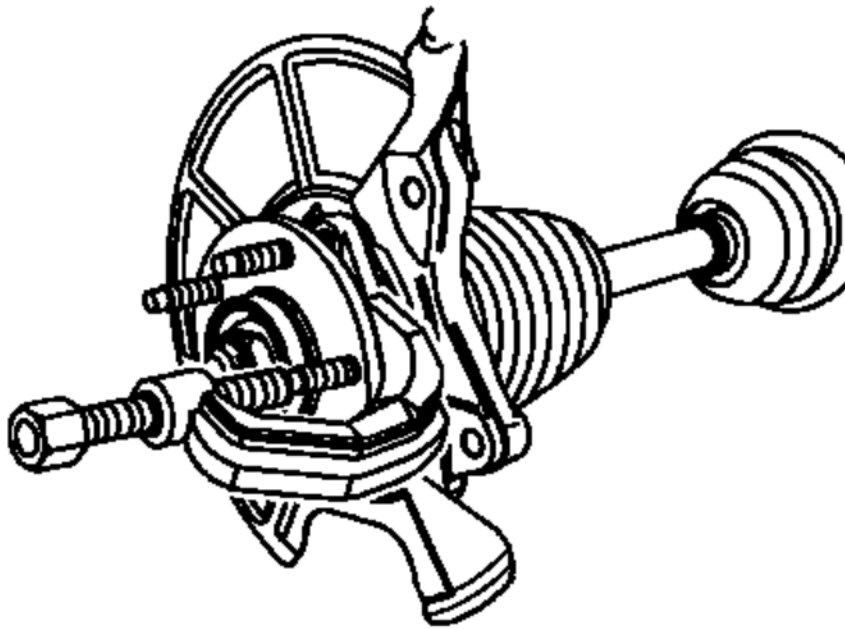


Fig. 7: Identifying Wheel Stud - 5-Stud Pattern
Courtesy of GENERAL MOTORS COMPANY

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 wheel bearing and hub assembly. Refer to **Front Wheel Bearing and Hub Replacement**.
4. Use the **CH-43631** remover to release the wheel stud from the front wheel bearing and hub assembly. Discard the stud.

Installation Procedure

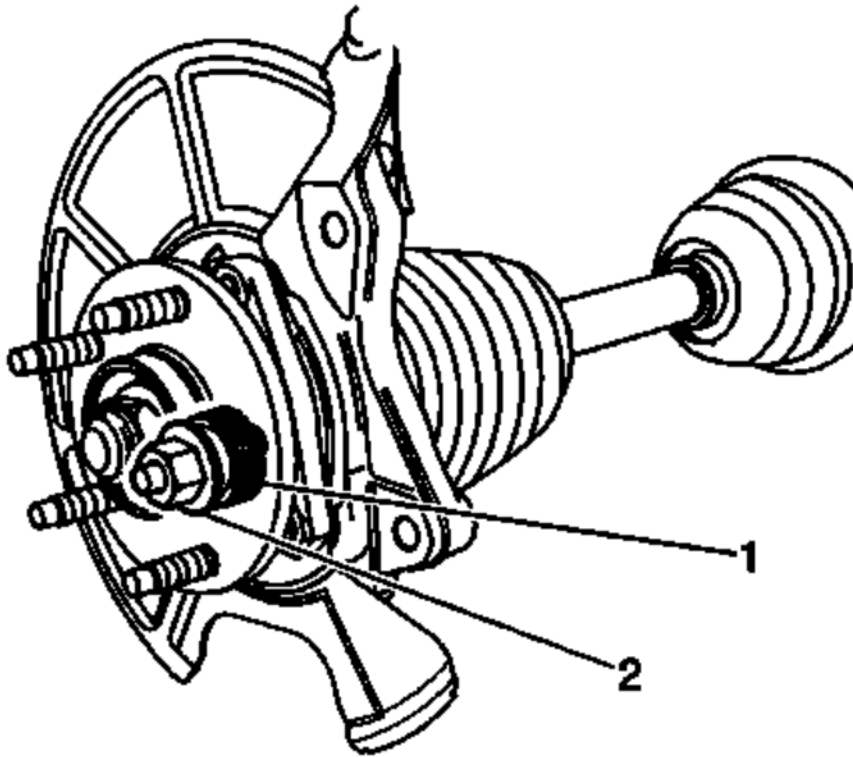


Fig. 8: Identifying Washers & Wheel Nut - 5-Stud Pattern
Courtesy of GENERAL MOTORS COMPANY

1. Install the NEW wheel stud in the front wheel bearing and hub assembly flange.
2. Position flat washers (1) and an old wheel nut (2) on the wheel stud.
3. Use a pry bar to prevent the front wheel bearing and hub assembly flange from turning.
4. Tighten the wheel nut (2) until the wheel stud is firmly seated in the front wheel bearing and hub assembly flange.
5. Remove the wheel nut (2) and the flat washers (1).
6. Install the front wheel bearing and hub assembly. Refer to **Front Wheel Bearing and Hub Replacement**.
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation**.
8. Lower the vehicle.

STRUT ASSEMBLY REMOVAL AND INSTALLATION

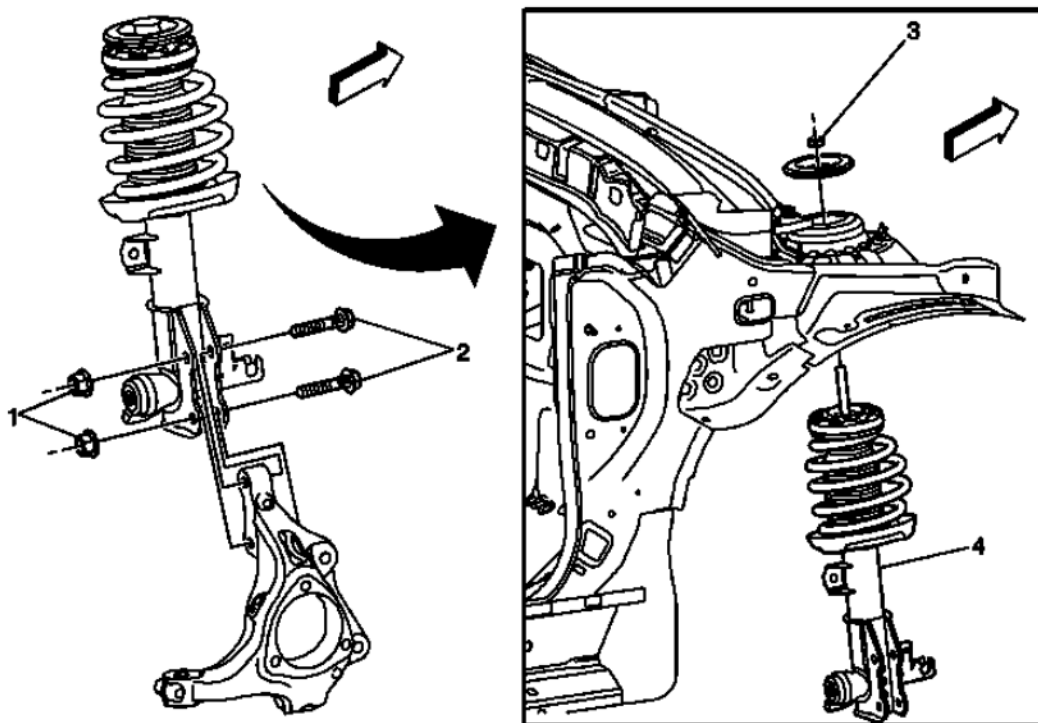


Fig. 9: Strut Assembly Components (GNA)
 Courtesy of GENERAL MOTORS COMPANY

Strut Assembly Removal and Installation

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. Disconnect the stabilizer shaft link from the strut assembly. Refer to <u>Stabilizer Shaft Link Replacement</u>.	
1	Steering Knuckle Nut (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Support the lower control arm with a jackstand. 2. If equipped, disconnect the front wheel speed sensor electrical connector from the strut assembly. Refer to <u>Front Wheel Speed Sensor Replacement</u> . 3. If equipped, remove the front brake hose, connector and clip from the bracket on the strut assembly.

	Tighten 85 N.m (63 lb ft) + 60 degrees
2	Steering Knuckle Bolt (Qty: 2) 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. Procedure Removed and discard the bolts. DO NOT re-use, replace with NEW only.
3	Front Suspension Strut Mount Nut Procedure 1. If equipped, remove the front suspension strut mount nut cap. 2. Use the CH-49375 wrench to remove and install the front suspension strut mount nut. NOTE: DO NOT tighten the front suspension strut mount nut to specification until the vehicle is completely on the ground. Tighten 55 N.m (41 lb ft) Special Tools CH-49375 Wrench For equivalent regional tools, refer to <u>Special Tools</u> .
4	Strut Assembly

SUSPENSION STRUT DISPOSAL

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

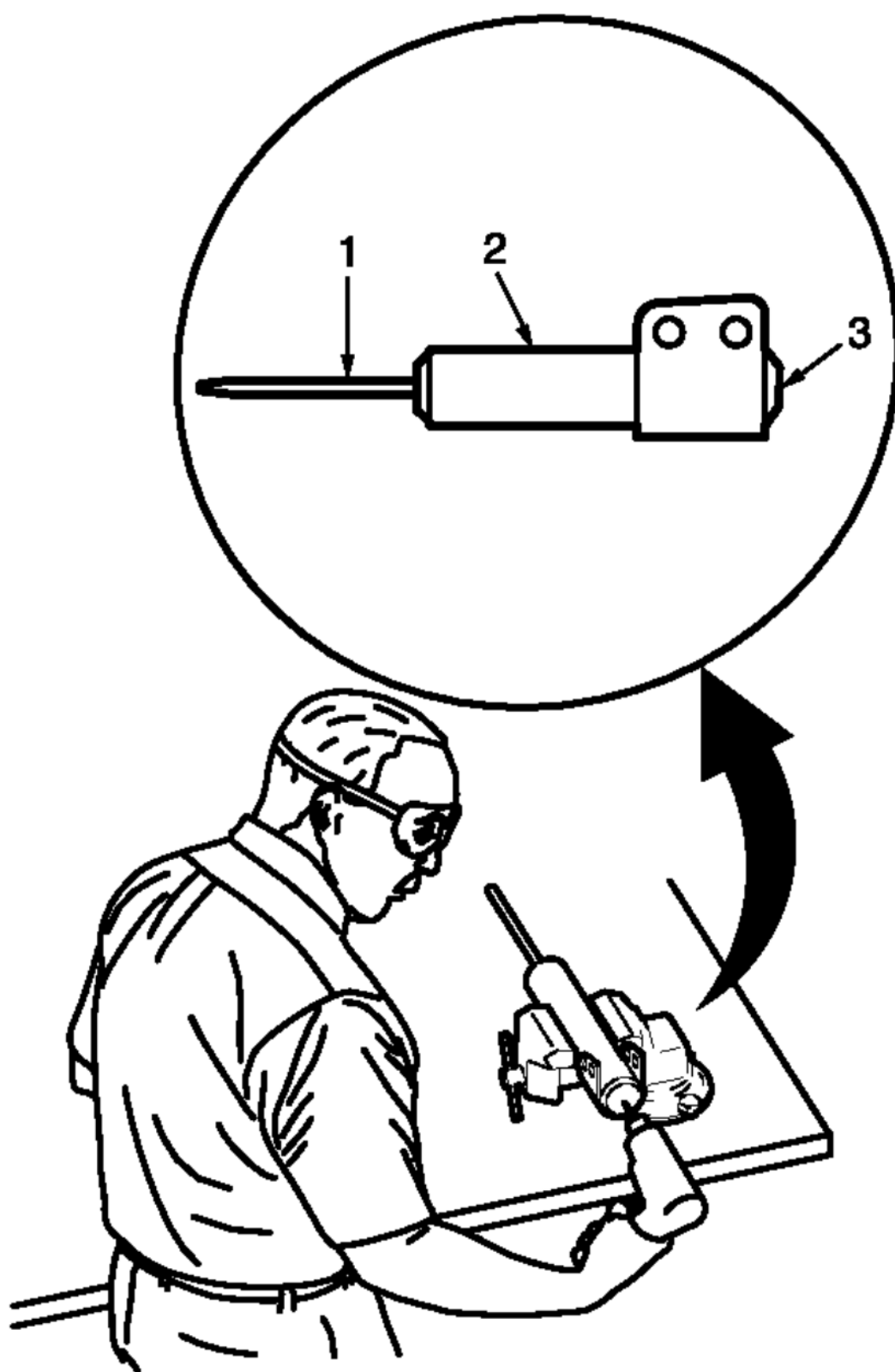


Fig. 10: Drilling Hole In Strut At Center Of End Cap

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

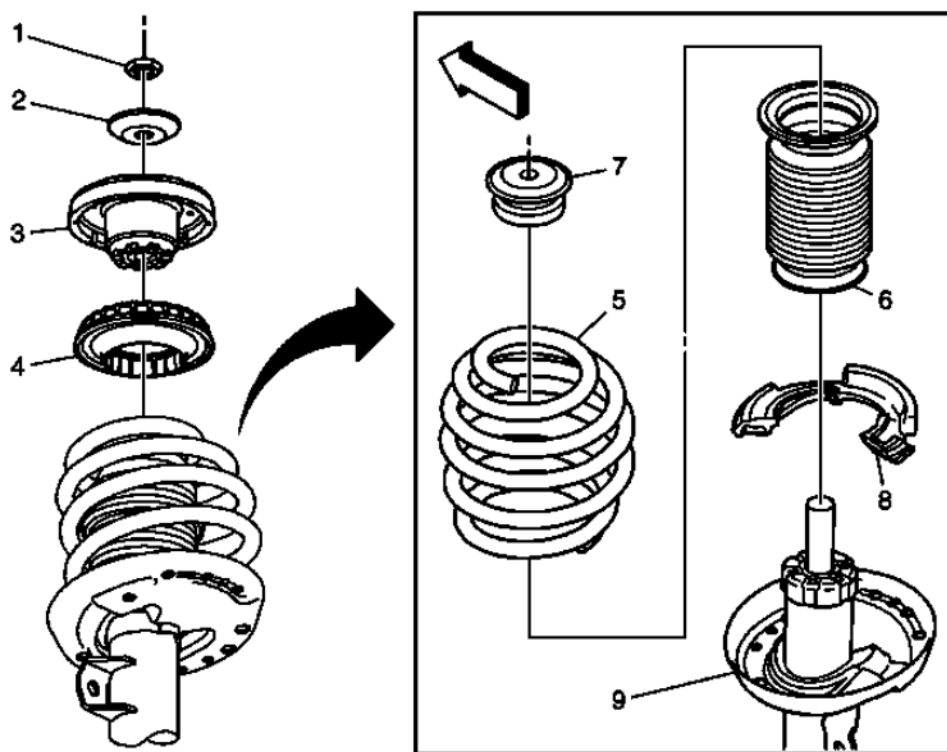


Fig. 11: Strut, Strut Components And Spring
Courtesy of GENERAL MOTORS COMPANY

Strut, Strut Component, or Spring Replacement

Callout	Component Name
WARNING: To prevent personal injury and/or component damage, use the proper tools to support and compress the coil spring prior to removal of the strut shaft nut when removing the coil spring. The coil spring is under extreme pressure and can become a projectile should the spring separate from the strut before all of the tension is relieved. Preliminary Procedure	

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the strut assembly. Refer to **Strut Assembly Removal and Installation**.

1	Front Suspension Strut Nut CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Use the CH-48845 compressor to compress the front strut assembly. 2. Use the CH-49375 spanner and a suitable tool to remove the front suspension strut nut. Tighten 70 (52 lb ft) Special Tool • CH-48845 Strut Spring Compressor • CH-49375 Spanner For equivalent regional tools, refer to <u>Special Tools</u>.
2	Front Suspension Strut Mount Washer
3	Front Suspension Strut Mount Insulator
4	Front Suspension Strut Mount Bearing
5	Front Spring
6	Front Shock Absorber Boot
7	Front Suspension Strut Bumper Inspect the strut bumper for the following: • Cracks or structural damage • Wetness from oil contamination • Loose fit to strut rod or excessive play from damage to the inner diameter retention fingers If any issues are noted, replace the front suspension strut bumper.
8	Front Spring Lower Insulator
9	Front Suspension Strut

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

The front MacPherson-type wheel suspension comprises a spring, damper and upper suspension strut pivot integrated in one unit. The lower part of this unit, a MacPherson strut, is connected to the steering swivel member.

In order to allow the MacPherson strut to rotate, the upper section contains a bearing which serves as the point of attachment for the MacPherson strut to the body.

The front suspension consists of the following parts:

- MacPherson strut
- Steering swivel member
- Link arm
- Wheel hub
- Anti-roll bar
- Anti-roll bar rod

GENERAL DESCRIPTION

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.

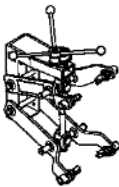
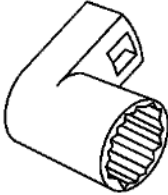
This up and down motion of the steering knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. This spring is retained under tension over the strut assembly. A strut is used in conjunction with this system in order to dampen out the oscillations of the coil spring. A 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-43631 J-43631 Ball Joint Separator
	CH-48845 Strut Spring Compressor
	CH-49375 Spanner
	GE-6600-2 MKM-6600-2 Torque Wrench

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• Final Pass	plus 100 Degrees	
Front Suspension Strut Mount Nut	55 N.m	41 lb ft
Front Suspension Strut Nut	70 N.m	52 lb ft
Front Wheel Bearing and Hub Assembly Bolt (1)		
• First Pass	100 N.m	74 lb ft
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Stabilizer Shaft Insulator Clamp Bolt (1)		
• First Pass	22 N.m	16 lb ft
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Stabilizer Shaft Link Nut	65 N.m	48 lb ft
Steering Knuckle Nut (at Lower Control Arm)		
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• Second Pass	loosen 120 Degrees	
• Third Pass	50 N.m	37 lb ft
• Final Pass	plus 45 Degrees	
Steering Knuckle Nut (at Strut Assembly)		
• First Pass	85 N.m	63 lb ft
• Final Pass	plus 60 Degrees	
1. Use NEW Fastener.		

REPAIR INSTRUCTIONS

STABILIZER SHAFT REPLACEMENT

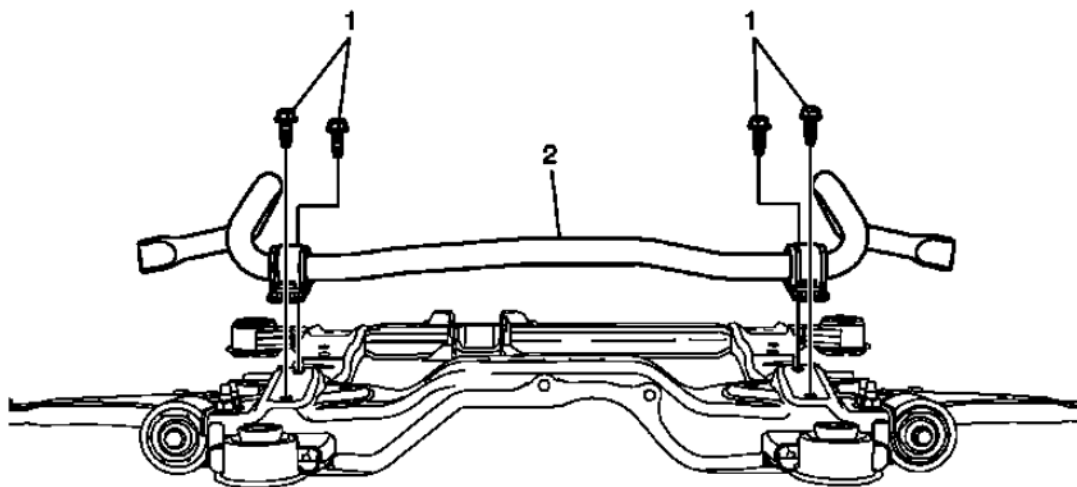


Fig. 1: Stabilizer Shaft & Clamp Bolts
Courtesy of GENERAL MOTORS COMPANY

Stabilizer Shaft Replacement

Callout	Component Name
Preliminary Procedure	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the tire and wheel assemblies. Refer to <u>Tire and Wheel Removal and Installation</u> . 3. Disconnect the stabilizer shaft links from the stabilizer shaft. Refer to <u>Stabilizer Shaft Link Replacement</u> . 4. Lower the rear of the drivetrain and front suspension frame to gain enough clearance to remove the stabilizer shaft. Refer to <u>Drivetrain and Front Suspension Frame Replacement</u> .	
	Stabilizer Shaft Insulator Clamp Bolt (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> . CAUTION: This vehicle is equipped with torque-to-yield or single use

1	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. Procedure Remove and discard the bolts. DO NOT reuse, replace with NEW only. Tighten 22 N.m (16 lb ft) + 30 degrees
2	Stabilizer Shaft

STABILIZER SHAFT LINK REPLACEMENT

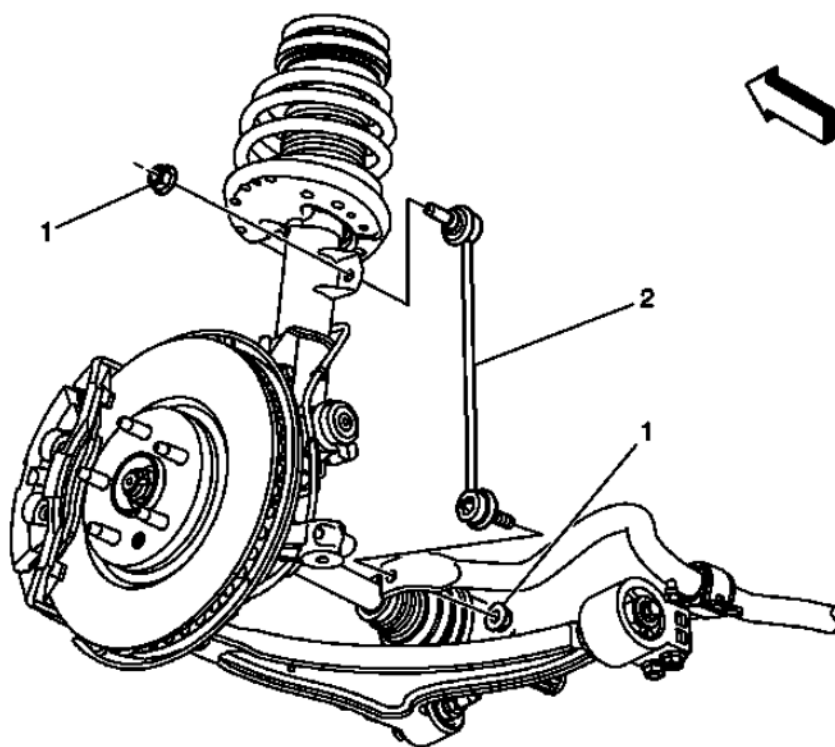


Fig. 2: Stabilizer Shaft Link And Nuts
Courtesy of GENERAL MOTORS COMPANY

Stabilizer Shaft Link Replacement

Callout	Component Name
Preliminary Procedure 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. Disconnect any harnesses or retainers secured to the stabilizer shaft link. Note any attaching points	

to aid in installation.

1	Stabilizer Shaft Link Nut (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 65 N.m (48 lb ft)
2	Stabilizer Shaft Link

STABILIZER SHAFT INSULATOR REPLACEMENT

The stabilizer shaft insulator is not serviced separately, but with the stabilizer shaft. For the stabilizer shaft replacement, refer to Stabilizer Shaft Replacement.

FRONT WHEEL BEARING AND HUB REPLACEMENT

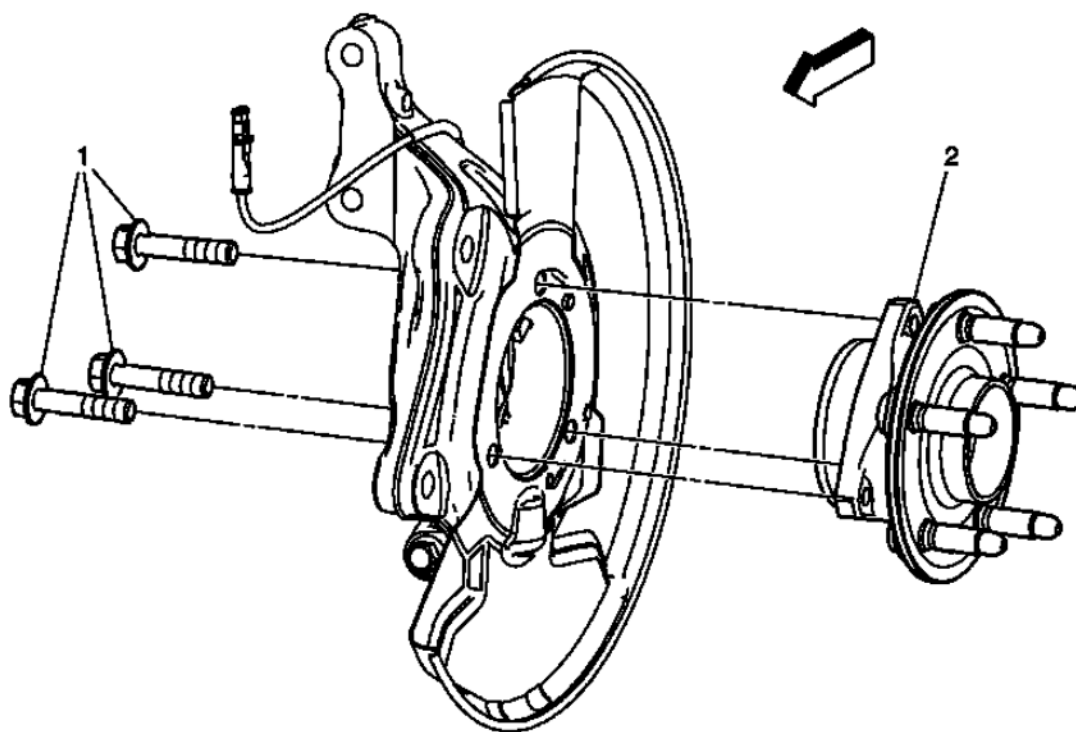


Fig. 3: Identifying Front Wheel Bearing, Hub & Bolts
 Courtesy of GENERAL MOTORS COMPANY

Front Wheel Bearing and Hub Replacement

Callous	Component Name
Preliminary Procedures	

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** .
4. Disconnect the front wheel drive shaft from the front wheel bearing and hub assembly. Refer to **Front Wheel Drive Shaft Replacement - Left Side** , or **Front Wheel Drive Shaft Replacement - Right Side** .

1	Front Wheel Bearing and Hub Assembly Bolt (Qty: 3) CAUTION: Refer to <u>Fastener Caution</u> . 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. Procedure Remove and discard the bolts. DO NOT re-use, replace with NEW only. Tighten 100 N.m (74 lb ft) + 75 degrees
2	Front Wheel Bearing and Hub Assembly

STEERING KNUCKLE REPLACEMENT

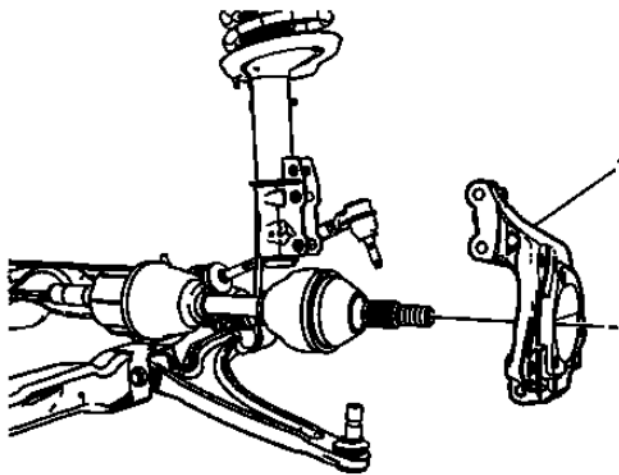


Fig. 4: View Of Steering Knuckle
Courtesy of GENERAL MOTORS COMPANY

Steering Knuckle Replacement

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 wheel bearing and hub assembly. Refer to <u>Front Wheel Bearing and Hub Replacement</u>.	
1	Steering Knuckle CAUTION: Do not pry in such a way that the ball joint seal is contacted. Damage to the seal may result. Procedure 1. Disconnect the steering linkage outer tie rod from the steering knuckle. Refer to <u>Steering Linkage Outer Tie Rod Replacement</u> . 2. Disconnect the strut assembly from the steering knuckle. Refer to <u>Strut Assembly Removal and Installation</u>. 3. Disconnect the lower control arm from the steering knuckle. Refer to <u>Lower Control Arm Replacement</u>.

LOWER CONTROL ARM REPLACEMENT

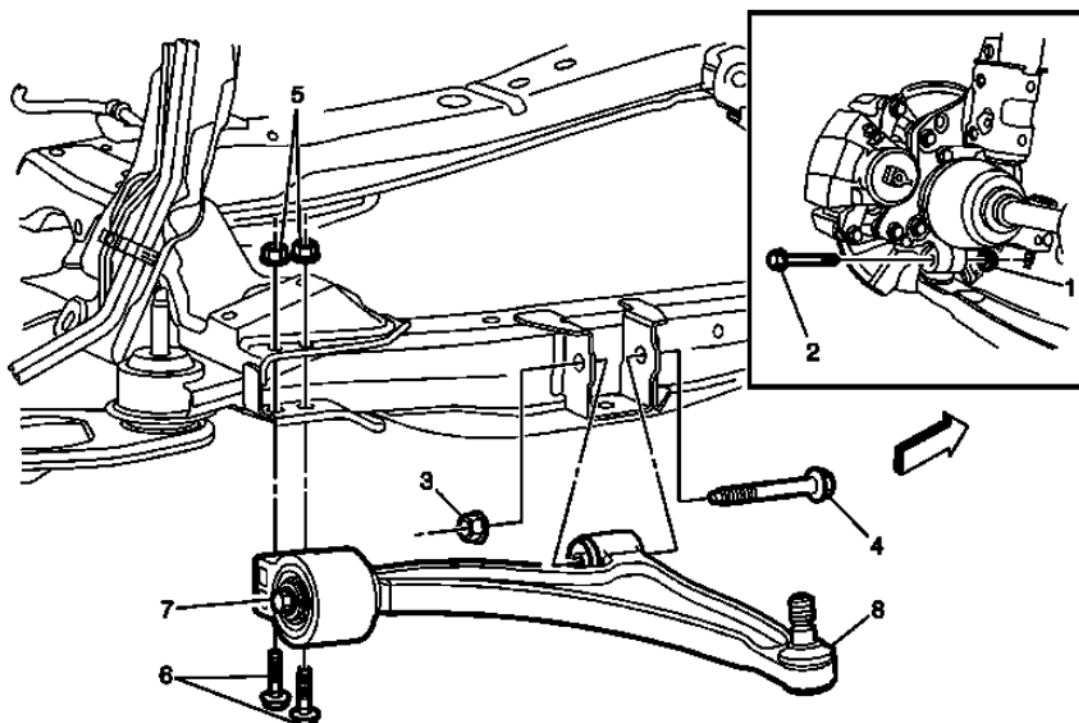


Fig. 5: Lower Control Arm (GNA)
 Courtesy of GENERAL MOTORS COMPANY

Lower Control Arm Replacement

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> .	
1	Steering Knuckle Nut CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Support the knuckle with the proper jack stand. 2. Using a suitable tool, open the pinch joint on the steering knuckle and disconnect the lower control arm ball joint from the knuckle. Tighten 1. Tighten the nut to 50 N.m (37 lb ft). 2. Loosen the nut to 120 degrees. 3. Tighten the nut to 50 N.m (37 lb ft) + 45 degrees.
2	Steering Knuckle Bolt 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. Procedure Discard the bolt. DO NOT re-use, replace with NEW.
3	Front Lower Control Arm Front Nut 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.

	Procedure Discard the nut. DO NOT re-use, replace with NEW.
4	Front Lower Control Arm Front Bolt 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. Procedure Discard the bolt. DO NOT re-use, replace with NEW. Tighten 100 N.m (74 lb ft) + 90 degrees
5	Front Lower Control Arm Rear Nut (Qty: 2)
6	Front Lower Control Arm Rear Bolt (Qty: 2) 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. Procedure Discard the bolt. DO NOT re-use, replace with NEW. Tighten 100 N.m (74 lb ft) + 90 degrees
7	Front Lower Control Arm Rear Bushing Bolt 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. Procedure 1. Discard the bolt. DO NOT re-use, replace with NEW. 2. Load the front suspension with the proper jackstand before tightening the bolt to specification. 3. Use the GE-6600-2 wrench to tighten the NEW bolt to specification.

	Tighten 55 N.m (41 lb ft) + 100 degrees Special Tools GE-6600-2 Torque Wrench For equivalent regional tools. Refer to Special Tools .
8	Front Lower Control Arm Procedure Verify the wheel alignment. Refer to Wheel Alignment Specifications .

FRONT LOWER CONTROL ARM REAR BUSHING REPLACEMENT

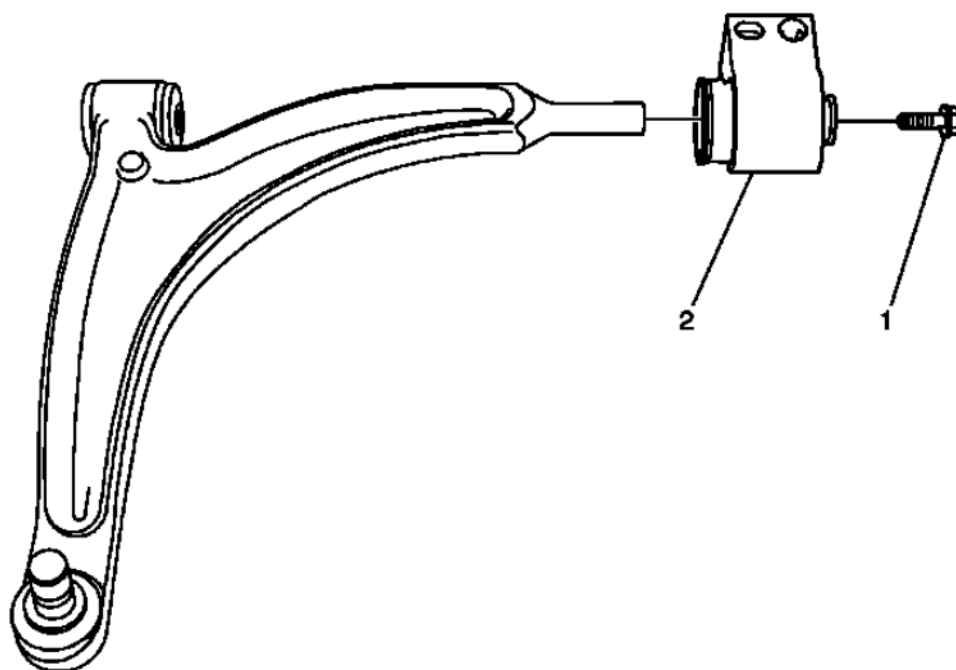


Fig. 6: Front Lower Control Arm Rear Bushing & Bolt
Courtesy of GENERAL MOTORS COMPANY

Front Lower Control Arm Rear 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 assembly. Refer to Tire and Wheel Removal and Installation . 3. Remove the lower control arm. Refer to Lower Control Arm Replacement .	
	Front Lower Control Arm Rear Bushing Bolt

1	CAUTION: Refer to <u>Fastener Caution</u> . 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. Procedure Discard the bolt. DO NOT re-use, replace with NEW. NOTE: Tighten the bolt with the vehicle at ride height. Tighten 55 N.m (41 lb ft) + 100 degrees
2	Front Lower Control Arm Rear Bushing

WHEEL STUD REPLACEMENT

Special Tools

CH-43631 Ball Joint Remover

For equivalent regional tools, refer to Special Tools.

Removal Procedure

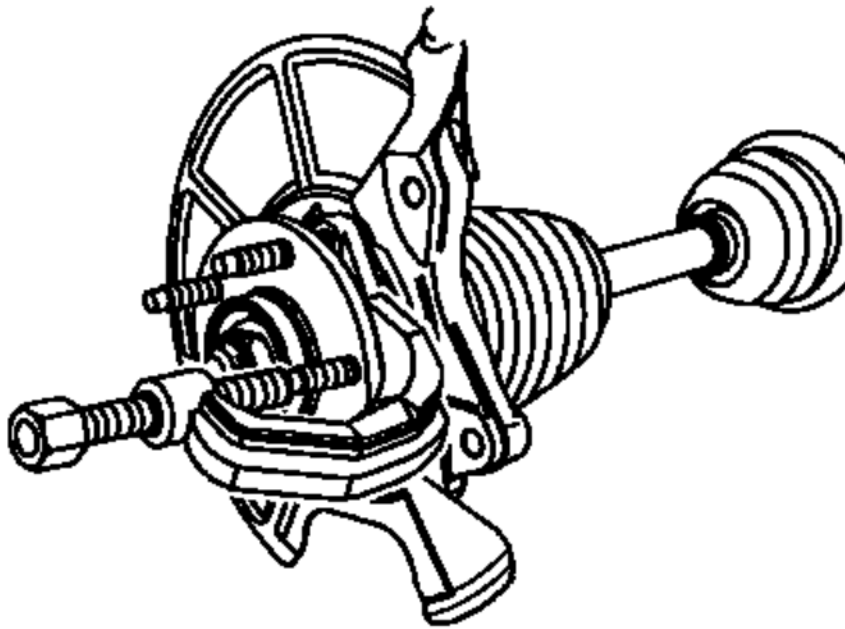


Fig. 7: Identifying Wheel Stud - 5-Stud Pattern
Courtesy of GENERAL MOTORS COMPANY

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 wheel bearing and hub assembly. Refer to **Front Wheel Bearing and Hub Replacement**.
4. Use the **CH-43631** remover to release the wheel stud from the front wheel bearing and hub assembly. Discard the stud.

Installation Procedure

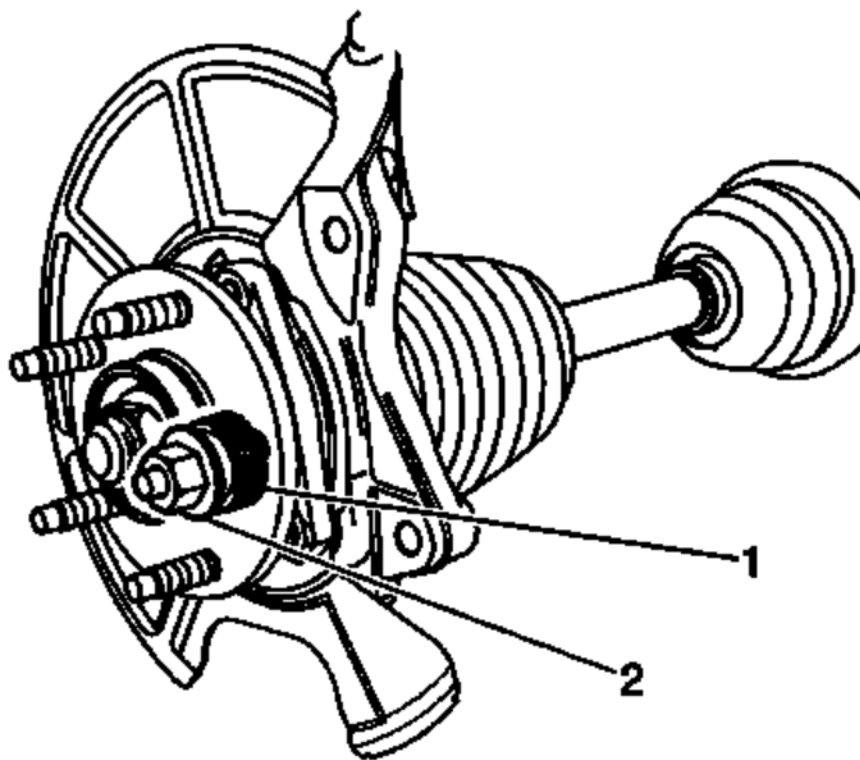


Fig. 8: Identifying Washers & Wheel Nut - 5-Stud Pattern
Courtesy of GENERAL MOTORS COMPANY

1. Install the NEW wheel stud in the front wheel bearing and hub assembly flange.
2. Position flat washers (1) and an old wheel nut (2) on the wheel stud.
3. Use a pry bar to prevent the front wheel bearing and hub assembly flange from turning.
4. Tighten the wheel nut (2) until the wheel stud is firmly seated in the front wheel bearing and hub assembly flange.
5. Remove the wheel nut (2) and the flat washers (1).
6. Install the front wheel bearing and hub assembly. Refer to **Front Wheel Bearing and Hub Replacement**.
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation**.
8. Lower the vehicle.

STRUT ASSEMBLY REMOVAL AND INSTALLATION

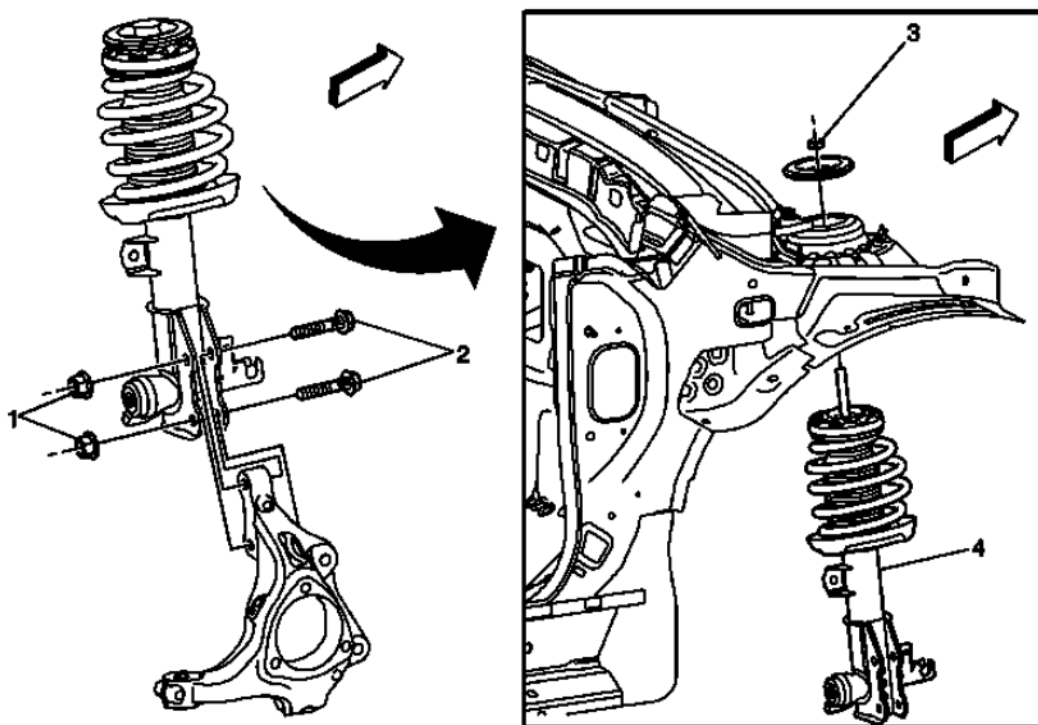


Fig. 9: Strut Assembly Components (GNA)
 Courtesy of GENERAL MOTORS COMPANY

Strut Assembly Removal and Installation

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. Disconnect the stabilizer shaft link from the strut assembly. Refer to <u>Stabilizer Shaft Link Replacement</u> .	
1	Steering Knuckle Nut (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Support the lower control arm with a jackstand. 2. If equipped, disconnect the front wheel speed sensor electrical connector from the strut assembly. Refer to <u>Front Wheel Speed Sensor Replacement</u> . 3. If equipped, remove the front brake hose, connector and clip from the bracket on the strut assembly.

	Tighten 85 N.m (63 lb ft) + 60 degrees
2	Steering Knuckle Bolt (Qty: 2) 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. Procedure Removed and discard the bolts. DO NOT re-use, replace with NEW only.
3	Front Suspension Strut Mount Nut Procedure 1. If equipped, remove the front suspension strut mount nut cap. 2. Use the CH-49375 wrench to remove and install the front suspension strut mount nut. NOTE: DO NOT tighten the front suspension strut mount nut to specification until the vehicle is completely on the ground. Tighten 55 N.m (41 lb ft) Special Tools CH-49375 Wrench For equivalent regional tools, refer to Special Tools .
4	Strut Assembly

SUSPENSION STRUT DISPOSAL

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

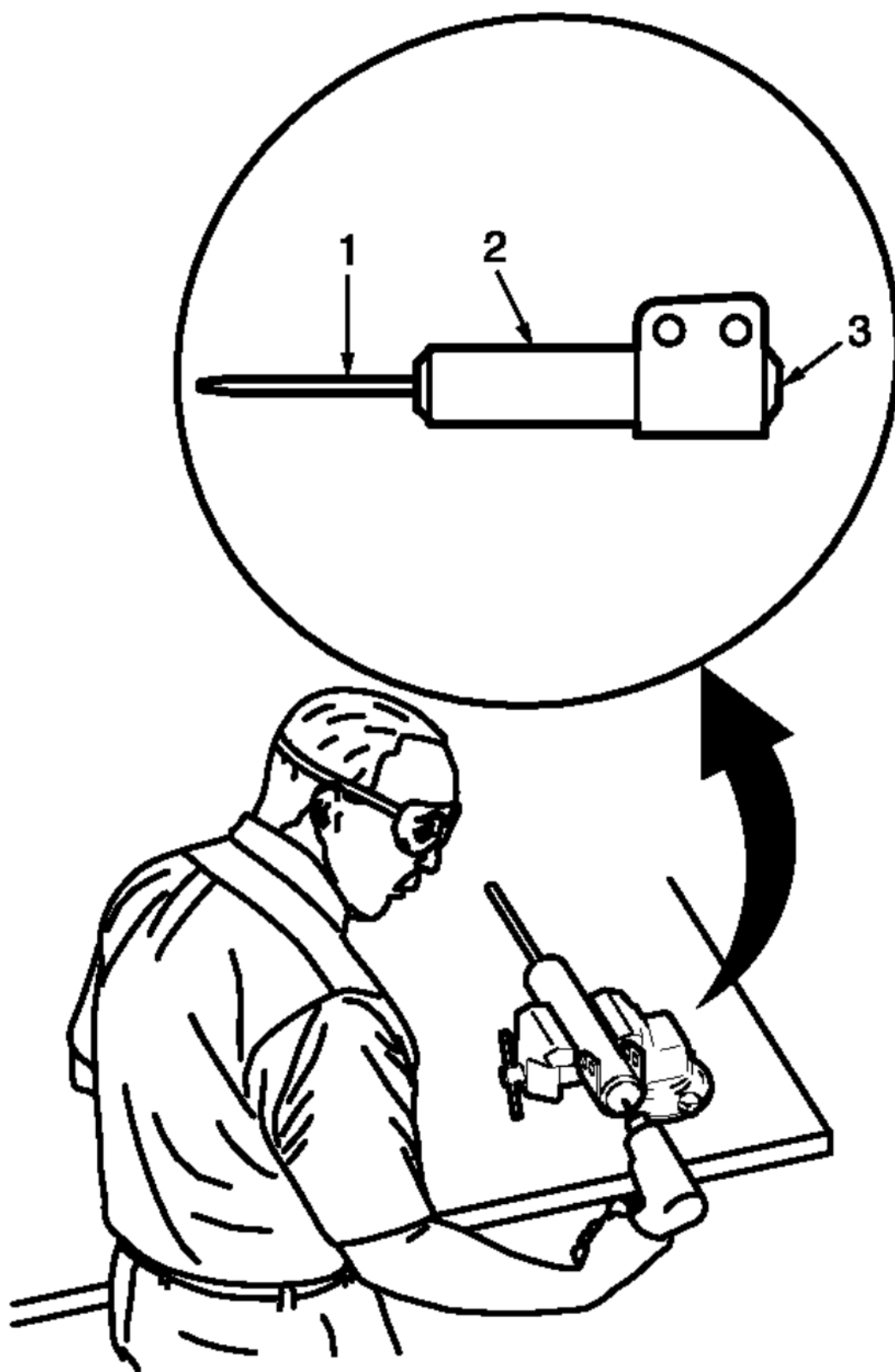


Fig. 10: Drilling Hole In Strut At Center Of End Cap

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

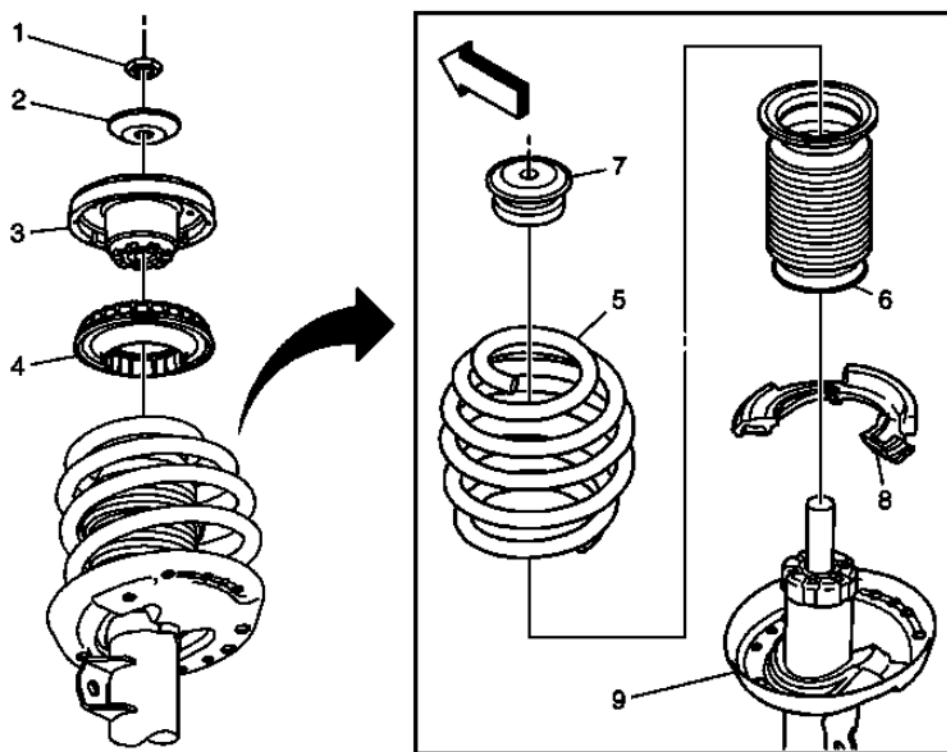


Fig. 11: Strut, Strut Components And Spring
Courtesy of GENERAL MOTORS COMPANY

Strut, Strut Component, or Spring Replacement

Callout	Component Name
WARNING: To prevent personal injury and/or component damage, use the proper tools to support and compress the coil spring prior to removal of the strut shaft nut when removing the coil spring. The coil spring is under extreme pressure and can become a projectile should the spring separate from the strut before all of the tension is relieved. Preliminary Procedure	

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</u> .	
1	Front Suspension Strut Nut CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Use the CH-48845 compressor to compress the front strut assembly. 2. Use the CH-49375 spanner and a suitable tool to remove the front suspension strut nut. Tighten 70 (52 lb ft) Special Tool • CH-48845 Strut Spring Compressor • CH-49375 Spanner For equivalent regional tools, refer to <u>Special Tools</u>.
2	Front Suspension Strut Mount Washer
3	Front Suspension Strut Mount Insulator
4	Front Suspension Strut Mount Bearing
5	Front Spring
6	Front Shock Absorber Boot
7	Front Suspension Strut Bumper Inspect the strut bumper for the following: • Cracks or structural damage • Wetness from oil contamination • Loose fit to strut rod or excessive play from damage to the inner diameter retention fingers If any issues are noted, replace the front suspension strut bumper.
8	Front Spring Lower Insulator
9	Front Suspension Strut

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

The front MacPherson-type wheel suspension comprises a spring, damper and upper suspension strut pivot integrated in one unit. The lower part of this unit, a MacPherson strut, is connected to the steering swivel member.

In order to allow the MacPherson strut to rotate, the upper section contains a bearing which serves as the point of attachment for the MacPherson strut to the body.

The front suspension consists of the following parts:

- MacPherson strut
- Steering swivel member
- Link arm
- Wheel hub
- Anti-roll bar
- Anti-roll bar rod

GENERAL DESCRIPTION

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.

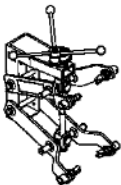
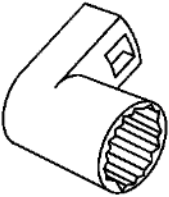
This up and down motion of the steering knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. This spring is retained under tension over the strut assembly. A strut is used in conjunction with this system in order to dampen out the oscillations of the coil spring. A 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-43631 J-43631 Ball Joint Separator
	CH-48845 Strut Spring Compressor
	CH-49375 Spanner
	GE-6600-2 MKM-6600-2 Torque Wrench