

2004 SUSPENSION

Front Suspension - Vue

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Ball Joint to Control Arm Bolt and Nut	68 N.m	50 lb ft
Brake Bracket Bolt	15 N.m	11 lb ft
Control Arm to Frame Front Bolt	200 N.m	148 lb ft
Control Arm to Frame Rear Nuts	70 N.m	52 lb ft
Lower Control Arm Ball Stud Nut (Ball Stud with Silver Cup on Bottom)	60 N.m	44 lb ft
Lower Control Arm Ball Stud Nut (Ball Stud with Bottom Flat and Black)	40 N.m	30 lb ft
Rear Bushing to Lower Control Arm Nut	115 N.m	85 lb ft
Stabilizer Bar Clamp Bolt	50 N.m	37 lb ft
Stabilizer Link Nuts	65 N.m	48 lb ft
Strut Shaft Nut	75 N.m	55 lb ft
Strut to Body Nuts and Bolts	25 N.m	18 lb ft
Strut to Steering Knuckle Bolt and Nut	180 N.m	133 lb ft
Tie Rod Retention Nut	50 N.m	37 lb ft
Wheel Bearing/Hub Mounting Bolt	130 N.m	96 lb ft
Wheel Drive Shaft Spindle Nut	205 N.m	157 lb ft

REPAIR INSTRUCTIONS

STABILIZER SHAFT REPLACEMENT

Tools Required

- **J 44015** Steering Linkage Installer
- **SA91100C** Tie Rod Separator

Removal Procedure

1. Turn the front to the full right position.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Remove the front tire and wheels. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

4. If equipped with a 2.2L (L61) engine, remove the front exhaust pipe. Refer to **Exhaust Manifold Pipe Replacement (L66)** or **Exhaust Manifold Pipe Replacement (L61)** in Engine Exhaust.

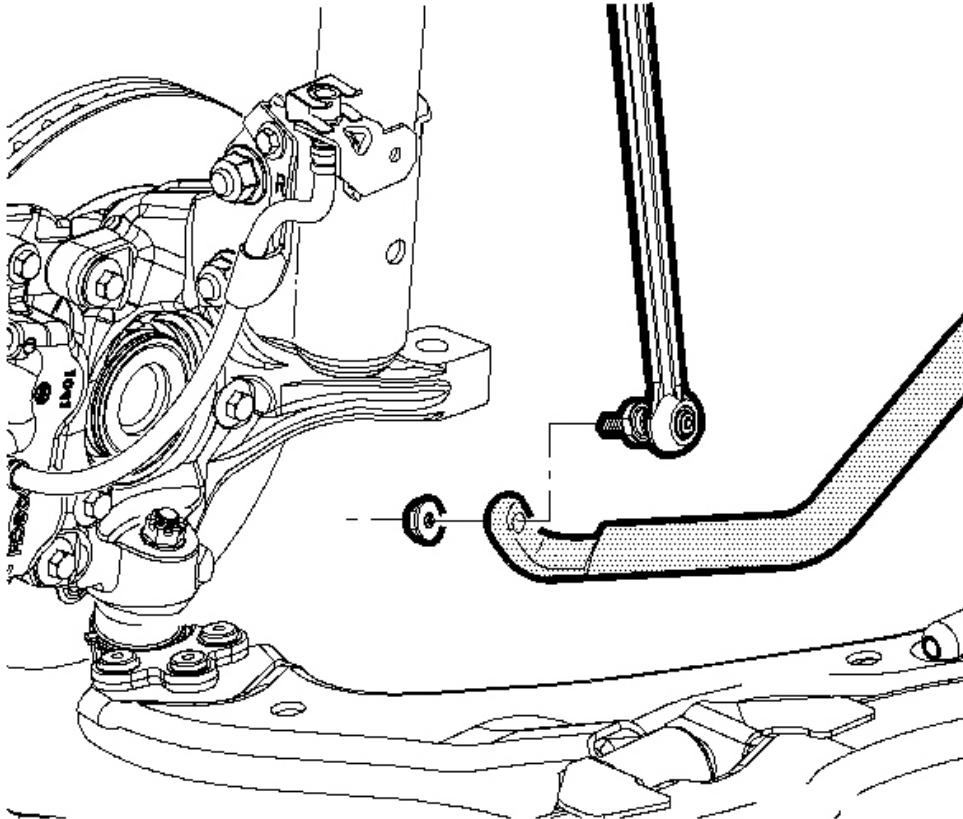


Fig. 1: Locating Rod & Bar
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the stabilizer link from the stabilizer bar.
6. Remove the left outer tie rod to steering knuckle nut. Discard the nut.

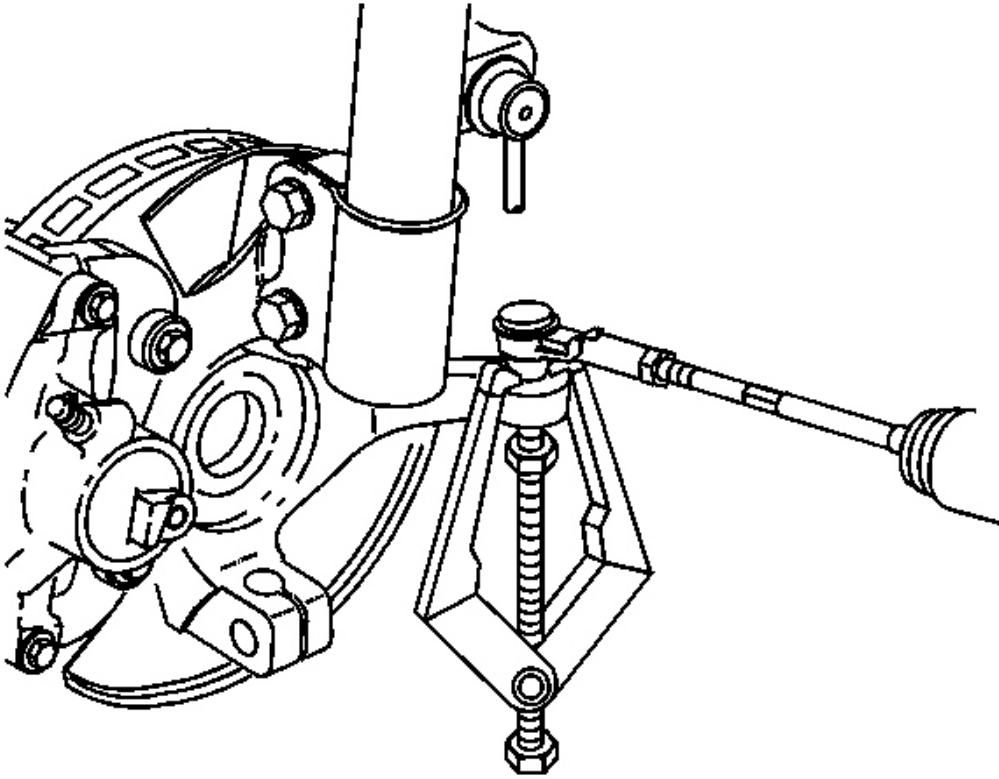


Fig. 2: Outer Tie Rod & Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

7. Using the SA91100C , separate the outer tie rod from the steering knuckle.

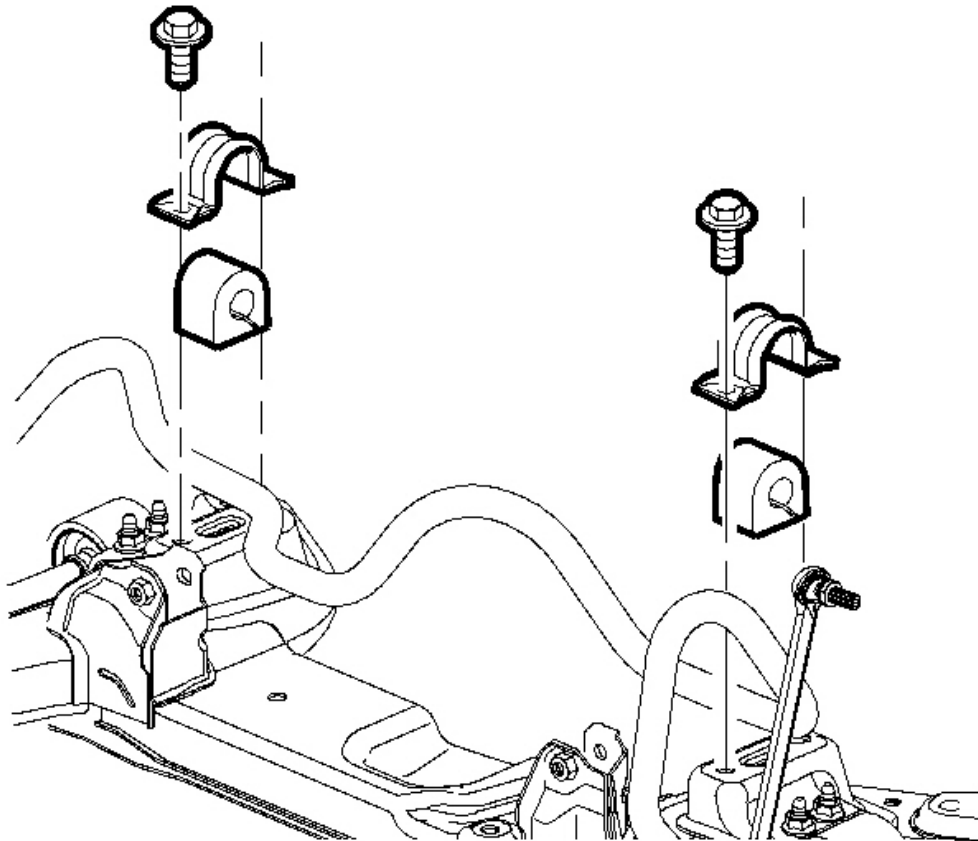


Fig. 3: Stabilizer Bar Clamp & Cradle Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the stabilizer bar clamp to cradle bolts.
9. Remove the stabilizer bar clamps and bushings from the stabilizer bar.

IMPORTANT: Take care not to catch the transmission shift cable or left wheel house plastic trim when removing the stabilizer bar.

10. Remove the stabilizer bar from the vehicle through the left wheel opening.

Installation Procedure

IMPORTANT: Take care not to catch the transmission shift cable or left wheel house plastic trim when installing the stabilizer bar.

1. Install the stabilizer bar to the vehicle through the left wheel opening.

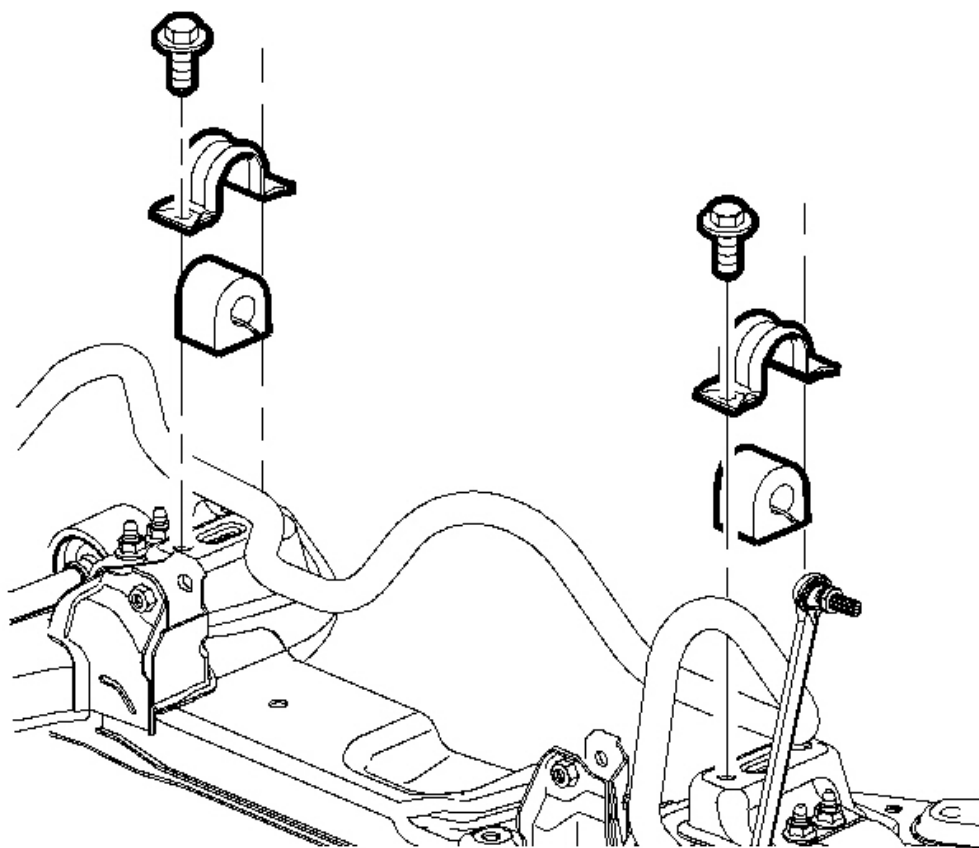


Fig. 4: Stabilizer Bar Clamp & Cradle Bolts
Courtesy of GENERAL MOTORS CORP.

2. Install the stabilizer bar clamps and bushings to the stabilizer bar.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the stabilizer bar clamp bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

4. Inspect the stabilizer link boots for damage and replace the stabilizer link if needed.

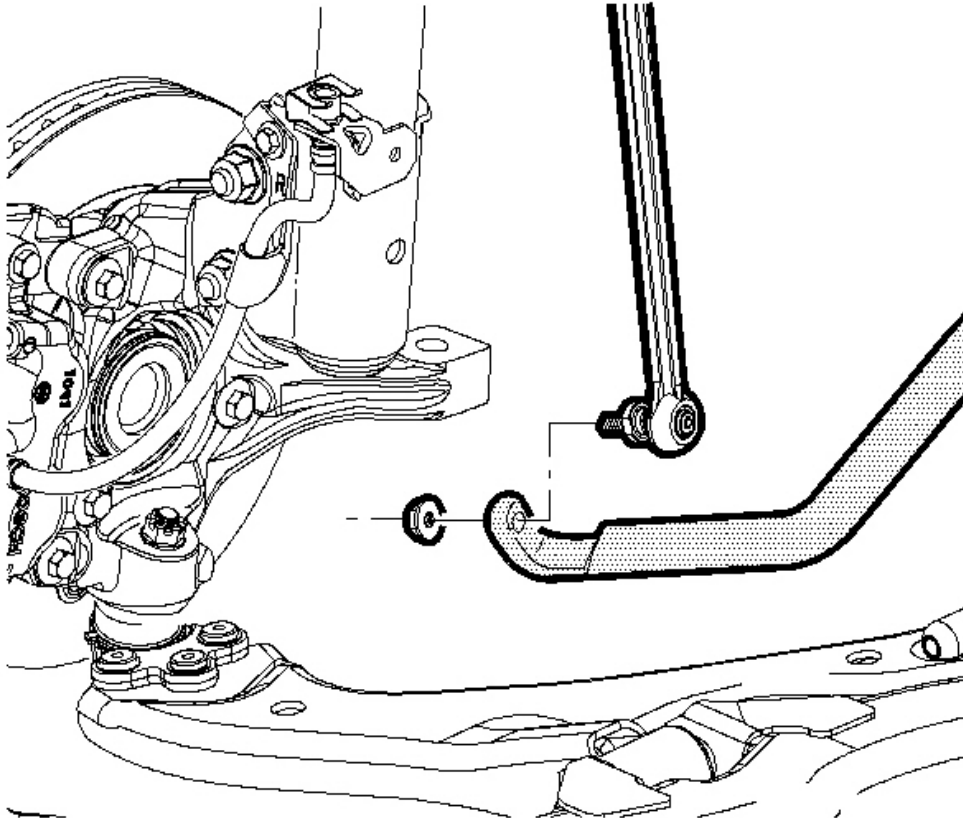


Fig. 5: Locating Rod & Bar
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Hold the ball stud when tightening the nut.

5. Connect the stabilizer links to the stabilizer bar. Do not allow the boot to twist.

Tighten: Tighten the bar to link nut to 65 N.m (48 lb ft).

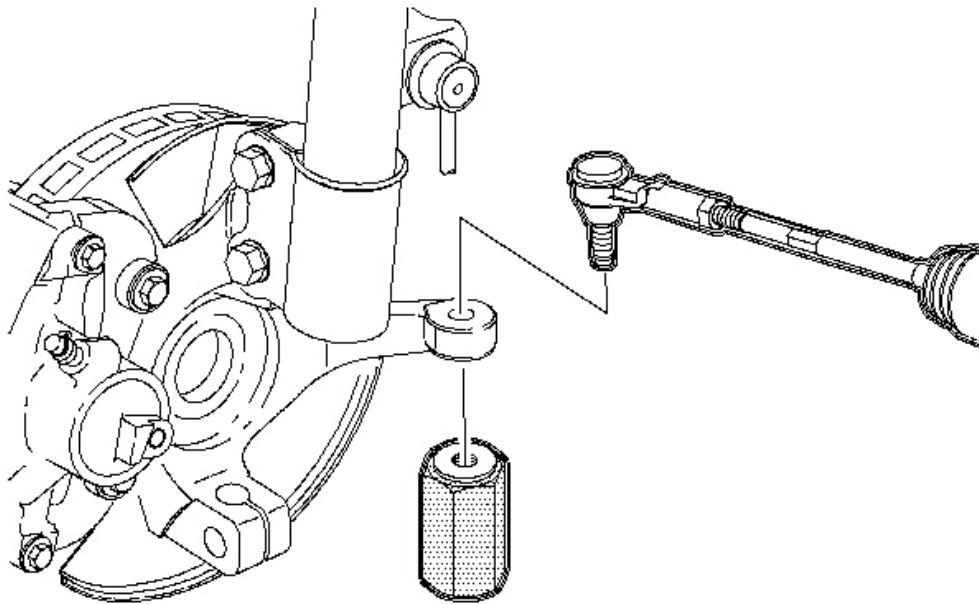


Fig. 6: Left Outer Tie Rod & Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

6. Connect the left outer tie rod to the steering knuckle.
7. Use the **J 44015** to seat the ball stud taper to 40 N.m (30 lb ft).
8. Remove the **J 44015**.
9. Install a new tie rod retention nut.

Tighten: Tighten the nut to 50 N.m (37 lb ft).

10. If equipped with a 2.2L (L61) engine, install the front exhaust pipe. Refer to **Exhaust Manifold Pipe Replacement (L66)** or **Exhaust Manifold Pipe Replacement (L61)** in Engine Exhaust.
11. Install the front tire and wheels. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
12. Lower the vehicle.

STABILIZER SHAFT LINK REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

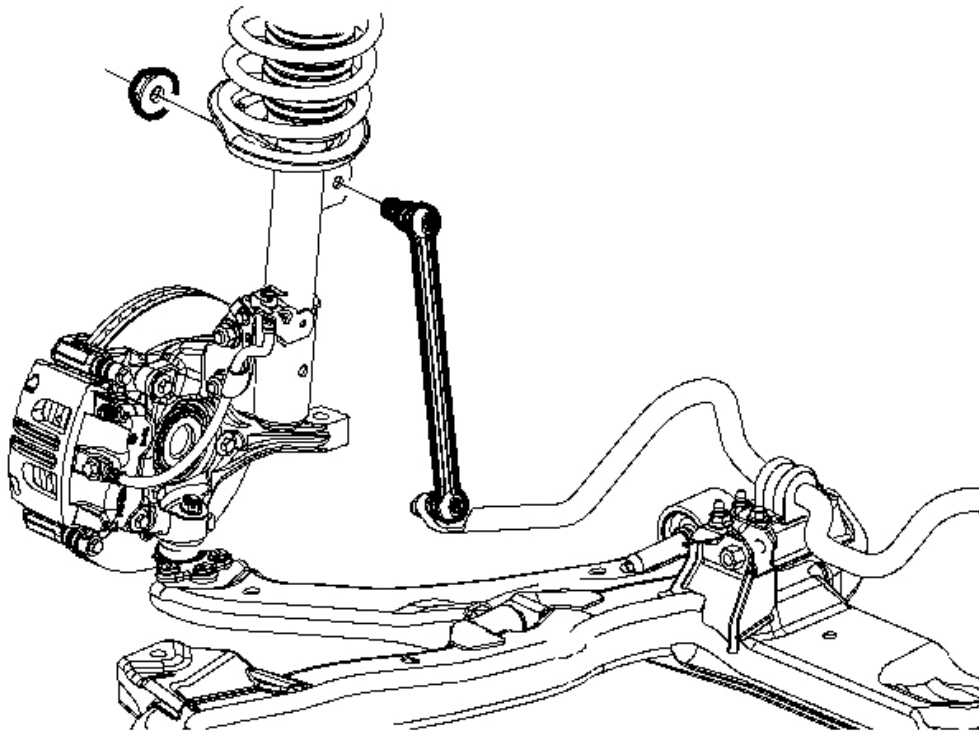


Fig. 7: Stabilizer Link & Strut Nut
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not allow the stabilizer link ball stud to rotate while removing the link nut.

3. Remove the stabilizer link to strut nut.

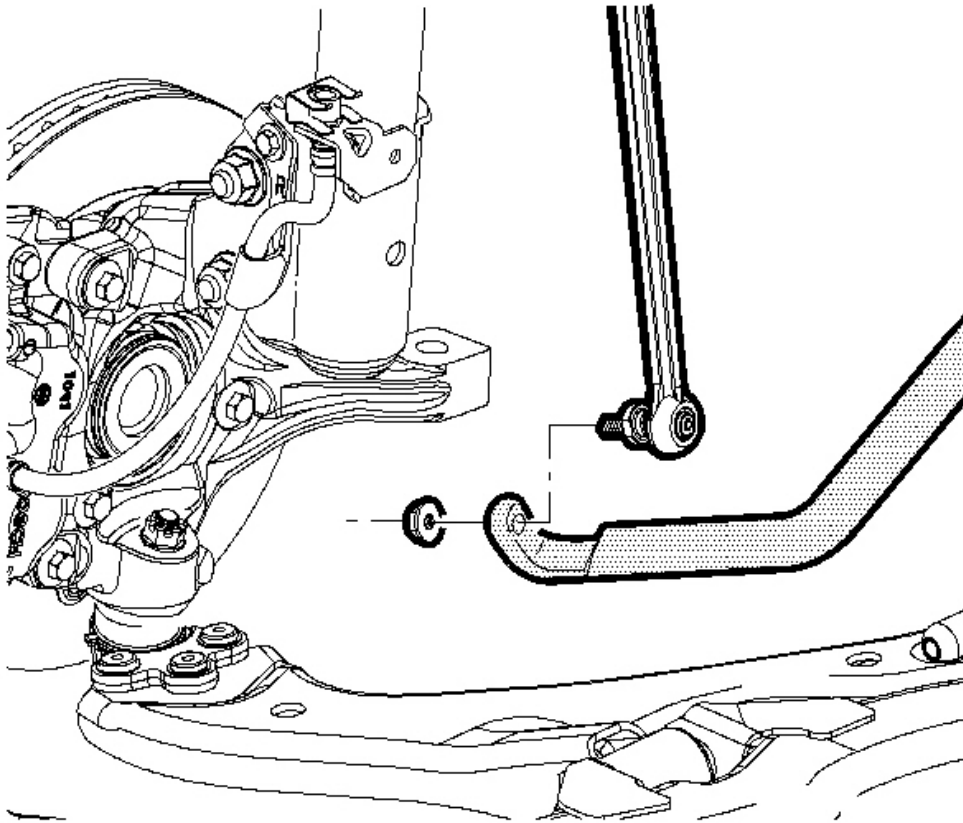


Fig. 8: Locating Rod & Bar
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not allow the stabilizer link ball stud to rotate while removing the link nut.

4. Remove the stabilizer link to stabilizer bar nut.
5. Remove the stabilizer link.

Installation Procedure

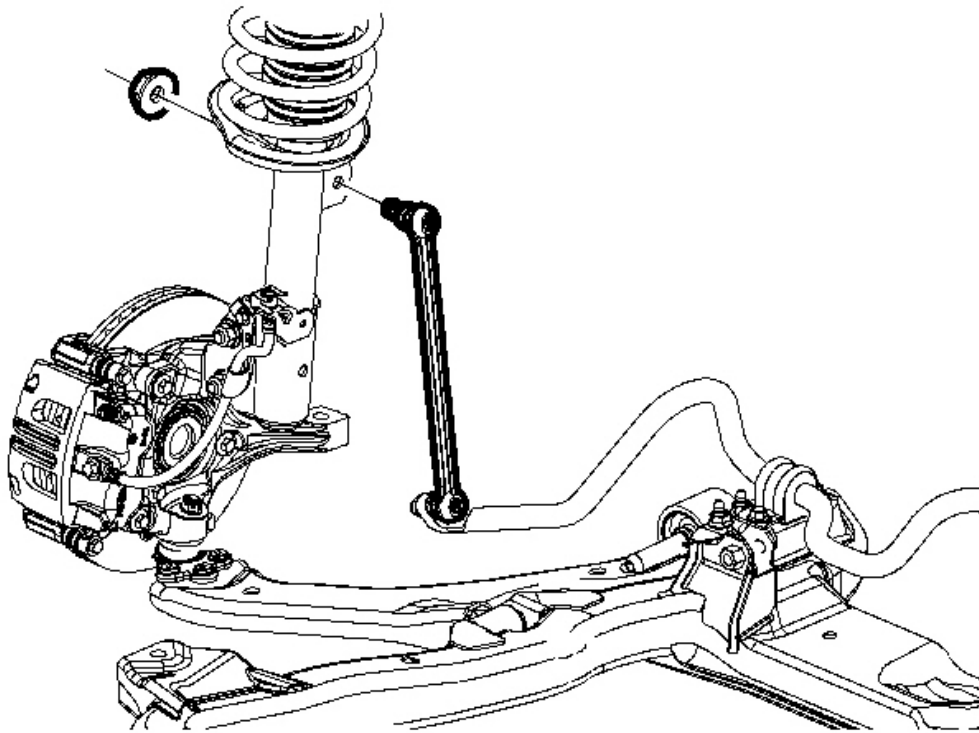


Fig. 9: Stabilizer Link & Strut Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT: Do not allow the stabilizer link ball stud to rotate while installing the link nut.

1. Connect the stabilizer link to the strut.

Tighten: Tighten the nut to 65 N.m (48 lb ft).

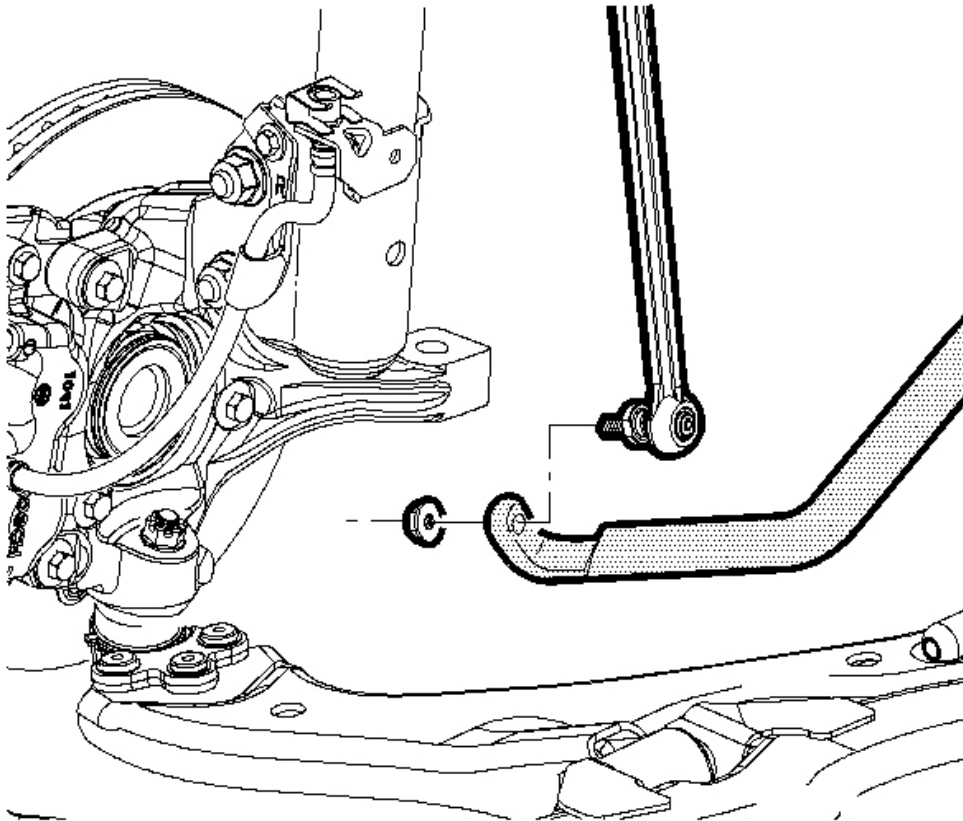


Fig. 10: Locating Rod & Bar
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not allow the stabilizer link ball stud to rotate while installing the link nut.

2. Connect the stabilizer link to the stabilizer bar.

Tighten: Tighten the nut to 65 N.m (48 lb ft).

3. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
4. Lower the vehicle.

STABILIZER SHAFT INSULATOR REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

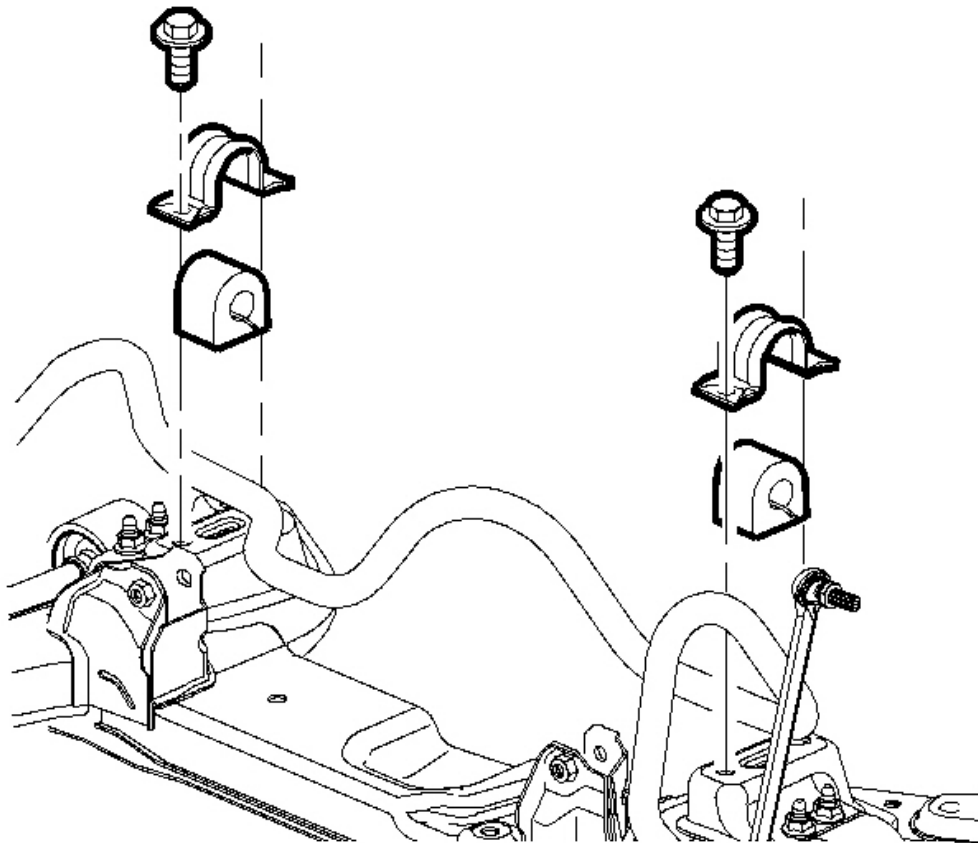


Fig. 11: Stabilizer Bar Clamp & Cradle Bolts
Courtesy of GENERAL MOTORS CORP.

2. Remove the stabilizer bar clamp to cradle bolts.
3. Remove the stabilizer bar clamps and bushings from the stabilizer bar.

Installation Procedure

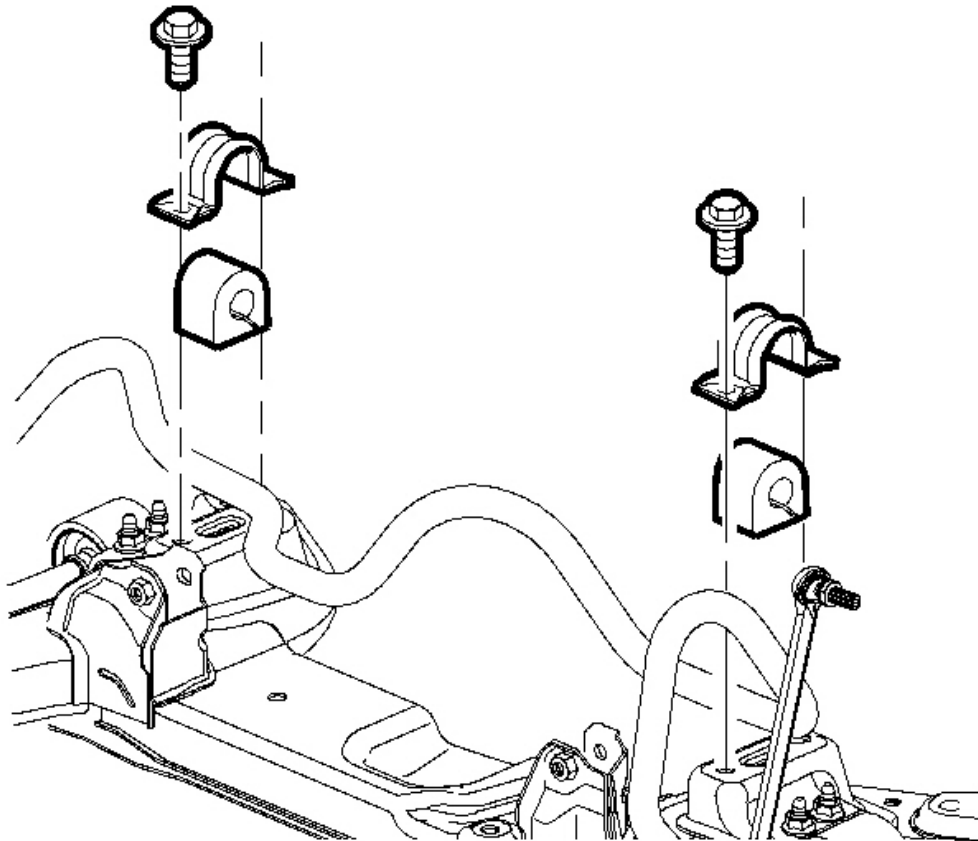


Fig. 12: Stabilizer Bar Clamp & Cradle Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the stabilizer bar clamps and bushings to the stabilizer bar.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the stabilizer bar clamp to cradle bolts.

Tighten: Tighten the bolts to 50 N.m (37 lb ft).

3. Lower the vehicle.

STABILIZER SHAFT STOP RING REPLACEMENT

Tools Required

J-45646 Stabilizer Bar Collar Installer. See Special Tools and Equipment .

Removal Procedure

CAUTION: Refer to Vehicle Lifting Caution in Cautions and Notices.

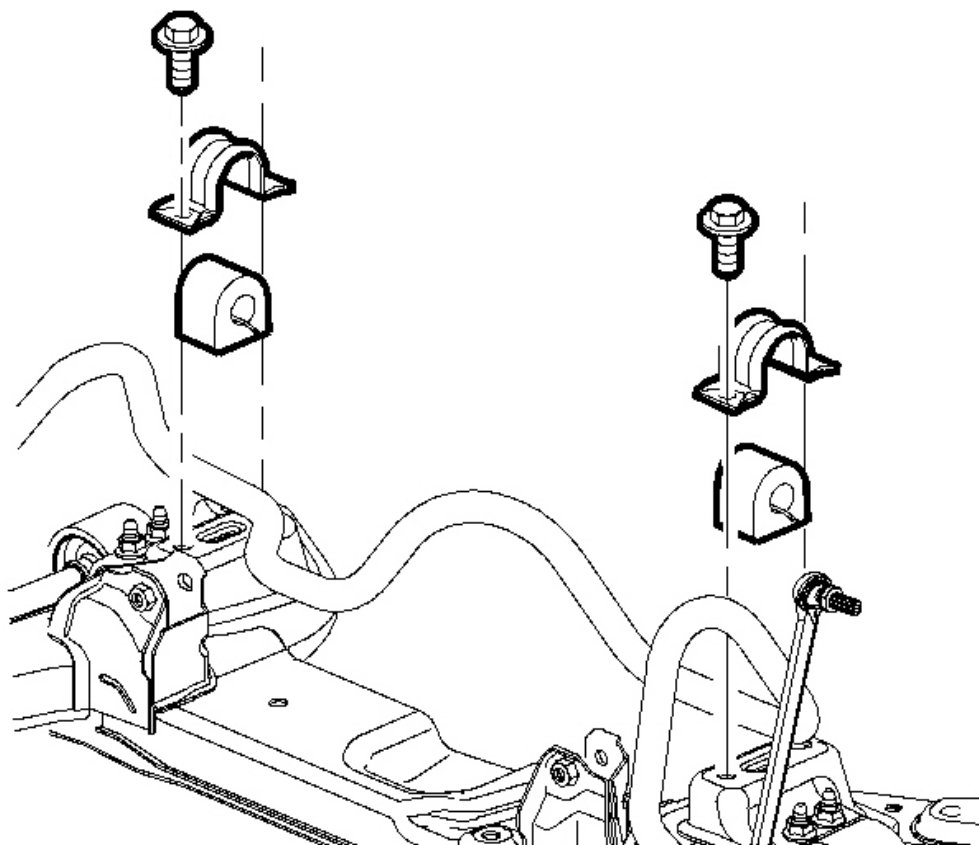


Fig. 13: Stabilizer Bar Clamp & Cradle Bolts
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle on a hoist.
2. Remove the left side stabilizer bar clamp-to-cradle bolts.
3. Remove the left side stabilizer clamp and bushing from the stabilizer bar.

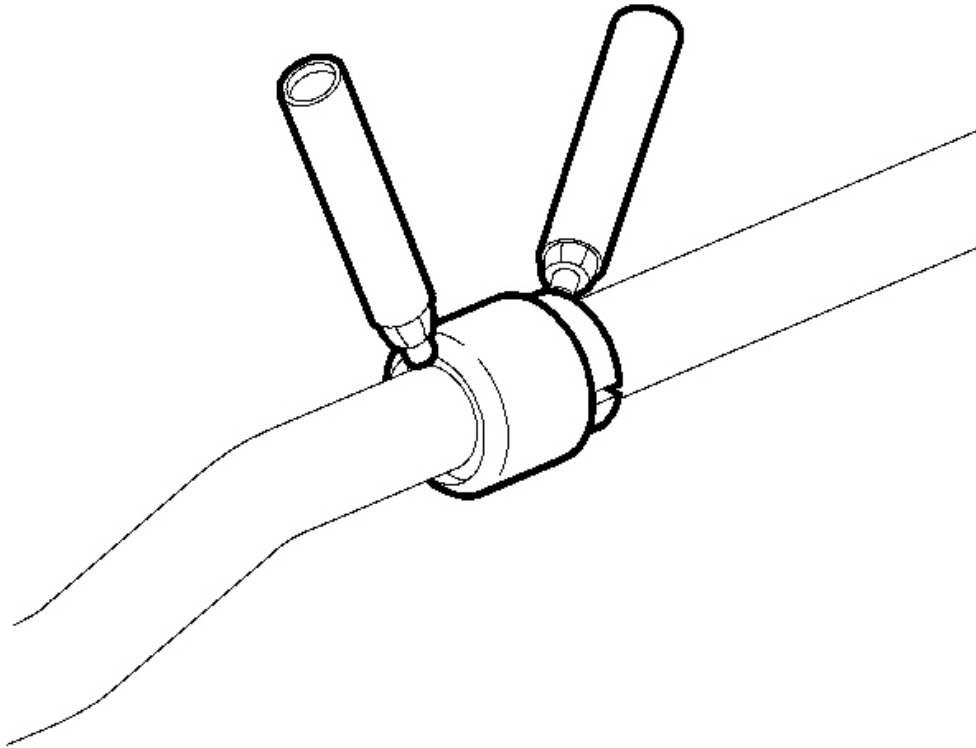


Fig. 14: Marking Stabilizer Bar On Both Sides Of Stabilizer Bar Bushing Ring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Failure to mark the stabilizer bar bushing ring location on the stabilizer bar may result in stabilizer bar bushing failure and excessive stabilizer bar lateral movement. Stabilizer bar bushing ring must be installed in proper place on the stabilizer bar.

4. Mark the stabilizer bar on both sides of the stabilizer bar bushing ring by drawing two lines onto stabilizer bar to verify the location of the stabilizer bar bushing ring.
5. Remove the metal coupling from the stabilizer bar bushing ring by gently tapping on coupling with a hammer and a punch.

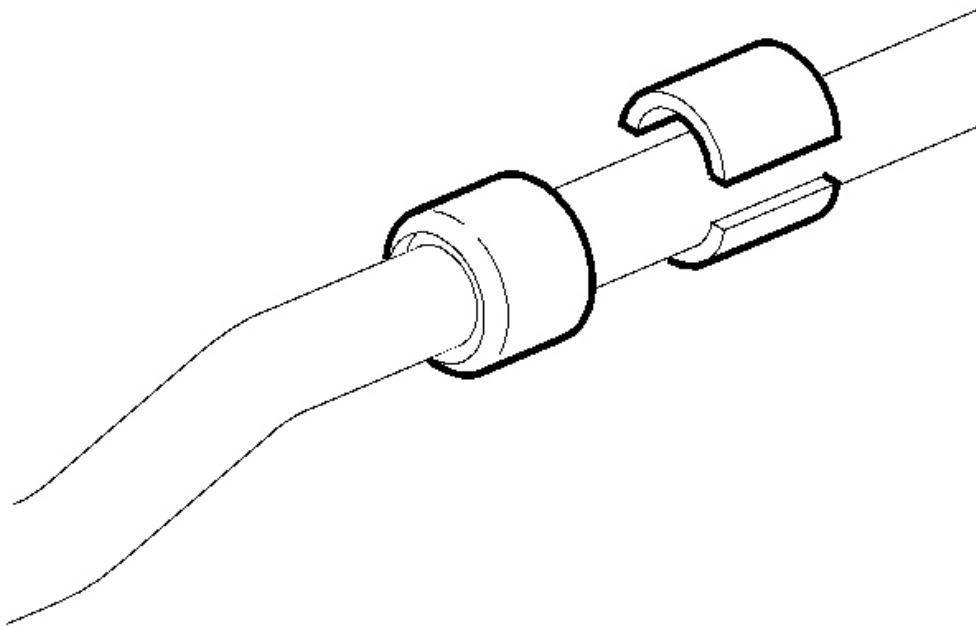


Fig. 15: Stabilizer Ring Plastic Inserts
Courtesy of GENERAL MOTORS CORP.

6. Remove the stabilizer ring plastic inserts.

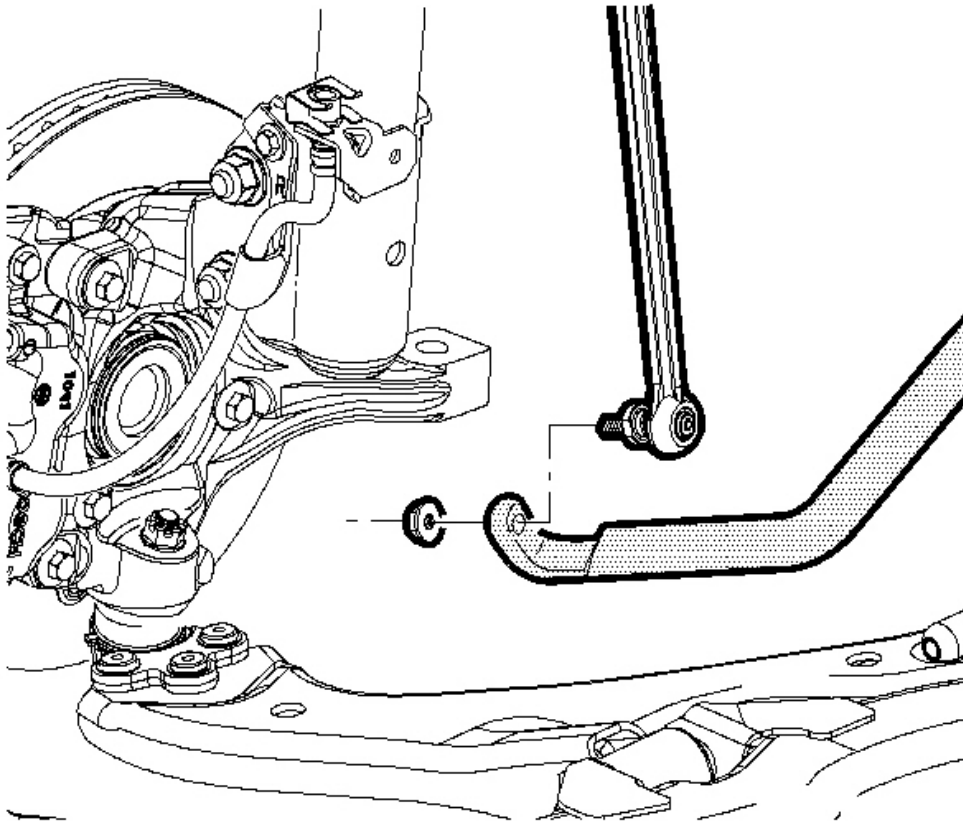


Fig. 16: Locating Rod & Bar
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Hold ball stud from turning when removing nut. The boot can become torn and damaged if the ball stud turns.

7. Remove the left side stabilizer bar-to-link nut and separate link from the stabilizer bar.
8. Slide the stabilizer bar bushing ring coupling from the stabilizer bar assembly.

Installation Procedure

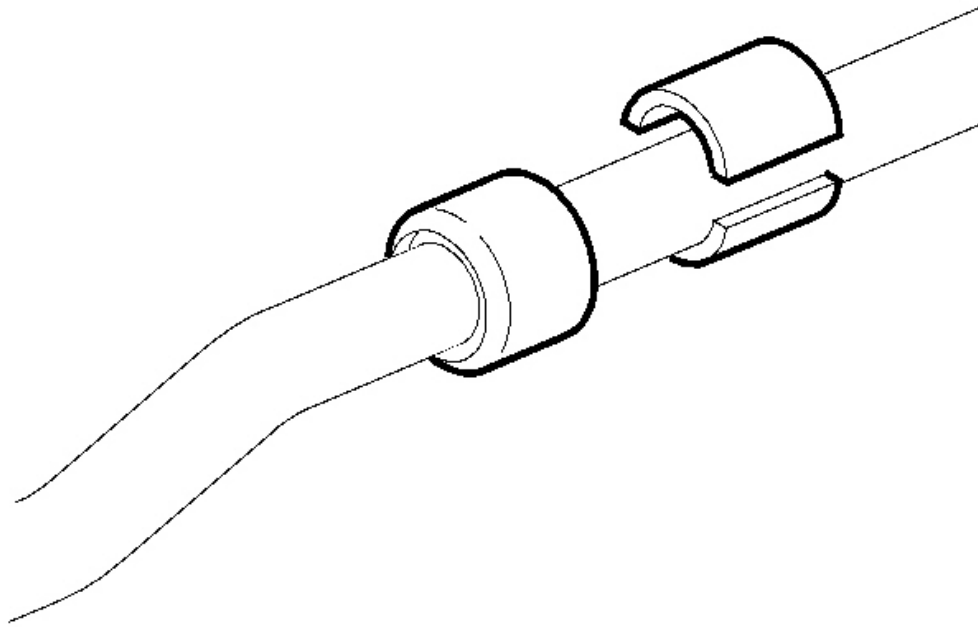


Fig. 17: Stabilizer Ring Plastic Inserts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Failure to install the stabilizer bar bushing ring properly on the stabilizer bar may result in stabilizer bar bushing failure and excessive stabilizer bar lateral movement. Stabilizer bar bushing ring must be installed in correct place on the stabilizer bar.

1. Install the metal stabilizer bar bushing ring metal coupling onto the stabilizer bar.
2. Install the stabilizer bar bushing ring plastic inserts onto the stabilizer bar assembly between the scribed marks.

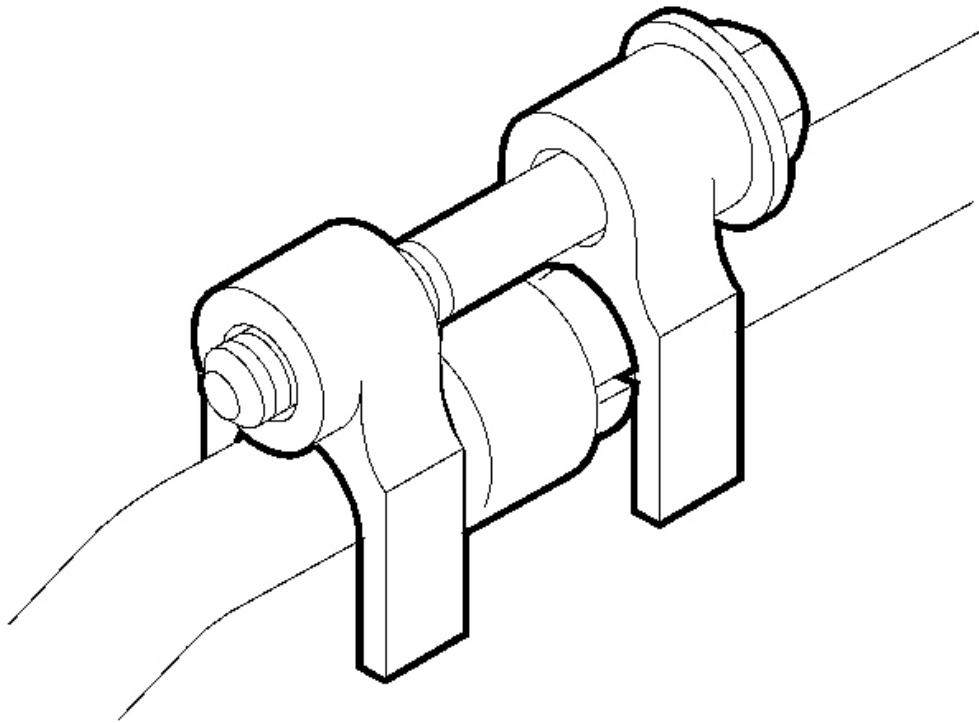


Fig. 18: Stabilizer Bushing Ring & Stabilizer Bar
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The stabilizer bar bushing ring must be compressed tight enough so the stabilizer bar bushing plastic inserts do not move.

3. Verify that the stabilizer bushing ring is in the correct location on the stabilizer bar and does not move.
4. Using the **J-45646** compress the stabilizer bar bushing ring and stabilizer bar bushing ring plastic inserts together. See **Special Tools and Equipment** .

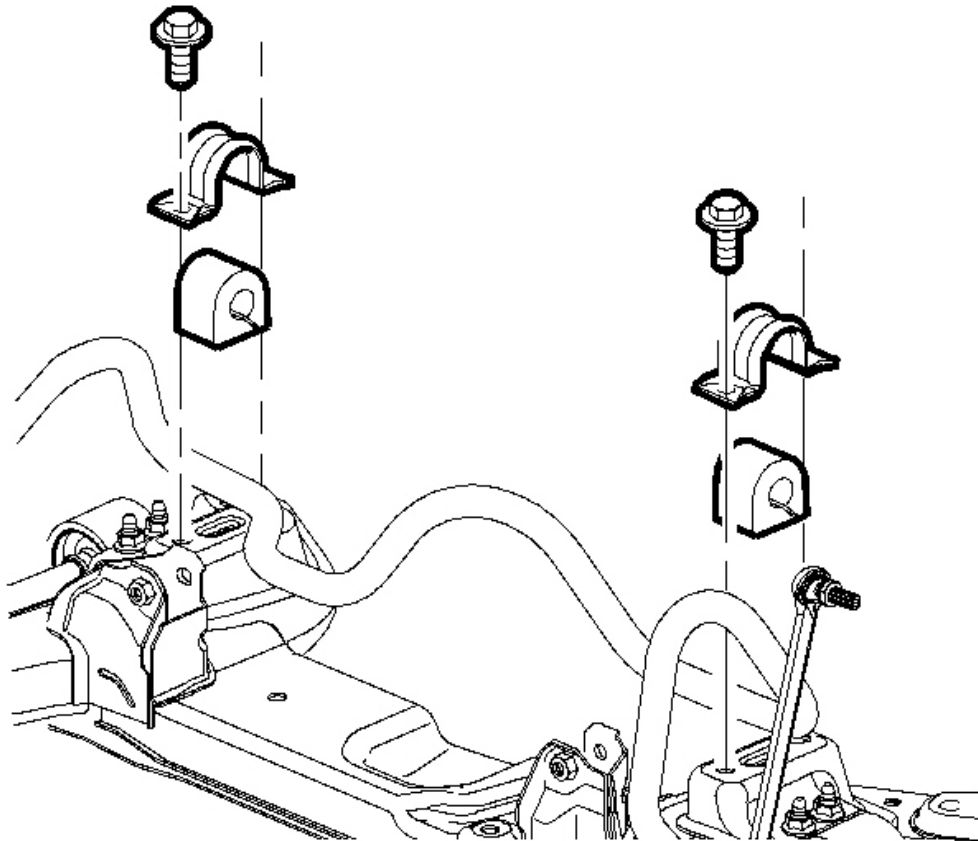


Fig. 19: Stabilizer Bar Clamp & Cradle Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the stabilizer bar bushings.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the stabilizer bar clamps.

Tighten: Tighten the stabilizer bar clamp-to-frame bolts to 50 N.m (37 lb ft).

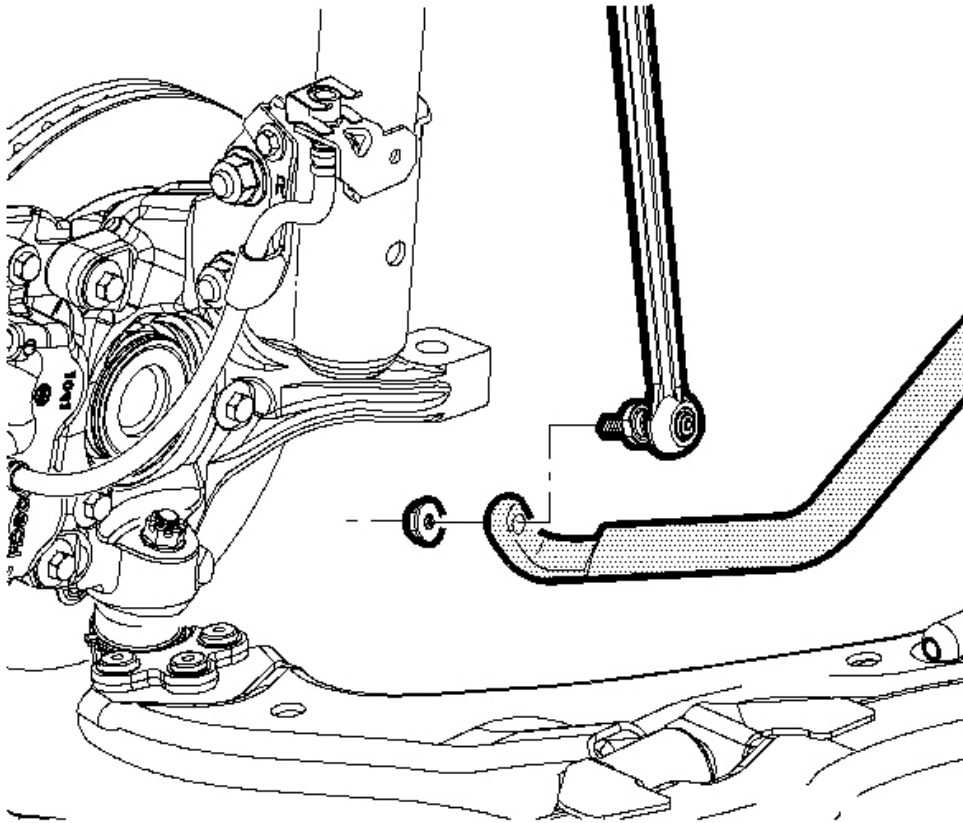


Fig. 20: Locating Rod & Bar
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Hold the ball stud from turning when installing the nut. The boot can become torn and damaged if the ball stud turns.

7. Install the left side stabilizer bar-to-link-nut and tighten the nut.

Tighten: Tighten the stabilizer bar-to-link-nut to 65 N.m (48 lb ft).

8. Lower the vehicle from the hoist.

LOWER BALL JOINT REPLACEMENT

Removal Procedure

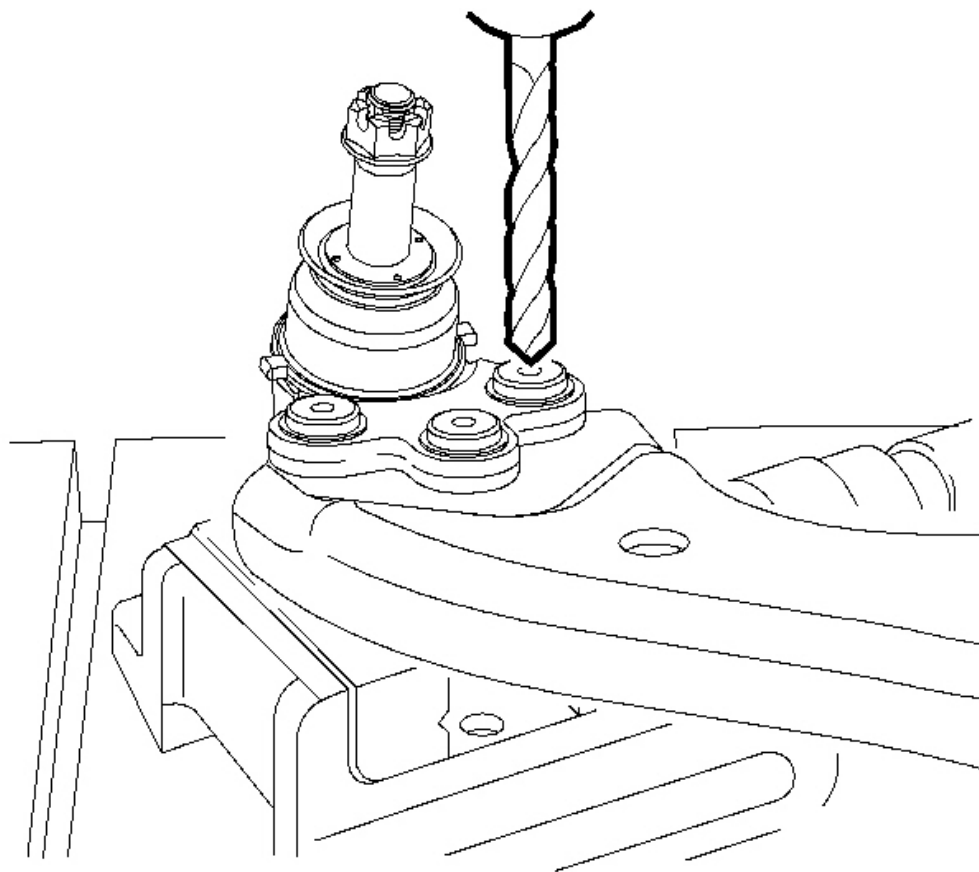


Fig. 21: Removing Ball Joint Rivets Using A Drill
Courtesy of GENERAL MOTORS CORP.

1. Remove the lower control arm. Refer to **Lower Control Arm Replacement** .
2. Place the control arm in a vise or suitable holding device.
3. Remove the ball joint rivets using the following procedure.
 1. Drill through the rivets using a 8 mm (5/16 in) drill bit.
 2. Enlarge the hole using a 12 mm (31/64 in) drill bit.
 3. Remove any remaining burrs from the control arm.
4. Remove the ball joint from the control arm. Note the position of the ball joint for reassembly.

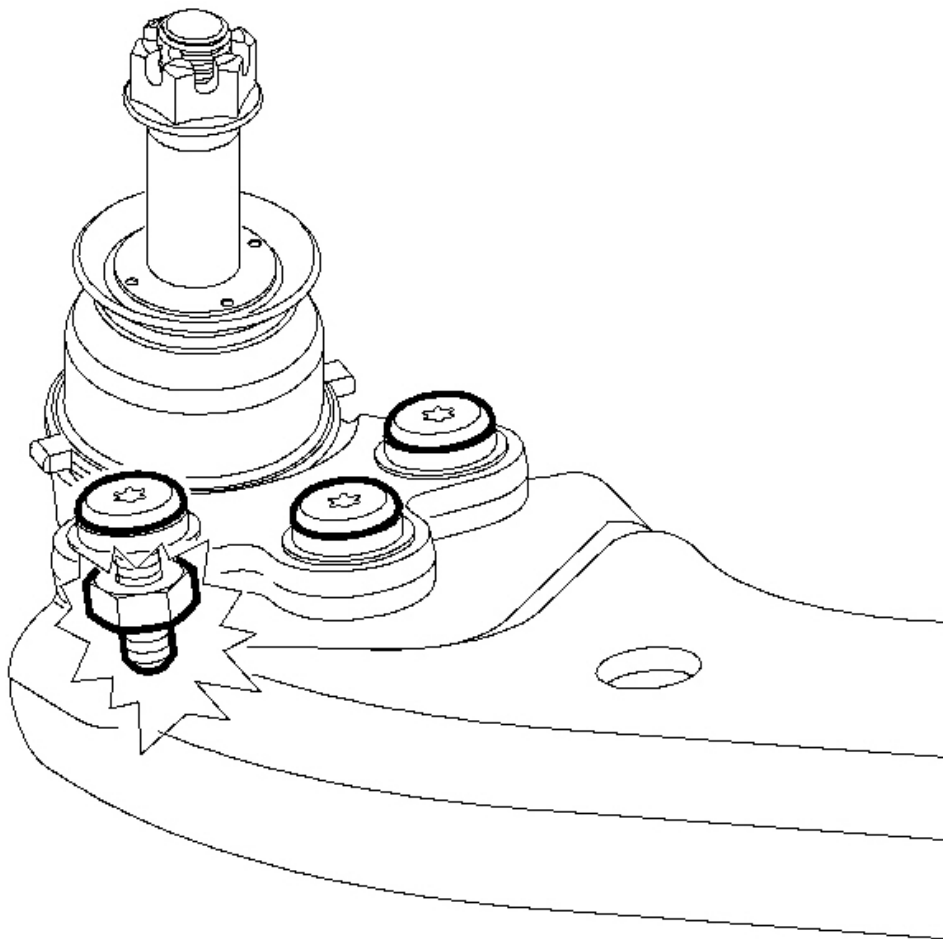


Fig. 22: Ball Joint & Control Arm
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The control arm must be clean and free of debris.

1. Install the ball joint to the control arm as previously noted.

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT: • Only use hardware provided with the new ball joint.

- The bolts must be installed with the bolt head on top of the ball joint.

2. Install the ball joint to control arm bolts.

Tighten: Tighten the bolts and nuts to 68 N.m (50 lb ft).

3. Install the lower control arm. Refer to **Lower Control Arm Replacement** .

WHEEL BEARING/HUB REPLACEMENT - FRONT

Removal Procedure

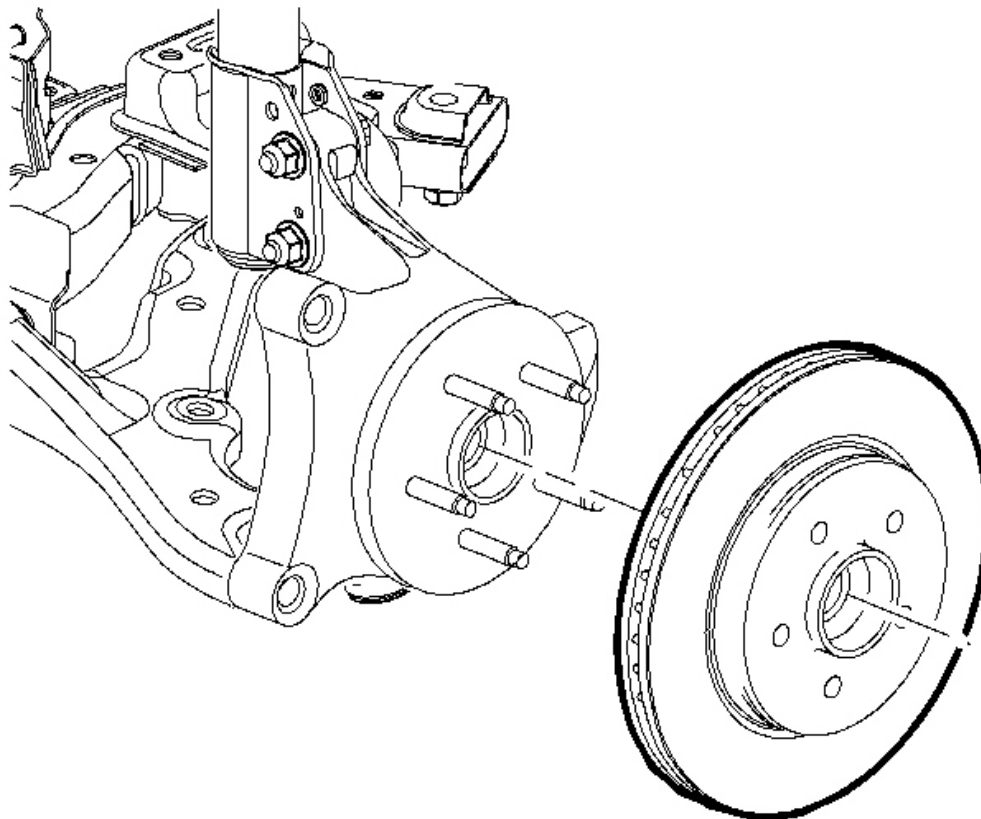


Fig. 23: Front Brake Rotor
Courtesy of GENERAL MOTORS CORP.

1. Remove the front brake rotor. Refer to **Brake Rotor Replacement** in Disc Brakes.

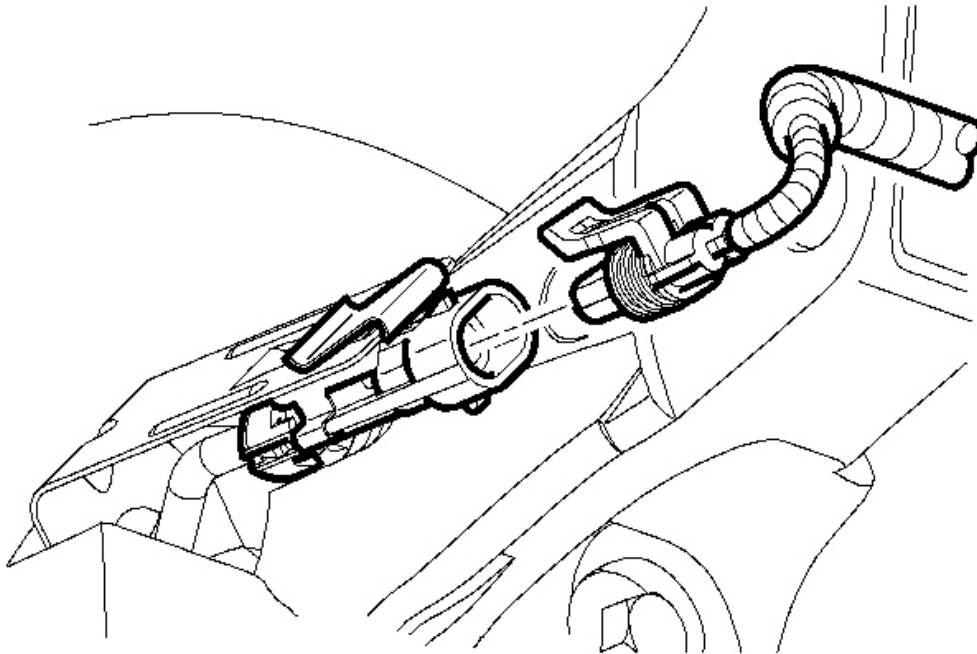


Fig. 24: Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the wheel speed sensor electrical connector, if equipped.

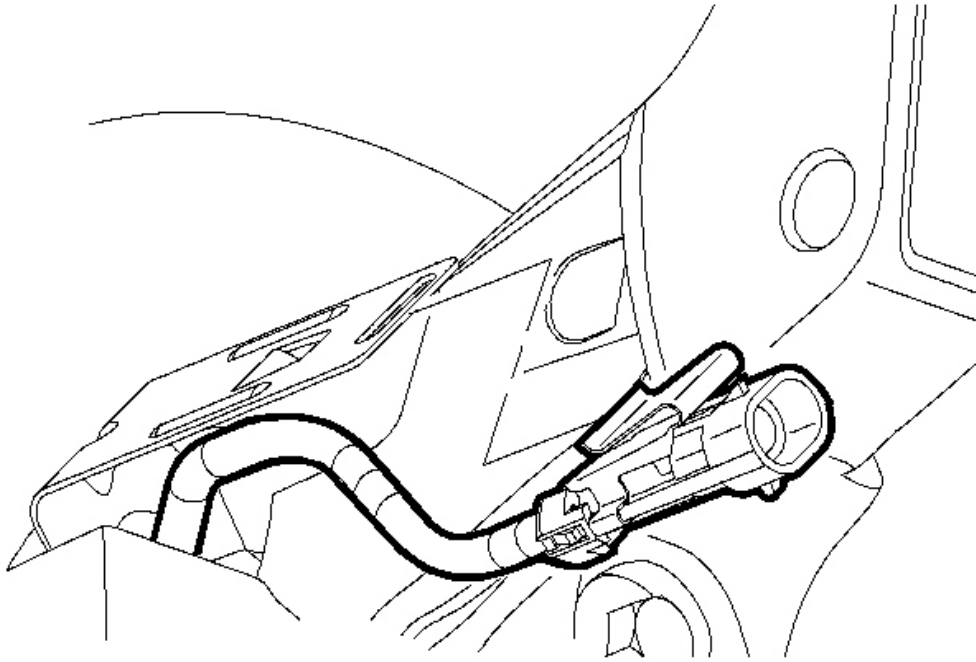


Fig. 25: Wheel Speed Sensor Electrical Connector & Connector Bracket
Courtesy of GENERAL MOTORS CORP.

3. Remove the wheel speed sensor electrical connector from the connector bracket.

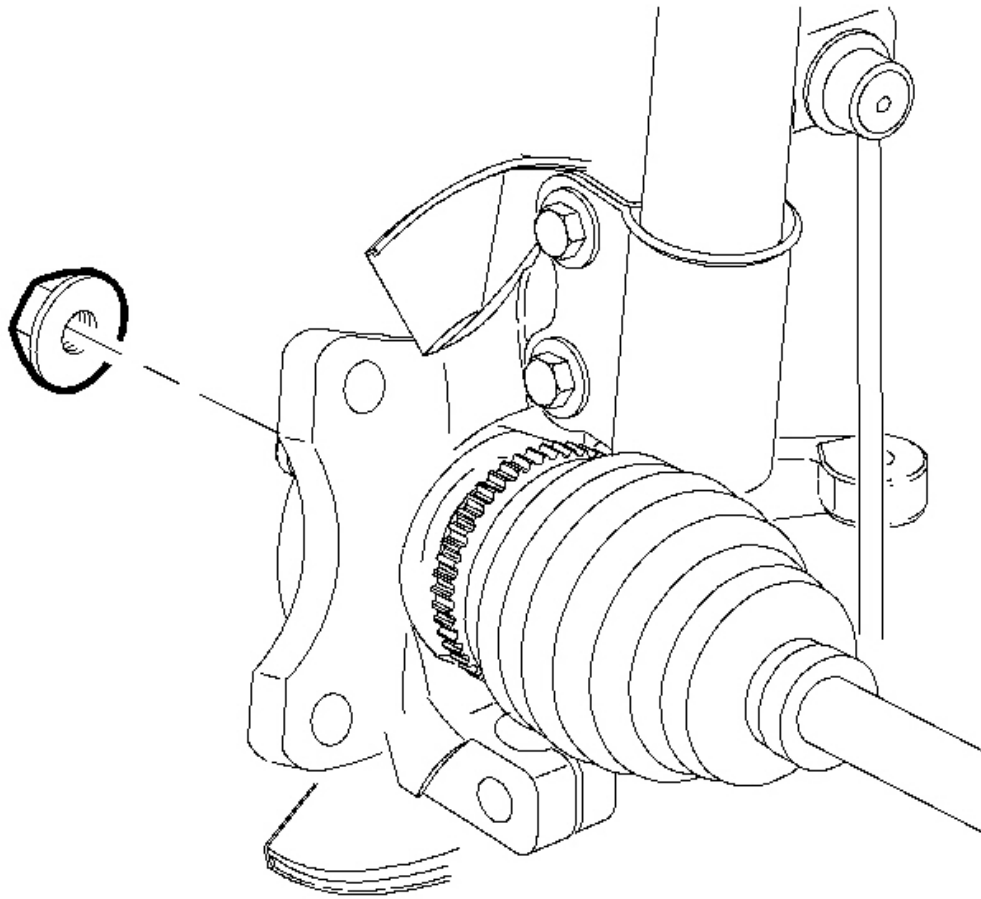


Fig. 26: Front Wheel Drive Shaft Spindle & Nut
Courtesy of GENERAL MOTORS CORP.

4. Remove the front wheel drive shaft spindle nut.

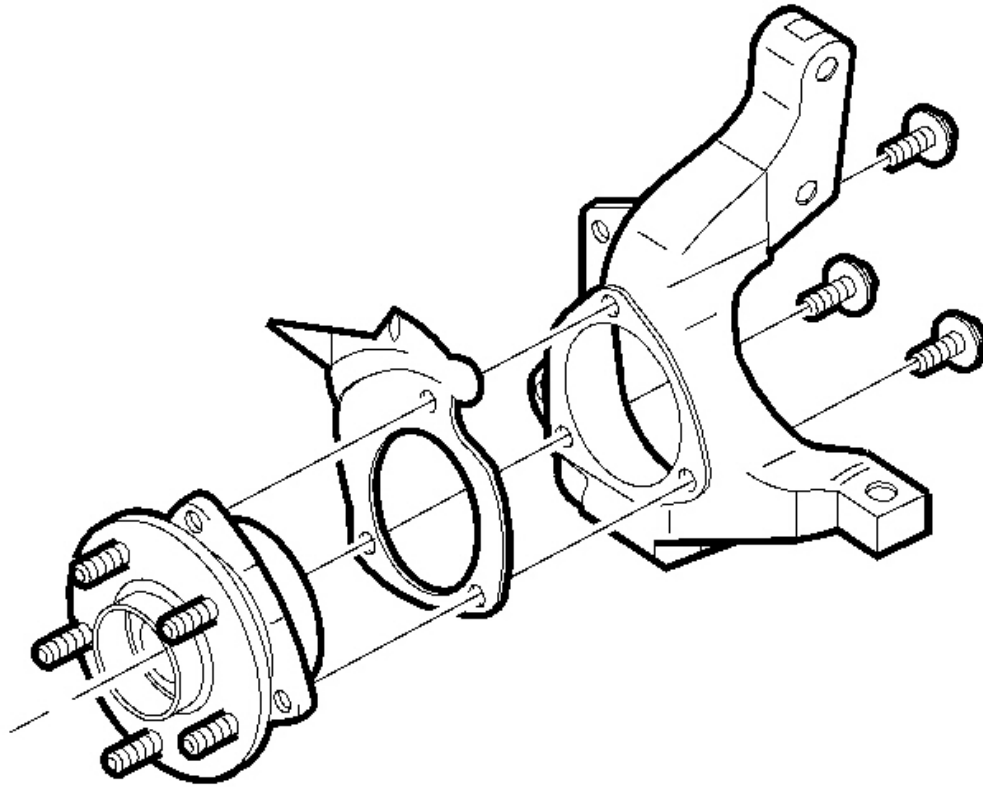


Fig. 27: Wheel Bearing/Hub & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

5. Support the wheel drive shaft with heavy mechanic's wire or equivalent.
6. Remove and discard the wheel bearing/hub mounting bolts.
7. Remove the wheel bearing/hub assembly from the steering knuckle.

Installation Procedure

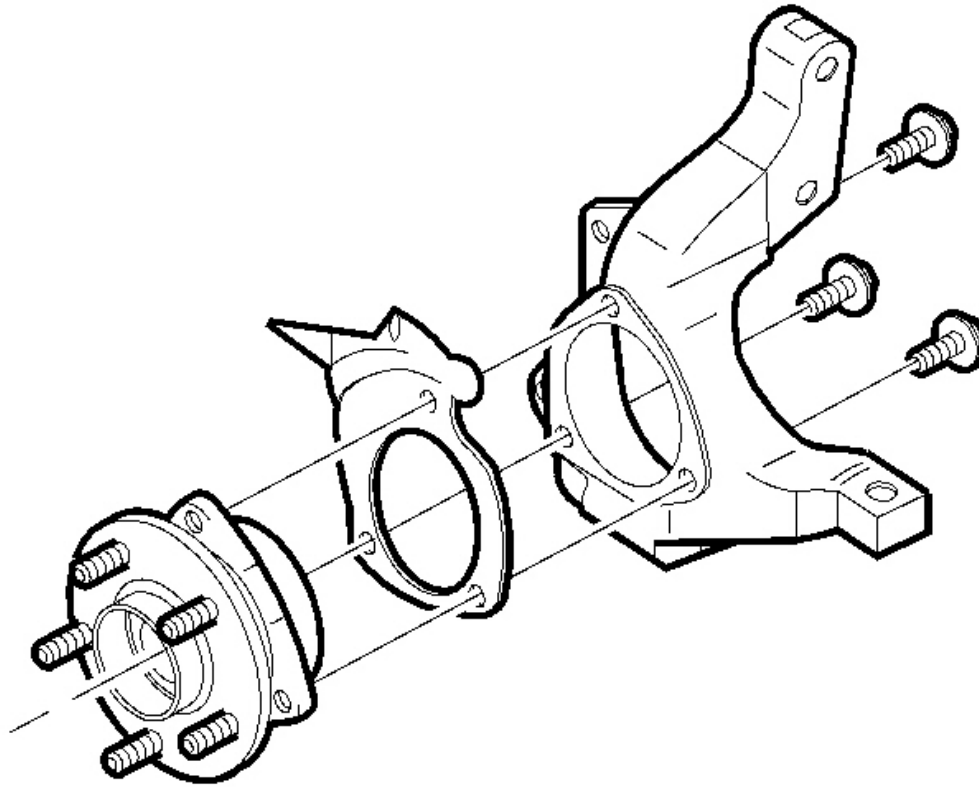


Fig. 28: Wheel Bearing/Hub & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the wheel bearing/hub assembly to the steering knuckle.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the wheel bearing/hub mounting bolts.

Tighten: Tighten the bolts to 130 N.m (96 lb ft).

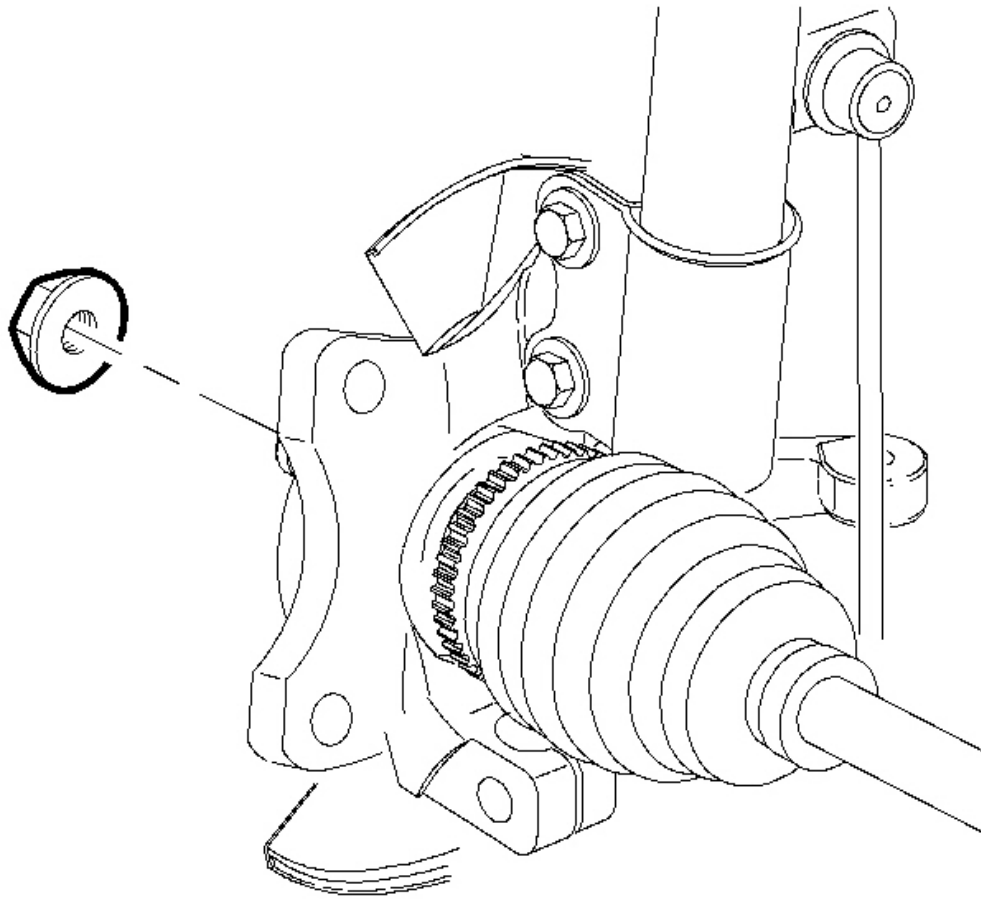


Fig. 29: Front Wheel Drive Shaft Spindle & Nut
Courtesy of GENERAL MOTORS CORP.

3. Install the wheel drive shaft spindle nut.

Tighten: Tighten the nut to 205 N.m (151 lb ft).

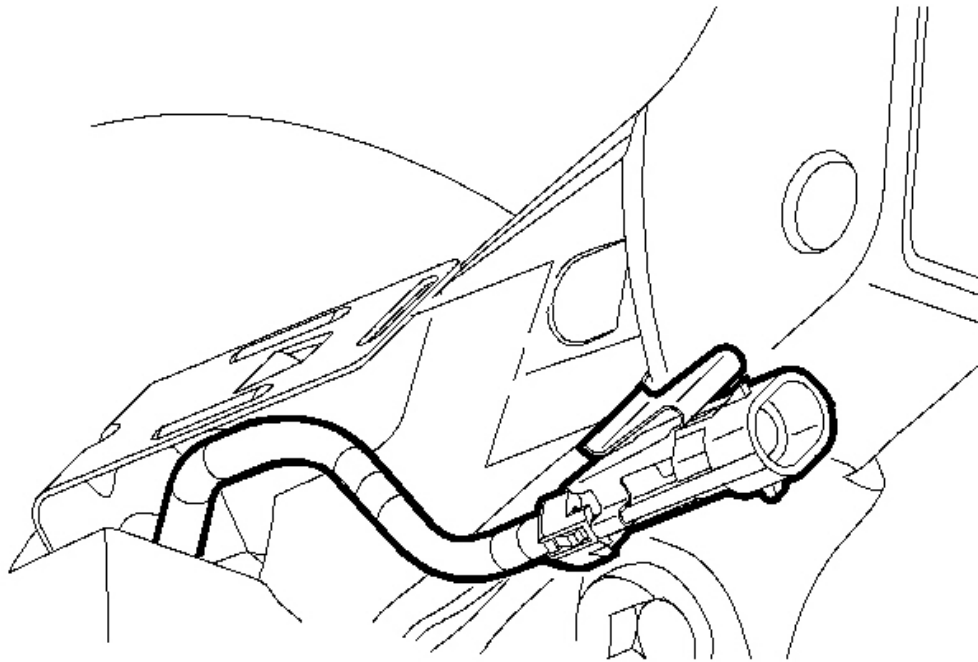


Fig. 30: Wheel Speed Sensor Electrical Connector & Connector Bracket
Courtesy of GENERAL MOTORS CORP.

4. Install the wheel speed sensor electrical connector to the mounting bracket, if equipped.

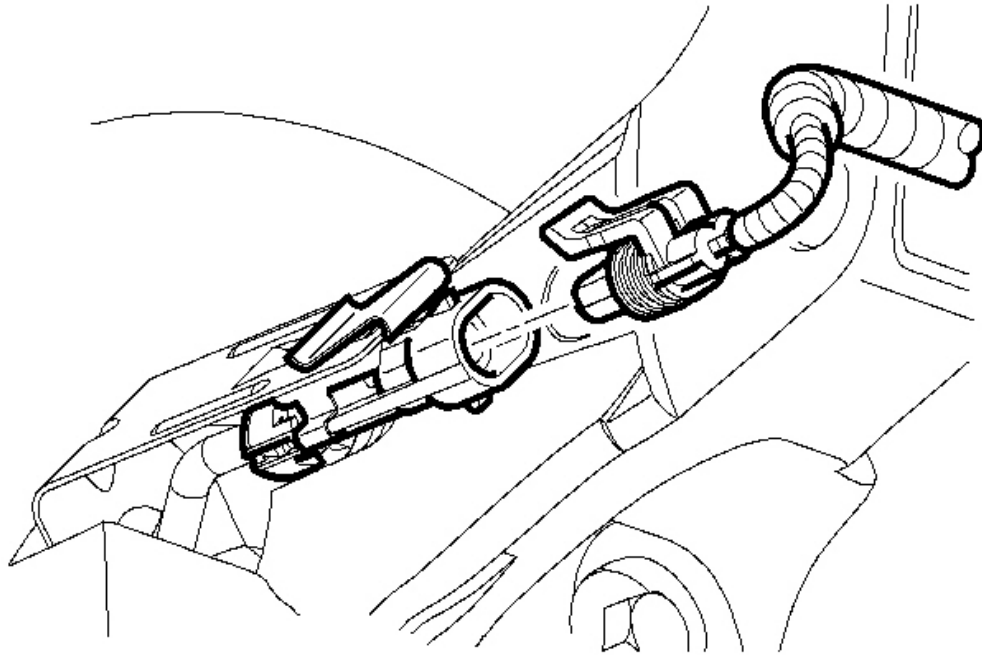


Fig. 31: Wheel Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the wheel speed sensor electrical connector.

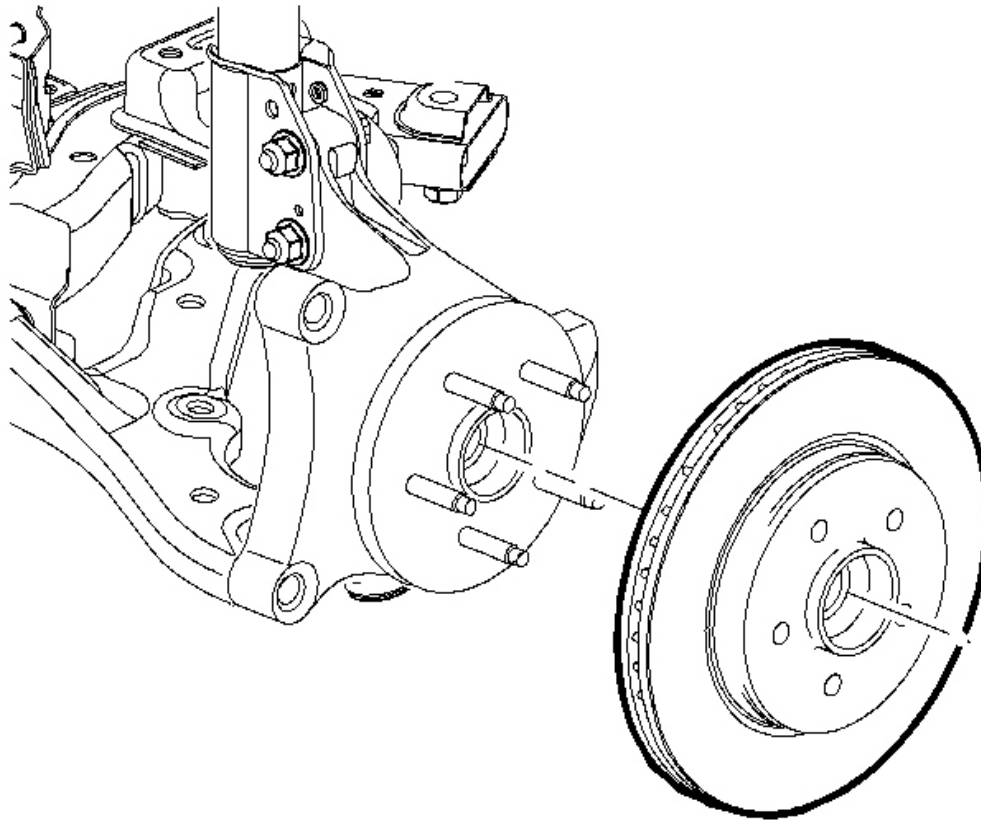


Fig. 32: Front Brake Rotor
Courtesy of GENERAL MOTORS CORP.

6. Install the front brake rotor. Refer to **Brake Rotor Replacement** in Disc Brakes.

STEERING KNUCKLE REPLACEMENT

Tools Required

- **J 43828** Ball Joint Remover
- **J 44015** Steering Linkage Installer
- **SA91100C** Tie Rod Separator

- SA9140E Torque Angle Gage

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

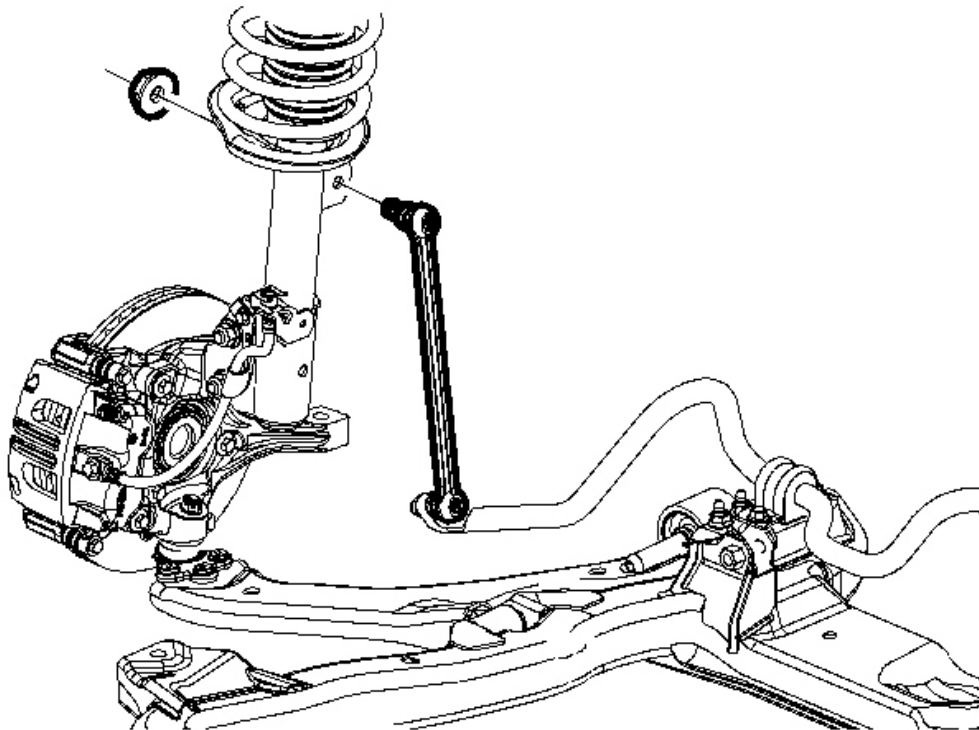


Fig. 33: Stabilizer Link & Strut Nut
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not allow the stabilizer link ball stud to rotate while removing the link nut.

3. Disconnect the stabilizer link from the strut assembly.

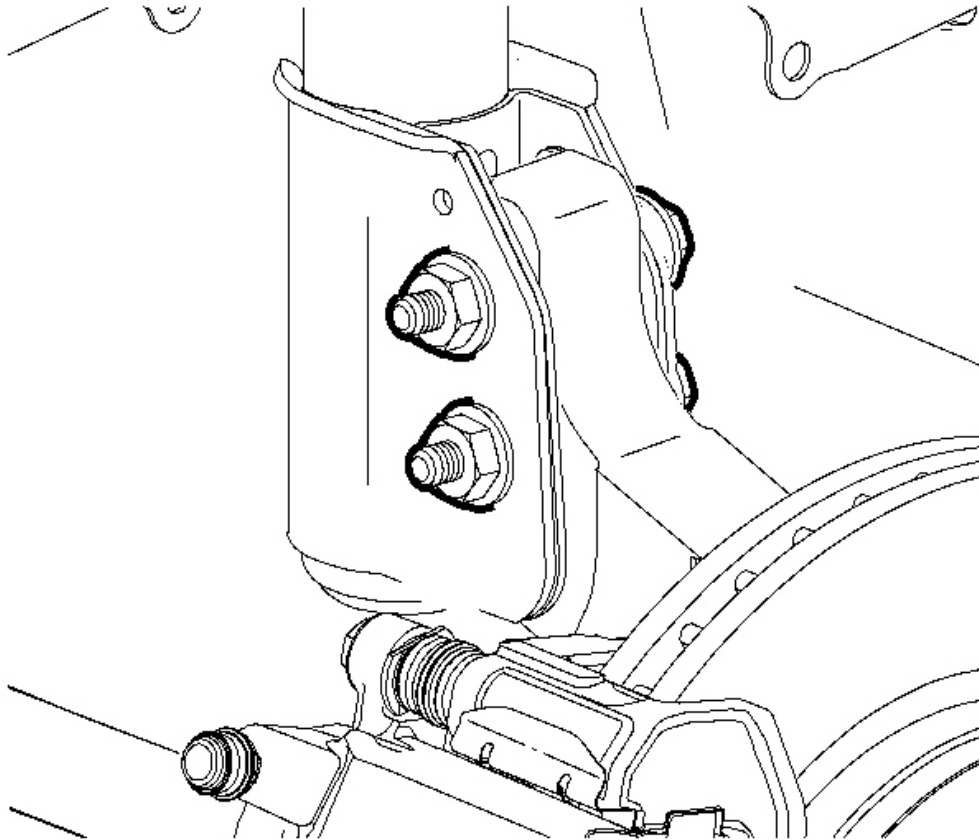


Fig. 34: Steering Knuckle, Strut Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

4. Loosen the steering knuckle to strut bolts and nuts.

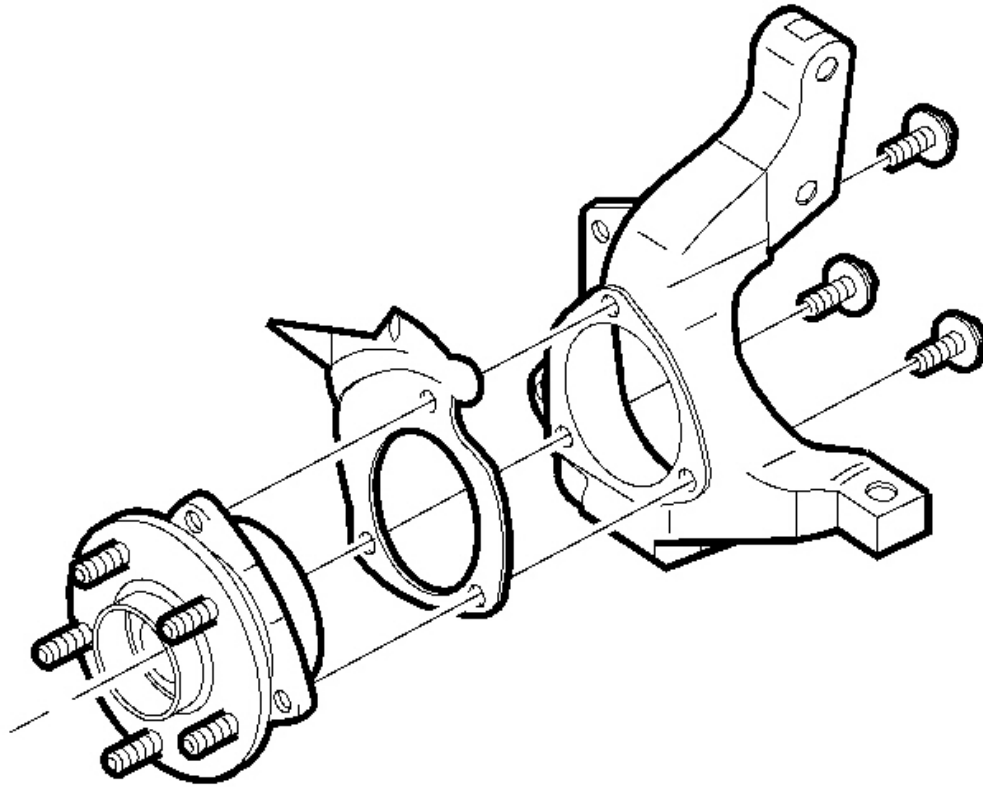


Fig. 35: Wheel Bearing/Hub & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the wheel bearing/hub assembly. Refer to **Wheel Bearing/Hub Replacement - Front** .

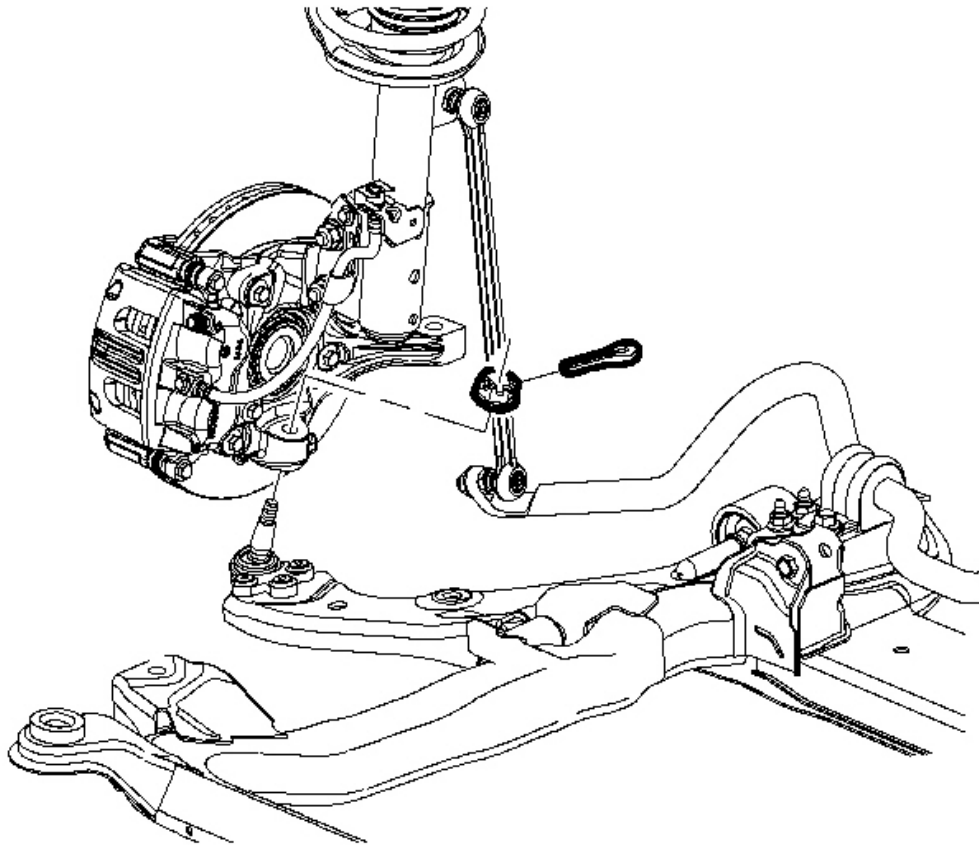


Fig. 36: Lower Ball Joint Cotter Pin, Ball Stud & Nut
Courtesy of GENERAL MOTORS CORP.

6. Remove and discard the lower ball joint cotter pin.
7. Loosen the ball stud nut, until level with the top of the ball stud.

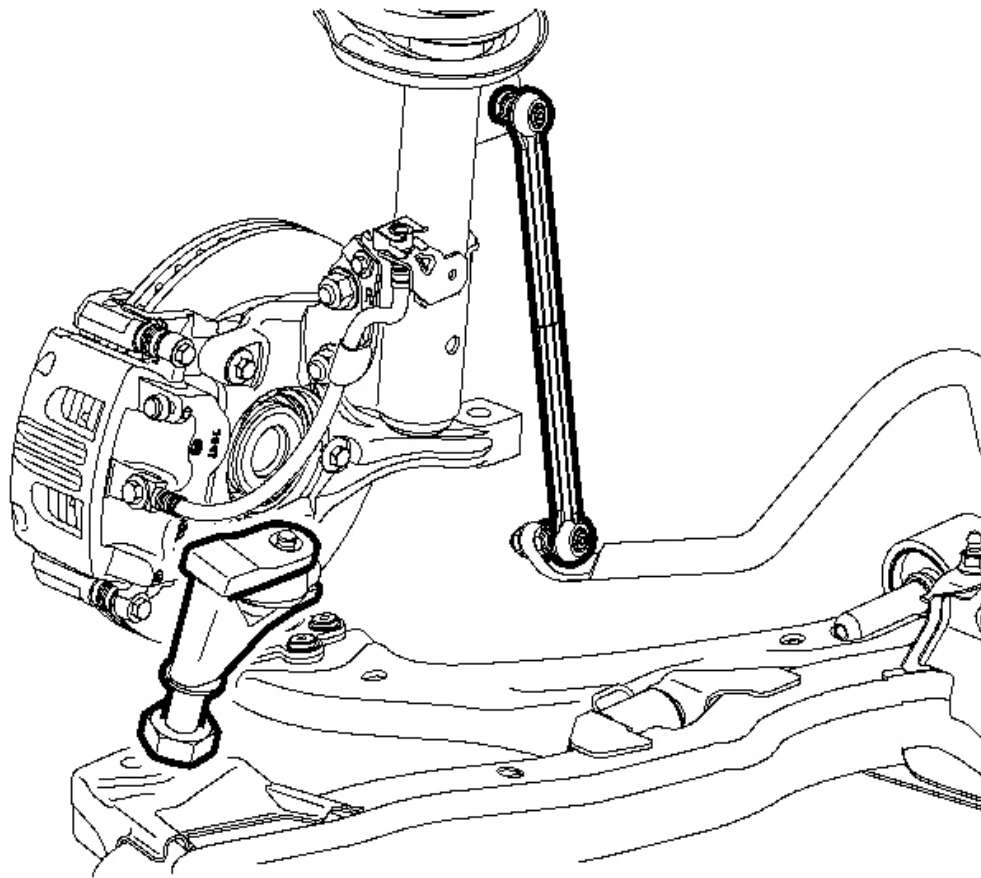


Fig. 37: Lower Control Arm, Steering Knuckle & J 43828
Courtesy of GENERAL MOTORS CORP.

8. Using the **J 43828** , separate the lower control arm from the steering knuckle.
9. Remove the lower control arm and nut from the steering knuckle.
10. Remove the outer tie rod end to knuckle nut.

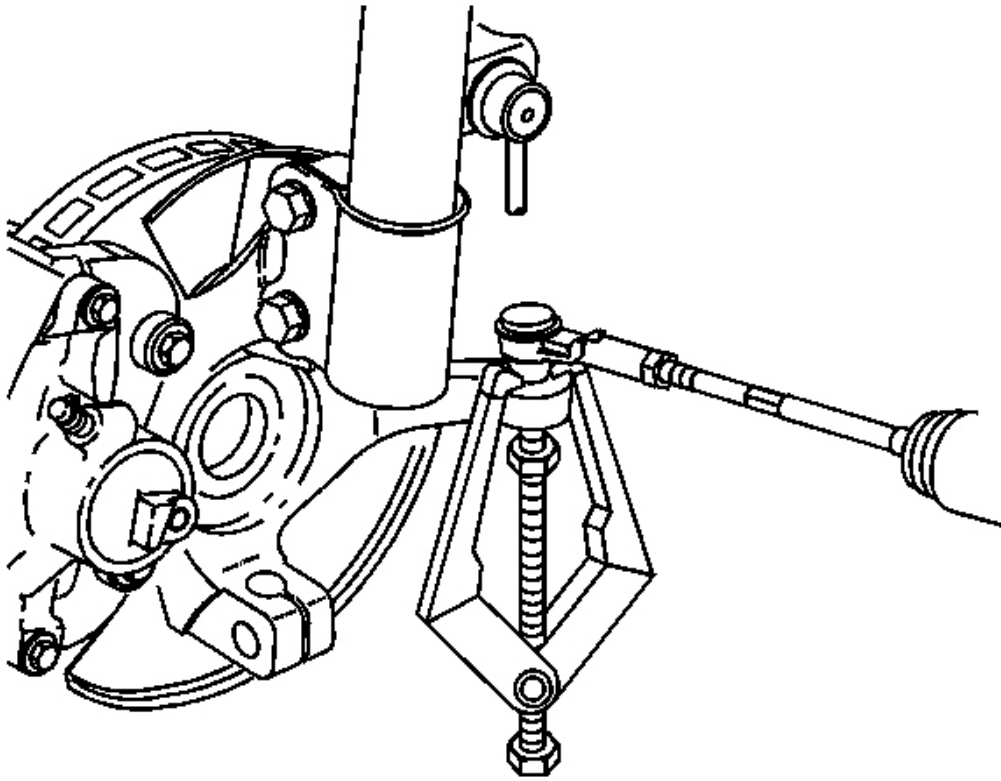


Fig. 38: Outer Tie Rod & Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

11. Using the SA91100C , separate the outer tie rod from the steering knuckle.

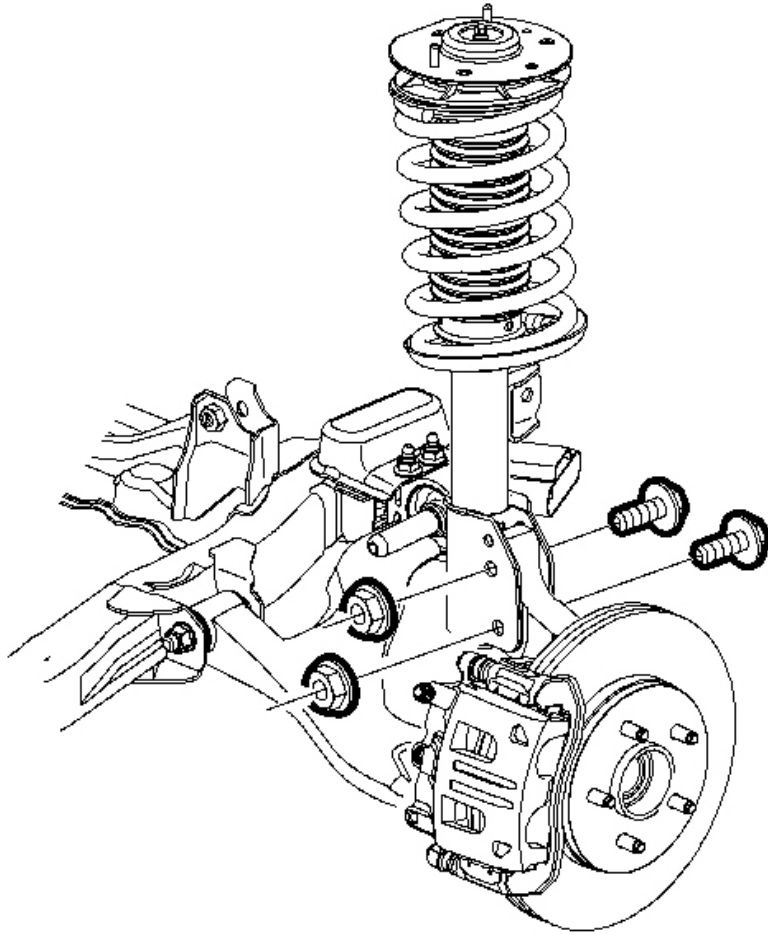


Fig. 39: Steering Knuckle, Strut Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

12. Remove the steering knuckle to strut bolts and nuts. Discard the bolts and nuts.
13. Remove the steering knuckle from the vehicle.

Installation Procedure

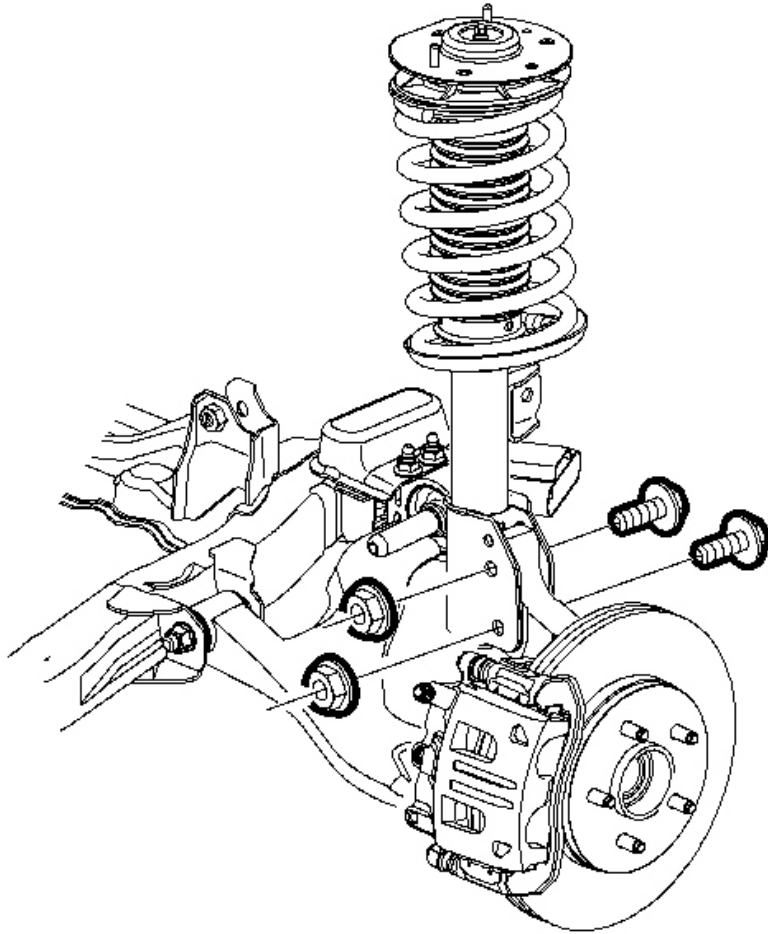


Fig. 40: Steering Knuckle, Strut Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the steering knuckle to strut assembly.
2. Loosely install the strut to steering knuckle bolts and nuts.

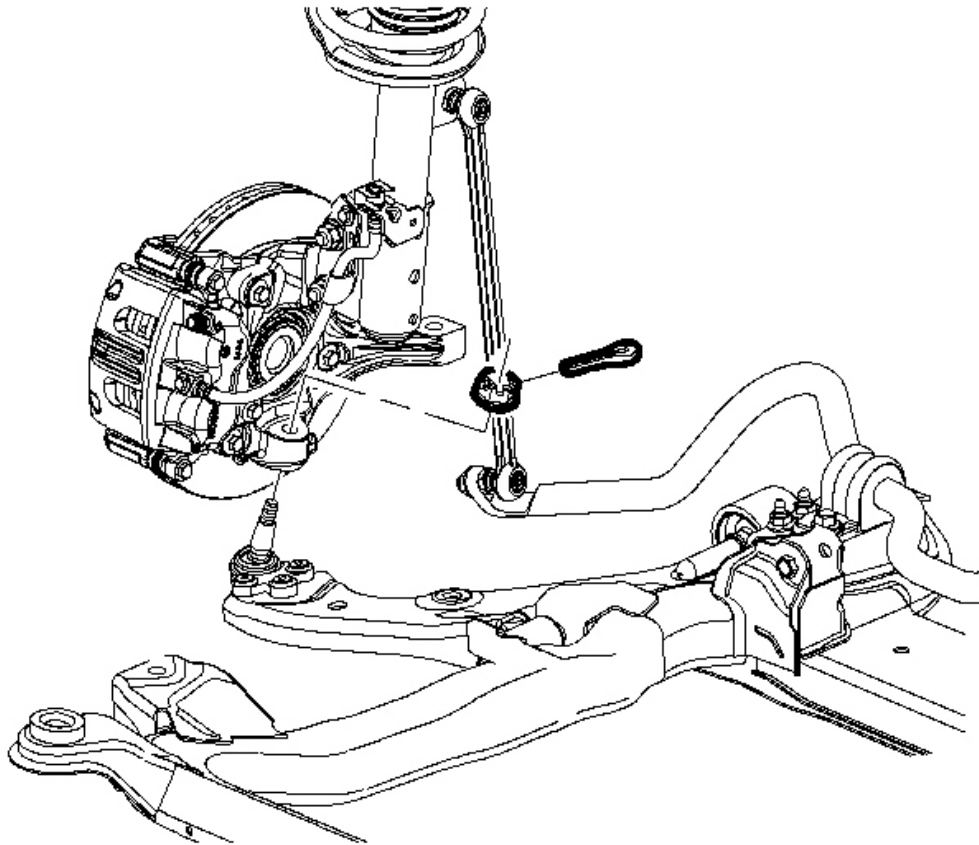


Fig. 41: Lower Ball Joint Cotter Pin, Ball Stud & Nut
Courtesy of GENERAL MOTORS CORP.

3. Install the control arm ball stud into the steering knuckle.

NOTE: Refer to Fastener Notice in Cautions and Notices.

NOTE: Refer to Lower Control Arm Ball Stud Identification Notice .

4. Using the SA9140E , install the ball stud nut.

Tighten:

1. If the bottom of the ball stud has a cup and is silver, tighten the nut to 60 N.m (44 lb ft).
 2. If the bottom of the ball stud is flat and black, tighten the nut to 40 N.m (30 lb ft).
5. Tighten the strut to steering knuckle bolts and nuts.

Tighten: Tighten the bolts and nuts to 180 N.m (133 lb ft).

IMPORTANT: Do not loosen the castle nut for cotter pin installation.

6. Tighten the castle nut enough to allow for cotter pin installation.

IMPORTANT: The cotter pin must not contact the wheel speed sensor or drive axle.

7. Install the cotter pin.

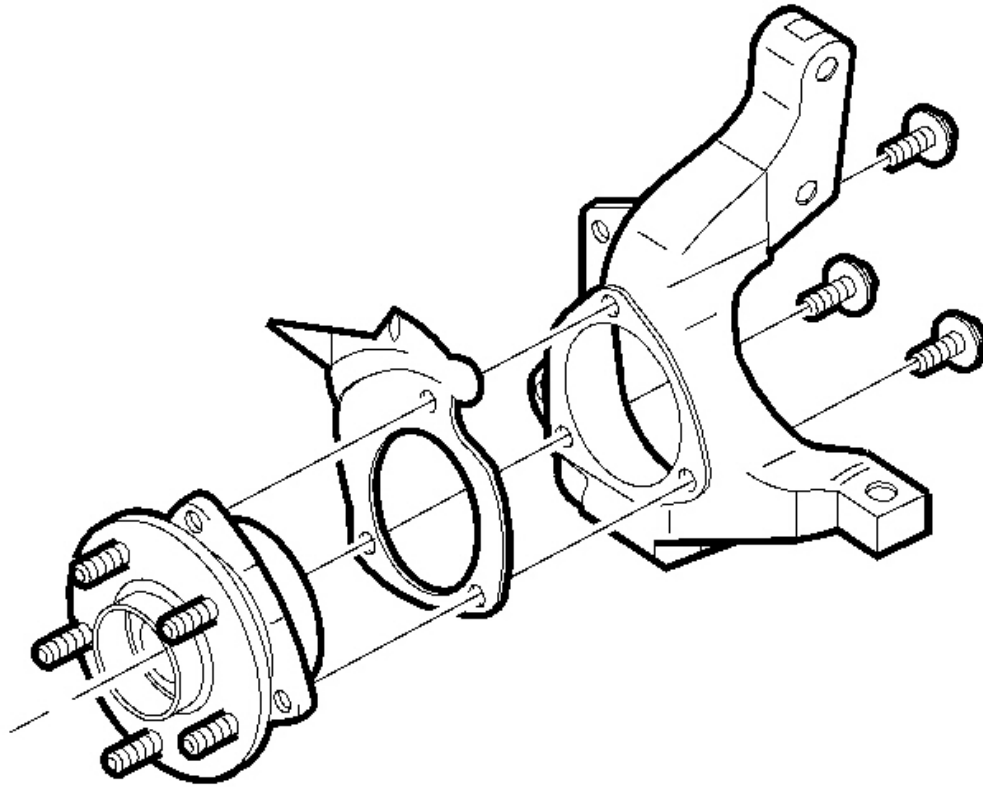


Fig. 42: Wheel Bearing/Hub & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

8. Install the wheel bearing/hub assembly. Refer to **Wheel Bearing/Hub Replacement - Front** .

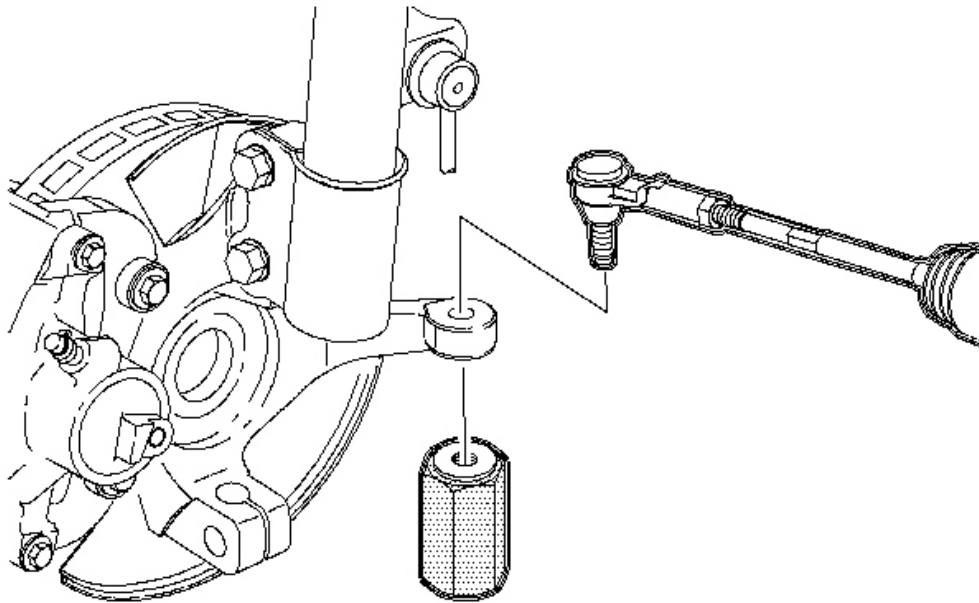


Fig. 43: Left Outer Tie Rod & Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

9. Connect the outer tie rod end to the steering knuckle.
10. Use the **J 44015** to seat the ball stud taper to 40 N.m (30 lb ft).
11. Remove the **J 44015** .

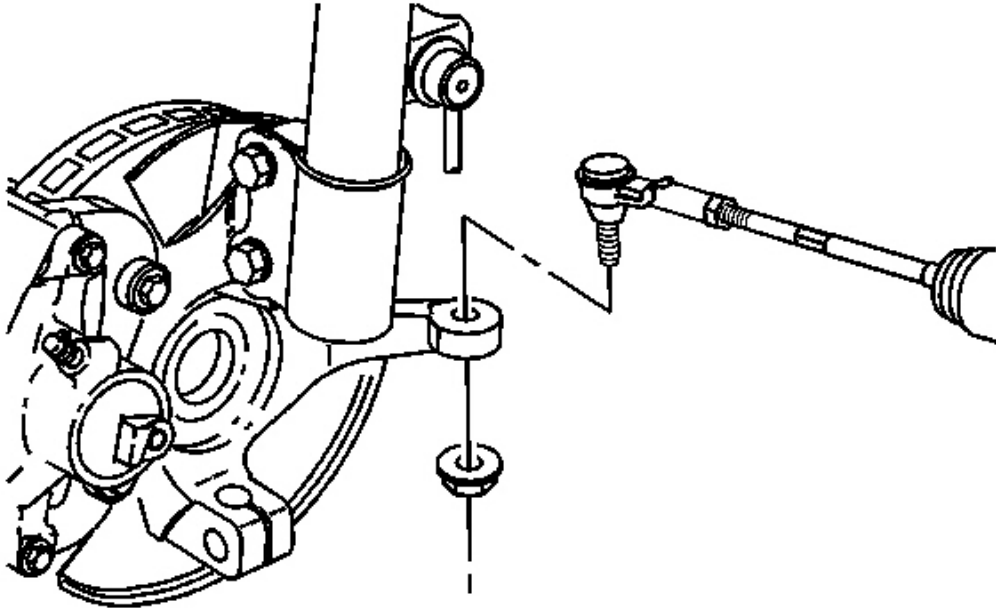


Fig. 44: Tie Rod To Knuckle View
Courtesy of GENERAL MOTORS CORP.

12. Install a new tie rod retention nut.

Tighten: Tighten the nut to 60 N.m (44 lb ft).

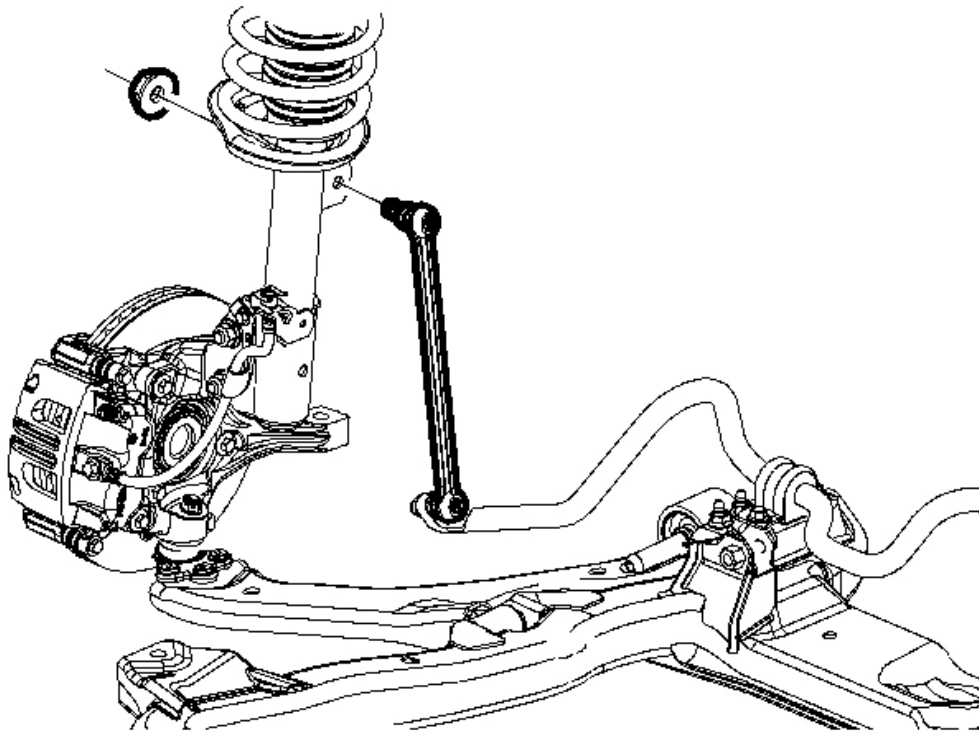


Fig. 45: Stabilizer Link & Strut Nut
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not allow the stabilizer link ball stud to rotate while installing the link nut.

13. Connect the stabilizer link to the strut assembly.

Tighten: Tighten the nut to 65 N.m (48 lb ft).

14. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
15. Lower the vehicle.

16. Perform a wheel alignment. Refer to **Measuring Wheel Alignment** in Wheel Alignment.

LOWER CONTROL ARM REPLACEMENT

Tools Required

- **J 43828** Ball Joint Remover
- **SA9140E** Torque Angle Gage

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the wheel and tire assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

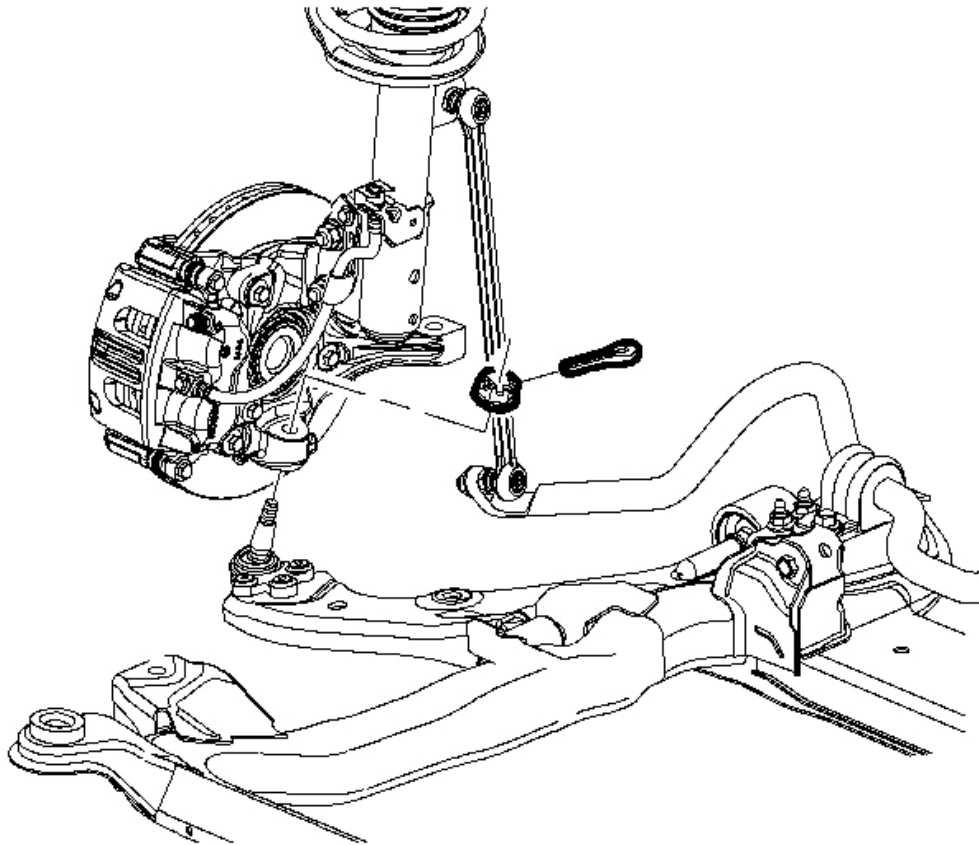


Fig. 46: Lower Ball Joint Cotter Pin, Ball Stud & Nut
Courtesy of GENERAL MOTORS CORP.

3. Remove the control arm ball stud cotter pin. Discard the cotter pin.
4. Loosen the ball stud nut until the nut is level with the top of the ball stud.

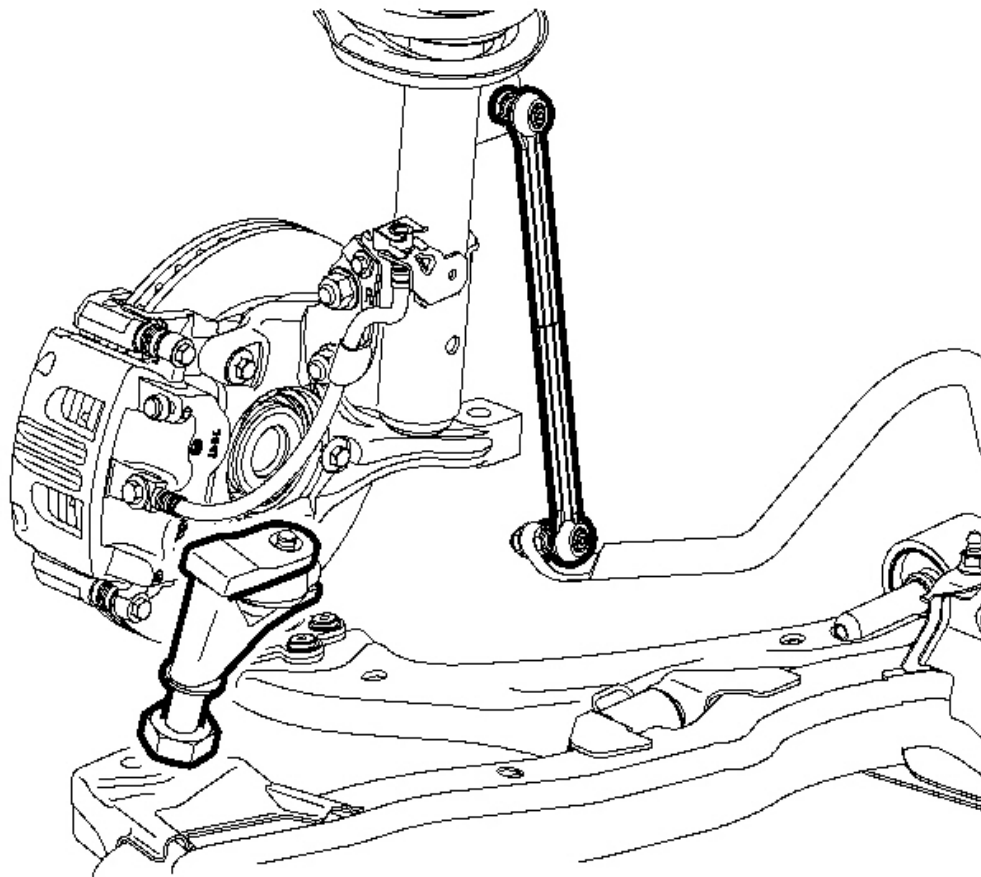


Fig. 47: Lower Control Arm, Steering Knuckle & J 43828
Courtesy of GENERAL MOTORS CORP.

5. Using the **J 43828** , separate the lower control arm from the steering knuckle.
6. Remove the ball stud nut.

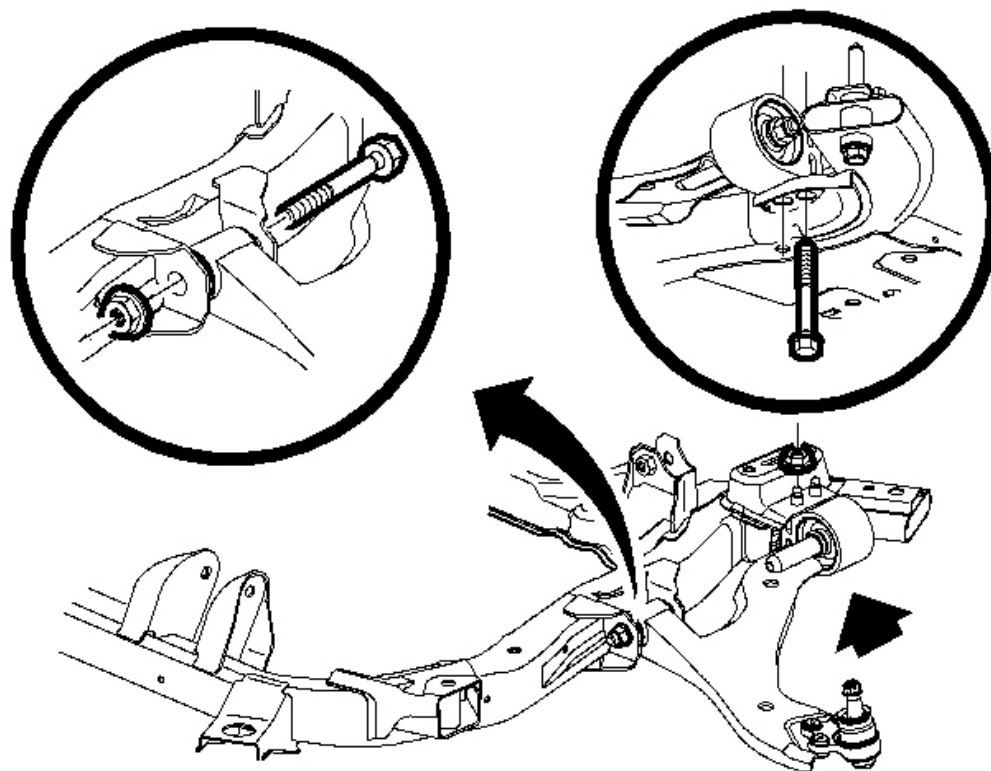


Fig. 48: Control Arm-To-Frame, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

7. Remove the control arm-to-frame front bolt and nut. Discard the bolt and nut.
8. Remove the control arm-to-frame rear bolts and nuts. Discard the bolts and nuts.
9. Remove the control arm.

Installation Procedure

1. Install the control arm to the frame.

NOTE: Refer to Fastener Notice in Cautions and Notices.

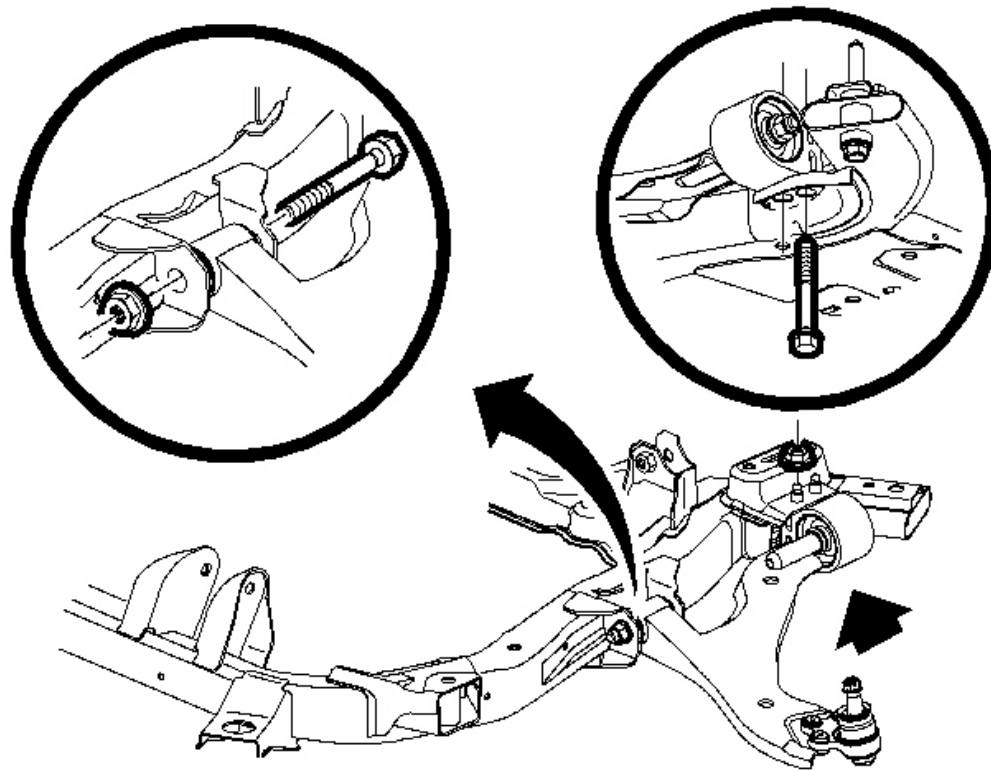


Fig. 49: Control Arm-To-Frame, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

2. Install new control arm-to-frame rear bolts and nuts.

Tighten: Tighten the nuts to 70 N.m (52 lb ft).

3. Install a new arm-to-frame front bolt and nut.

Install new control arm-to-frame rear bolts and nuts.

Tighten: Tighten the bolt to 200 N.m (148 lb ft).

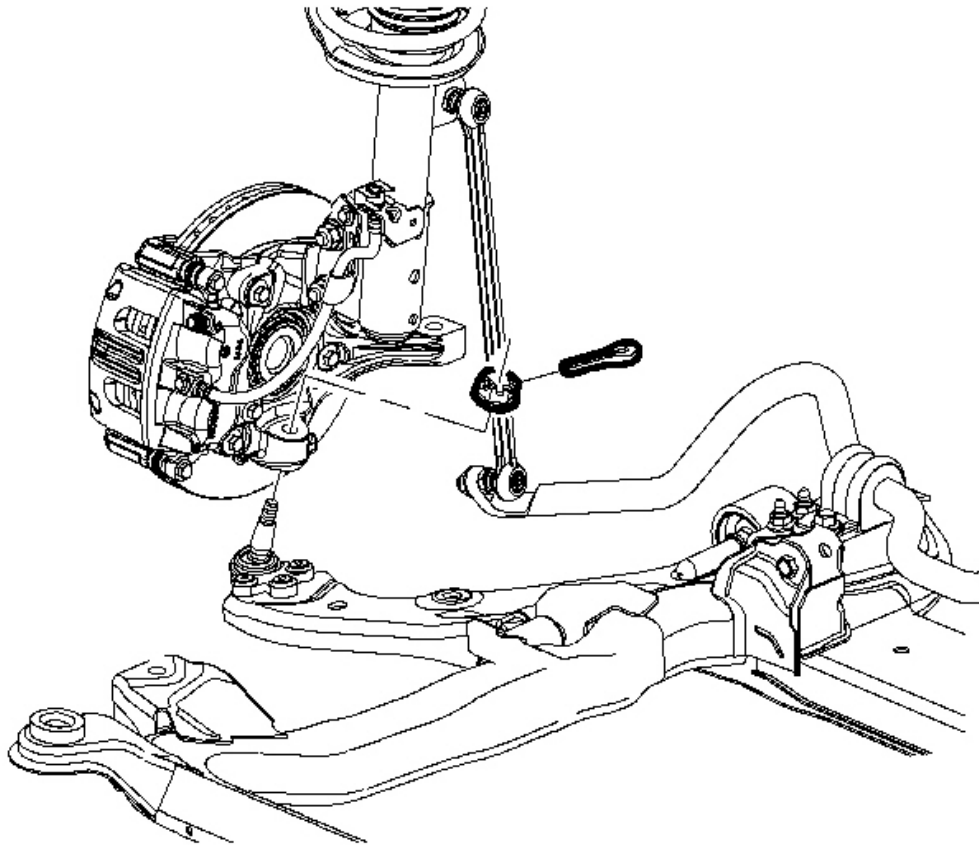


Fig. 50: Lower Ball Joint Cotter Pin, Ball Stud & Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Lower Control Arm Ball Stud Identification Notice .

4. Install the control arm ball stud into the steering knuckle.
5. Using the **SA9140E** , install the ball stud nut.

Tighten:

1. If the bottom of the ball stud has a cup and is silver, tighten the nut to 60 N.m (44 lb ft).
2. If the bottom of the ball stud is flat and black, tighten the nut to 40 N.m (30 lb ft).

IMPORTANT:

- Do not loosen the castle nut, only tighten to align the ball stud slot.
- Ensure that the cotter pin ends do not contact the ABS sensor harness or drive axle.

6. Continue to tighten the nut only enough to align the castle nut slots with the ball stud, install the cotter pin.
7. Install the wheel and tire assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
8. Lower the vehicle.

LOWER CONTROL ARM BUSHINGS REPLACEMENT (FRONT)**Tools Required**

J 44971 Control Arm Bushing Remover/Installer. See **Special Tools and Equipment** .

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the front tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the lower control arm. Refer to **Lower Control Arm Replacement** .
4. Place the control arm in a vise or suitable holding device.

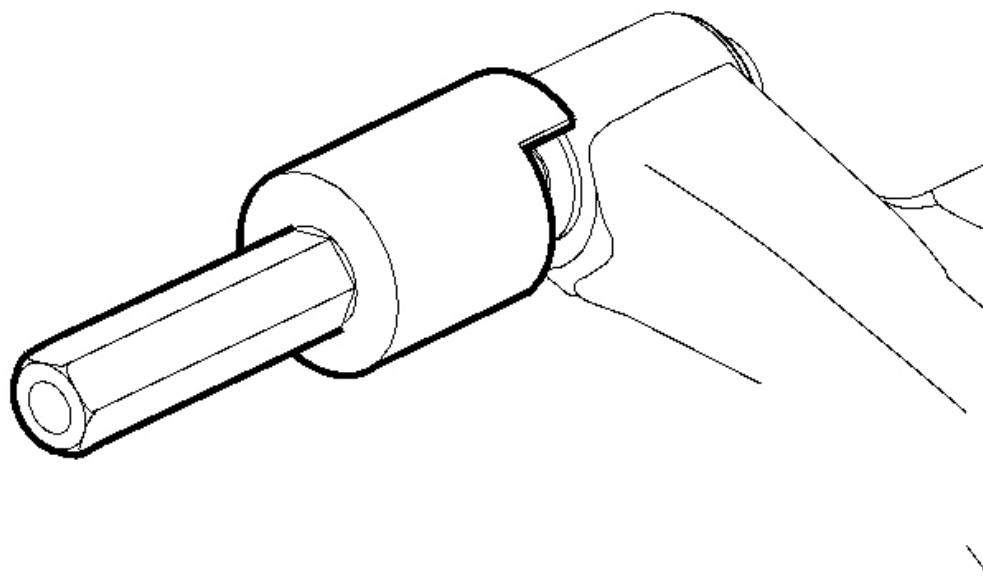


Fig. 51: Front Control Arm Bushing
Courtesy of GENERAL MOTORS CORP.

5. Use the **J 44971** to press out the front control arm bushing. See **Special Tools and Equipment** .

Installation Procedure

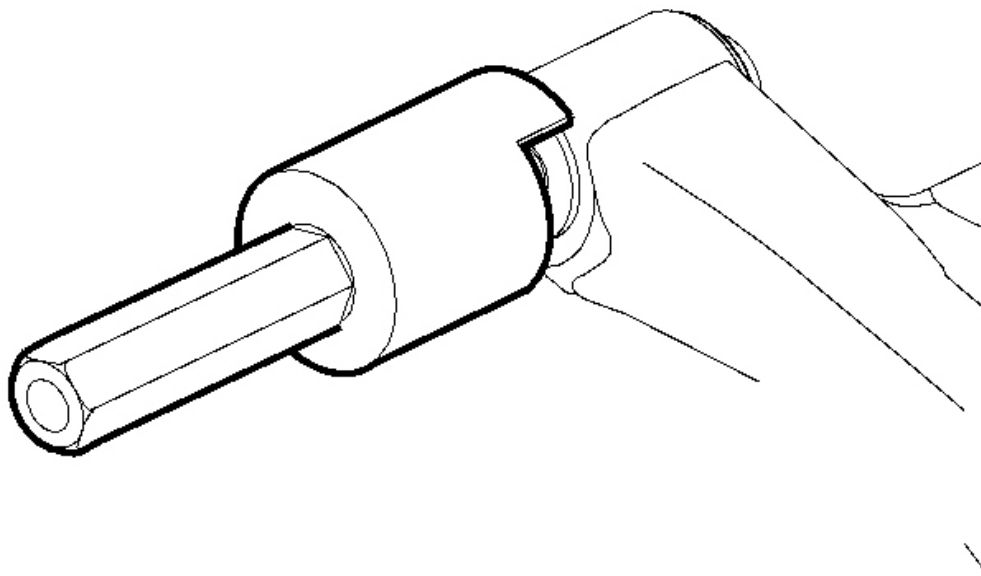


Fig. 52: Front Control Arm Bushing
Courtesy of GENERAL MOTORS CORP.

1. Use the **J 44971** to press in the front control arm bushing. See **Special Tools and Equipment** .
2. Install the lower control arm. Refer to **Lower Control Arm Replacement** .
3. Install the front tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
4. Lower the vehicle.

LOWER CONTROL ARM BUSHINGS REPLACEMENT (REAR)

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the front tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and wheels.
3. Remove the lower control arm. Refer to **Lower Control Arm Replacement** .

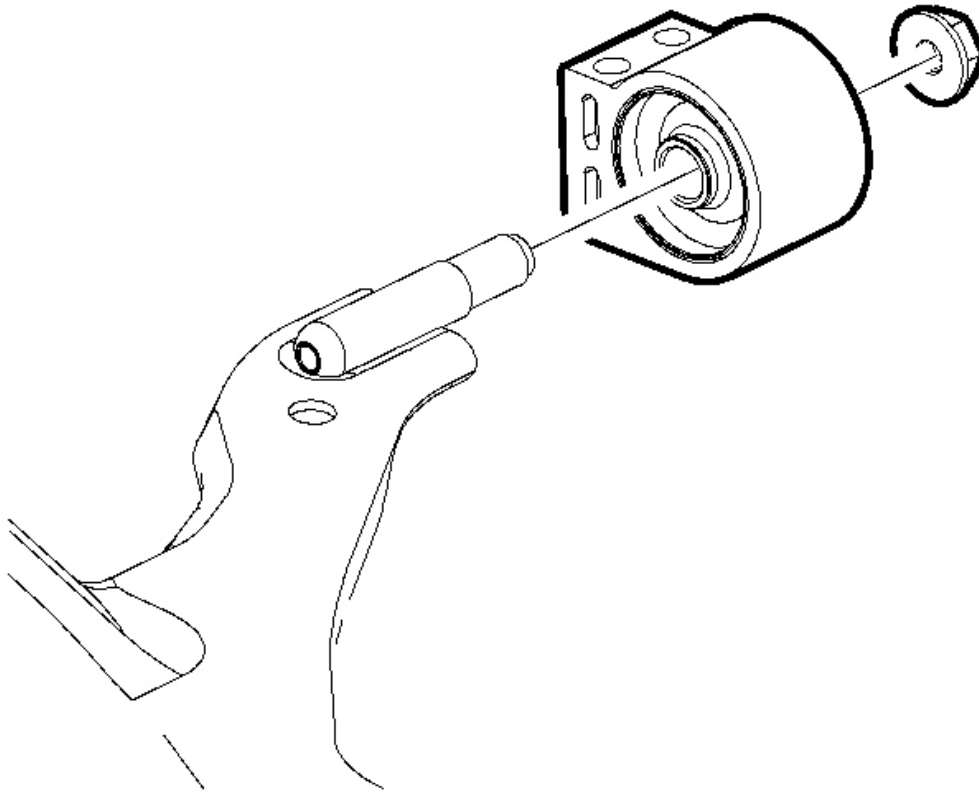


Fig. 53: Rear Bushing & Nut
Courtesy of GENERAL MOTORS CORP.

4. Remove the rear bushing nut.
5. Remove the rear bushing.

Installation Procedure

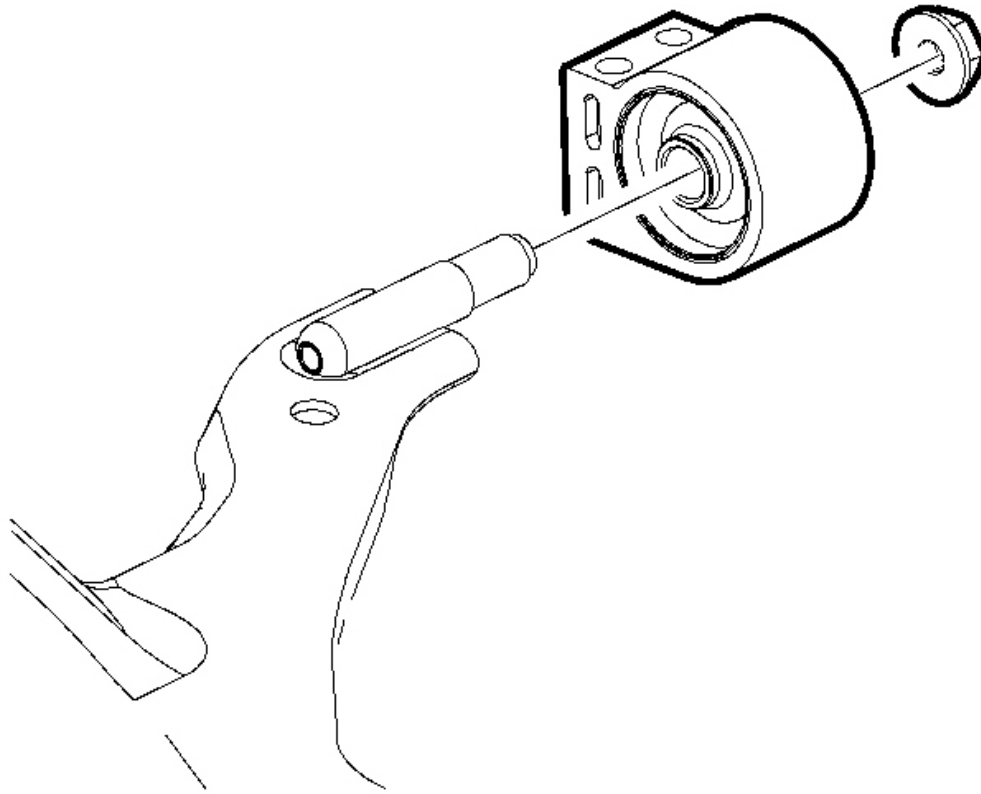


Fig. 54: Rear Bushing & Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the rear bushing to the lower control arm.

Tighten: Tighten the nut to 115 N.m (85 lb ft).

2. Install the lower control arm. Refer to Lower Control Arm Replacement.
3. Install the front tire and wheel assembly. Refer to Tire and Wheel Removal and Installation in Tires and wheels.

4. Lower the vehicle.

WHEEL STUD REPLACEMENT

Tools Required

J 43631 Ball Joint Remover. See Special Tools and Equipment .

Removal Procedure

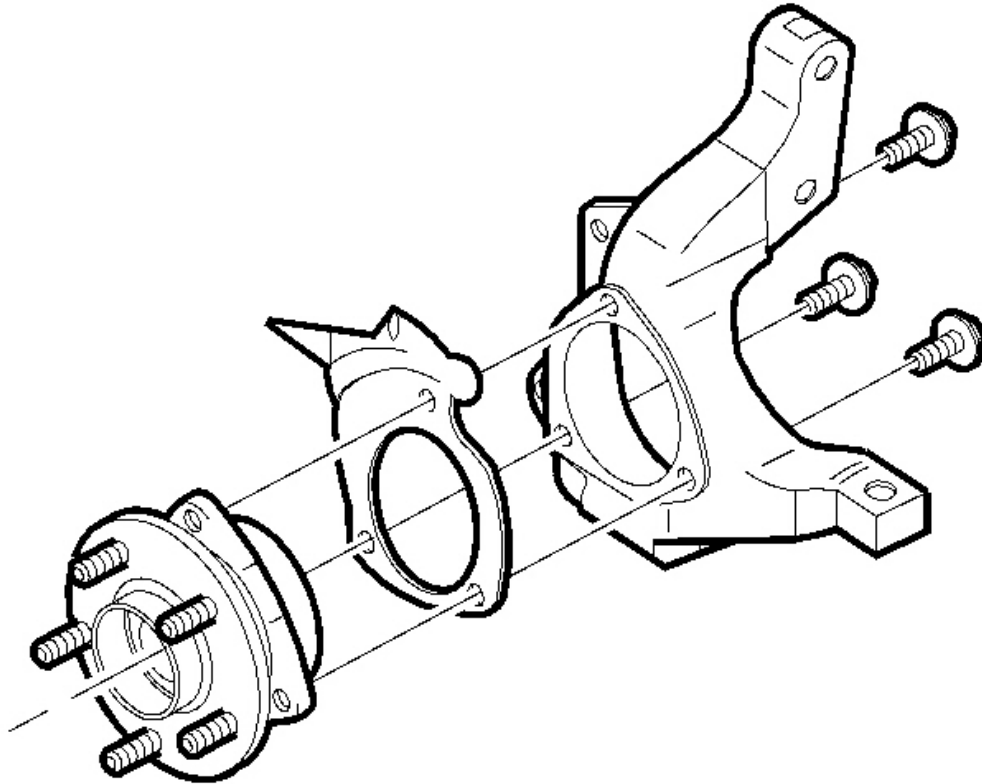


Fig. 55: Wheel Bearing/Hub & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the wheel bearing/hub assembly. Refer to **Wheel Bearing/Hub Replacement - Front** .

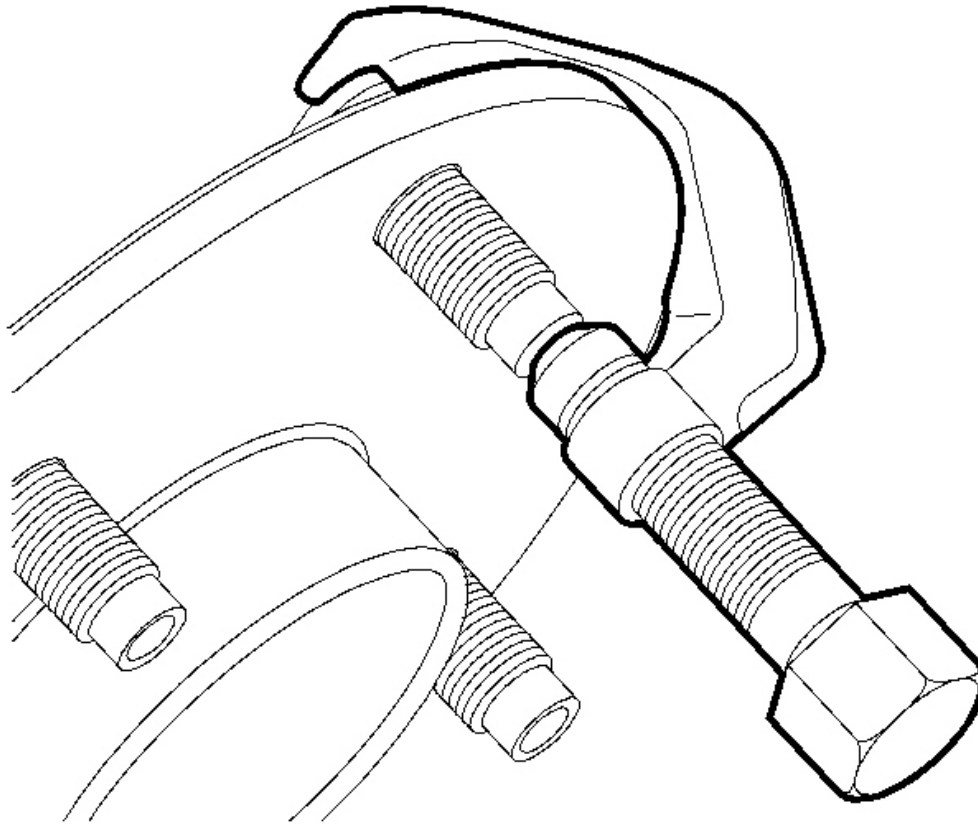


Fig. 56: Wheel Stud & Wheel Bearing/Hub Assembly
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 43631** , press out the wheel stud from the wheel bearing/hub assembly. See **Special Tools and Equipment** .

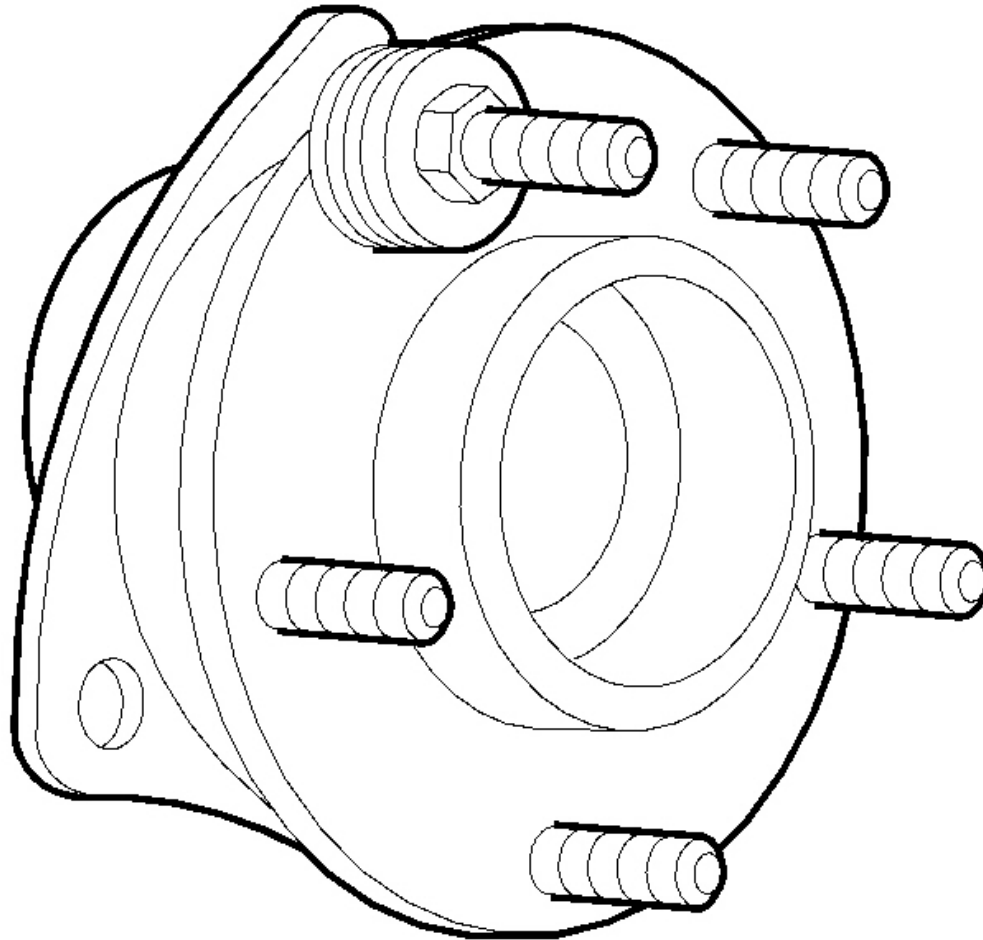


Fig. 57: Hex Head Nut & Wheel Stud
Courtesy of GENERAL MOTORS CORP.

1. Install the wheel stud to the wheel bearing/hub assembly from the bearing side of the hub flange.
2. Place flat washers over the wheel stud being installer.
3. Install the wheel nut or a hex head nut to the wheel stud.
4. Gradually tighten the nut in order to draw the stud into the hub flange until the head of the wheel stud is fully seated against the hub flange.
5. Remove the nut and flat washers.

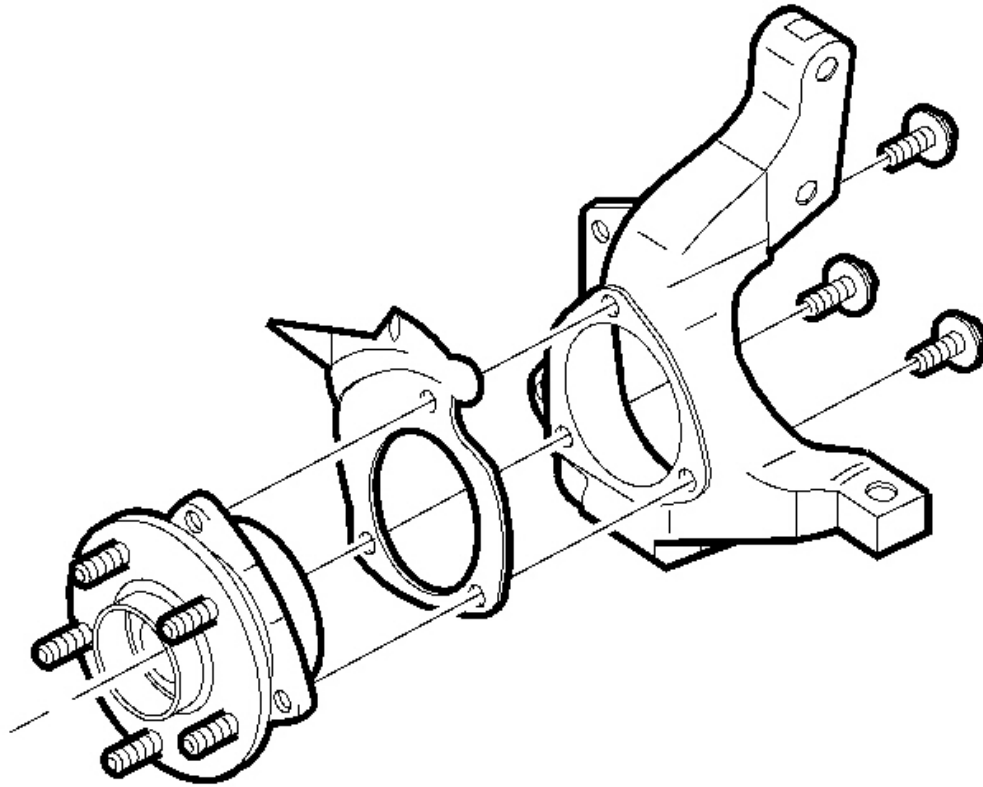


Fig. 58: Wheel Bearing/Hub & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the wheel bearing/hub assembly to the steering knuckle. Refer to **Wheel Bearing/Hub Replacement - Front**.
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
8. Lower the vehicle.

STRUT ASSEMBLY REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

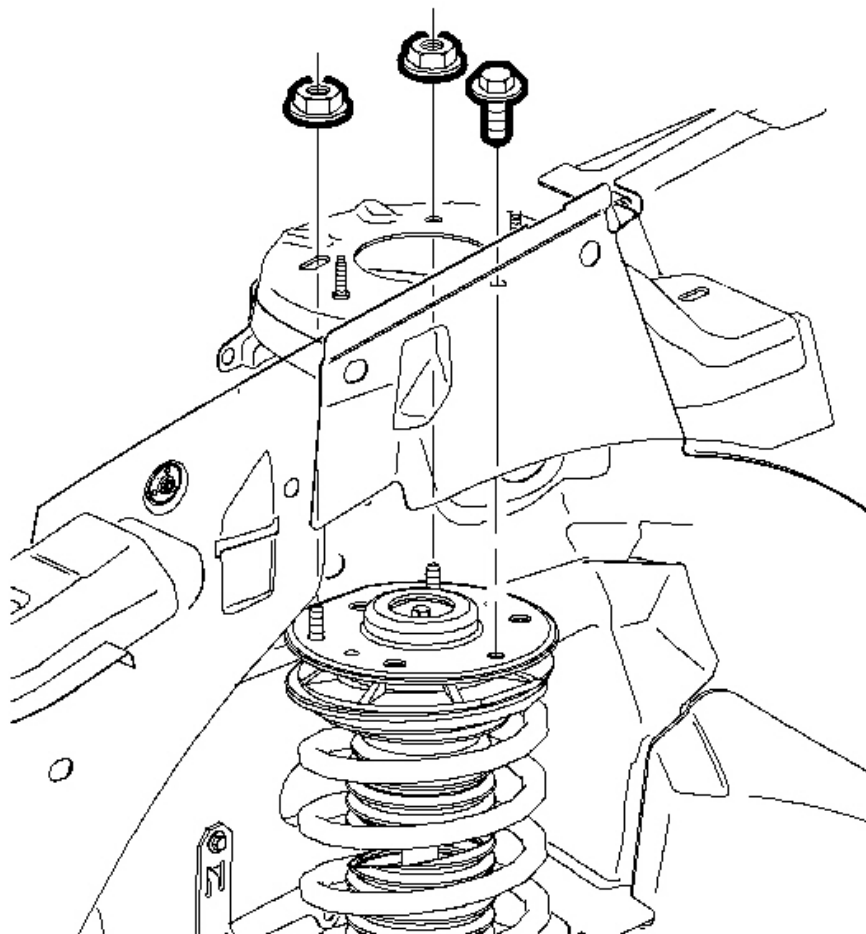


Fig. 59: Strut Assembly & Body Fasteners
Courtesy of GENERAL MOTORS CORP.

2. Remove the strut assembly to body fasteners.
3. Remove the wheel and tire. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

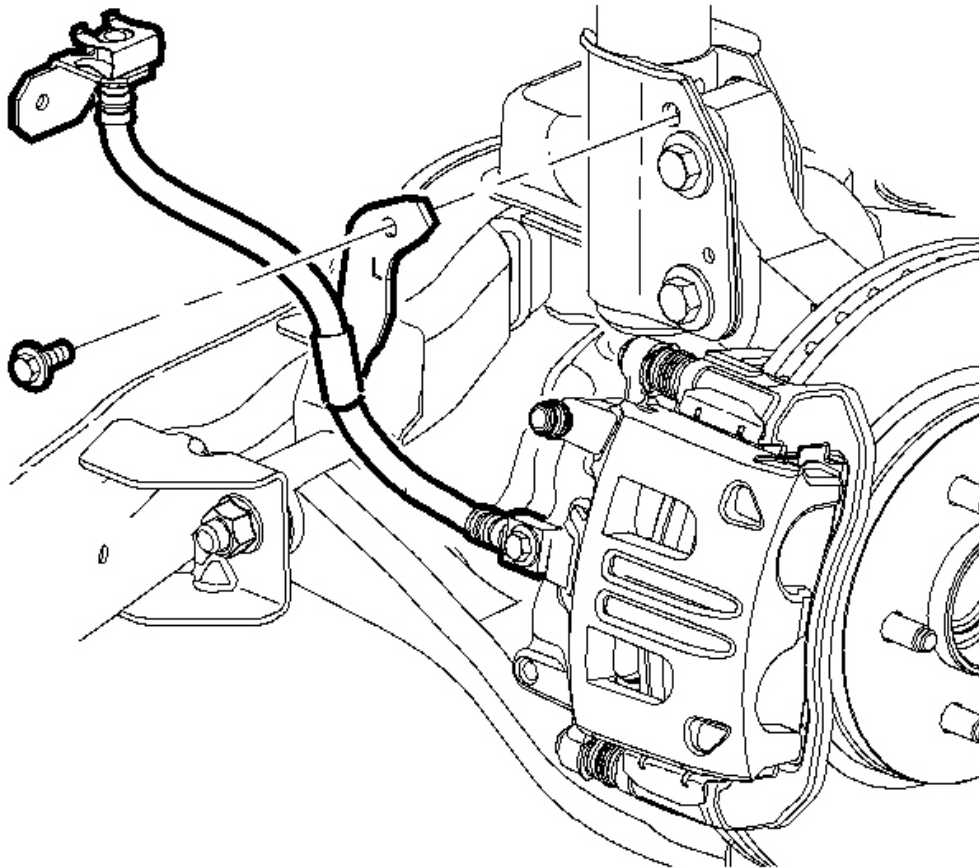


Fig. 60: Brake Hose Bracket & Strut Assembly
Courtesy of GENERAL MOTORS CORP.

4. Remove the brake hose bracket from the strut assembly.

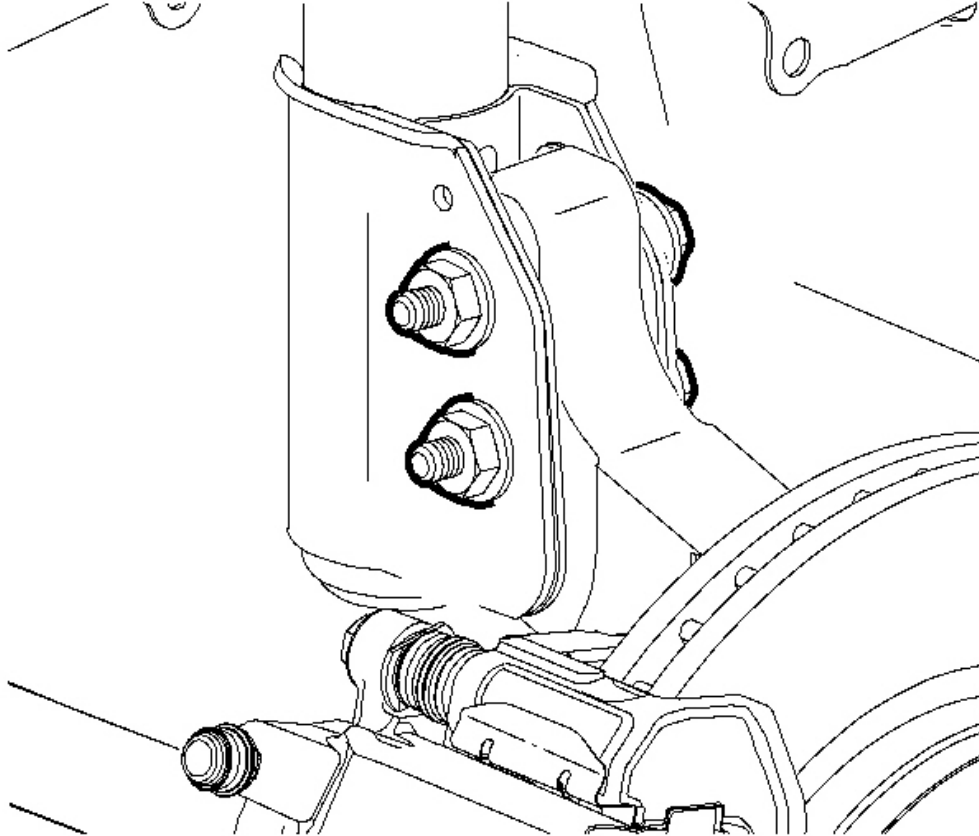


Fig. 61: Steering Knuckle, Strut Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

5. Loosen, do not remove the strut to knuckle bolts and nuts.

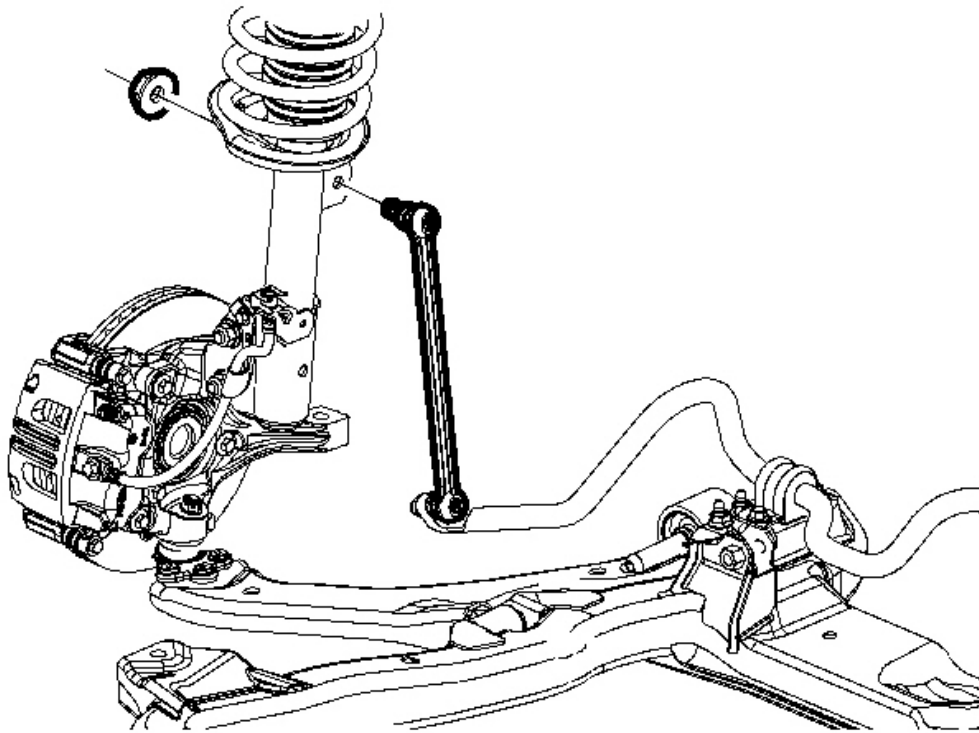


Fig. 62: Stabilizer Link & Strut Nut
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the stabilizer link from the strut assembly.

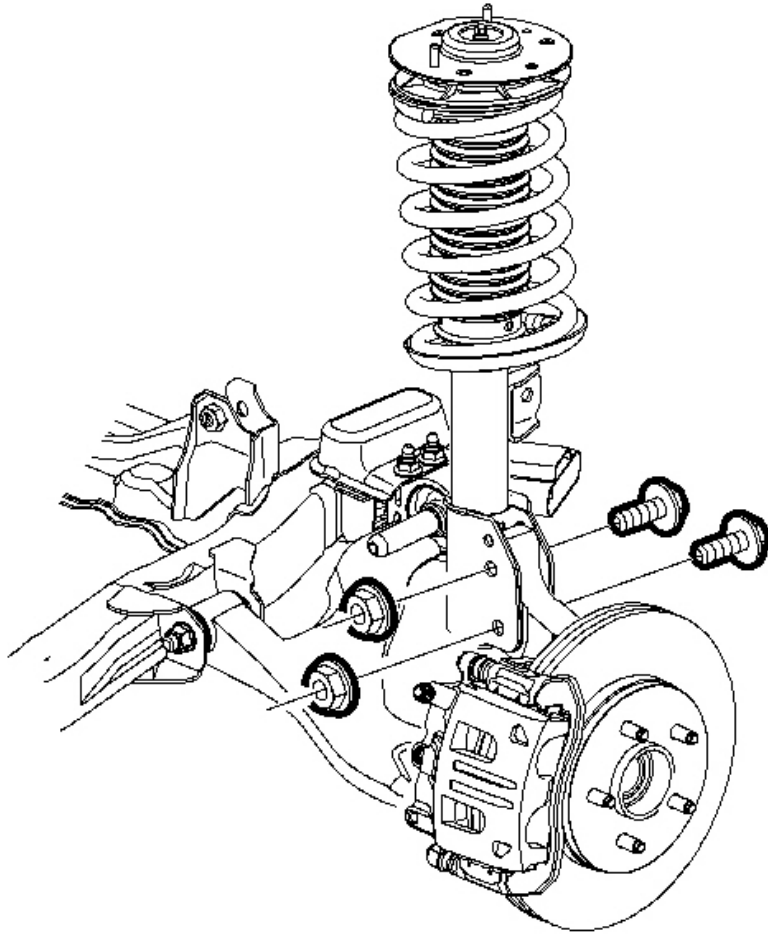


Fig. 63: Steering Knuckle, Strut Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

7. Remove the strut to knuckle bolts and nuts. Discard the bolts and nuts.
8. Remove the strut assembly from the vehicle.

Installation Procedure

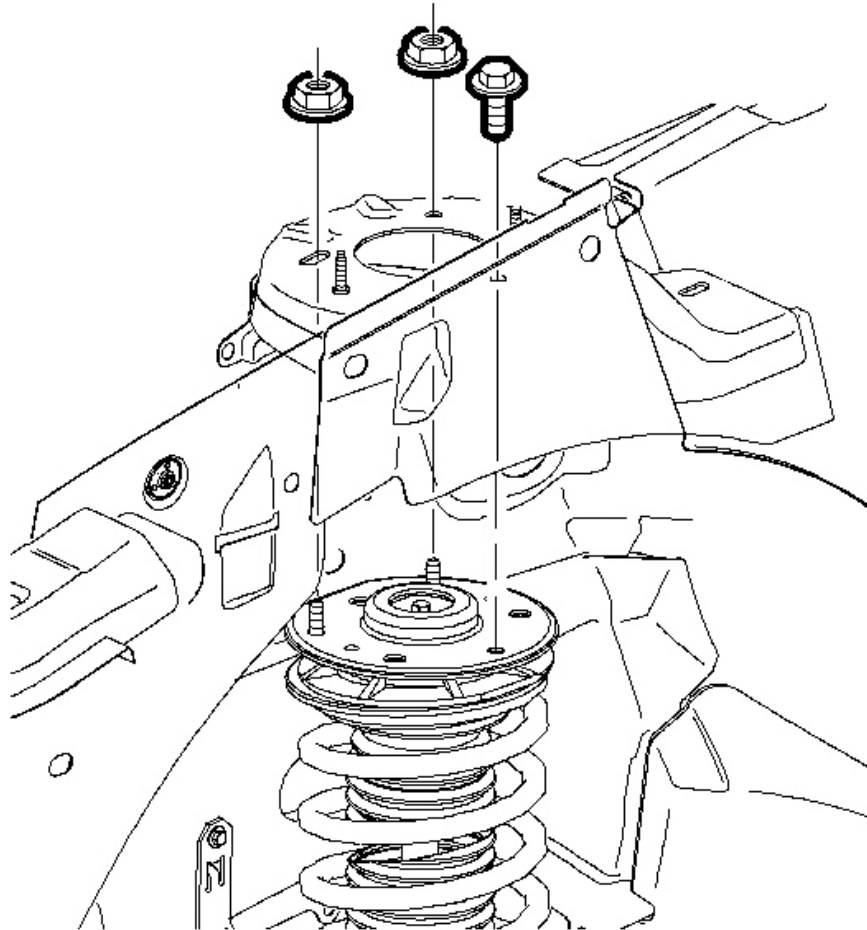


Fig. 64: Strut Assembly & Body Fasteners
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the Strut assembly to the vehicle.

Tighten:

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

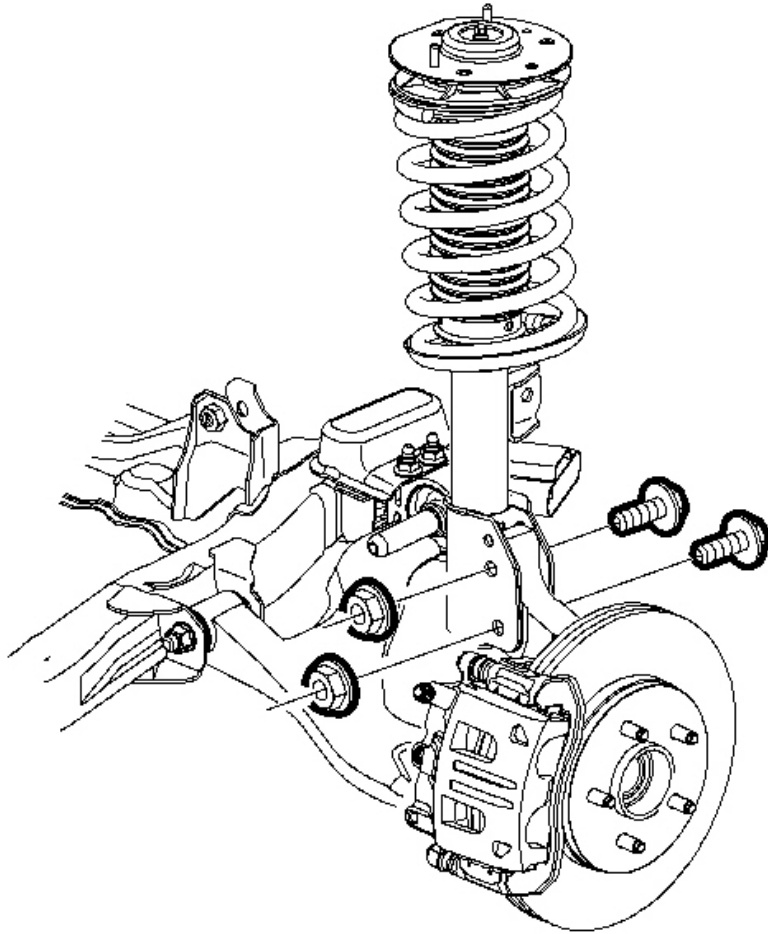


Fig. 65: Steering Knuckle, Strut Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

2. Attach the strut to the steering knuckle using new bolts and nuts.

Tighten: Tighten the bolts and nuts to 180 N.m (133 lb ft).

3. Inspect the stabilizer link seals for damage and replace the link as necessary.

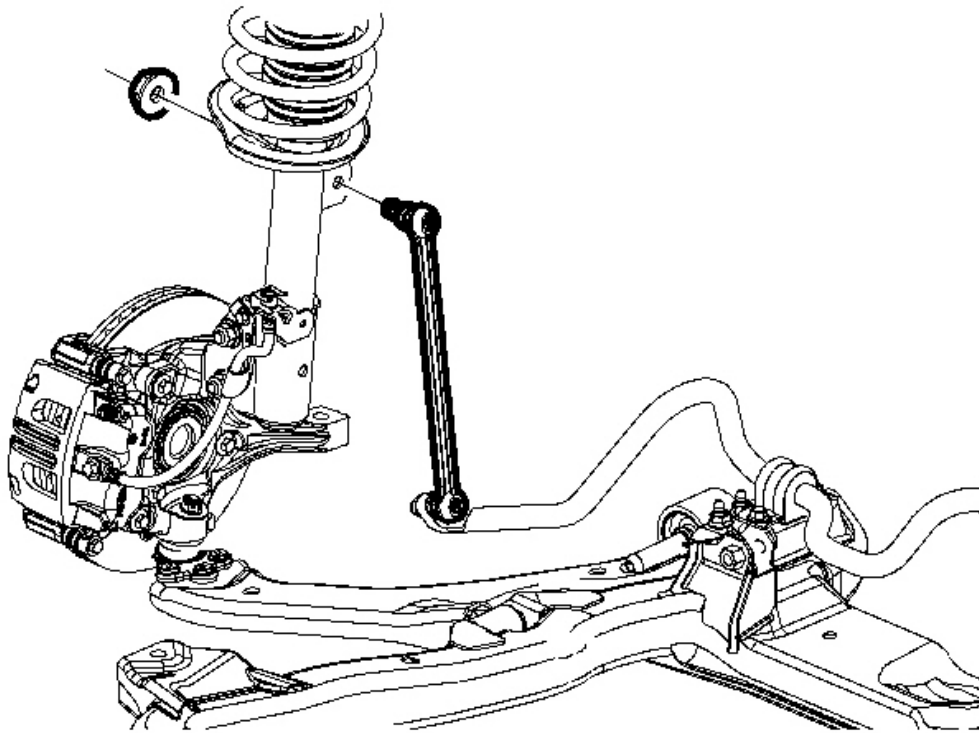


Fig. 66: Stabilizer Link & Strut Nut
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not allow the stabilizer link ball stud to rotate while installing the link nut.

4. Connect the stabilizer link to the strut.

Tighten: Tighten the nut to 65 N.m (48 lb ft).

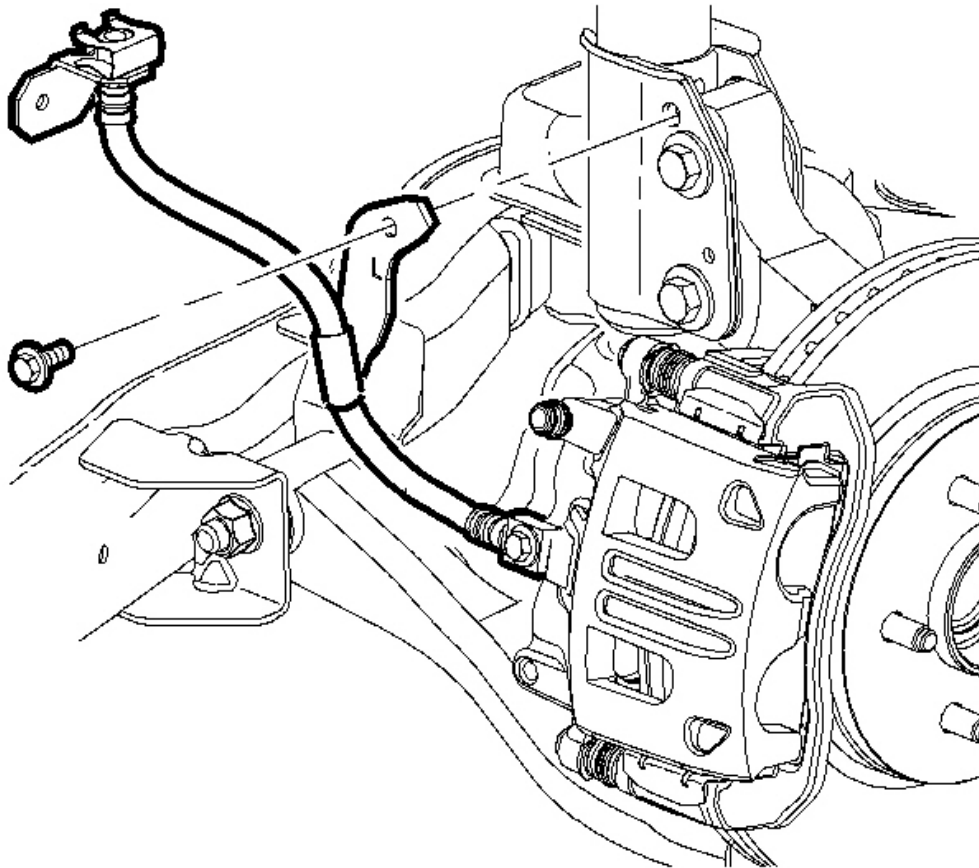


Fig. 67: Brake Hose Bracket & Strut Assembly
Courtesy of GENERAL MOTORS CORP.

5. Install the brake hose bracket to the strut assembly.

Tighten: Tighten the brake bracket bolt to 15 N.m (11 lb ft).

6. Install the wheel and tire. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
7. Lower the vehicle.
8. Perform a wheel alignment. Refer to **Measuring Wheel Alignment** in Wheel Alignment.

SUSPENSION STRUT DISPOSAL

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

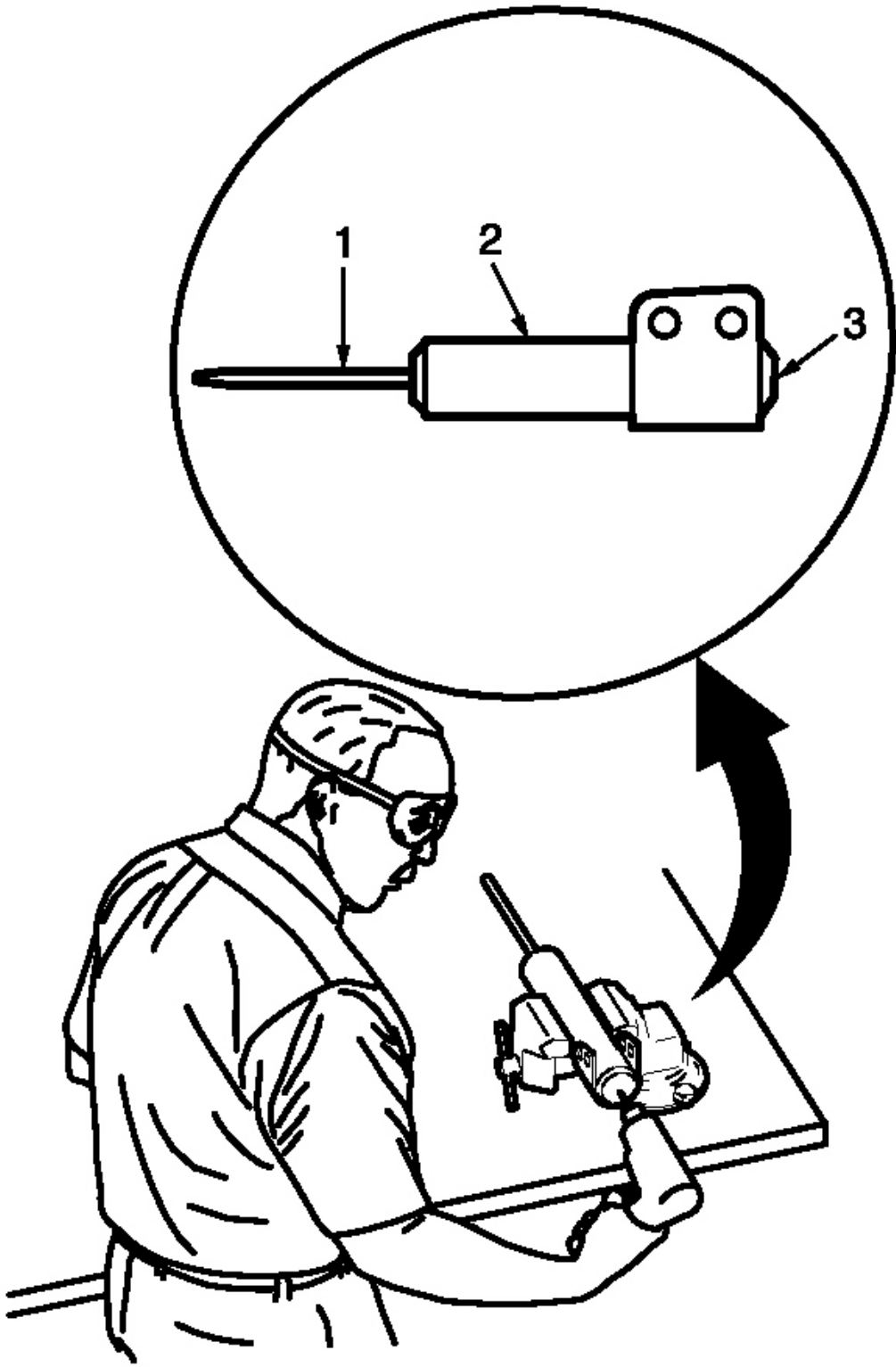


Fig. 68: Drilling Hole In Strut At Center Of End Cap
Courtesy of GENERAL MOTORS CORP.

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 AND/OR SPRING REPLACEMENT

Tools Required

J 45400 Strut Spring Compressor. See **Special Tools and Equipment** .

Removal Procedure

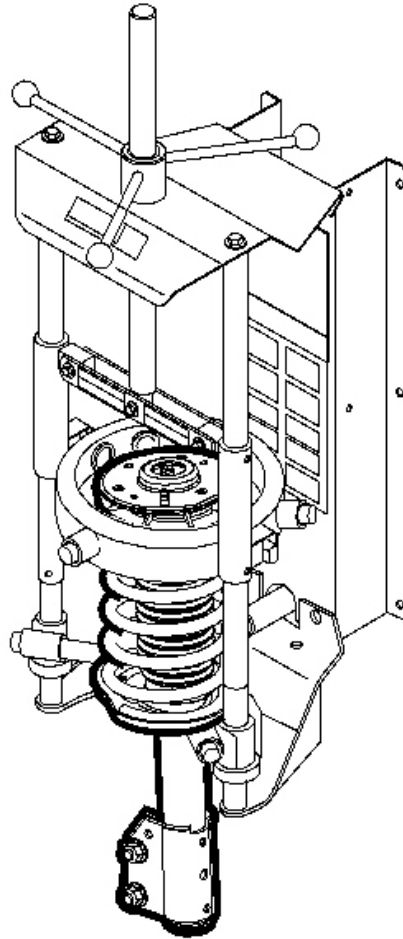


Fig. 69: Strut Assembly & J 45400
Courtesy of GENERAL MOTORS CORP.

1. Install the strut assembly in the **J 45400** using the following procedure. See **Special Tools and Equipment** .
 1. Adjust the lower legs of the **J 45400** to the lowest possible coil of the spring. See **Special Tools and Equipment** .
 2. Adjust the upper legs of the **J 45400** to the highest possible coil of the spring. See **Special Tools and Equipment** .
 3. Inspect the strut assembly to insure hooks on the strut compress legs are properly installed on the spring coils.
 4. Verify the strut assembly is parallel with the **J 45400** . See **Special Tools and Equipment** .

2. Compress the spring enough to unload the upper strut mount.

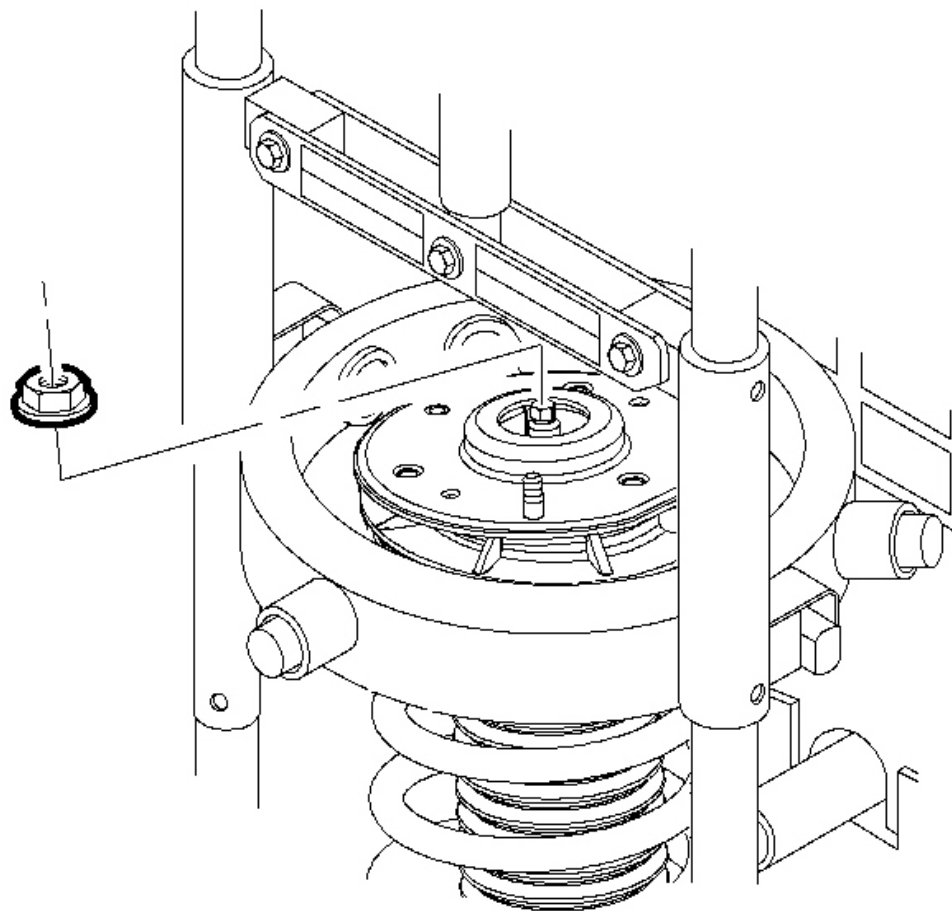


Fig. 70: Strut Shaft & Nut
Courtesy of GENERAL MOTORS CORP.

3. Remove the strut shaft nut.

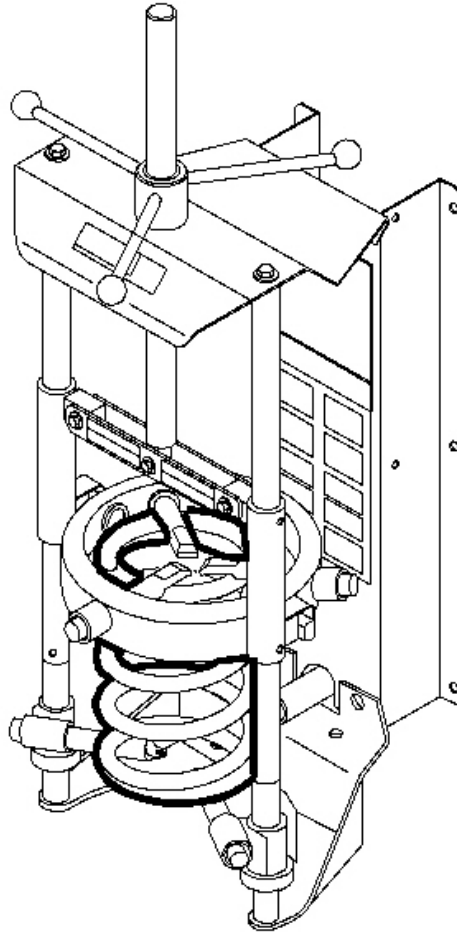


Fig. 71: Strut & Spring Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Leave the spring in the spring compressor.

4. Lower the strut from the spring assembly.

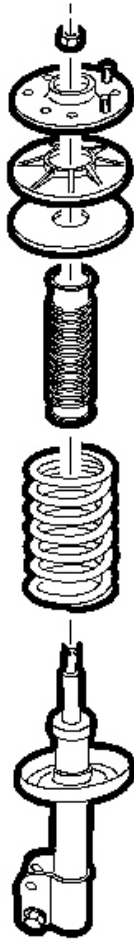


Fig. 72: Upper Mount Assembly, Strut Dust Shield, Strut Shaft & Spring
Courtesy of GENERAL MOTORS CORP.

5. Remove the upper mount assembly, inspect for damage and deterioration. Replace as necessary.
6. Remove the strut dust shield and inspect for damage and deterioration. Replace as necessary.
7. Remove the hollow bumper from the strut shaft and inspect for damage and deterioration. Replace as necessary.
8. Inspect the spring for damage. Replace as necessary.

Installation Procedure

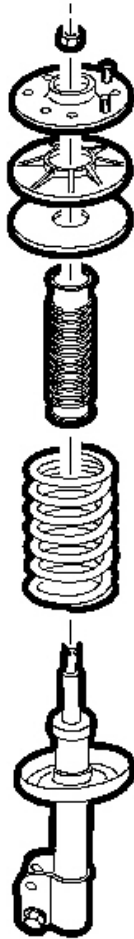


Fig. 73: Upper Mount Assembly, Strut Dust Shield, Strut Shaft & Spring
Courtesy of GENERAL MOTORS CORP.

1. Extend the strut to its limit of travel.
2. Install the hollow bumper and dust boot to the strut shaft.

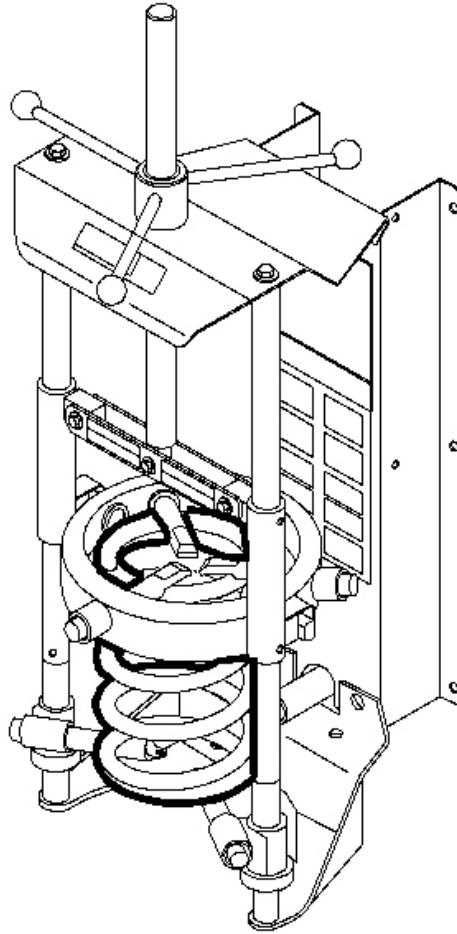


Fig. 74: Strut & Spring Assembly
Courtesy of GENERAL MOTORS CORP.

3. With the spring in the compressor, install the strut into the spring.
4. Assemble the upper spring seat onto the strut shaft and align the flat with the strut to knuckle mounting bracket.
5. Assemble the top mount onto the strut shaft and align the flat 180 degrees from flat on the upper spring seat.

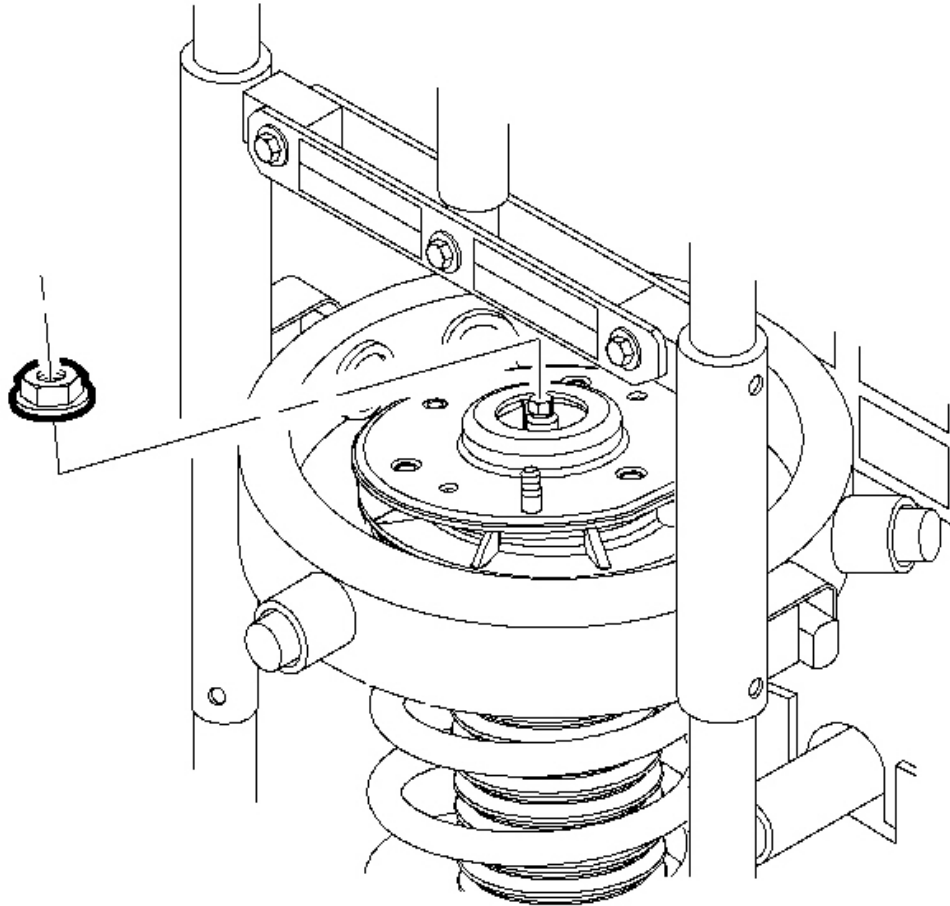


Fig. 75: Strut Shaft & Nut
Courtesy of GENERAL MOTORS CORP.

6. Loosely install the strut shaft nut.

NOTE: Refer to Fastener Notice in Cautions and Notices.

7. Hold the strut shaft and tighten the shaft nut while verifying that the upper spring seat flats align with the top mount.

Tighten: Tighten the strut shaft nut to 75 N.m (55 lb ft).

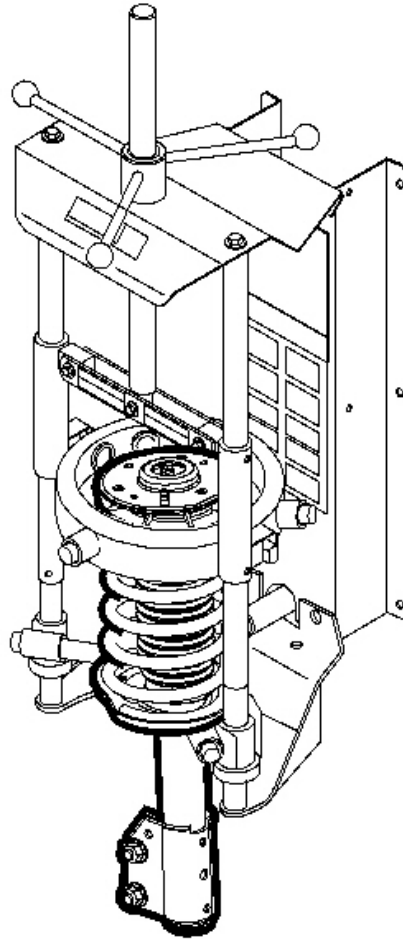


Fig. 76: Strut Assembly & J 45400
Courtesy of GENERAL MOTORS CORP.

8. Release the tension on the **J 45400** . See **Special Tools and Equipment** .
9. Remove the strut assembly from the **J 45400** . See **Special Tools and Equipment** .

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION (STRUT)

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.

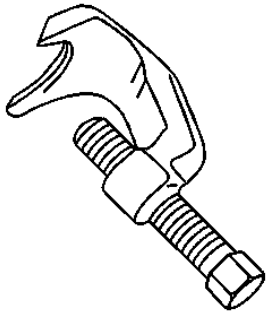
Front suspensions systems utilize a stabilizer shaft. The stabilizer bar connects between the left and right lower control arm assemblies through the stabilizer link and stabilizer shaft insulators. This bar controls the amount of independent movement of the suspension when the vehicle turns. Limiting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

SPECIAL TOOLS AND EQUIPMENT

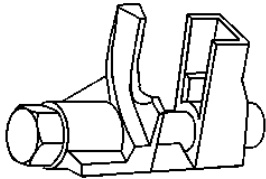
SPECIAL TOOLS

Special Tools

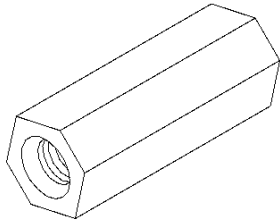
Illustration	Tool Number/ Description



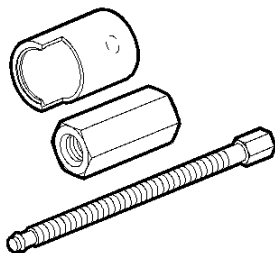
J 43631
Ball Joint Remover



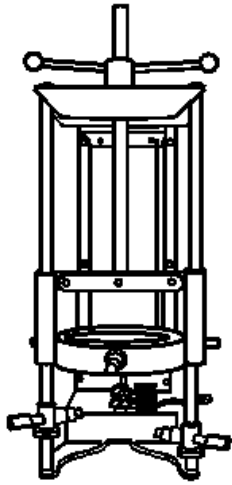
J 43828
Ball Joint Remover



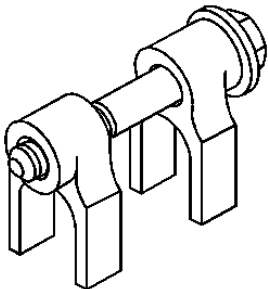
J 44015
Steering Linkage Installer



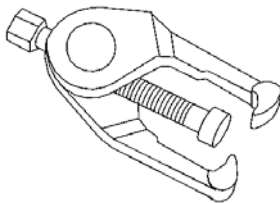
J 44971
Control Arm Bushing Remover/Installer



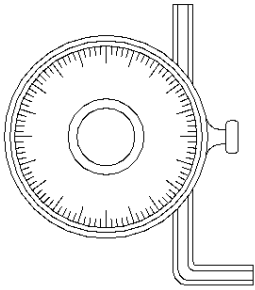
J 45400
Strut Spring Compressor



J 45646
Stabilizer Bar Collar Installer



SA91100C
Tie Rod Separator



SA9140E
Torque Angle Gage