

## 2010 SUSPENSION

### Front Suspension - Equinox & Terrain

## SPECIFICATIONS

### FASTENER TIGHTENING SPECIFICATIONS

| Application                                        | Specification           |                           |
|----------------------------------------------------|-------------------------|---------------------------|
|                                                    | Metric                  | English                   |
| Ball Joint To Control Arm Nuts and Bolts           | 68 N.m                  | 50 lb ft                  |
| Brake Hose Bracket To Strut Bolt                   | 15 N.m                  | 11 lb ft                  |
| Control Arm Ball Joint To Knuckle Nut              | 10 N.m<br>+ 165 Degrees | 89 lb in<br>+ 165 Degrees |
| Control Arm To Cradle Front Nuts and Bolts         |                         |                           |
| • For vehicles equipped with RPO FE2               | 190 N.m                 | 140 lb ft                 |
| • For vehicles equipped with RPO FE3               | 145 N.m                 | 107 lb ft                 |
| Control Arm To Cradle Rear Nuts and Bolts          | 115 N.m<br>+ 90 Degrees | 85 lb ft<br>+ 90 Degrees  |
| Hub To Axle Shaft Nut                              | 205 N.m                 | 157 lb ft                 |
| Hub To Knuckle Bolts                               | 100 N.m                 | 74 lb ft                  |
| Outer Tie Rod To Knuckle Nut                       | 25 N.m<br>+ 90 Degrees  | 18 lb ft<br>+ 90 Degrees  |
| Stabilizer Shaft to Link Nut                       | 85 N.m                  | 63 lb ft                  |
| Stabilizer Shaft Link to Strut Nut                 | 75 N.m                  | 55 lb ft                  |
| Stabilizer Shaft Insulator Bracket To Cradle Bolts | 50 N.m                  | 37 lb ft                  |
| Strut Shaft Nut                                    | 55 N.m                  | 41 lb ft                  |
| Strut To Body Bolts                                | 25 N.m                  | 22 lb ft                  |
| Strut To Knuckle Nuts and Bolts                    | 185 N.m                 | 136 lb ft                 |

### ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

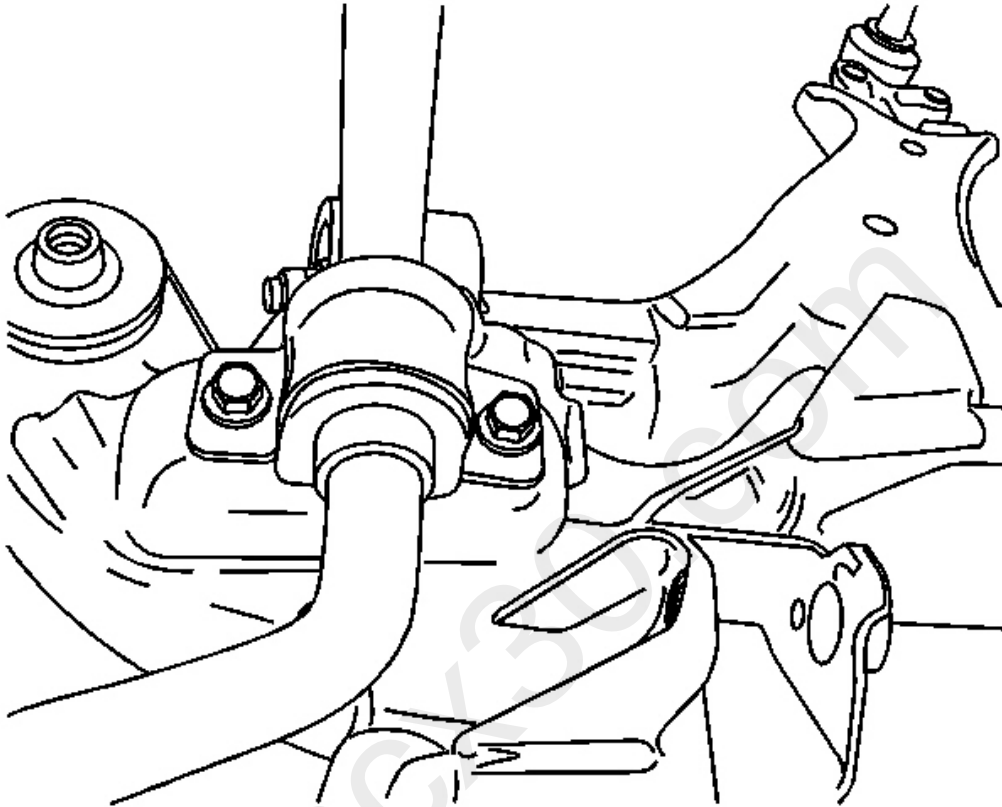
| Application                                     | Type of Material | GM Part Number |          |
|-------------------------------------------------|------------------|----------------|----------|
|                                                 |                  | US             | Canada   |
| Front and Rear Wheel Bearing/Hub Mounting Bolts | Thread Locker©   | 89021297       | 10953488 |

## REPAIR INSTRUCTIONS

### STABILIZER SHAFT REPLACEMENT

#### Removal Procedure

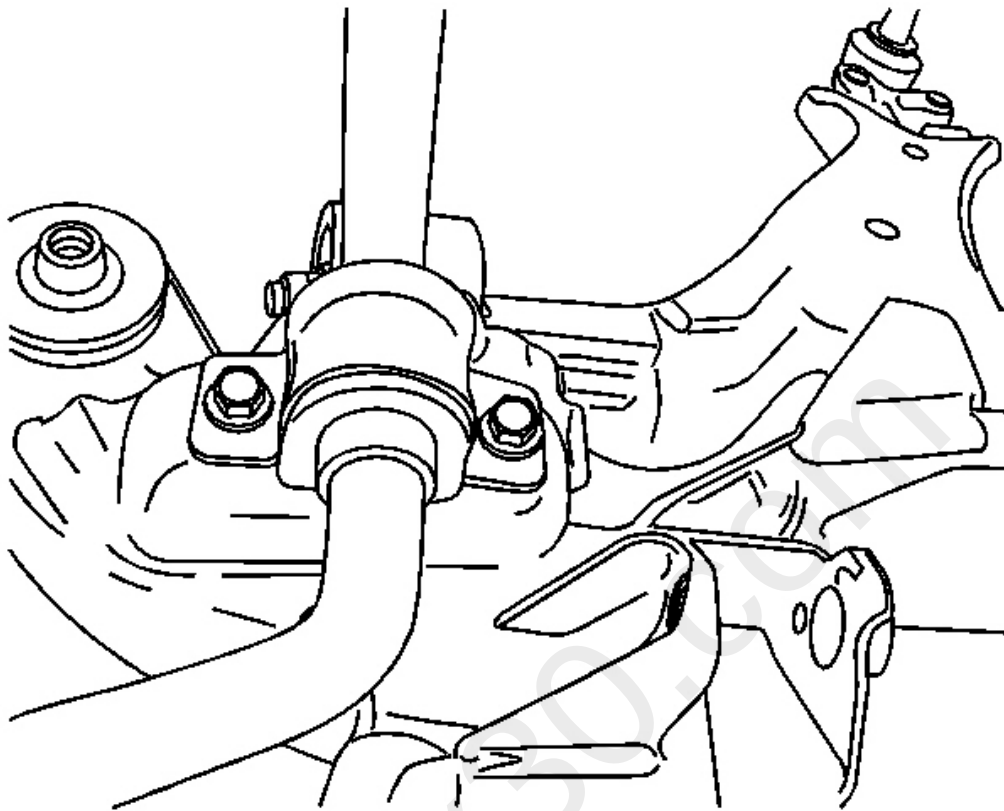
1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Lower the front suspension frame. Refer to **Drivetrain and Front Suspension Frame Replacement** .



**Fig. 1: Identifying Stabilizer Shaft Insulator Bracket Bolts**  
Courtesy of GENERAL MOTORS CORP.

3. Remove the stabilizer shaft insulator bracket bolts.
4. Remove the stabilizer shaft assembly from the frame.
5. Remove the stabilizer shaft insulator brackets.
6. Remove the stabilizer shaft insulators.

#### **Installation Procedure**



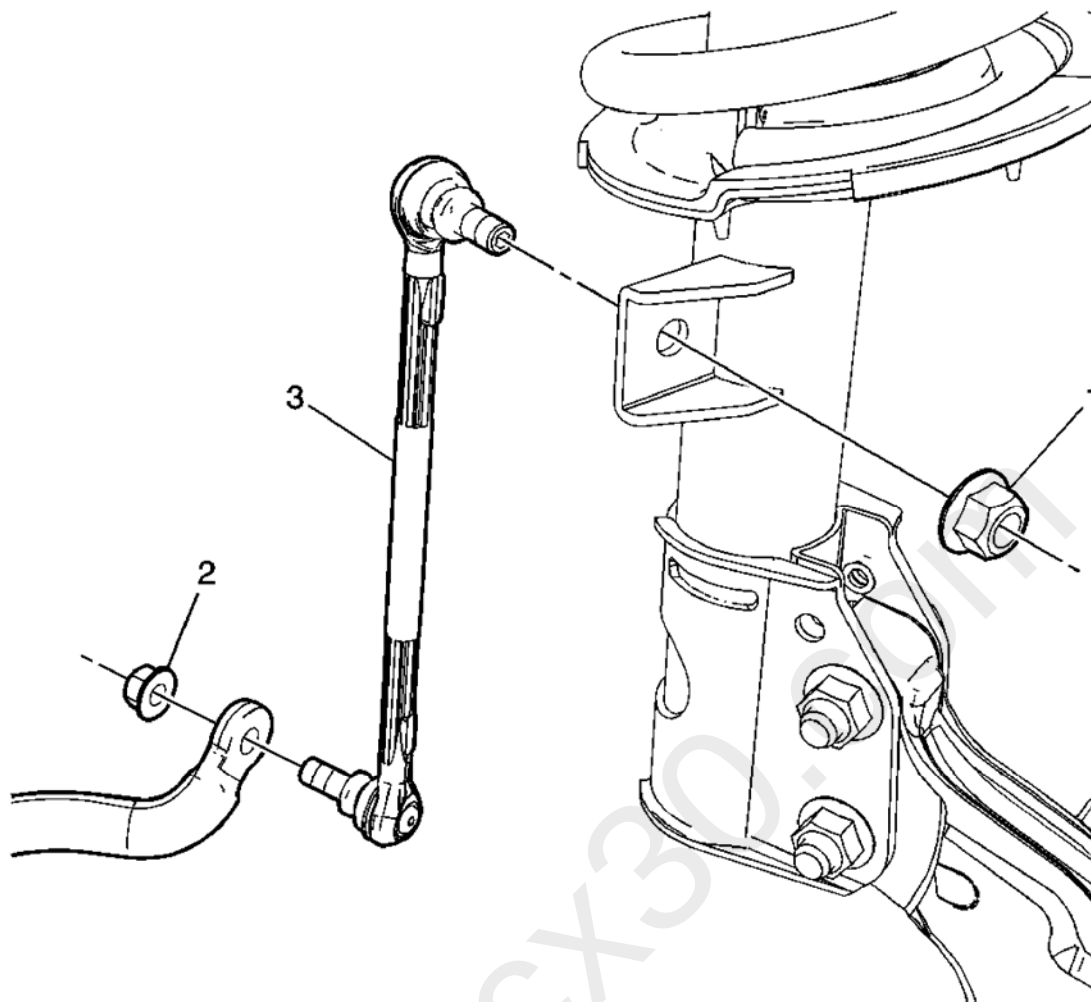
**Fig. 2: Identifying Stabilizer Shaft Insulator Bracket Bolts**  
**Courtesy of GENERAL MOTORS CORP.**

1. Install the stabilizer shaft insulators to the stabilizer shaft.
2. Install the stabilizer shaft insulator brackets.
3. Install the stabilizer shaft assembly to the frame.

**CAUTION: Refer to Fastener Caution .**

4. Install the stabilizer shaft insulator bracket bolts to 50 N.m (37 lb ft).
5. Install the front suspension frame. Refer to **Drivetrain and Front Suspension Frame Replacement** .
6. Lower the vehicle.

## **STABILIZER SHAFT LINK REPLACEMENT**

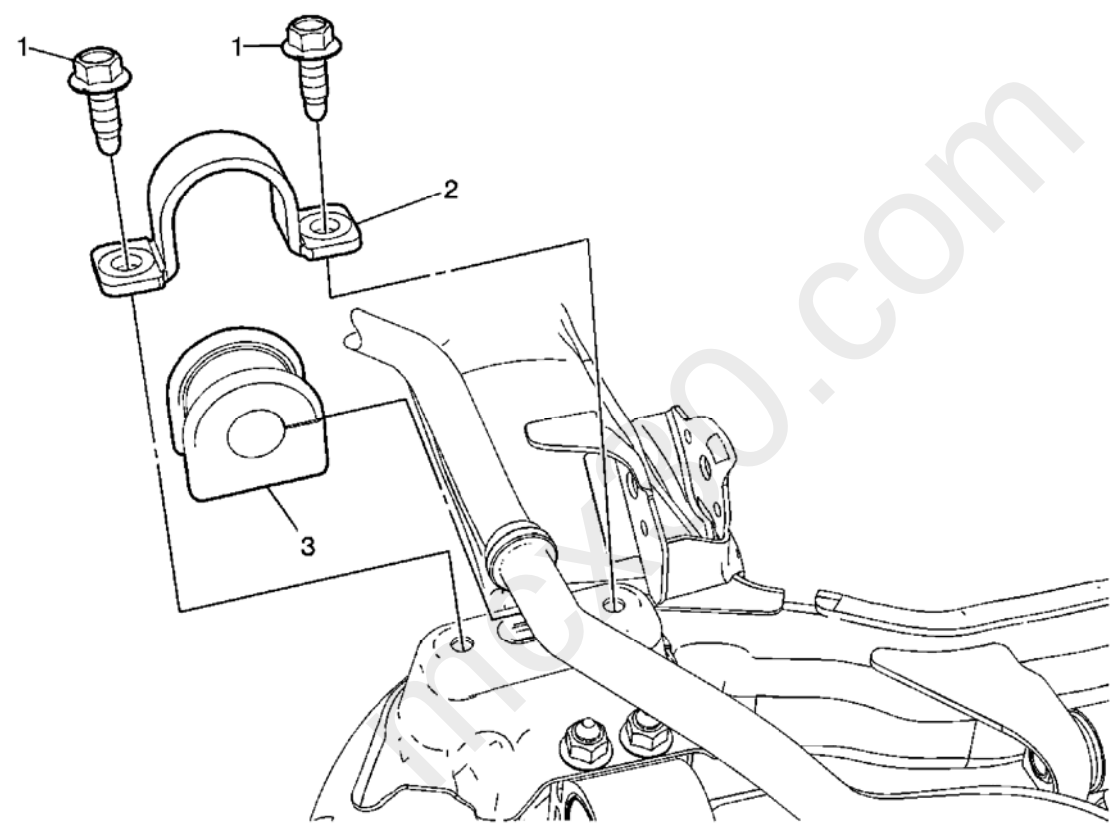


**Fig. 3: Stabilizer Shaft Link**  
 Courtesy of GENERAL MOTORS CORP.

| Callout                                                                                                                                                                                         | Component Name                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Preliminary Procedures</b>                                                                                                                                                                   |                                                                                                                                                                                                                                           |
| 1. Raise the vehicle. Refer to <b><u>Lifting and Jacking the Vehicle</u></b> .<br>2. Remove the front wheel and tire assembly. Refer to <b><u>Tire and Wheel Removal and Installation</u></b> . |                                                                                                                                                                                                                                           |
| 1                                                                                                                                                                                               | Stabilizer Shaft Link Nut<br><br><b>CAUTION:</b><br><b>Refer to <u>Fastener Caution</u> .</b><br><br><b>Tip:</b> Use the proper size allen wrench to keep the stabilizer link ball stud from rotate while removing or installing the nut. |

|   |                                                                                                                                                                                                         |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <b>Tighten:</b> 75 N.m (55 lb ft).                                                                                                                                                                      |
| 2 | Stabilizer Shaft Link Nut<br><b>Tip:</b> Use the proper size allen wrench to keep the stabilizer link ball stud from rotate while removing or installing the nut.<br><b>Tighten:</b> 85 N.m (63 lb ft). |
| 3 | Stabilizer Shaft Link                                                                                                                                                                                   |

STABILIZER SHAFT INSULATOR REPLACEMENT



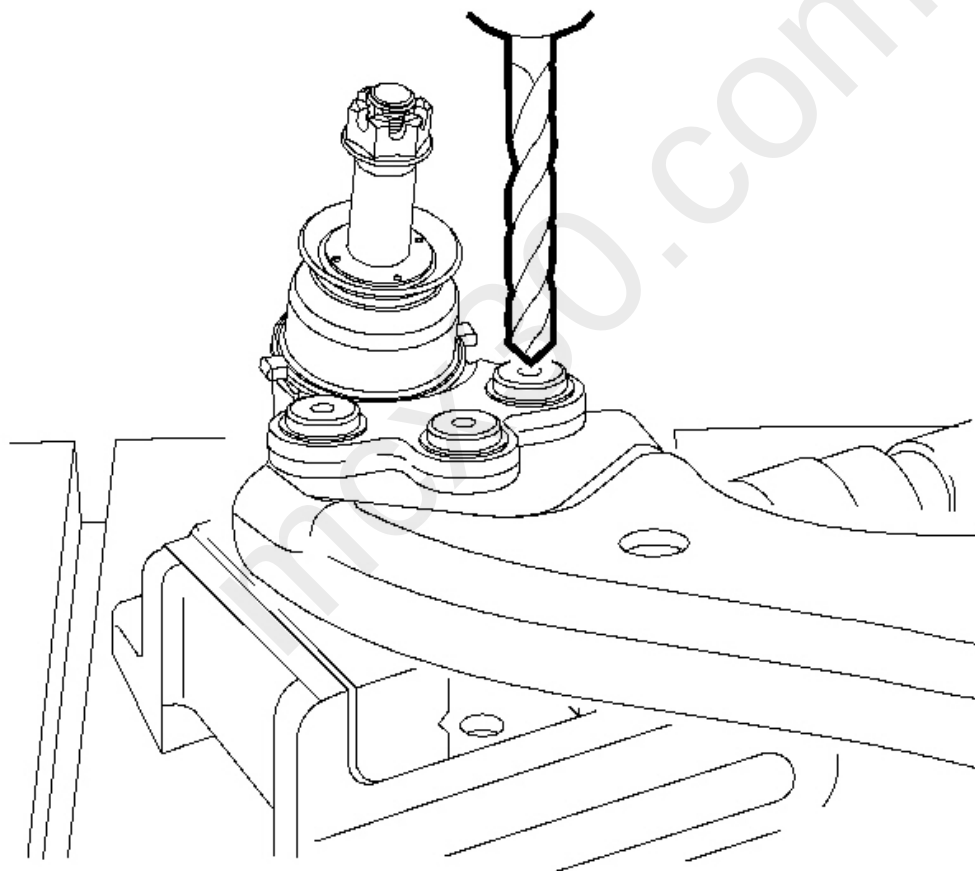
**Fig. 4: Stabilizer Shaft Insulator**  
Courtesy of GENERAL MOTORS CORP.

| Callout                                                                                                  | Component Name                           |
|----------------------------------------------------------------------------------------------------------|------------------------------------------|
| <b>Preliminary Procedures</b>                                                                            |                                          |
| 1. Raise the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .                                  |                                          |
| 2. Remove the front wheel and tire assemblies. Refer to <u>Tire and Wheel Removal and Installation</u> . |                                          |
|                                                                                                          | Stabilizer Shaft Insulator Bolt (Qty: 4) |
|                                                                                                          | <b>CAUTION:</b>                          |

|   |                                                                                 |
|---|---------------------------------------------------------------------------------|
| 1 | Refer to <b><u>Fastener Caution</u></b> .<br><b>Tighten:</b> 50 N.m (37 lb ft). |
| 2 | Stabilizer Shaft Insulator Clamp (Qty: 2)                                       |
| 3 | Stabilizer Shaft Insulator (Qty: 2)                                             |

## LOWER CONTROL ARM BALL JOINT REPLACEMENT

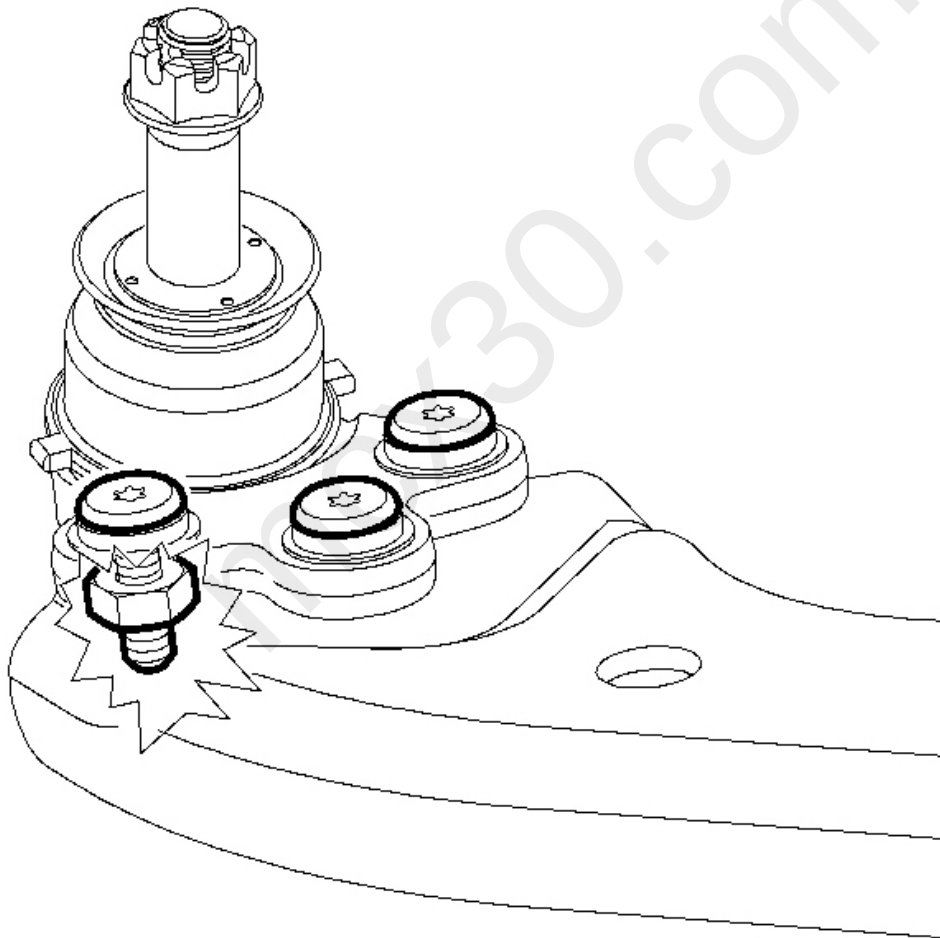
### Removal Procedure



**Fig. 5: Removing Ball Joint Rivets**  
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 burs from the control arm.
4. Remove the ball joint from the control arm. Note the position of the ball joint for reassembly.

#### **Installation Procedure**



**Fig. 6: View Of Ball Joint & Control Arm**  
Courtesy of GENERAL MOTORS CORP.

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

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

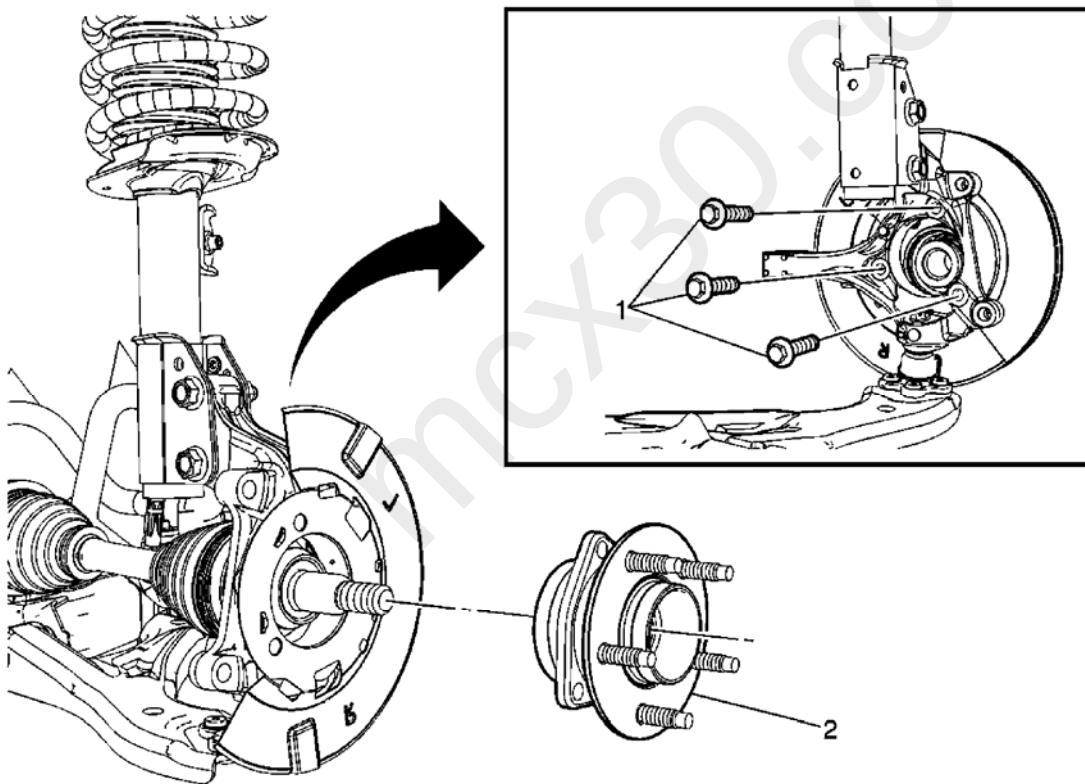
**CAUTION:** Refer to Fastener Caution .

**NOTE:**

- 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 and tighten the bolts/nuts to 68 N.m (50 lb ft).
3. Install the lower control arm. Refer to Lower Control Arm Replacement.

## FRONT WHEEL BEARING AND HUB REPLACEMENT



**Fig. 7: Front Wheel Bearing & Hub**  
Courtesy of GENERAL MOTORS CORP.

| Callout                | Component Name |
|------------------------|----------------|
| Preliminary Procedures |                |

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the wheel drive shaft nut. Refer to **Front Wheel Drive Shaft Replacement** .
4. Remove the brake rotor. Refer to **Front Brake Rotor Replacement** .
5. Remove the wheel speed sensor. Refer to **Front Wheel Speed Sensor Replacement** .

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <p>Wheel Bearing/Hub Bolt (Qty: 3)</p> <p><b>CAUTION:</b><br/>Refer to <b><u>Fastener Caution</u></b> .</p> <p><b>Procedure</b></p> <ol style="list-style-type: none"> <li>1. Use the proper cleaner on the threads on the wheel bearing/hub bolts.</li> <li>2. Apply threadlocker on 2/3 of the wheel bearing/hub bolts. Refer to <b><u>Adhesives, Fluids, Lubricants, and Sealers</u></b>.</li> </ol> <p><b>Tip:</b> Allow the threadlocker to set of 10 minutes before using.</p> <p><b>Tighten:</b> 100 N.m (74 lb ft)</p> |
| 2 | <p>Wheel Bearing and Hub Assembly</p> <p><b>Tip:</b> If removing the wheel bearing/hub assembly to service other components, support the wheel drive shaft with mechanics wire.</p>                                                                                                                                                                                                                                                                                                                                            |

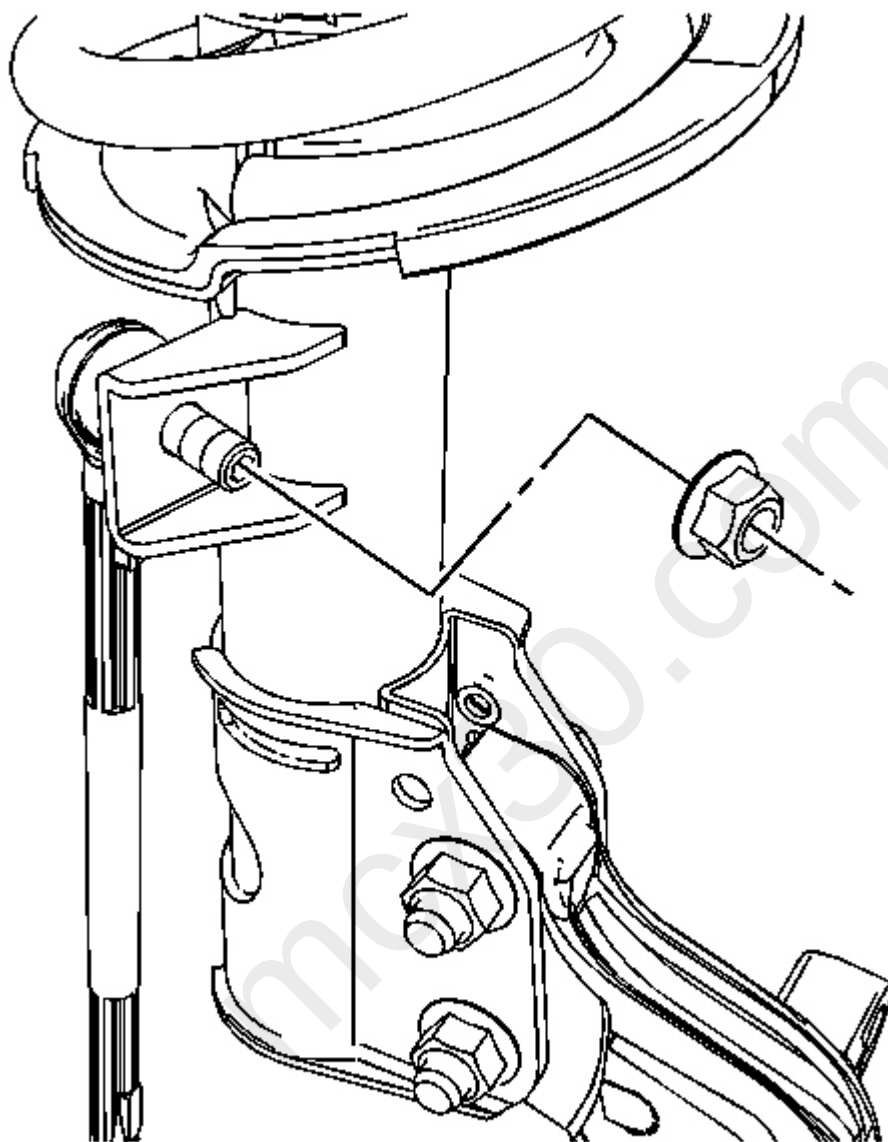
## STEERING KNUCKLE REPLACEMENT

### Special Tools

**J-42188-B** Ball Joint Separator

### Removal Procedure

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

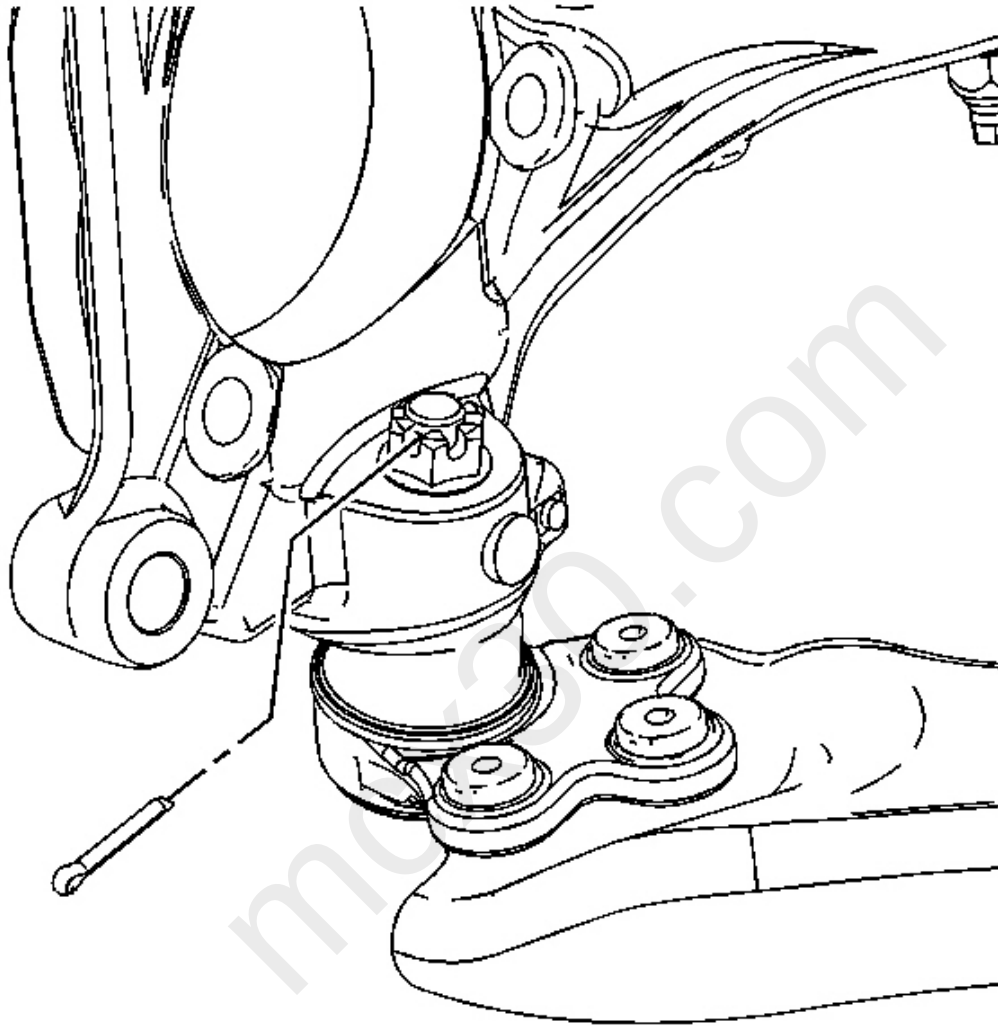


**Fig. 8: Identifying Stabilizer Link Retaining Nut**  
Courtesy of GENERAL MOTORS CORP.

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

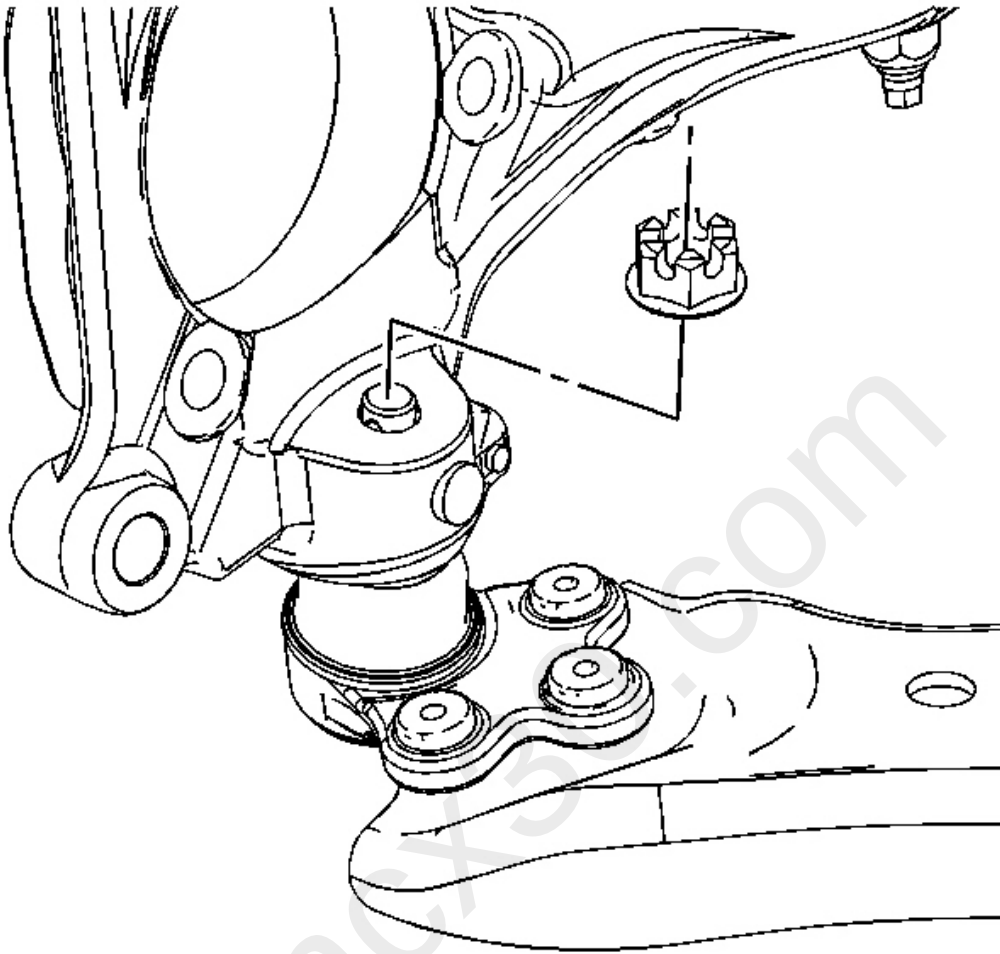
4. Remove the nut and separate the stabilizer link from the strut assembly.

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



**Fig. 9: Identifying Lower Ball Joint Cotter Pin**  
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.
8. Using the **J-42188-B** , separate the lower ball joint from the steering knuckle.

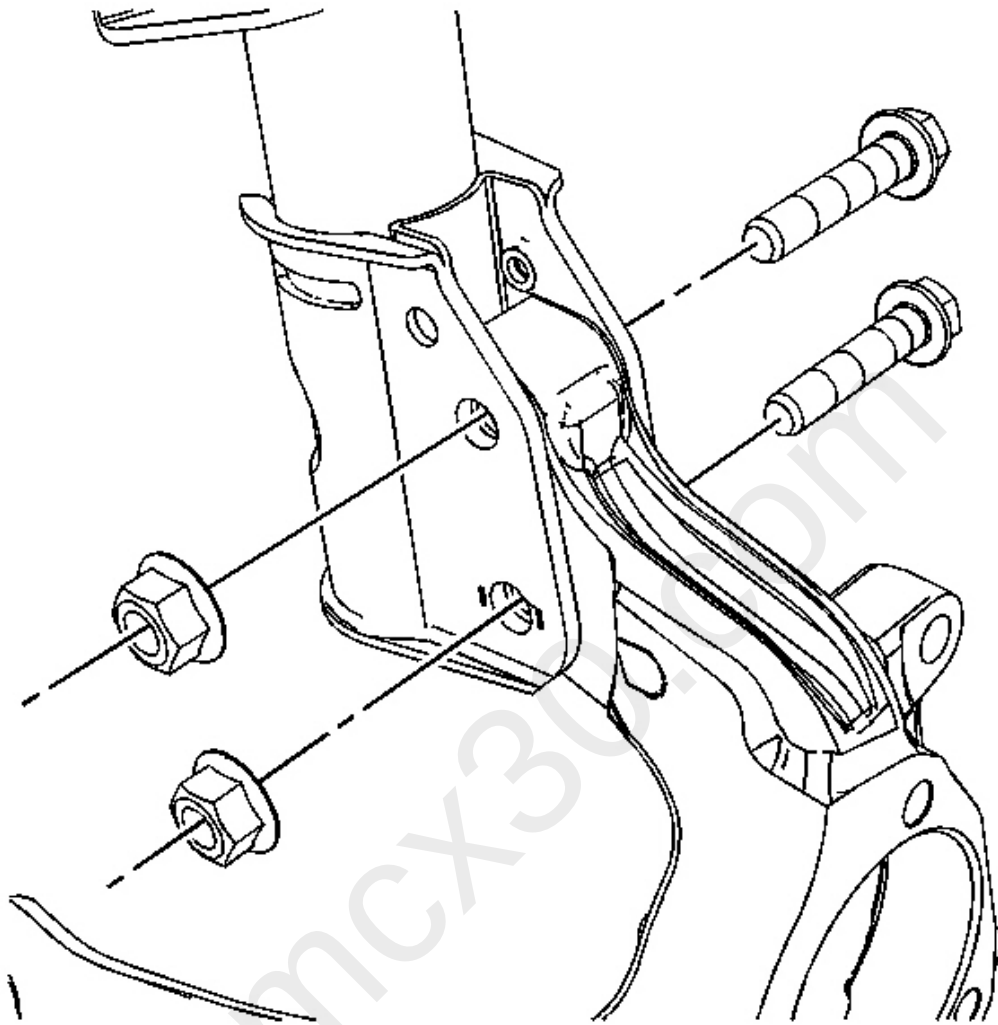


**Fig. 10: View Of Ball Joint & Knuckle**  
Courtesy of GENERAL MOTORS CORP.

9. Remove the lower ball joint nut and separate from the knuckle.

**CAUTION:** Do not free the ball stud by using a pickle fork or a wedge-type tool.  
Damage to the seal or bushing may result.

10. Remove the outer tie rod end from the knuckle. Refer to **Steering Linkage Outer Tie Rod Replacement** .

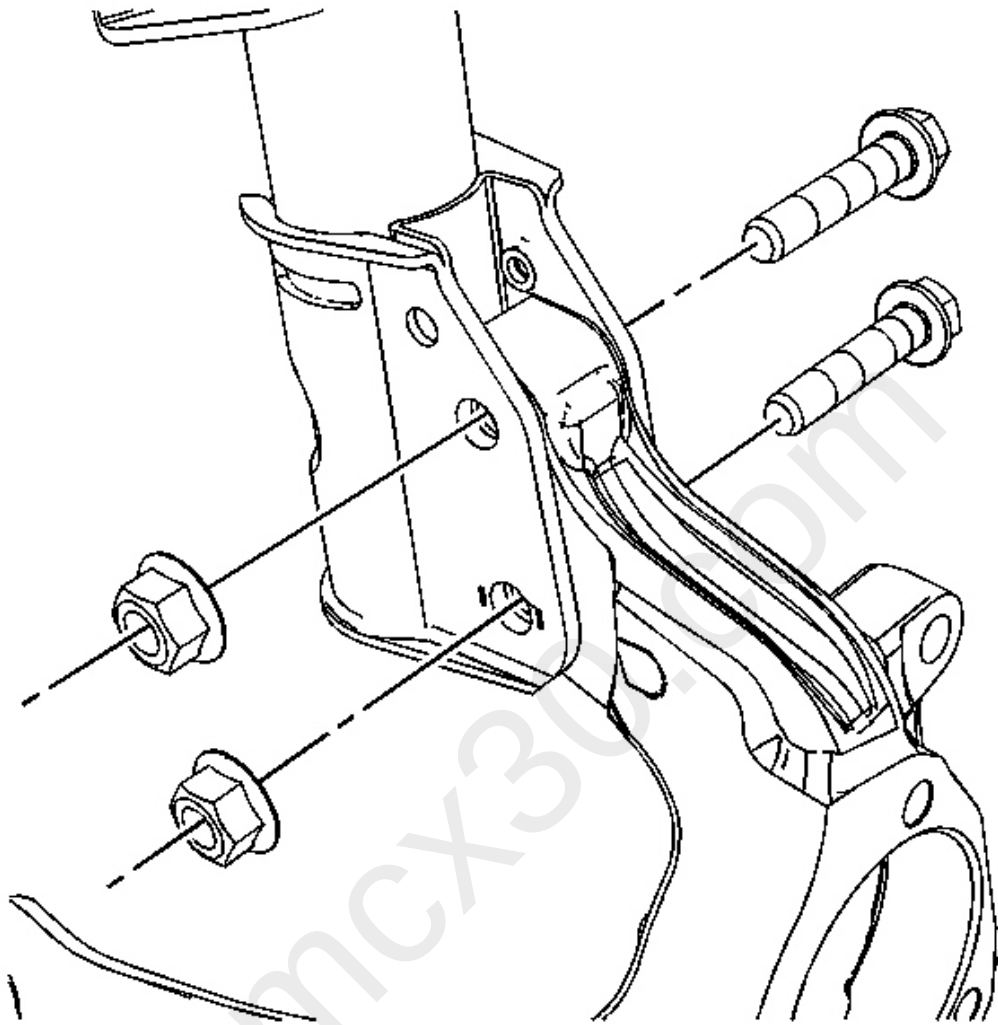


**Fig. 11: Identifying Steering Knuckle To Strut Bolts & Nuts**  
Courtesy of GENERAL MOTORS CORP.

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

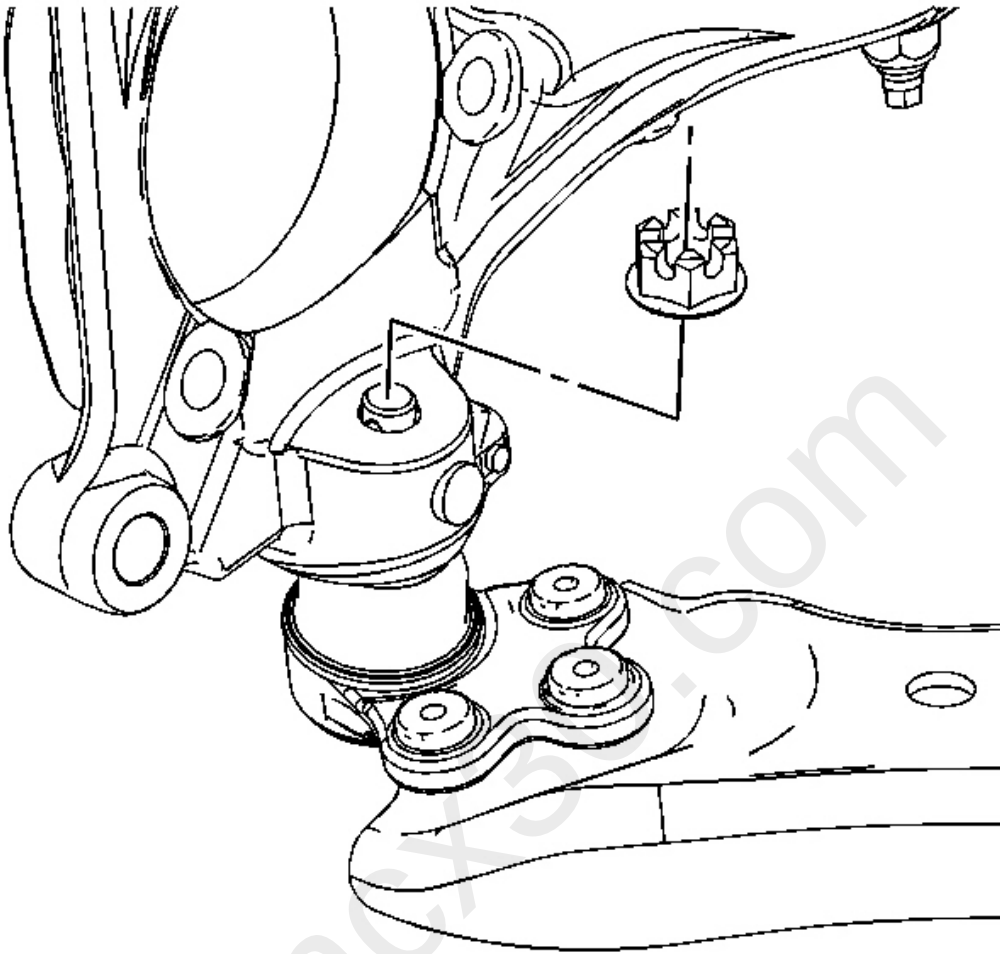
#### **Installation Procedure**

1. Position the steering knuckle to strut assembly.



**Fig. 12: Identifying Steering Knuckle To Strut Bolts & Nuts**  
Courtesy of GENERAL MOTORS CORP.

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

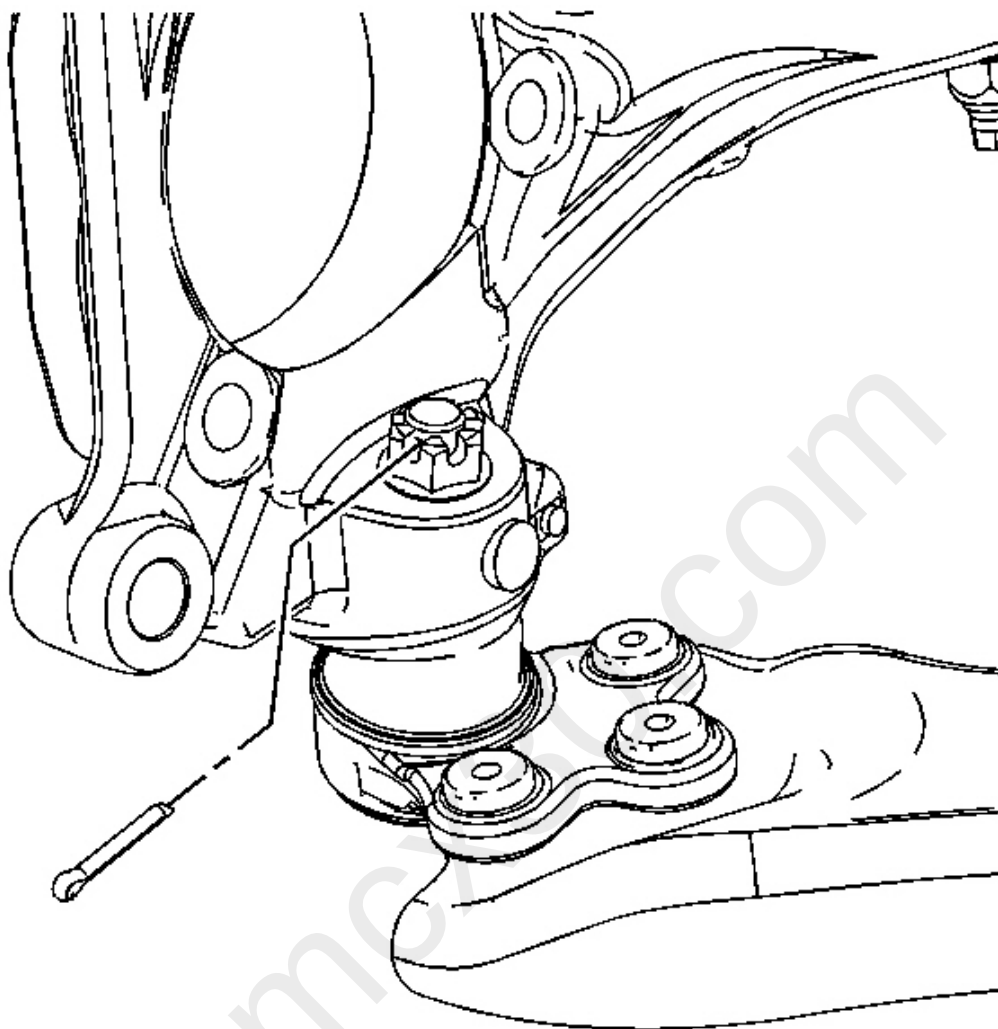


**Fig. 13: View Of Ball Joint & Knuckle**  
**Courtesy of GENERAL MOTORS CORP.**

3. Position the lower ball joint stud into the steering knuckle.

**CAUTION: Refer to Fastener Caution .**

4. Install the ball stud nut and tighten to 40 N.m (30 lb ft).
5. Tighten the strut to steering knuckle bolts and nuts to 180 N.m (133 lb ft).



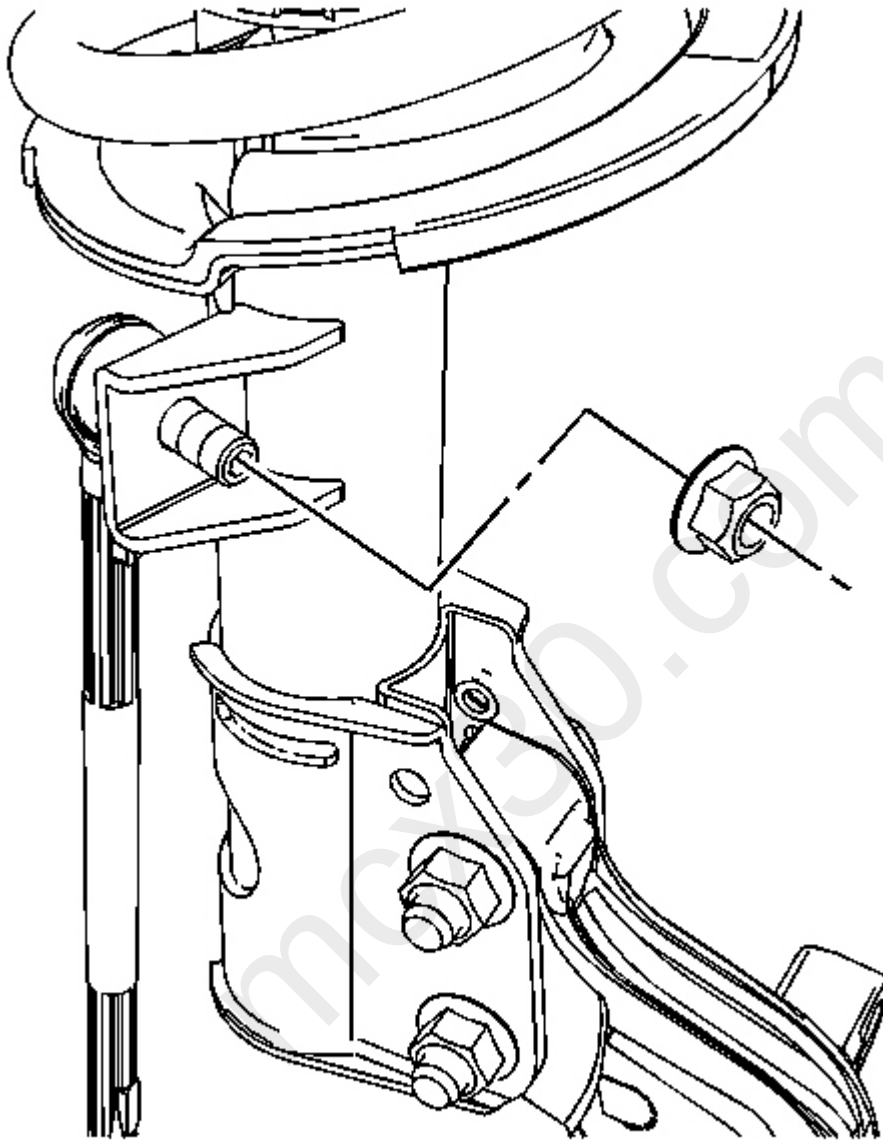
**Fig. 14: Identifying Lower Ball Joint Cotter Pin**  
Courtesy of GENERAL MOTORS CORP.

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

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

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

7. Install a new cotter pin.
8. Install the outer tie rod end to the knuckle. Refer to **Steering Linkage Outer Tie Rod Replacement**.



**Fig. 15: Identifying Stabilizer Link Retaining Nut**  
Courtesy of GENERAL MOTORS CORP.

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

9. Position the stabilizer shaft link to the strut assembly and install the nut.

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

10. Install the wheel bearing/hub assembly. Refer to **Front Wheel Bearing and Hub Replacement**.
11. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** .
12. Lower the vehicle.
13. Perform a wheel alignment. Refer to **Wheel Alignment Measurement** .

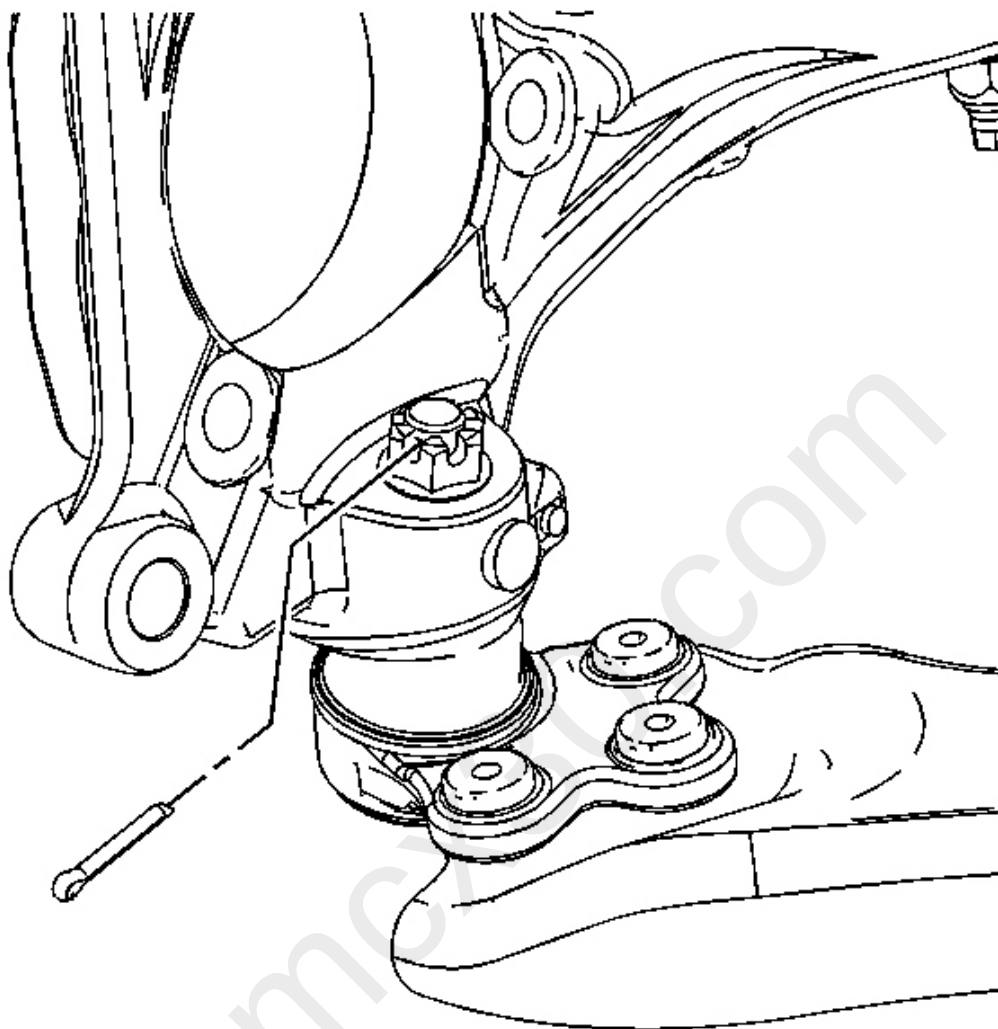
## **LOWER CONTROL ARM REPLACEMENT**

### **Special Tools**

**J-42188-B** Ball Joint Separator

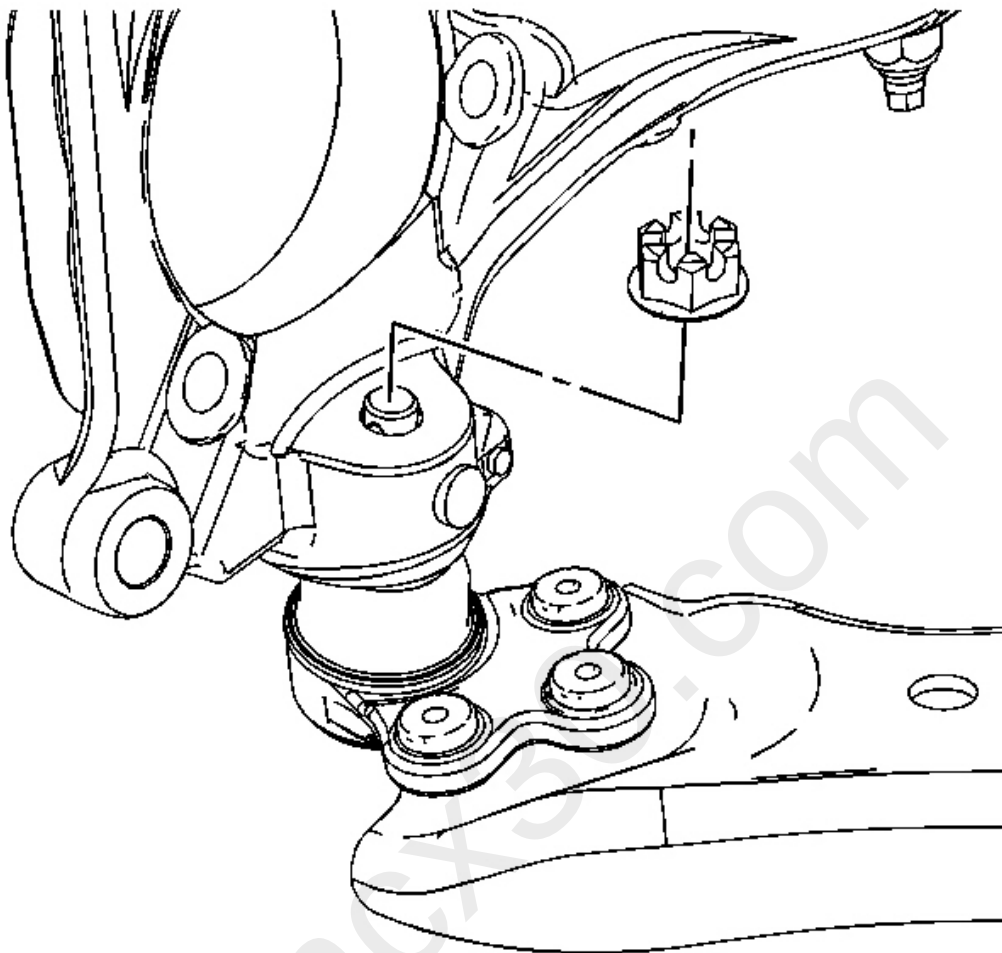
### **Removal Procedure**

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



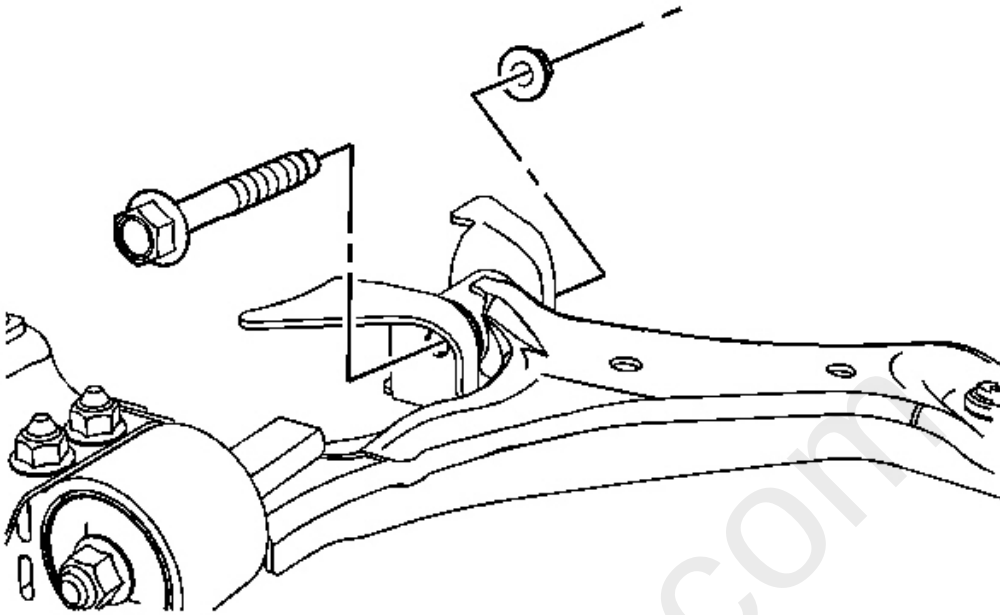
**Fig. 16: Identifying Lower Ball Joint Cotter Pin**  
Courtesy of GENERAL MOTORS CORP.

3. Remove the lower ball joint 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.
5. Using **J-42188-B** , separate the lower control arm from the steering knuckle.



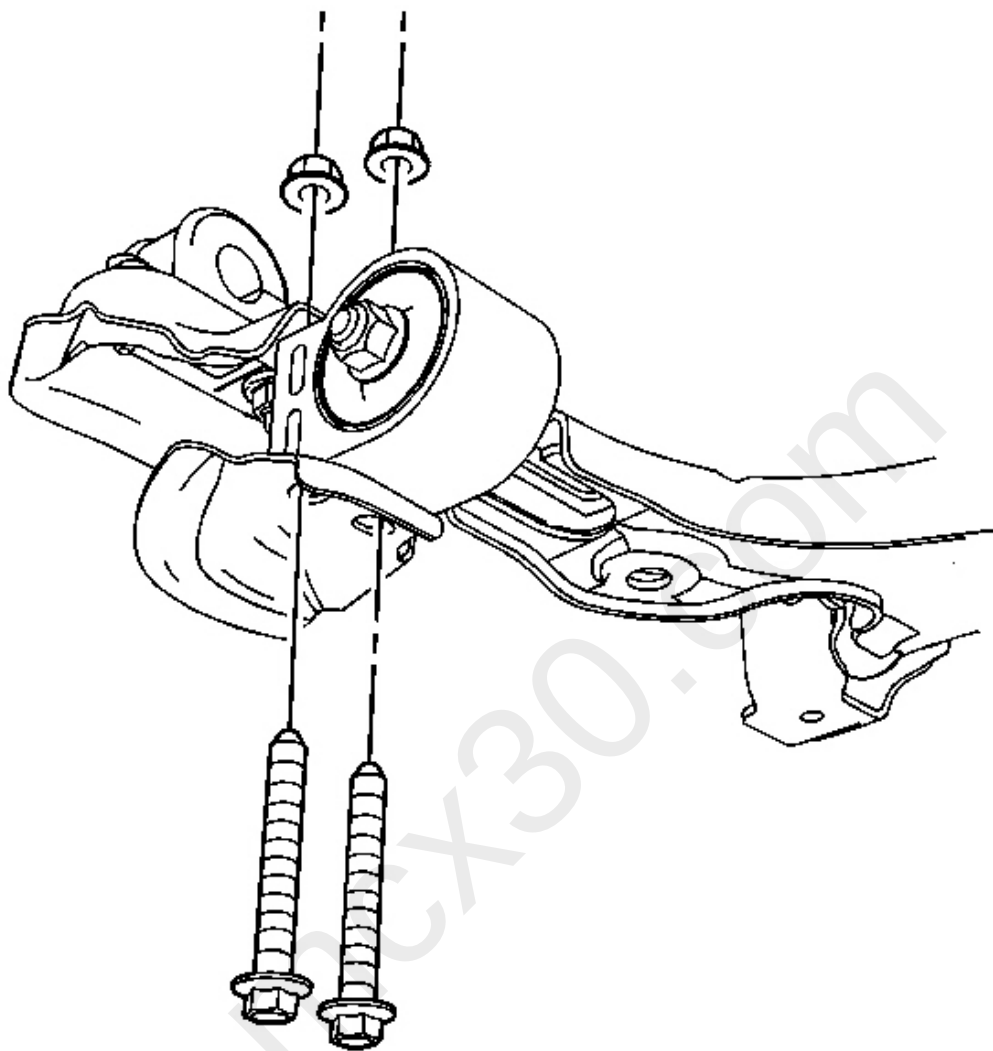
**Fig. 17: View Of Ball Joint & Knuckle**  
**Courtesy of GENERAL MOTORS CORP.**

6. Remove the lower ball joint stud nut.



**Fig. 18: View Of Control Arm-To-Frame Front Bolt & Nut**  
Courtesy of GENERAL MOTORS CORP.

7. Remove the control arm-to-frame front bolt and nut. Discard the bolt and nut.

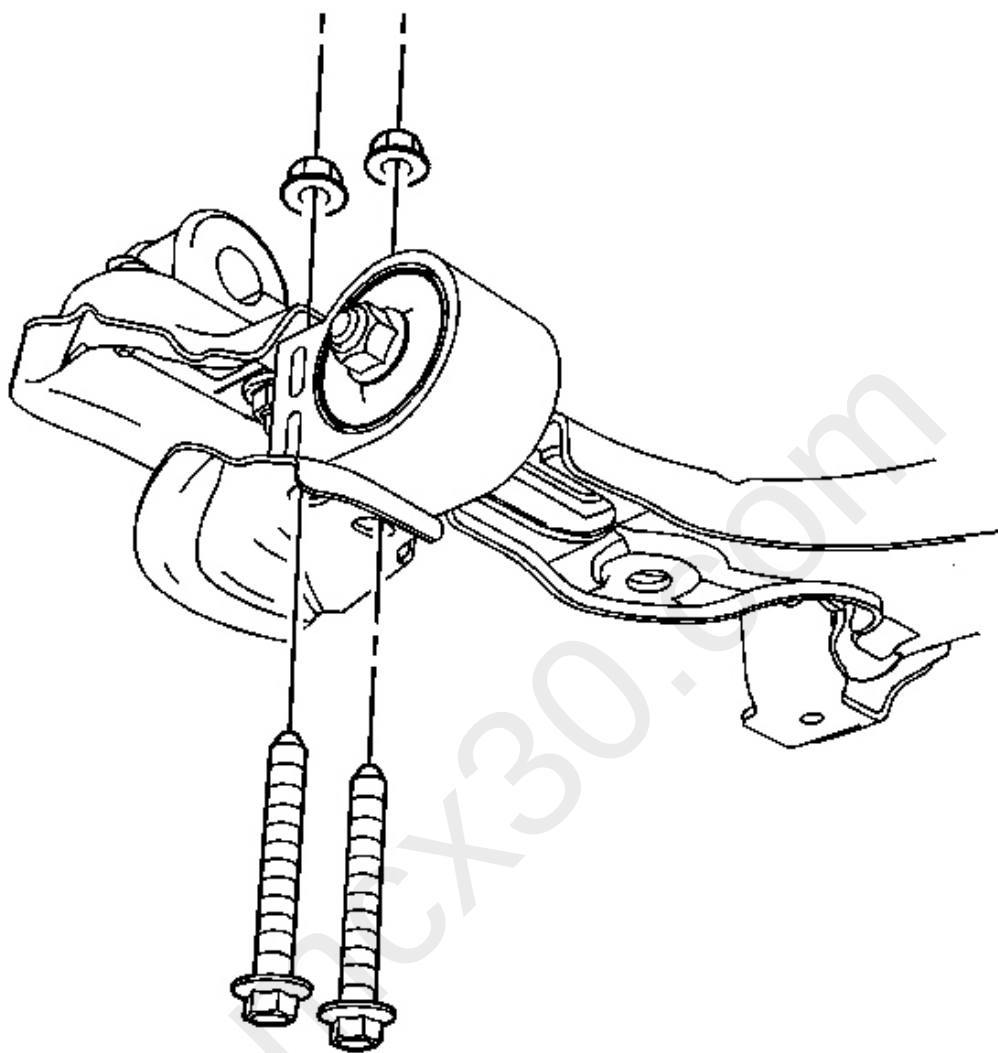


**Fig. 19: View Of Control Arm-To-Frame Rear Bolts & Nuts**  
Courtesy of GENERAL MOTORS CORP.

8. Remove the control arm-to-frame rear bolts and nuts. Discard the bolts and nuts.
9. Remove the control arm.

#### **Installation Procedure**

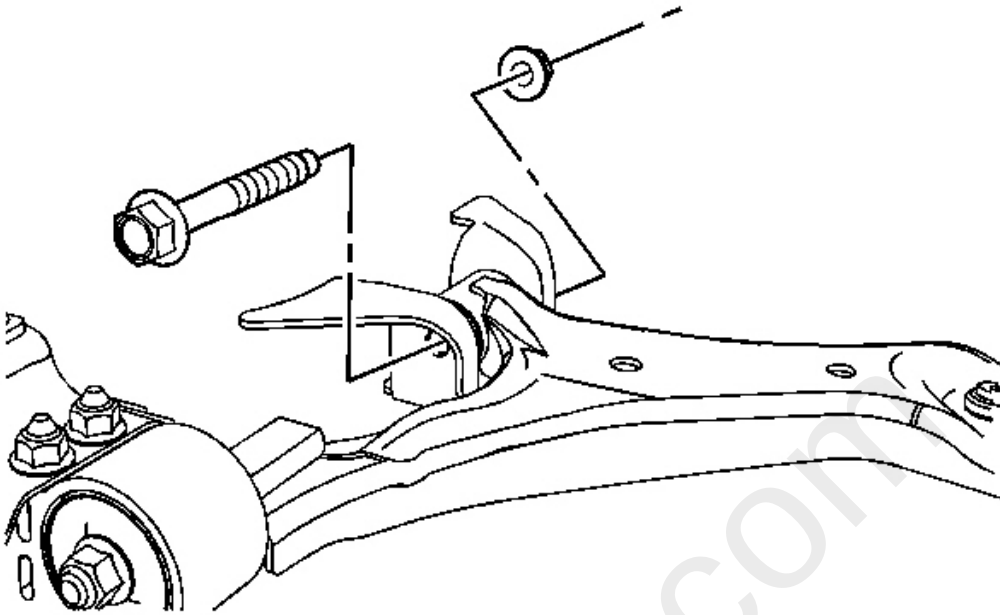
1. Position the control arm to the cradle/frame.



**Fig. 20: View Of Control Arm-To-Frame Rear Bolts & Nuts**  
Courtesy of GENERAL MOTORS CORP.

**CAUTION:** Refer to Fastener Caution .

2. Install new control arm-to-frame rear bolts and nuts and tighten to 70 N.m (52 lb ft).

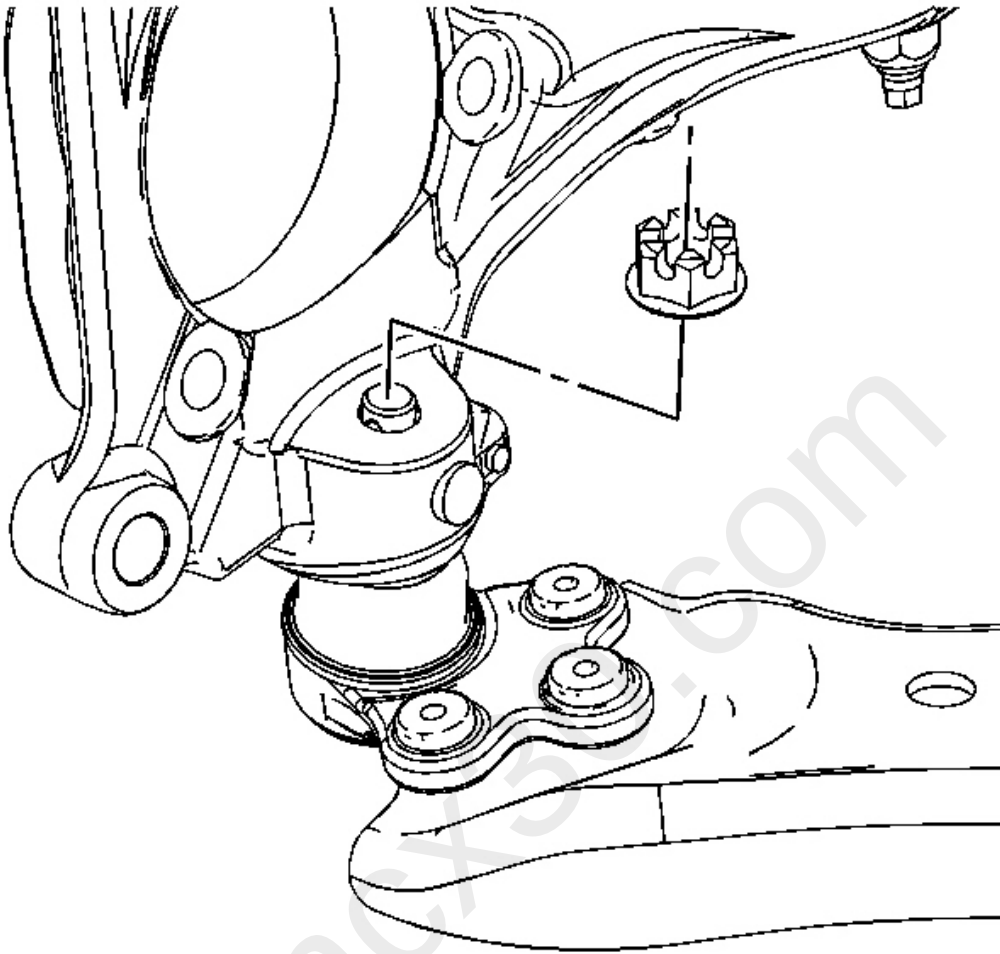


**Fig. 21: View Of Control Arm-To-Frame Front Bolt & Nut**  
Courtesy of GENERAL MOTORS CORP.

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

**Tighten:**

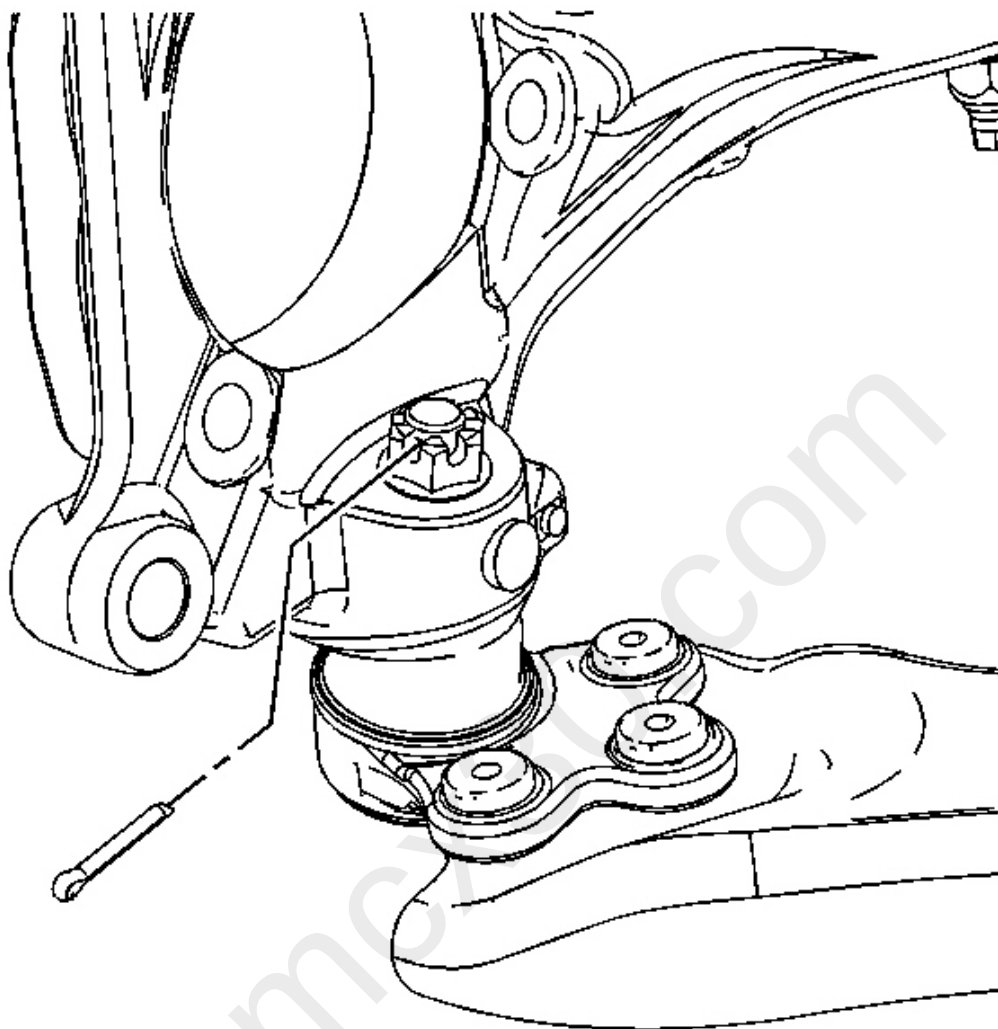
- For vehicles equipped RPO FE2, tighten the bolts and nuts and tighten to 190 N.m (140 lb ft)
- For vehicles equipped RPO FE3, tighten the bolts and nuts and tighten to 145 N.m (107 lb ft)



**Fig. 22: View Of Ball Joint & Knuckle**  
**Courtesy of GENERAL MOTORS CORP.**

4. Position the control arm ball stud into the steering knuckle and install the nut.

Tighten the nut to 40 N.m (30 lb ft).



**Fig. 23: Identifying Lower Ball Joint Cotter Pin**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:**

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

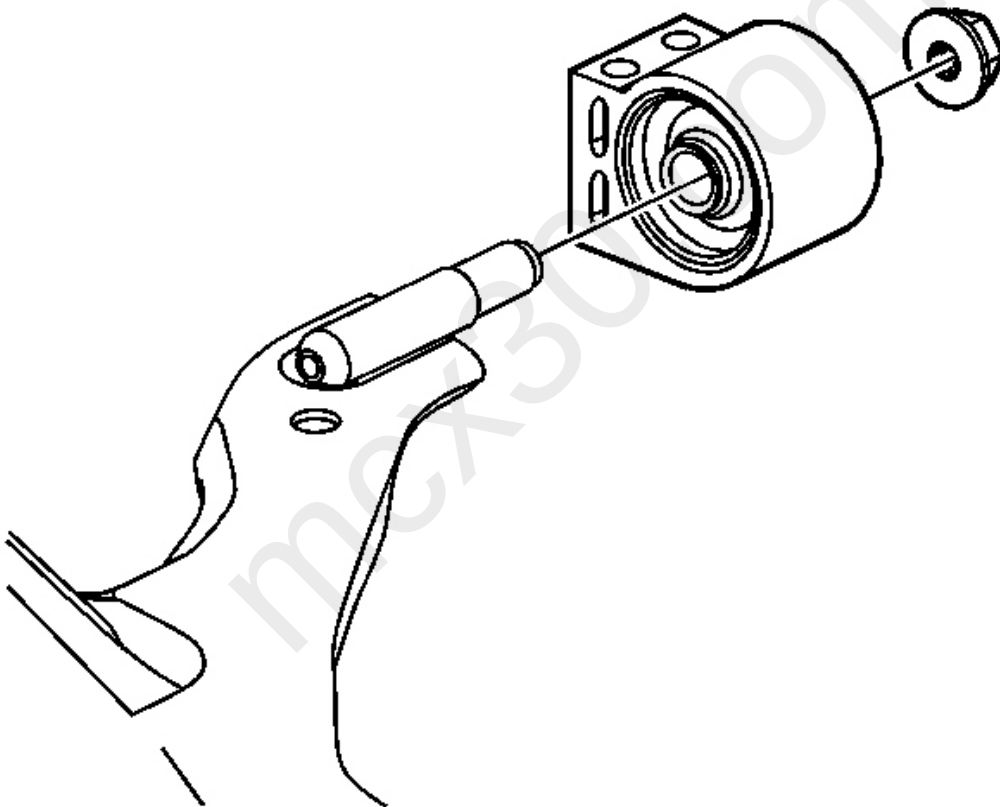
5. Continue to tighten the nut only enough to align the castle nut slots with the ball stud, install a new cotter pin.
6. Install the wheel and tire assembly. Refer to **Tire and Wheel Removal and Installation** .

7. Verify front end alignment. Refer to **Wheel Alignment Specifications** .
8. Lower the vehicle.

## **FRONT LOWER CONTROL ARM BUSHING REPLACEMENT (REAR BUSHING)**

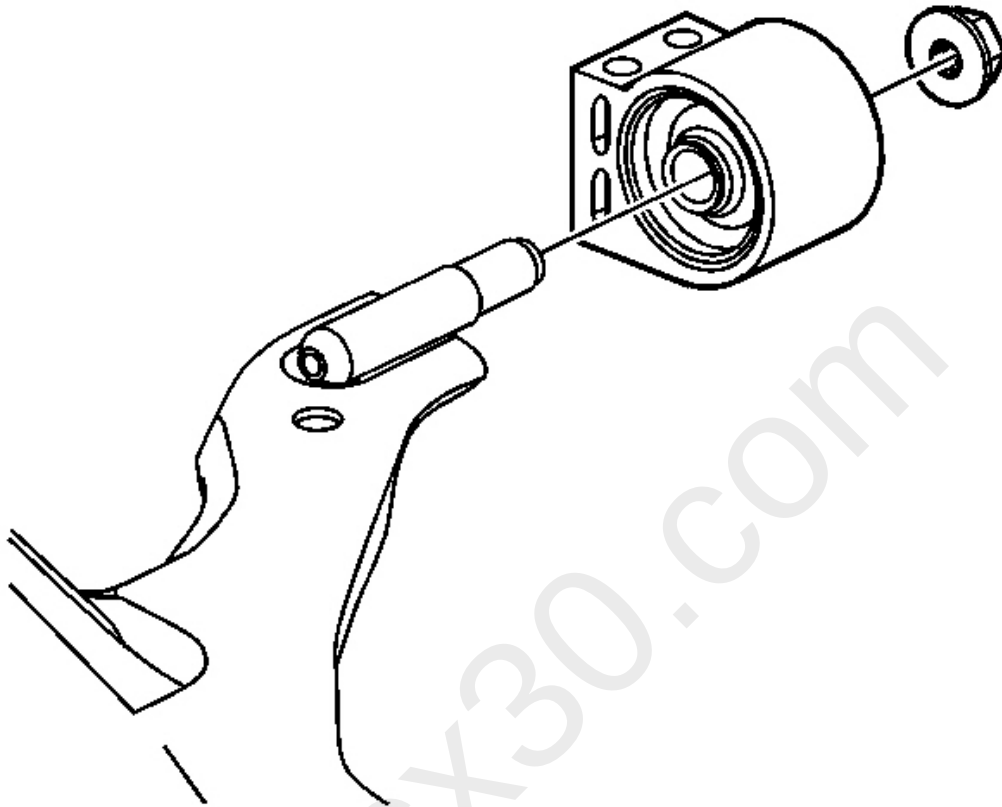
### **Removal Procedure**

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



**Fig. 24: View Of Rear Bushing & Nut**  
**Courtesy of GENERAL MOTORS CORP.**

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



**Fig. 25: View Of Rear Bushing & Nut**  
Courtesy of GENERAL MOTORS CORP.

**CAUTION: Refer to Fastener Caution .**

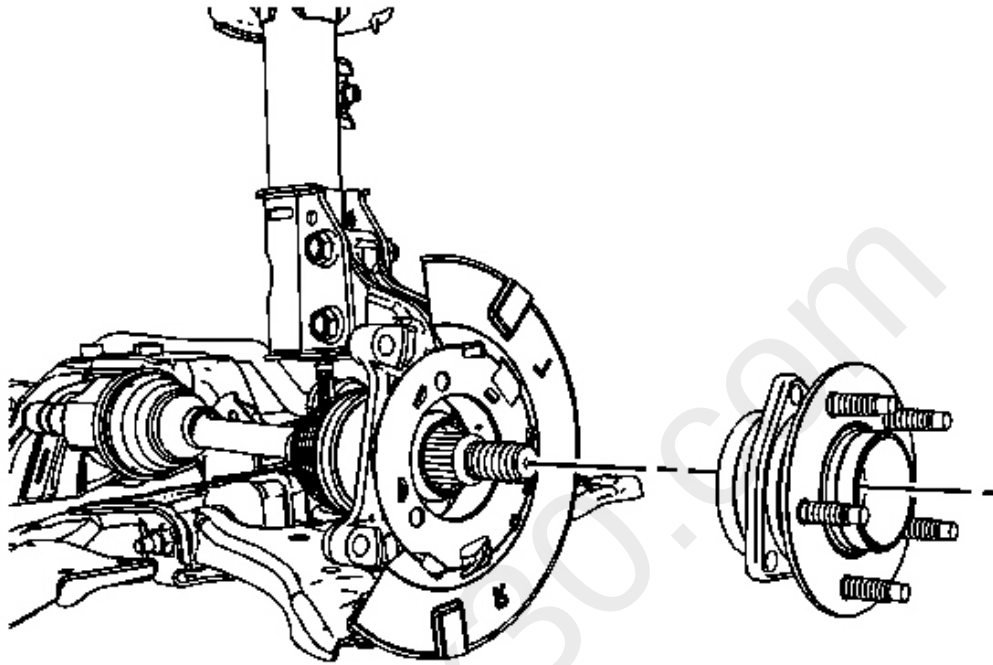
1. Install the rear bushing to the lower control arm and tighten the nut to 150 N.m (110 lb ft).
2. Install the lower control arm. Refer to **Lower Control Arm Replacement**.
3. Install the front tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
4. Lower the vehicle.

## **WHEEL STUD REPLACEMENT**

### **Tools Required**

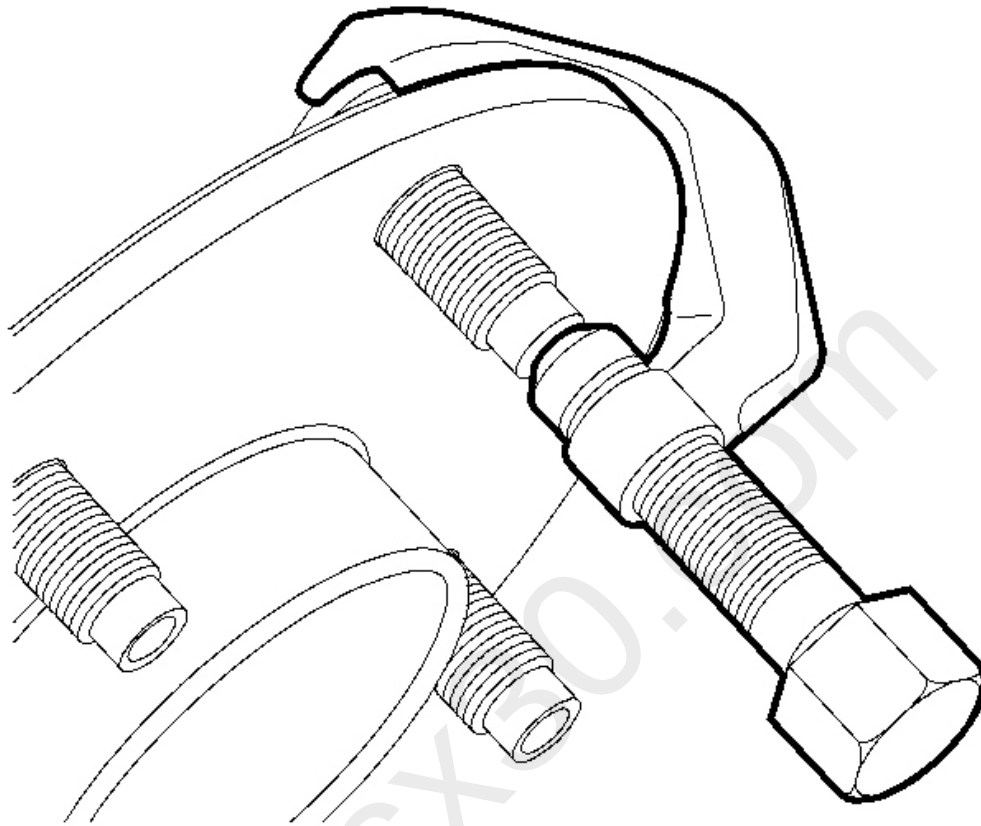
J 43631 Ball Joint Remover. See Special Tools.

### Removal Procedure



**Fig. 26: View Of Wheel Bearing/Hub Assembly**  
Courtesy of GENERAL MOTORS CORP.

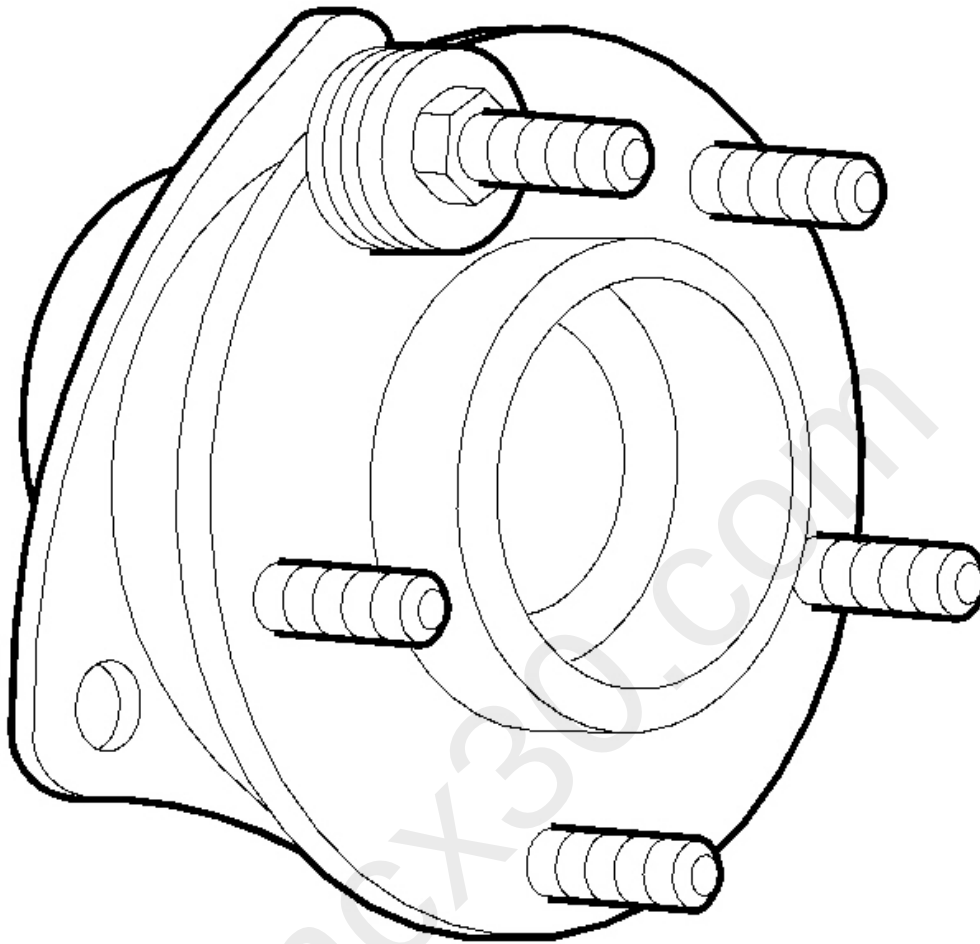
1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
2. Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation .
3. Remove the wheel bearing/hub assembly. Refer to Front Wheel Bearing and Hub Replacement.



**Fig. 27: Pressing Out Wheel Stud From Wheel Bearing/Hub Assembly**  
Courtesy of GENERAL MOTORS CORP.

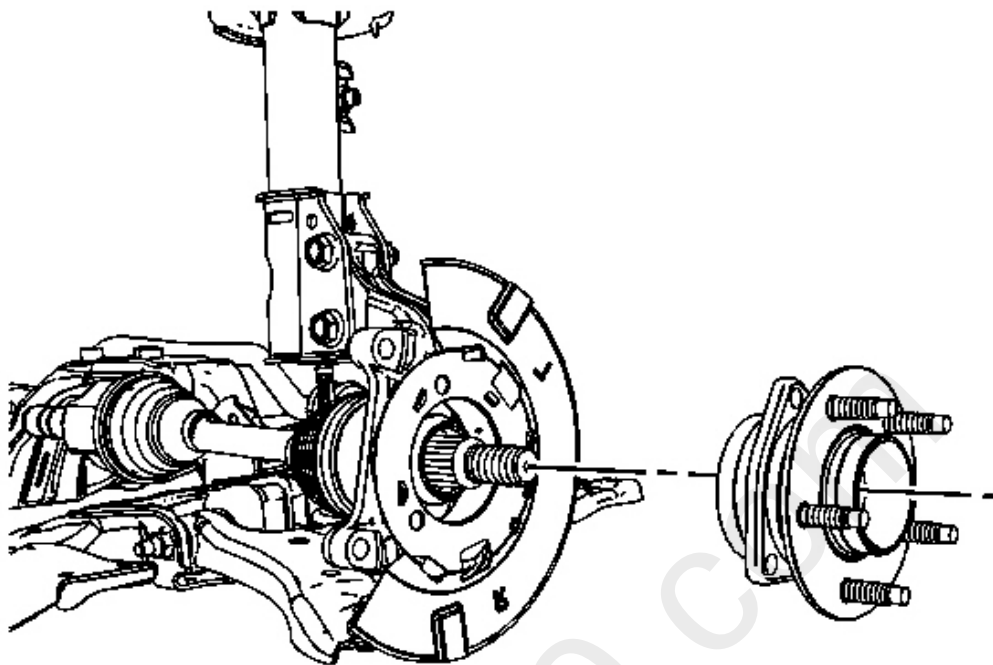
4. Using the **J 43631** , press out the wheel stud from the wheel bearing/hub assembly. See **Special Tools**.

#### **Installation Procedure**



**Fig. 28: View Of Flat Washers, 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.



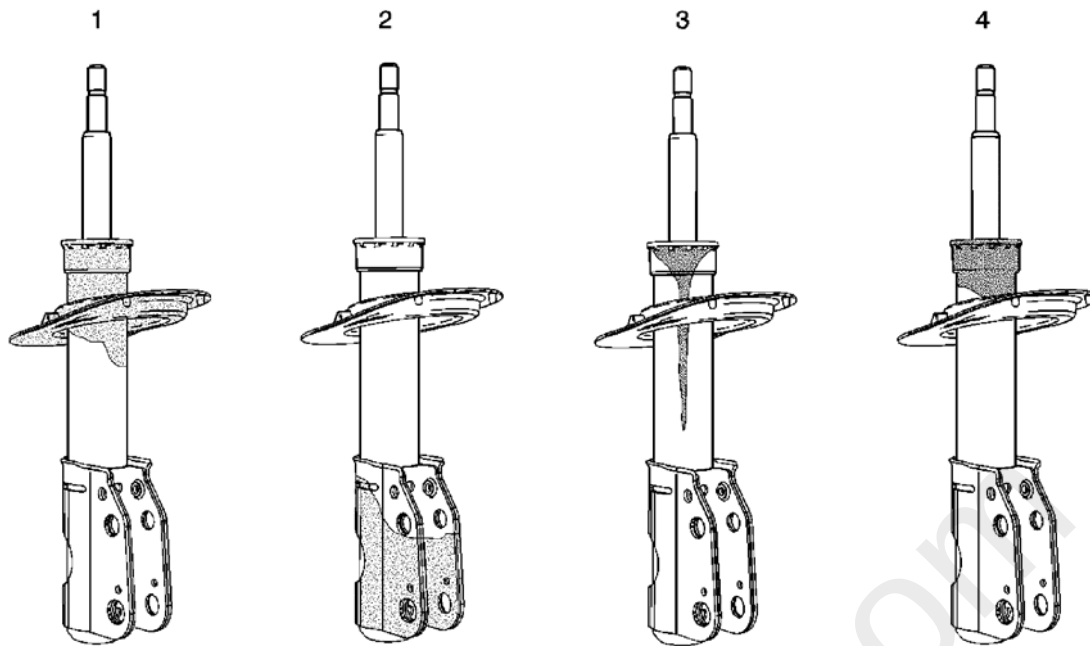
**Fig. 29: View Of Wheel Bearing/Hub Assembly**  
**Courtesy of GENERAL MOTORS CORP.**

6. Install the wheel bearing/hub assembly to the steering knuckle. 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 AND SHOCK ABSORBER INSPECTION (STRUT)**

**NOTE:** The strut assembly **DOES NOT** have to be removed from the vehicle to perform the following inspection procedure.

**NOTE:** A light film of oil on the top portion of the strut is normal. **DO NOT** replace the strut for this condition.



**Fig. 30: Identifying Strut Conditions**  
**Courtesy of GENERAL MOTORS CORP.**

**Condition 1**

Oil or fluid residue only on the bottom of the strut tube or on other strut components and not originating from the shaft seal, is not a strut related problem. DO NOT replace the strut, look for other external leaks.

**Condition 2**

Light film/residue on the strut tube, but not on the spring seat and originating from the shaft seal, is a NORMAL condition. DO NOT replace the strut.

**Condition 3**

Oil drip or trail down the strut tube and originating from the shaft seal, is an ABNORMAL condition. Replace the strut.

**Condition 4**

Extreme wet film of oil covering the strut tube and pooling in the spring seat and originating from the shaft seal, is an ABNORMAL condition. Replace the strut.

**Inspection**

1. Verify the customer's concern is present. If the concern is present, continue to the next step. If the concern is not present, then the vehicle is operating normally.

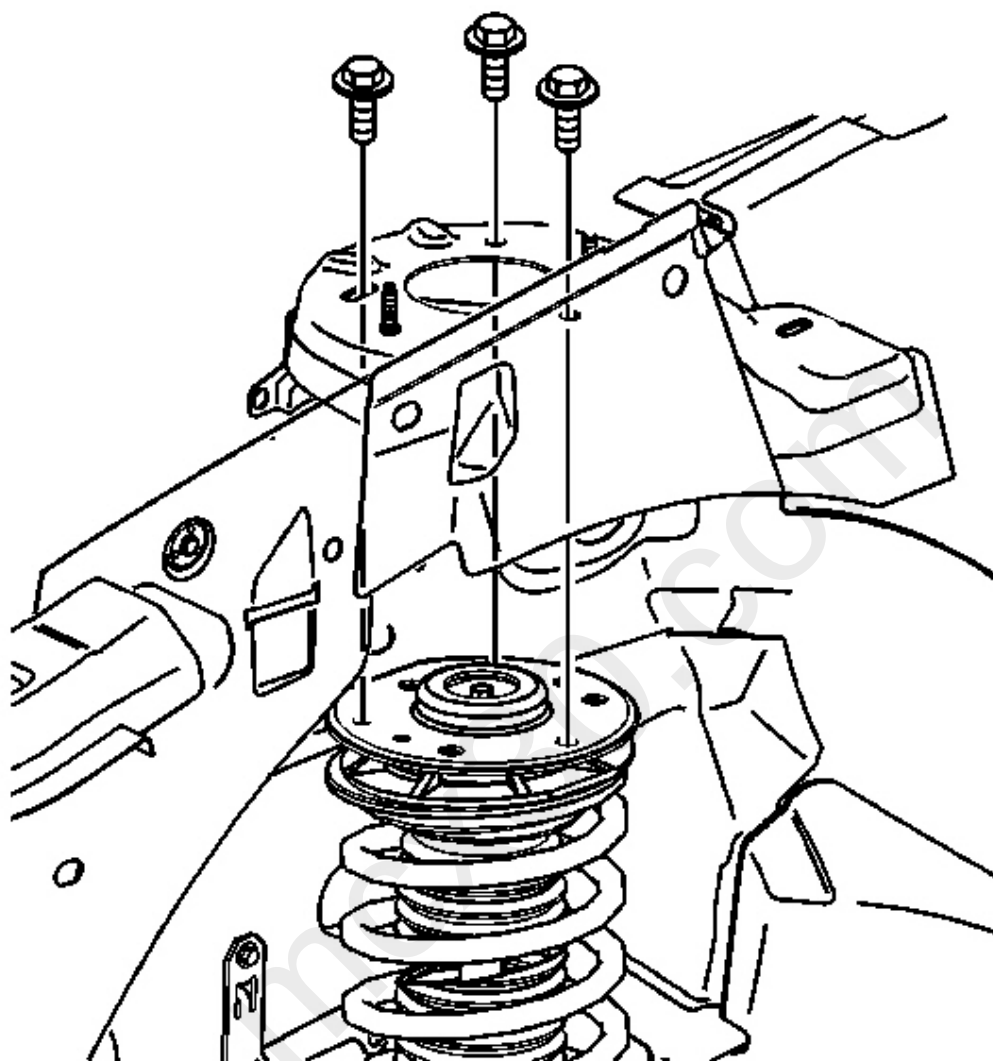
**NOTE:**        **The strut assembly DOES NOT have to be removed from the vehicle to perform the following inspection procedure.**

2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Visually inspect each of the shock absorbers or struts for external fluid leaks. Refer to the following conditions 1, 2, 3, and 4 for visual inspection.
  - If conditions 1 or 2 are found, continue to step 4.
  - If conditions 3 or 4 are found, replace strut. Refer to Strut Replacement.
4. If equipped with electronic suspension control system, ensure that the system is working properly. Refer to Diagnostic Starting Point-Electronic Suspension Control.
5. Use your hands in order to lift up and push down on each corner of the vehicle 3 times. Remove your hands from the vehicle. If the corner motion exceeds 2 cycles, replace the strut. If the strut does not exceed 2 cycles, NO repair is necessary.

## **STRUT ASSEMBLY REPLACEMENT**

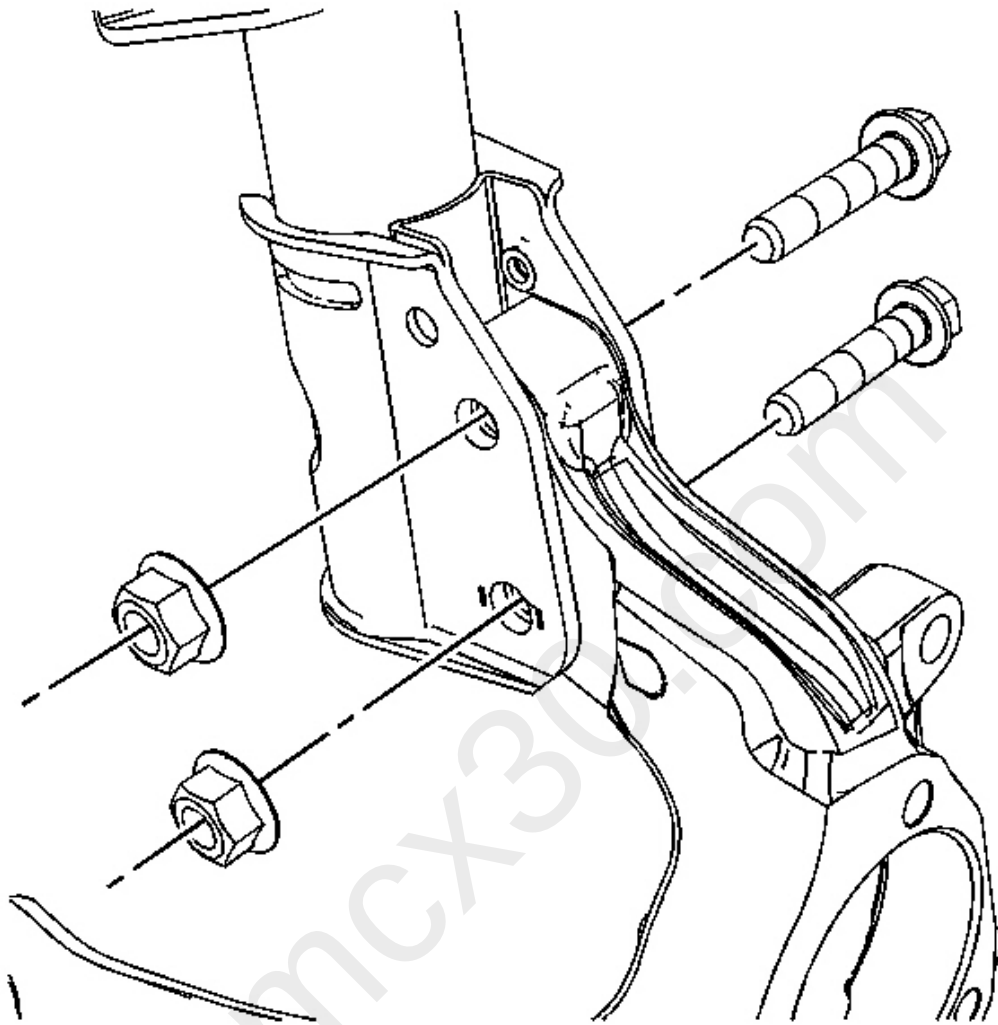
### **Removal Procedure**

1. Remove the air inlet screen. Refer to **Air Inlet Screen Replacement (Equinox)** or **Air Inlet Screen Replacement (Terrain)**



**Fig. 31: Upper Strut Mount Bolts**  
Courtesy of GENERAL MOTORS CORP.

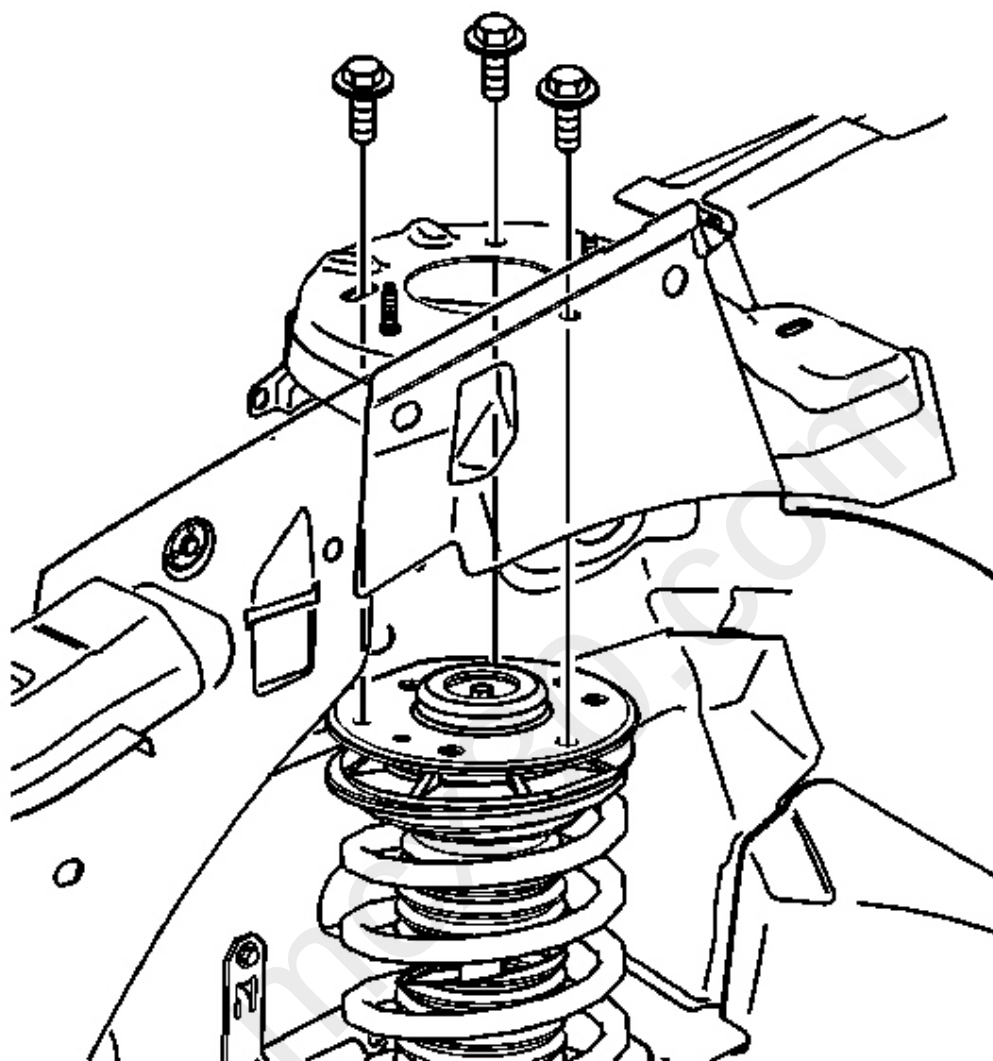
2. Remove the 3 upper strut mount bolts.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the wheel and tire assembly. Refer to **Tire and Wheel Removal and Installation** .
5. Remove the brake hose bracket from the front strut. Refer to **Front Brake Hose Replacement** .
6. Remove the stabilizer link from the front strut. Refer to **Stabilizer Shaft Link Replacement** .



**Fig. 32: Identifying Steering Knuckle To Strut Bolts & Nuts**  
Courtesy of GENERAL MOTORS CORP.

7. Remove the lower strut bolts and nuts.
8. Remove the strut assembly from the vehicle.

#### **Installation Procedure**

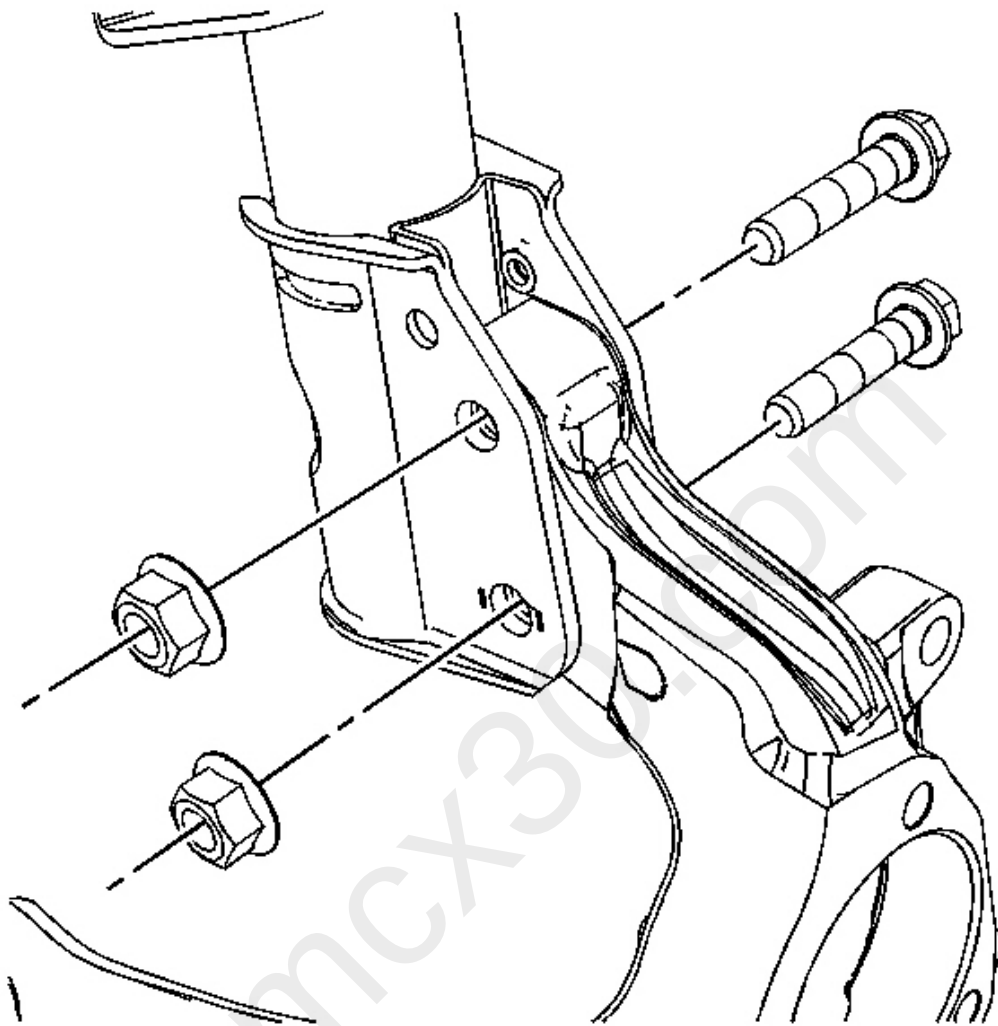


**Fig. 33: Upper Strut Mount Bolts**  
Courtesy of GENERAL MOTORS CORP.

1. Position the strut assembly to the vehicle.

**CAUTION:** Refer to Fastener Caution .

2. Install the 3 upper strut mount bolts and tighten to 25 N.m (18 lb ft).



**Fig. 34: Identifying Steering Knuckle To Strut Bolts & Nuts**  
Courtesy of GENERAL MOTORS CORP.

3. Install the lower strut bolts and nuts and tighten to 200 N.m (148 lb ft).

**NOTE:**        **Inspect the stabilizer link seals for damage prior to installation. Replace as required.**

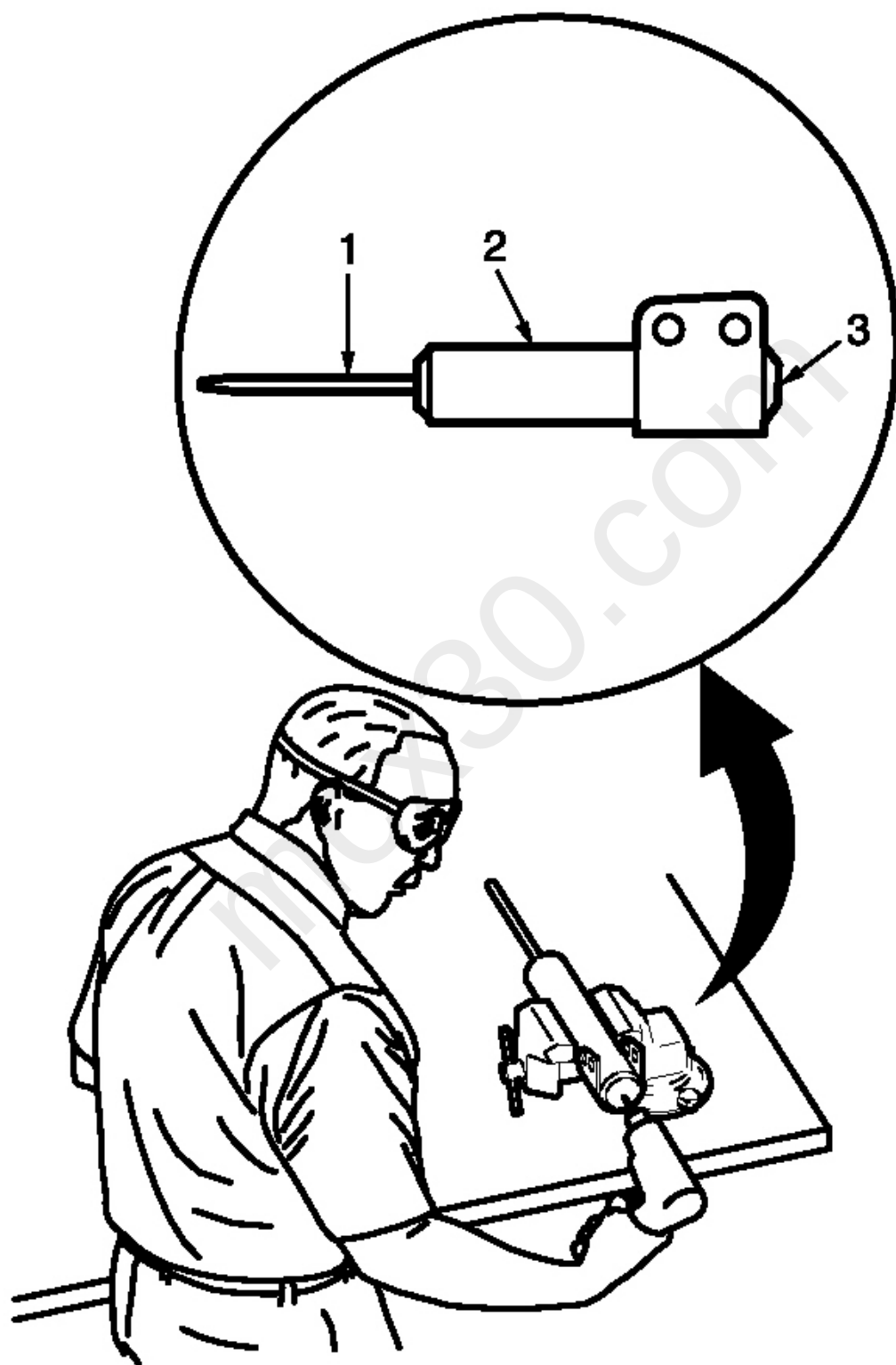
**NOTE:**        **Do not allow the stabilizer link ball stud to rotate while installing the link nut.**

4. Install the stabilizer link to the front strut. Refer to **Stabilizer Shaft Link Replacement**.
5. Install the brake hose bracket to the front strut. Refer to **Front Brake Hose Replacement** .
6. Install the wheel and tire. Refer to **Tire and Wheel Removal and Installation** .
7. Lower the vehicle.
8. Install the air inlet screen. Refer to **Air Inlet Screen Replacement (Equinox)** or **Air Inlet Screen Replacement (Terrain)**
9. Perform a wheel alignment. Refer to **Wheel Alignment Measurement** .

## **SUSPENSION STRUT DISPOSAL**

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

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**Fig. 35: Drilling Hole In Strut**  
**Courtesy of GENERAL MOTORS CORP.**

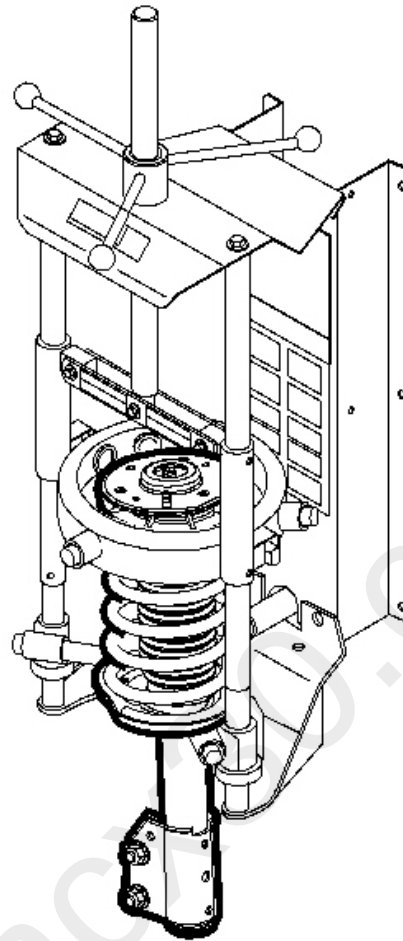
1. Clamp the strut in a vise horizontally with the rod (1) completely extended.
2. Drill a hole in the strut at the center of the end cap (3) using a 5 mm (3/16 in) drill bit. Gas or a gas/oil mixture will exhaust when the drill bit penetrates the strut. Use shop towels in order to contain the escaping 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, OR SPRING REPLACEMENT**

**Special Tools**

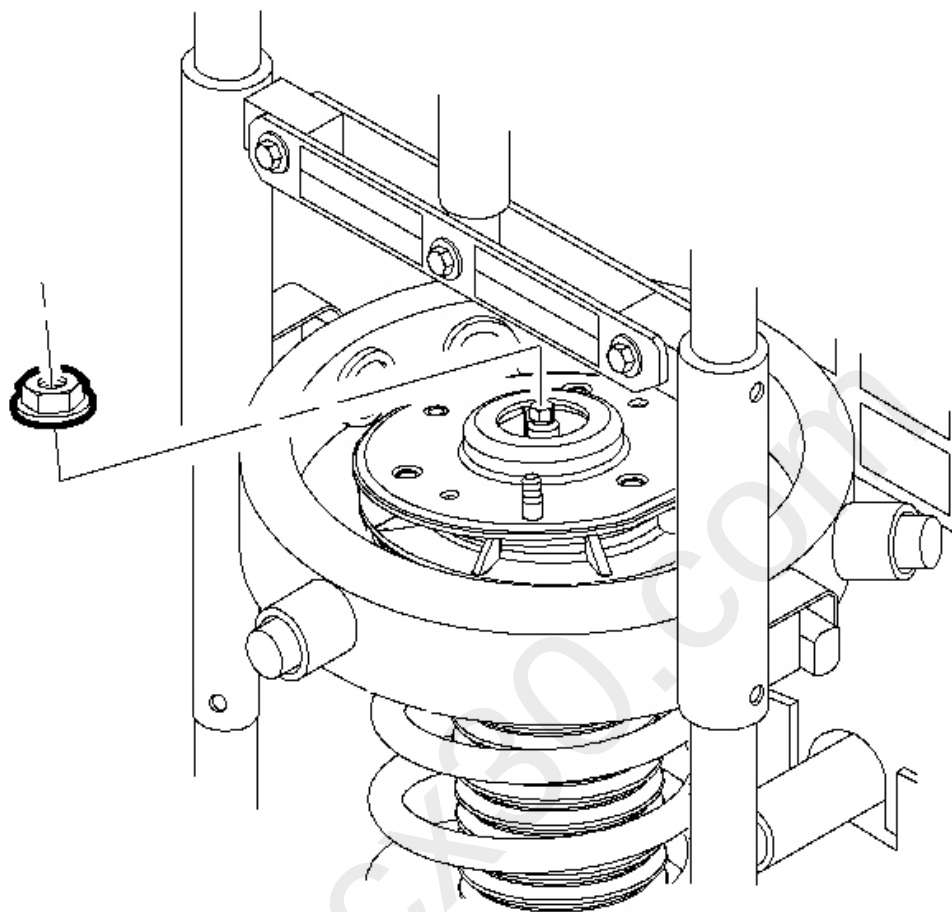
- **J 42991** Strut Rod Nut Socket. See **Special Tools**.
- **J 45400** Strut Spring Compressor. See **Special Tools**.

**Removal Procedure**



**Fig. 36: View Of Strut Assembly In J 45400**  
**Courtesy of GENERAL MOTORS CORP.**

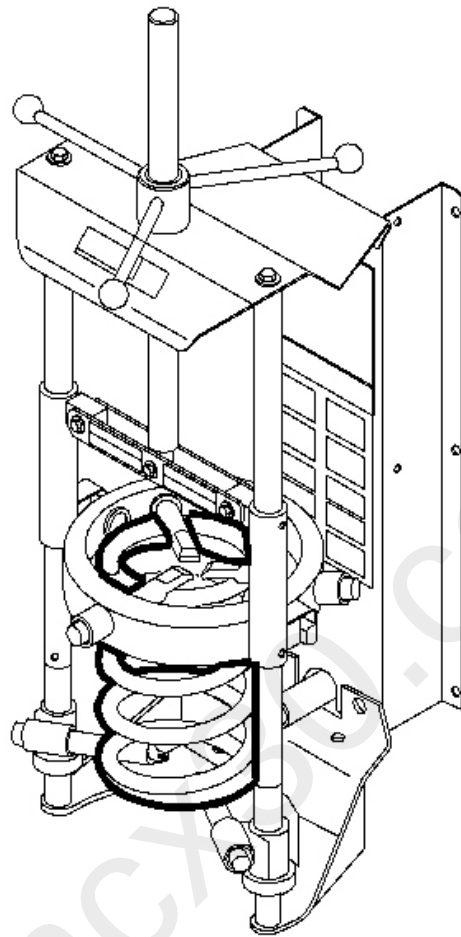
1. Install the strut assembly in the **J 45400** using the following procedure. See **Special Tools**.
  1. Adjust the lower legs of the **J 45400** to the lowest possible coil of the spring. See **Special Tools**.
  2. Adjust the upper legs of the **J 45400** to the highest possible coil of the spring. See **Special Tools**.
  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**.
2. Compress the spring enough to unload the upper strut mount.



**Fig. 37: View Of Strut Shaft Nut**  
Courtesy of GENERAL MOTORS CORP.

**CAUTION:** Do not allow the absorber rod to rotate during disassembly/reassembly. Use hand tools to keep the absorber rod from rotating. If air tools are used, and the rod is allowed to rotate, damage to the absorber may occur.

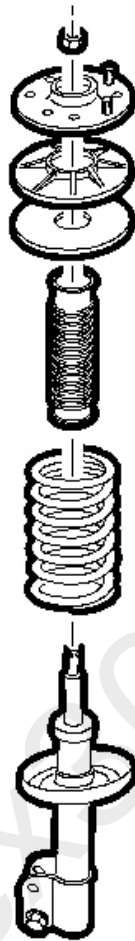
3. Use the **J 42991** or equivalent hand tools to remove the strut shaft nut. See **Special Tools**.



**Fig. 38: View Of Strut & Spring Assembly**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:**        **Leave the spring in the spring compressor.**

4. Lower the strut from the spring assembly.



**Fig. 39: View Of Upper Mount Assembly, Strut Dust Shield, Strut Shaft & Spring**  
Courtesy of GENERAL MOTORS CORP.

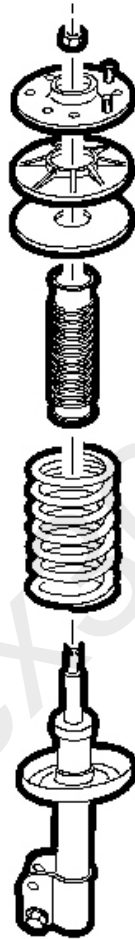
**CAUTION:** Do not handle the top mount assembly by the plastic portion. Handle the top mount assembly by the metal portion when removing/installing the top mount from/to the strut assembly. Holding the top mount assembly by the plastic portion may loosen the snap fit of the bearing components and cause the bearing to fall apart.

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.

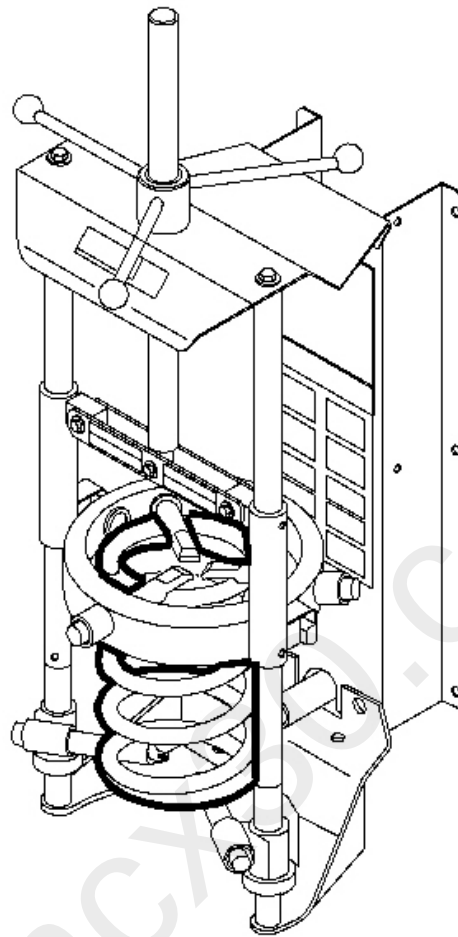
8. Inspect the spring for damage. Replace as necessary.

#### **Installation Procedure**



**Fig. 40: View Of 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. 41: View Of Strut & Spring Assembly**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** The tag identifying the spring will be closer to the bottom of the spring. The end of the coil sits up against the tab on the spring seat.

3. With the spring in the compressor, install the strut into the spring.

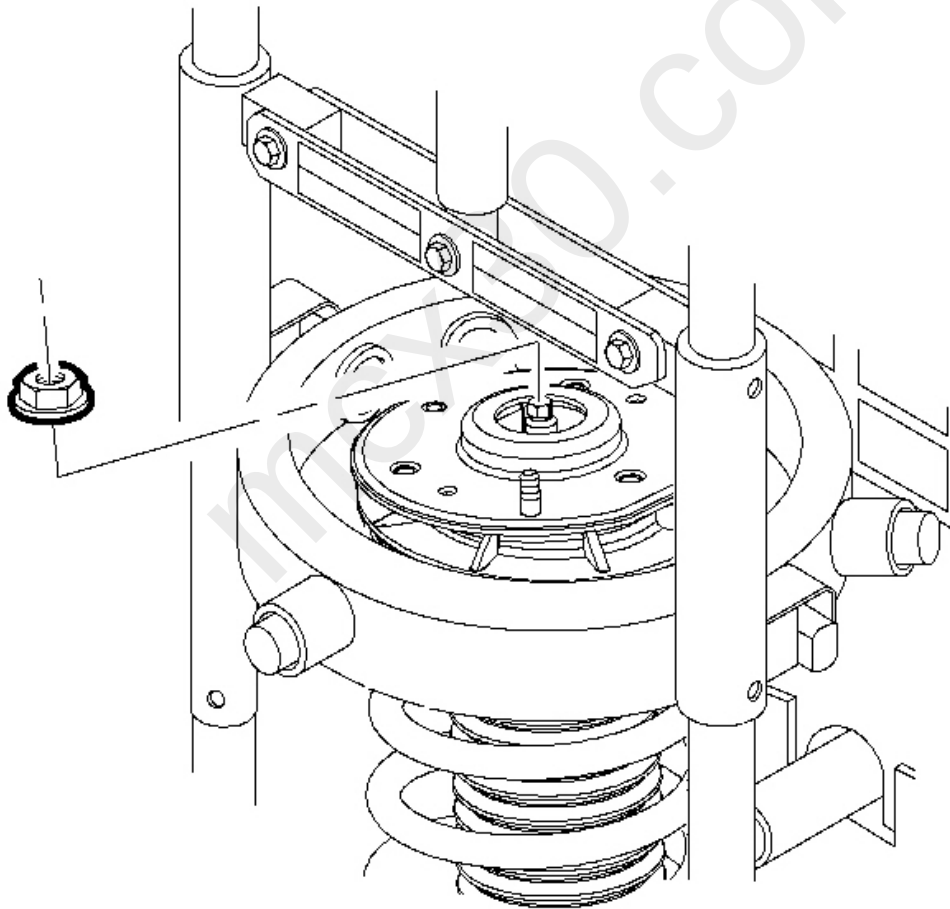
**NOTE:** The anti-rotation tab on the spring seat must face 180 degrees from the direction that the knuckle bracket points.

4. Assemble the upper spring seat onto the strut shaft and align the flat with the strut to knuckle mounting bracket.

**CAUTION:** Do not handle the top mount assembly by the plastic portion. Handle the top mount assembly by the metal portion when removing/installing the top mount from/to the strut assembly. Holding the top mount assembly by the plastic portion may loosen the snap fit of the bearing components and cause the bearing to fall apart.

**NOTE:** The flat on the metal plate of the top mount assembly must face the same direction of the anti-rotation tab on the spring seat.

5. Assemble the top mount onto the strut shaft and align the flat 180 degrees from flat on the upper spring seat.



**Fig. 42: View Of Strut Shaft Nut**  
**Courtesy of GENERAL MOTORS CORP.**

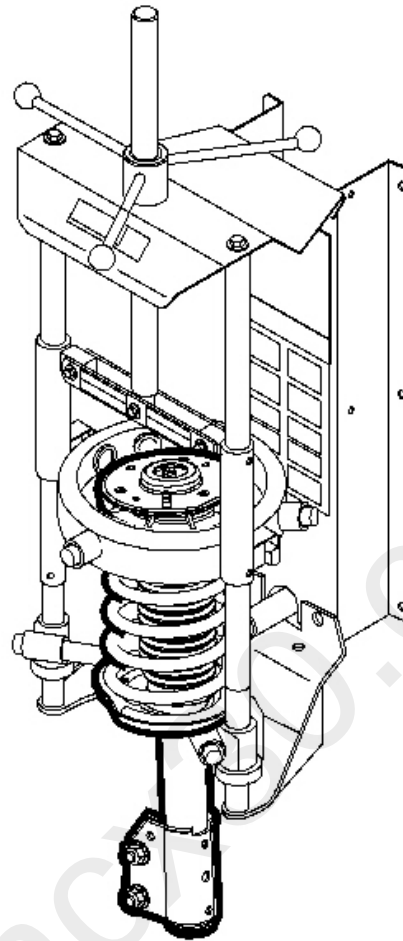
6. Loosely install the strut shaft nut.

**CAUTION: Do not allow the absorber rod to rotate during disassembly/reassembly. Use hand tools to keep the absorber rod from rotating. If air tools are used, and the rod is allowed to rotate, damage to the absorber may occur.**

**CAUTION: Refer to Fastener Caution .**

7. Hold the strut shaft and use the **J 42991** or equivalent hand tools to tighten the shaft while verifying that the upper spring seat flats align with the top mount. See **Special Tools**.

Tighten the strut shaft to 55 N.m (41 lb ft).



**Fig. 43: View Of Strut Assembly In J 45400**  
**Courtesy of GENERAL MOTORS CORP.**

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

## **DESCRIPTION AND OPERATION**

### **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.

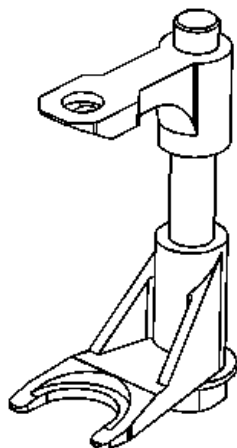
This up and down motion of the steering knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. This spring is retained under tension over the strut assembly. A strut is used in conjunction with this system in order to dampen out the oscillations of the coil spring. A 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.

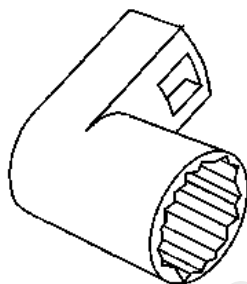
## SPECIAL TOOLS AND EQUIPMENT

### SPECIAL TOOLS

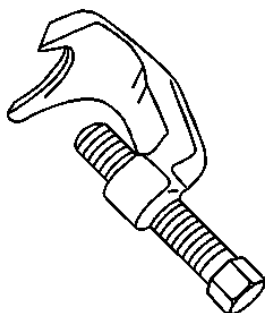
| Illustration | Tool Number/ Description |
|--------------|--------------------------|
|              |                          |



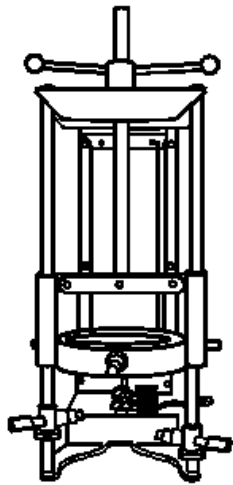
J 42188-B  
Ball Joint Separator



J 42991  
Strut Rod Nut Socket



J 43631  
Ball Joint Remover



J 45400  
Strut Spring Compressor

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