

2004 SUSPENSION

Front Suspension - Corvette

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Crossmember Mounting Nuts (Use New Nuts)	110 N.m	81 lb ft
Lower Control Arm Ball Joint Stud Nut		
• First Pass	30 N.m	20 lb ft
• Final Pass	180 degrees	
Power Steering Gear Mounting Bolts	100 N.m	74 lb ft
Shock Absorber Lower Mounting Nuts	28 N.m	21 lb ft
Shock Absorber Upper Mounting Nut	26 N.m	19 lb ft
Stabilizer Shaft Insulator Clamp Bolts	58 N.m	43 lb ft
Stabilizer Shaft Link Nuts	72 N.m	53 lb ft
Transverse Spring Retainer Bolts (Use New Bolts)	62 N.m	46 lb ft
Upper Control Arm Ball Joint Stud Nut		
• First Pass	20 N.m	15 lb ft
• Final Pass	250 degrees	
Upper Control Arm Mounting Bolts	65 N.m	48 lb ft
Wheel Hub/Bearing Mounting Bolts	130 N.m	96 lb ft

REPAIR INSTRUCTIONS

CROSSMEMBER REPLACEMENT - FRONT SUSPENSION

Tools Required

- **J 28467-B** Universal Engine Support Fixture. See **Special Tools and Equipment** .
- **J 41803** Engine Support Fixture. See **Special Tools and Equipment** .
- **J 33432-A** Transverse Spring Compressor. See **Special Tools and Equipment** .

Removal Procedure

1. Remove the generator from the accessory mounting bracket. Refer to **Generator Replacement** in Engine Electrical.
2. Remove the washer pump/reservoir. Refer to **Washer Solvent Container Replacement** in

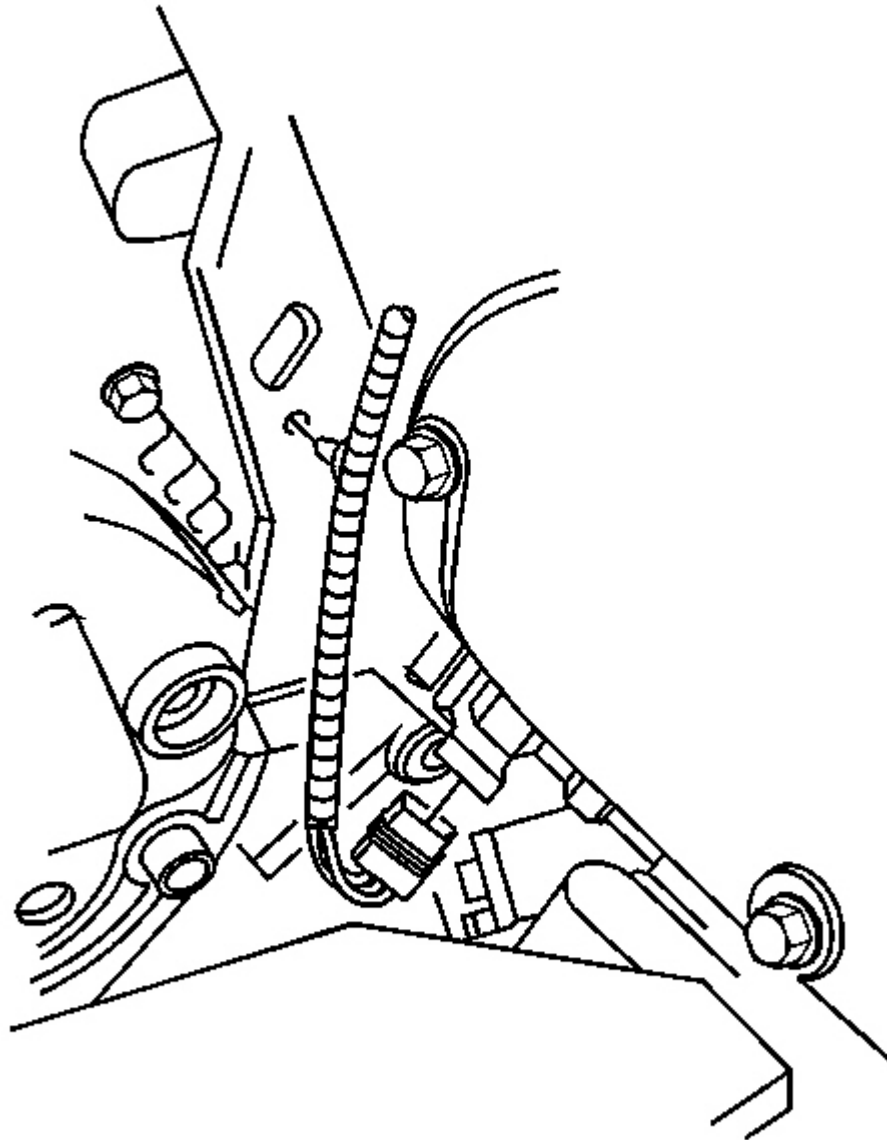


Fig. 1: Engine Coolant Temperature Switch Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Remove the engine coolant temperature switch electrical connector and reposition.
4. Remove the front headlamp electrical connector and reposition.

5. Install **J 41803** and **J 28467-B** and support the engine. See **Special Tools and Equipment** .
6. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
7. Remove the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

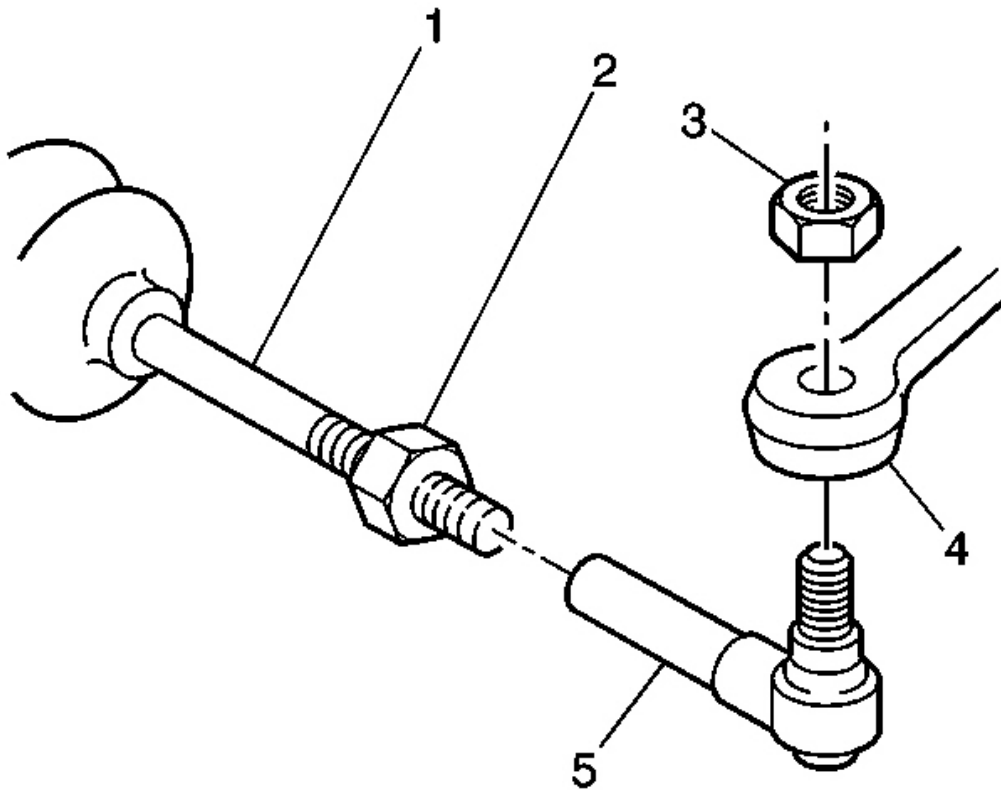


Fig. 2: Steering Linkage Outer Tie Rod End, Stud & Nuts
Courtesy of GENERAL MOTORS CORP.

8. Remove the steering linkage outer tie rod end stud nuts (3). Refer to **Rack and Pinion Outer Tie Rod End Replacement** in Power Steering Systems.

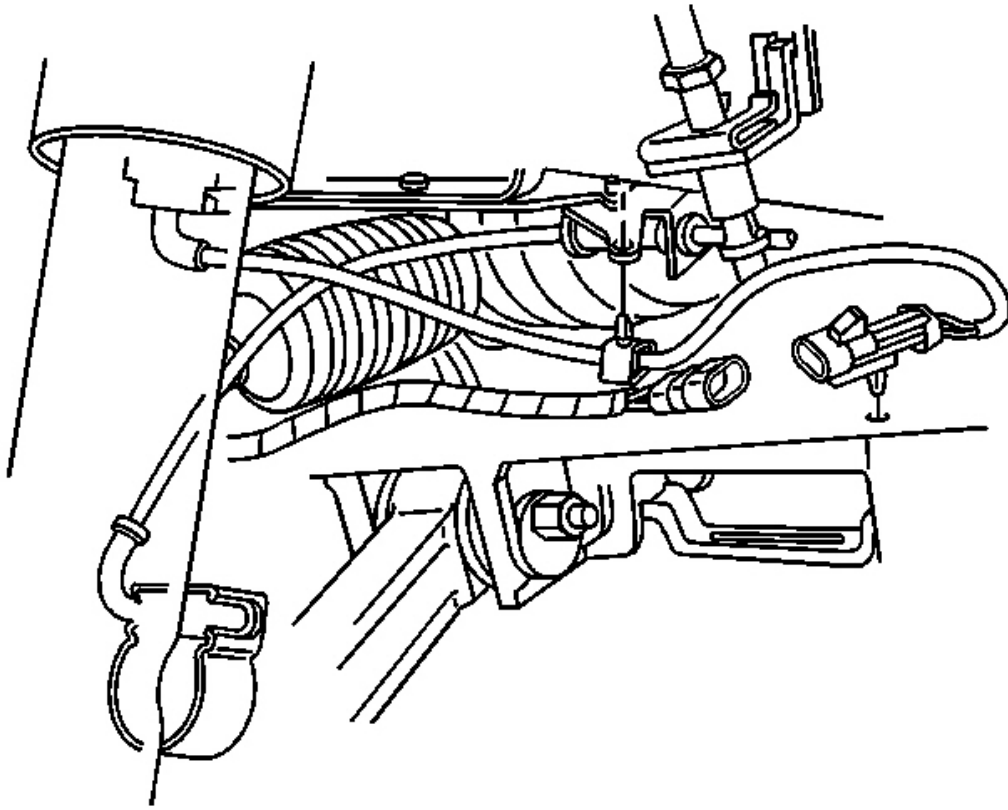


Fig. 3: Shock Absorber ESC Harness Connector
Courtesy of GENERAL MOTORS CORP.

9. Disconnect the shock absorber solenoid electrical connector, if equipped.

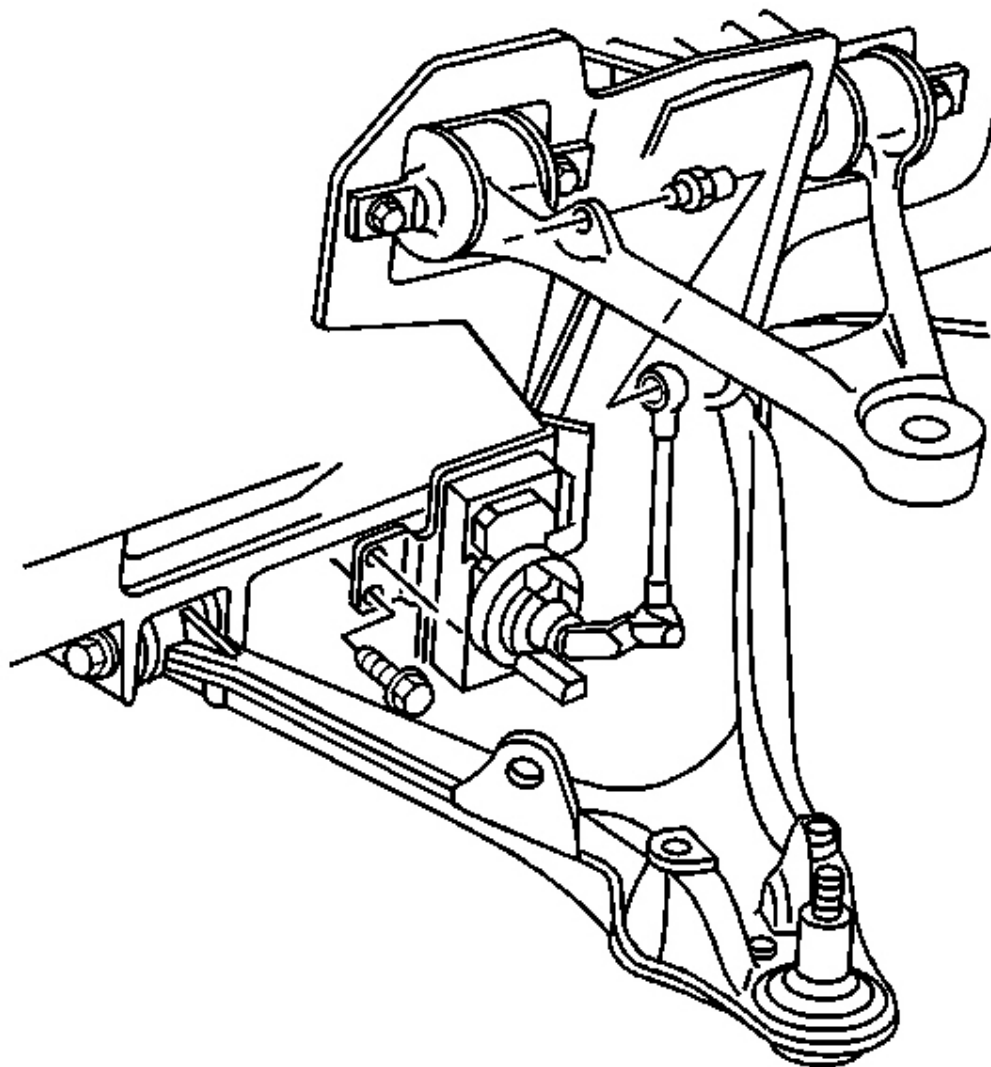


Fig. 4: ESC Sensor Link
Courtesy of GENERAL MOTORS CORP.

10. Disconnect the electronic suspension control (ESC) sensor links.
11. Remove the stabilizer shaft from the vehicle. Refer to **Stabilizer Shaft Replacement** .
12. Disconnect the intermediate shaft lower coupling from the steering gear. Refer to **Intermediate Steering Shaft Replacement** in Steering Wheel and Column.
13. Remove the bolts from the electronic brake control module/brake pressure modulator valve (EBCM/BPMV) bracket. Refer to **Brake Pressure Modulator Valve (BPMV) Bracket Replacement** in

Antilock Brake System.

14. Support and reposition the EBCM/BPMV and bracket away from the crossmember.

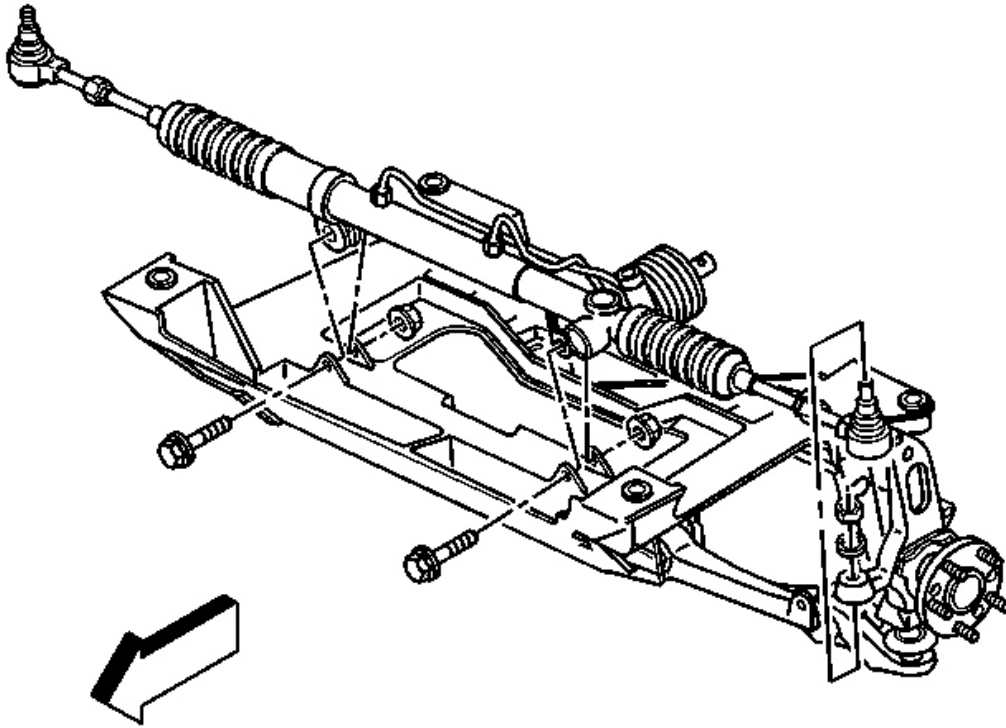


Fig. 5: Power Steering Gear & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

15. Remove the power steering gear mounting bolts.
16. Remove the power steering fluid cooler from the crossmember.
17. Lift the power steering gear off of the crossmember and support.

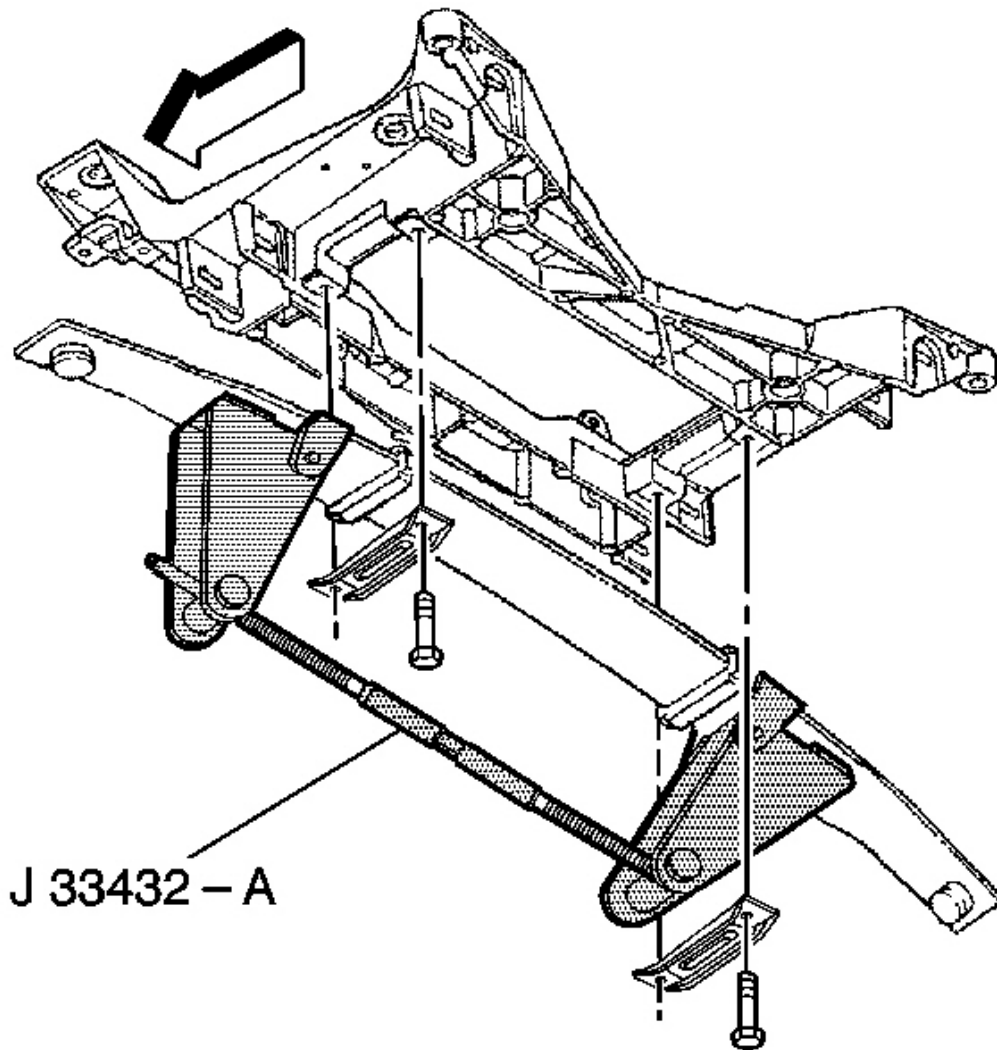


Fig. 6: Using J 33432-A
Courtesy of GENERAL MOTORS CORP.

18. Using the **J 33432-A** , remove the transverse spring from the vehicle. See **Special Tools and Equipment** . Refer to **Front Transverse Spring Replacement** .

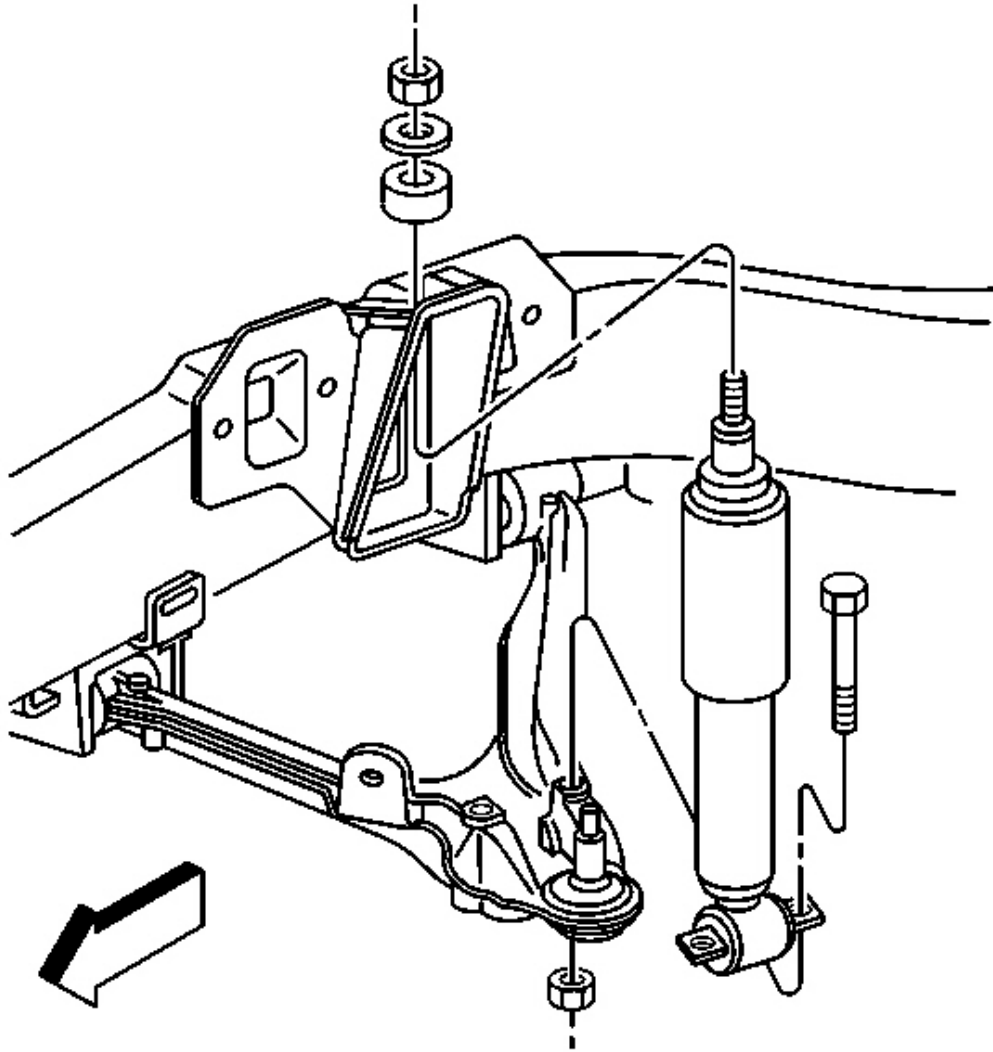


Fig. 7: Lower Shock Absorber & Bolts
Courtesy of GENERAL MOTORS CORP.

19. Disconnect the lower shock absorber bolts from the lower control arms.

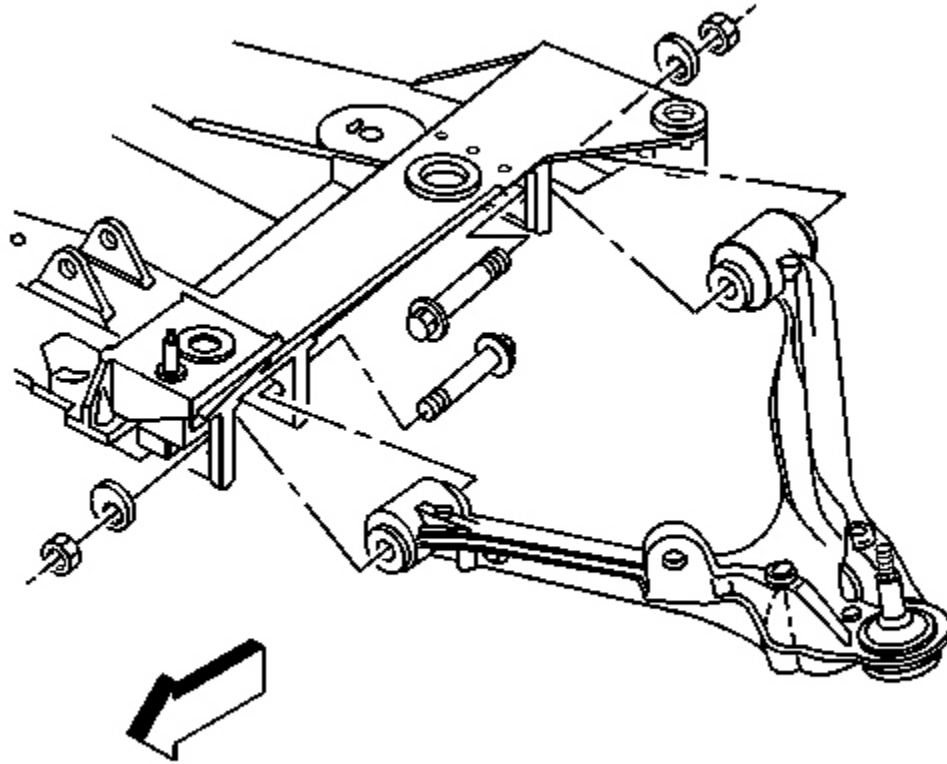


Fig. 8: Lower Control Arm & Bolts
Courtesy of GENERAL MOTORS CORP.

20. Remove the lower control arm bolts from the crossmember.
21. Place a transmission jack under the crossmember.
22. Remove the engine mount lower nuts. Refer to the following procedures:
 - **Engine Mount Replacement - Left** in Engine Mechanical - 5.7 L.
 - **Engine Mount Replacement - Right** in Engine Mechanical - 5.7 L.

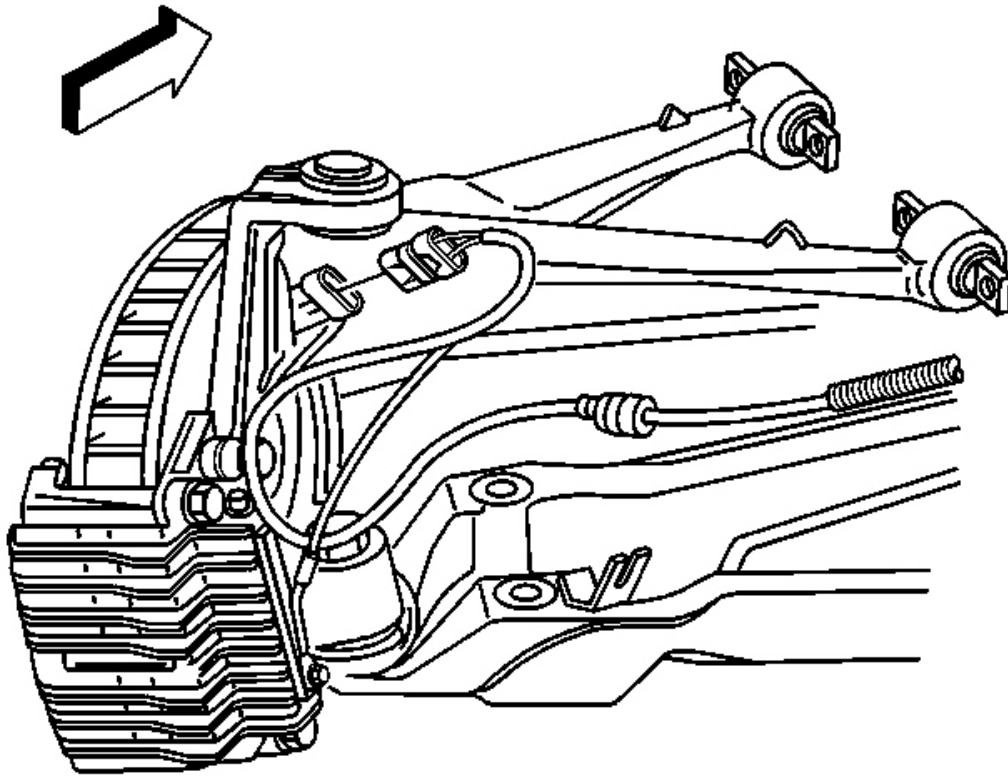


Fig. 9: View Of LF ABS Connector
Courtesy of GENERAL MOTORS CORP.

23. Disconnect the wheel speed sensor wiring harness from the crossmember.

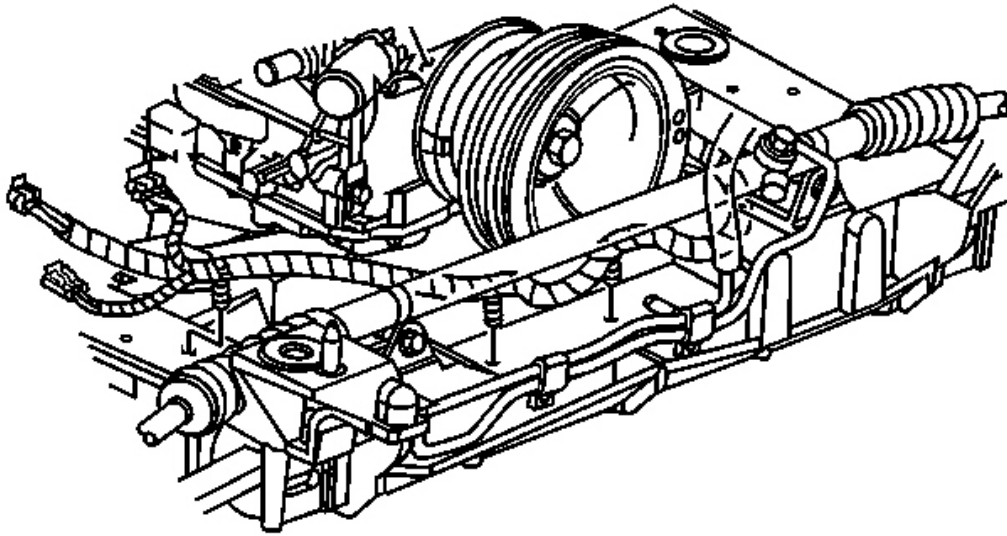


Fig. 10: Electrical Harness & Brake Pipe
Courtesy of GENERAL MOTORS CORP.

24. Disconnect the electrical harness from the clips on the crossmember.
25. Disconnect the brake pipe from the clips on the crossmember.

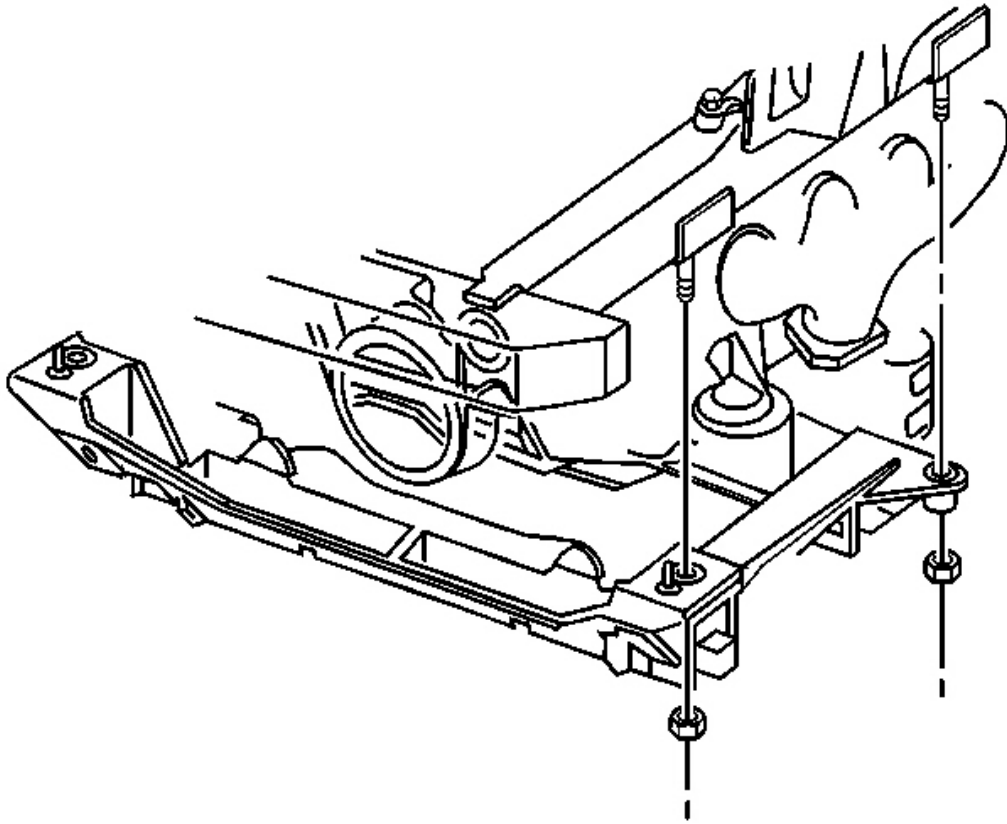


Fig. 11: Crossmember & Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

26. Remove the crossmember mounting nuts.
27. Lower the crossmember out of the vehicle by removing the transmission jack from under the crossmember.

Installation Procedure

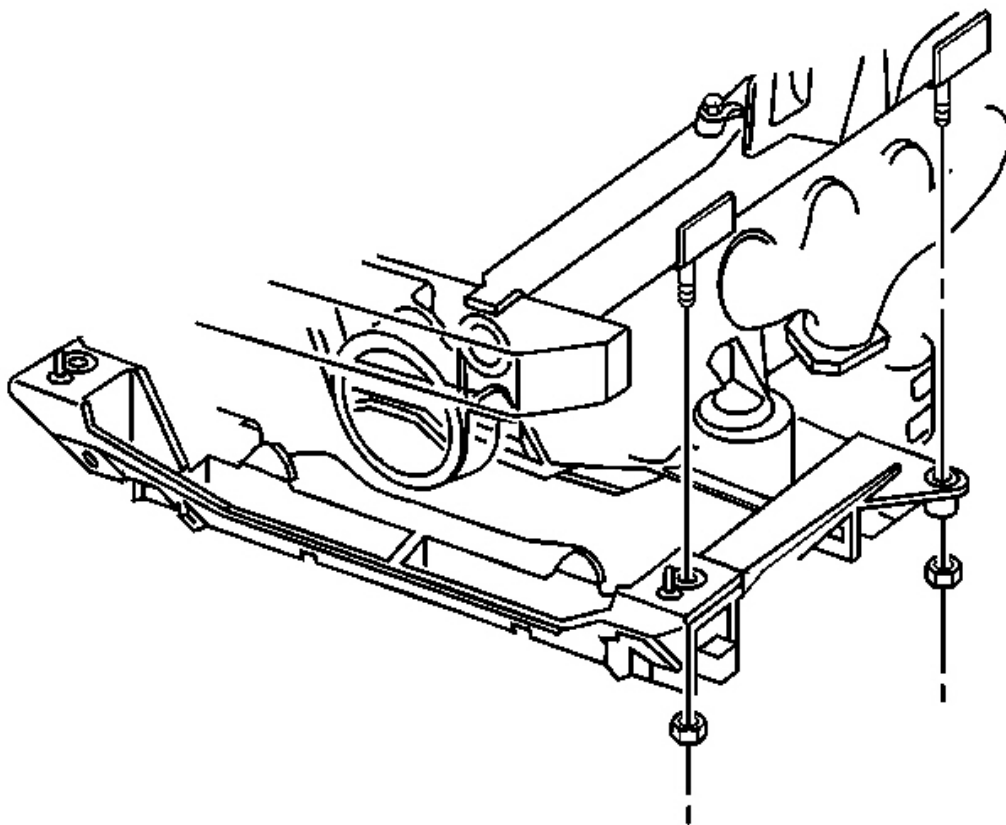


Fig. 12: Crossmember & Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

1. Raise the crossmember to the vehicle.
 1. Align the crossmember dowel pins to the frame rails.
 2. Align the engine mount studs.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install new crossmember mounting nuts.

Tighten: Tighten the new crossmember mounting nuts to 110 N.m (81 lb ft).

3. Install the engine mount lower nuts. Refer to one of the following procedures:
 - **Engine Mount Replacement - Left** in Engine Mechanical

- **Engine Mount Replacement - Right** in Engine Mechanical

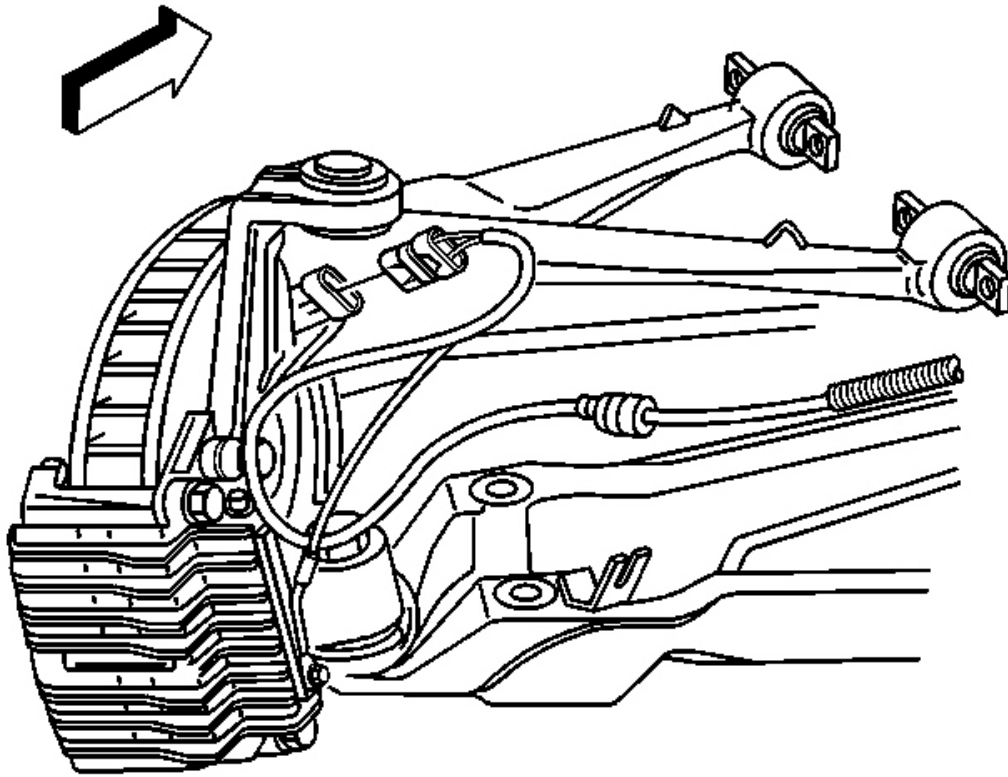


Fig. 13: View Of LF ABS Connector
Courtesy of GENERAL MOTORS CORP.

4. Fasten the wheel speed sensor wiring harness retaining clips to the crossmember.
5. Fasten the brake pipe to the retaining clips on the crossmember.

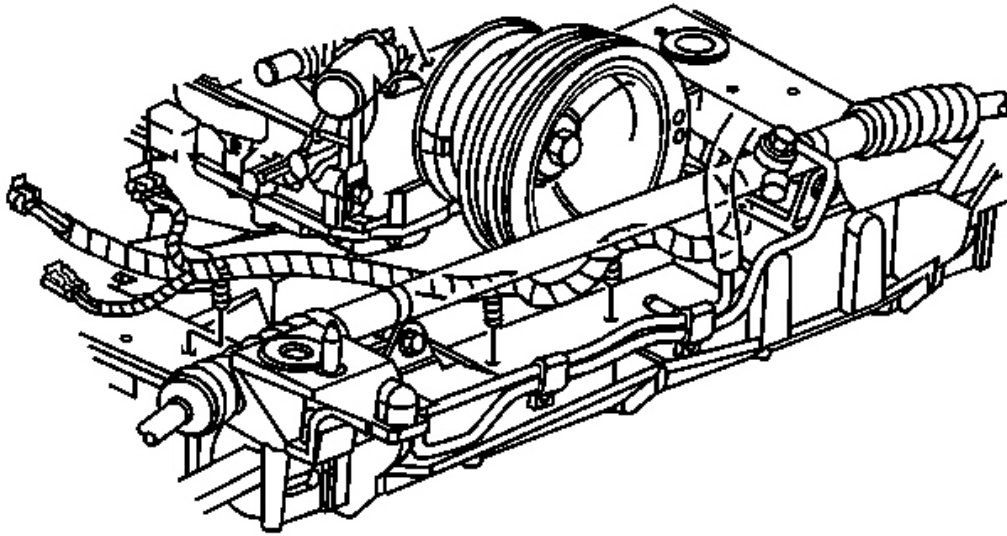


Fig. 14: Electrical Harness & Brake Pipe
Courtesy of GENERAL MOTORS CORP.

6. Connect the electrical harness to the clips on the crossmember.
7. Connect the brake pipe to the clips on the crossmember.

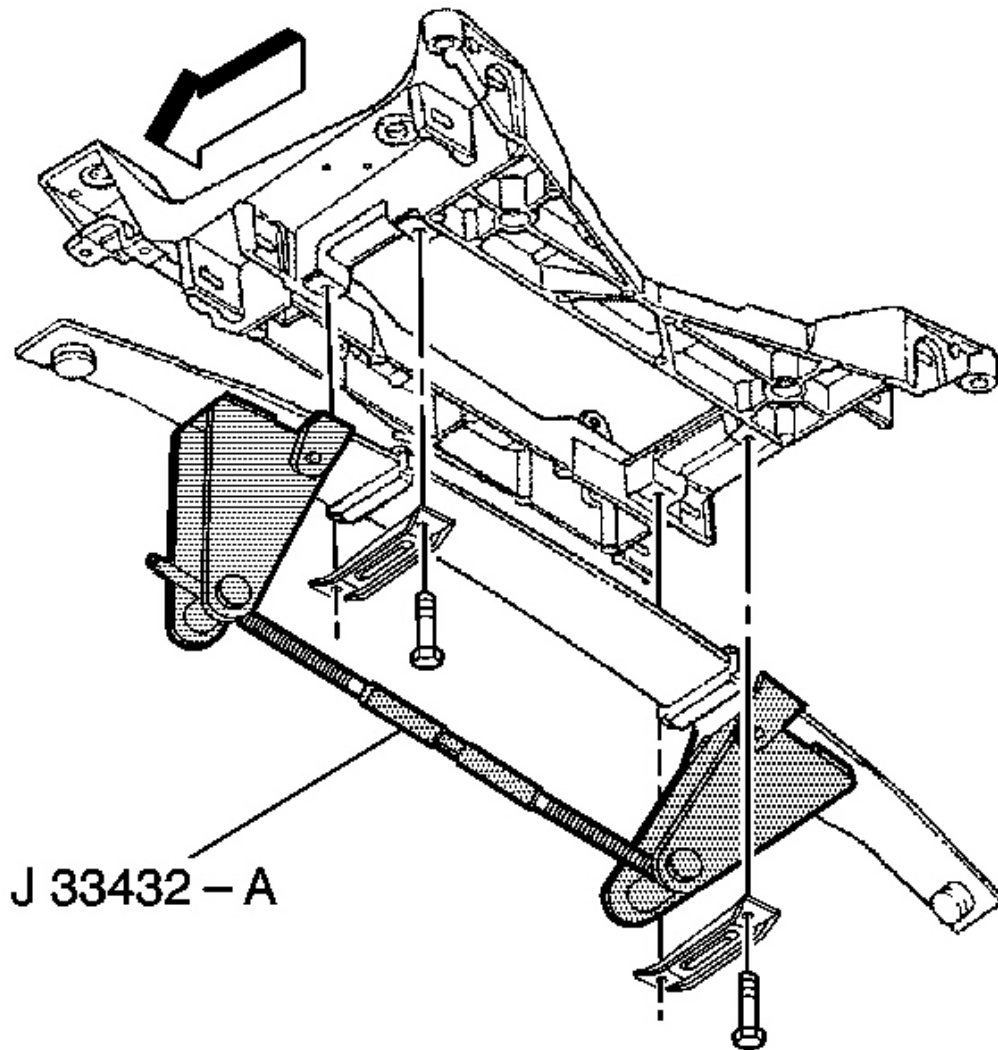


Fig. 15: Using J 33432-A
Courtesy of GENERAL MOTORS CORP.

8. Install the transverse spring with the J 33432-A connected, to the crossmember. See **Special Tools and Equipment** . Refer to **Front Transverse Spring Replacement** .

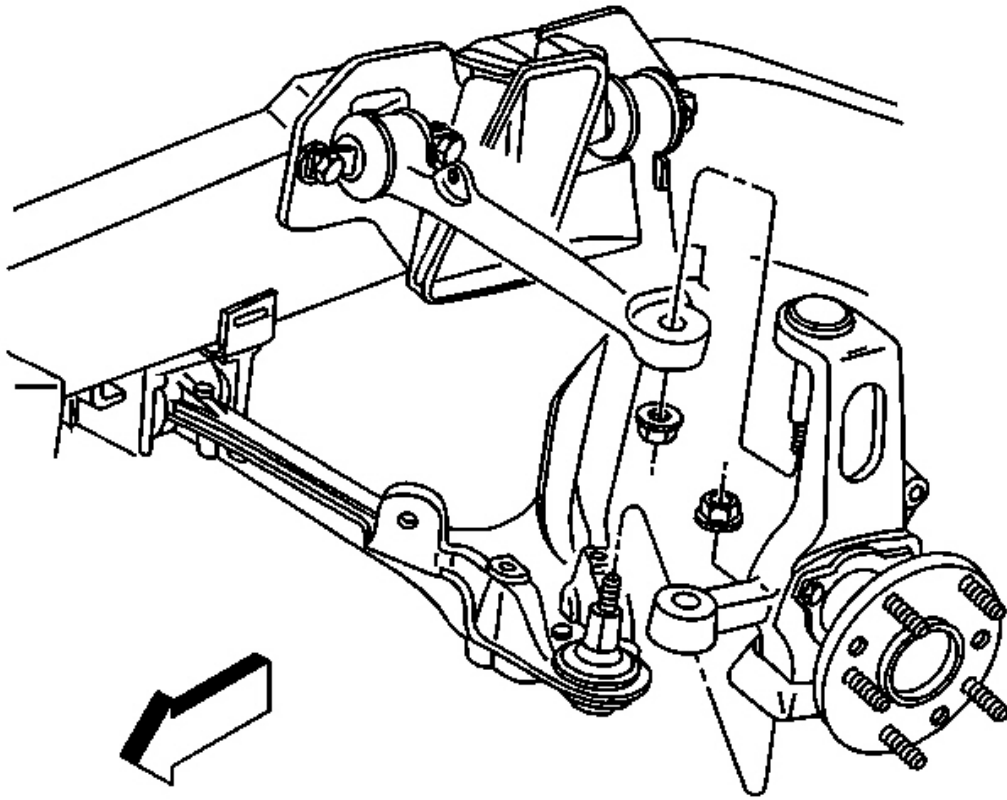


Fig. 16: Lower Control Arm & Outer Tie Rod Ball Stud
Courtesy of GENERAL MOTORS CORP.

9. Install the lower control arm to the crossmember. Refer to Lower Control Arm Replacement .

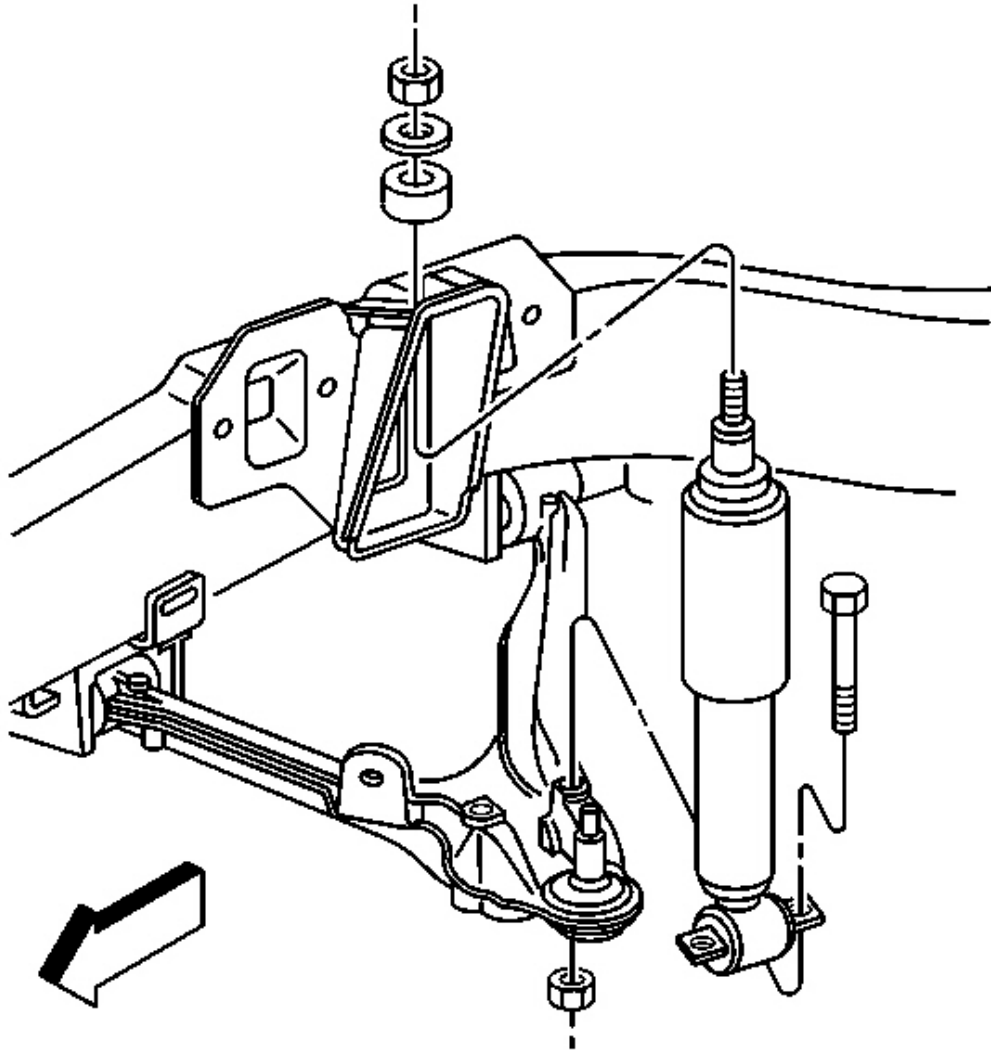


Fig. 17: Lower Shock Absorber & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Install the shock absorbers to the lower control arms.

Tighten: Tighten the shock absorber lower mounting nuts to 28 N.m (21 lb ft).

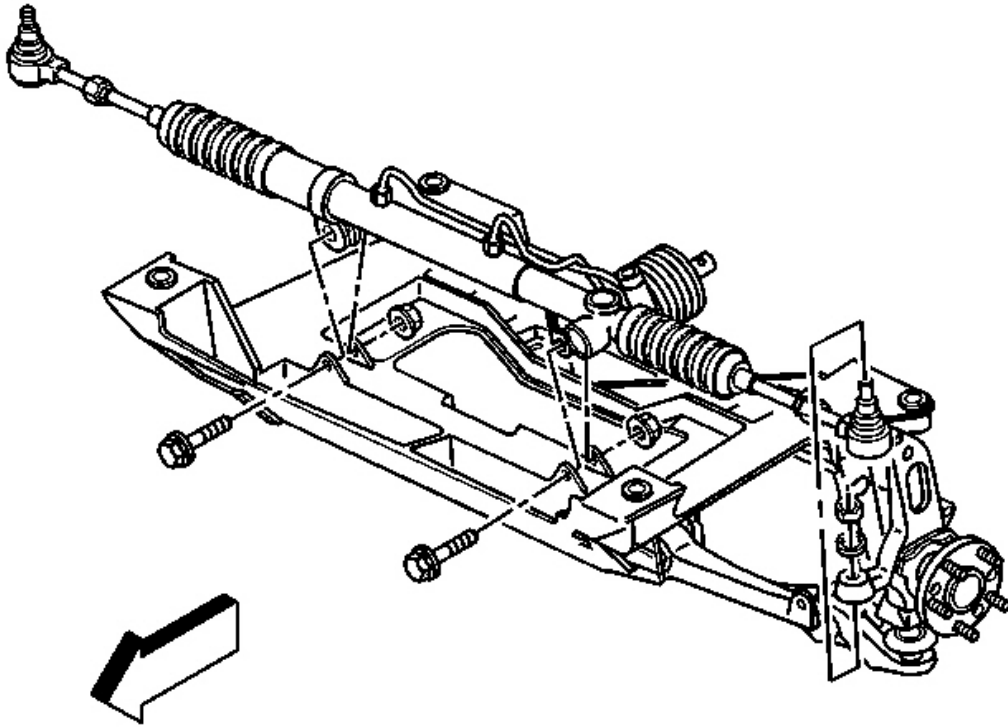


Fig. 18: Power Steering Gear & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

11. Install the power steering gear to the crossmember.

Tighten: Tighten the power steering gear mounting bolts to 100 N.m (74 lb ft).

12. Install the bolts to the brake pressure modulator valve bracket. Refer to **Brake Pressure Modulator Valve (BPMV) Bracket Replacement** in Antilock Brake System.
13. Connect the intermediate shaft to the steering gear. Refer to **Intermediate Steering Shaft Replacement** in Steering Wheel and Column.

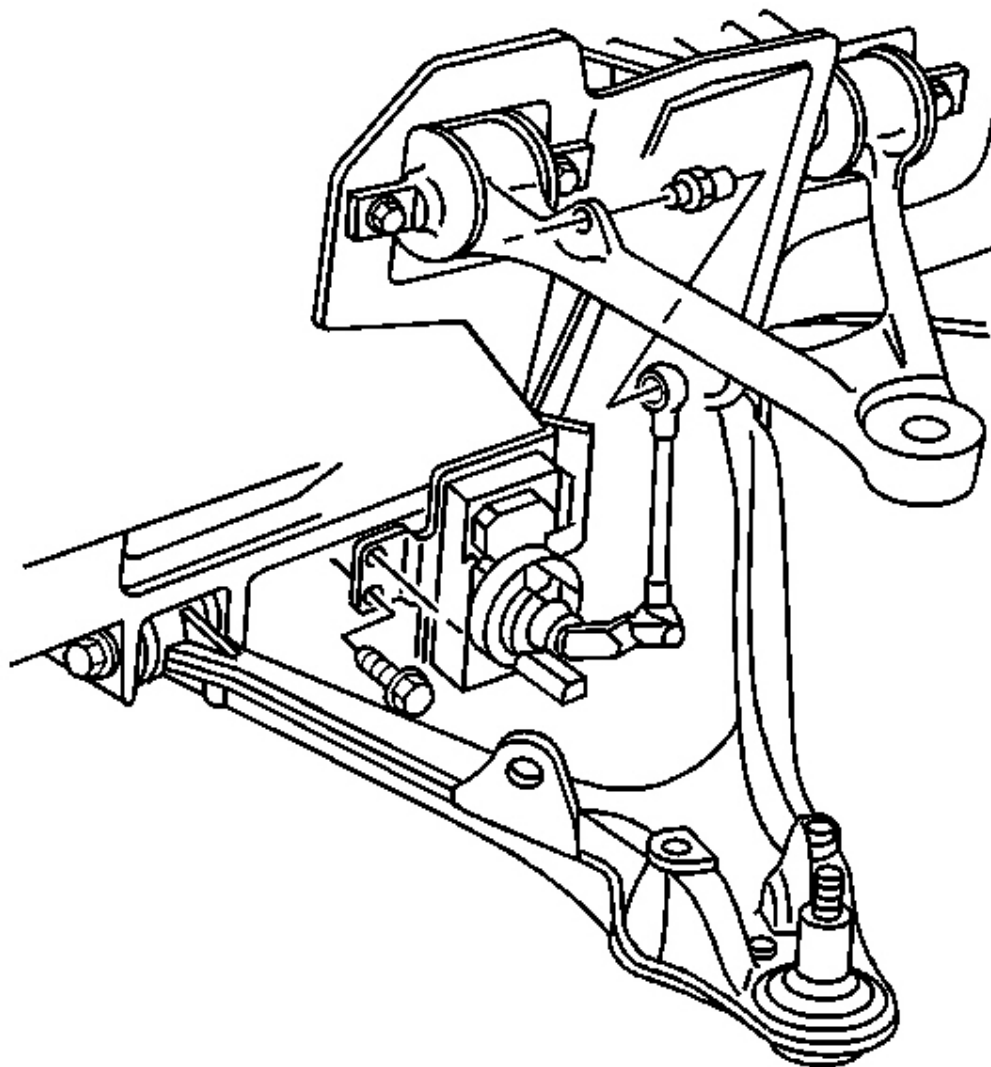


Fig. 19: ESC Sensor Link
Courtesy of GENERAL MOTORS CORP.

14. Install the steering linkage outer tie rod ends to the steering knuckles. Refer to **Rack and Pinion Outer Tie Rod End Replacement** in Power Steering Systems.
15. Connect the ESC sensor links to the upper control arm, if equipped.

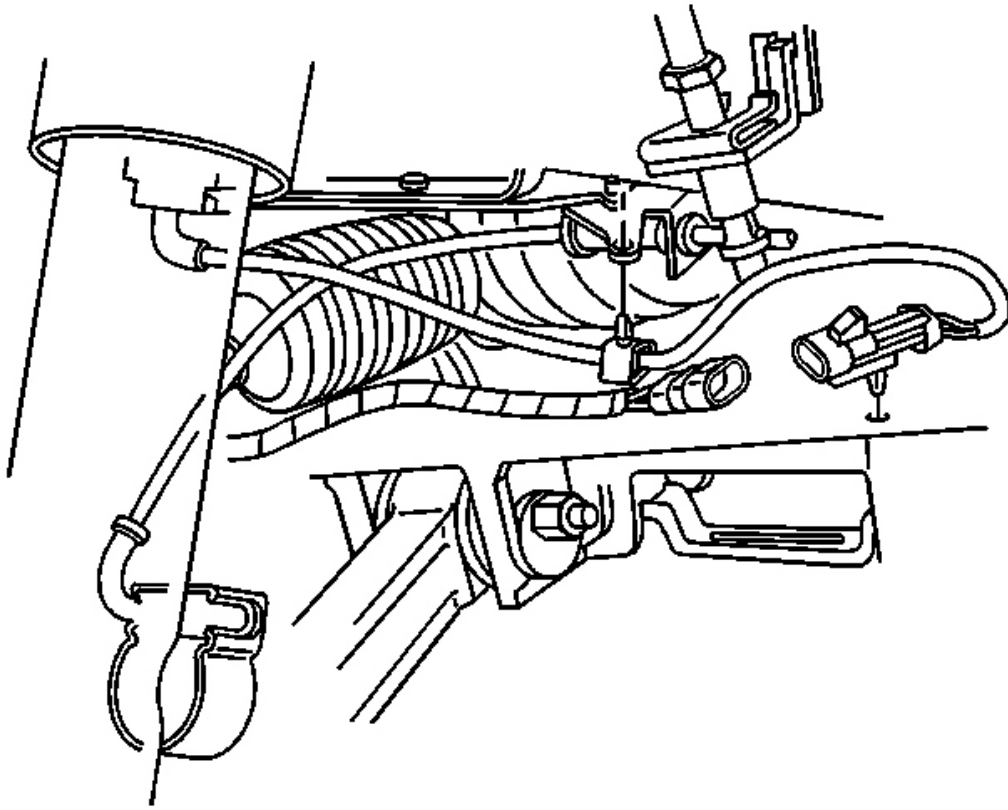


Fig. 20: Shock Absorber ESC Harness Connector
Courtesy of GENERAL MOTORS CORP.

16. Connect the shock absorber solenoid electrical connector, if equipped.
17. Install the stabilizer shaft to the vehicle. Refer to **Stabilizer Shaft Replacement** .
18. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
19. Lower the vehicle.
20. Remove **J 41803** and **J 28467-B** from the engine. See **Special Tools and Equipment** .
21. Install the generator. Refer to **Generator Replacement** in Engine Electrical.
22. Install the washer pump/reservoir. Refer to **Washer Solvent Container Replacement** in Wipers/Washer Systems.

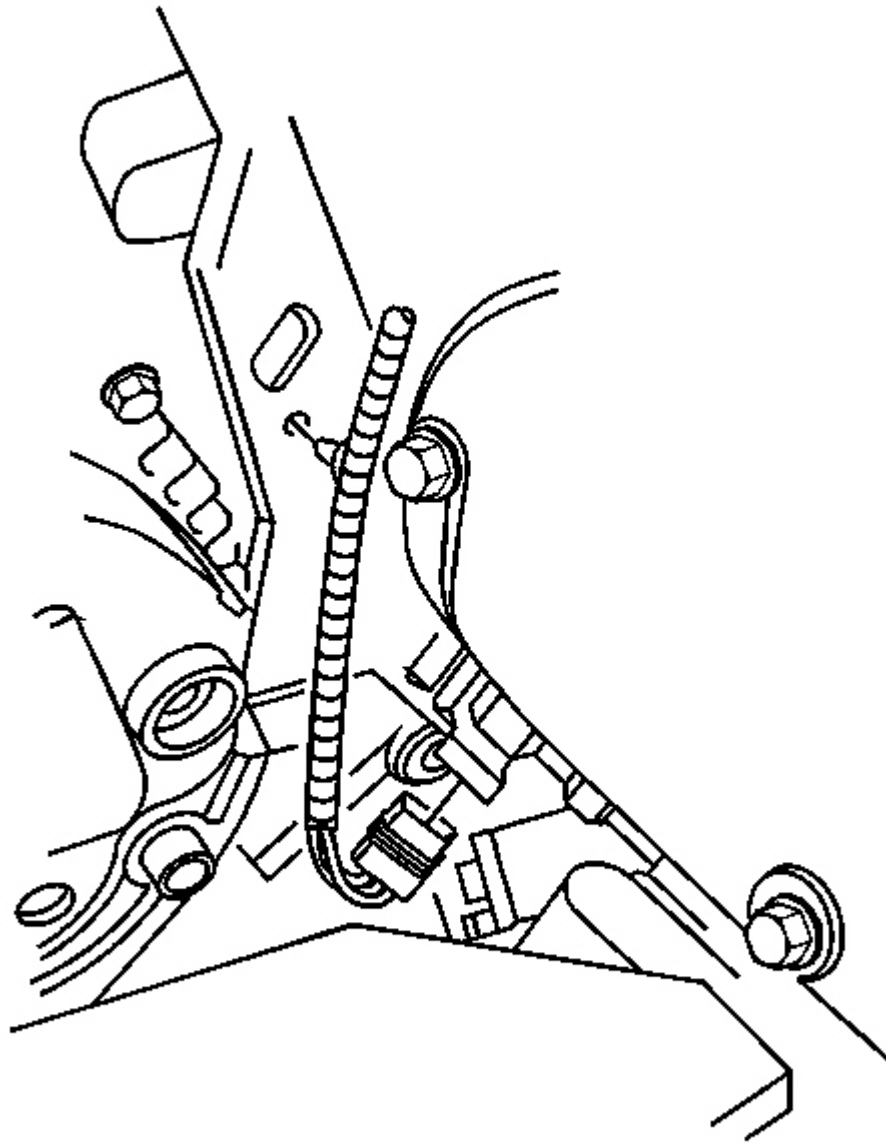


Fig. 21: Engine Coolant Temperature Switch Electrical Connector
Courtesy of GENERAL MOTORS CORP.

23. Install the engine coolant temperature switch electrical connector.
24. Install the front headlamp electrical connector.
25. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in

Engine Electrical.

26. Perform a vehicle front end alignment. Refer to **Measuring Wheel Alignment** in Wheel Alignment.

STABILIZER SHAFT REPLACEMENT

Removal Procedure

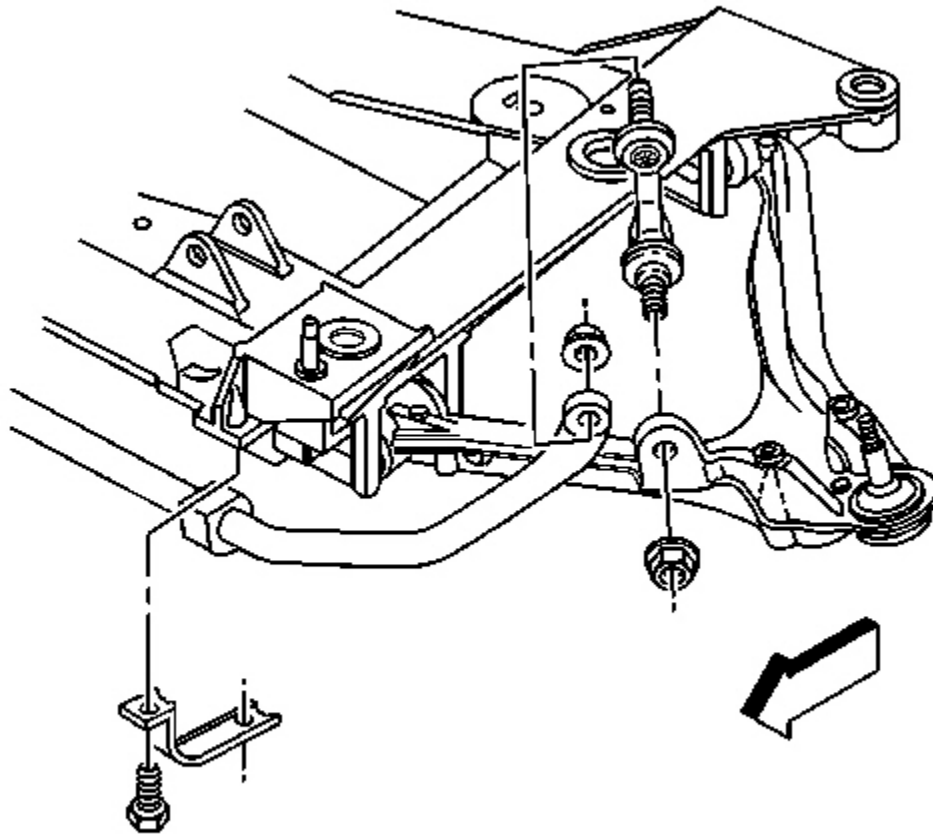


Fig. 22: Stabilizer Shaft Insulator Clamps, Stabilizer Shaft Link & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the stabilizer shaft link nuts from the stabilizer shaft.

4. Remove the stabilizer shaft insulator clamps from the front crossmember.
5. Remove the stabilizer shaft from the vehicle.

Installation Procedure

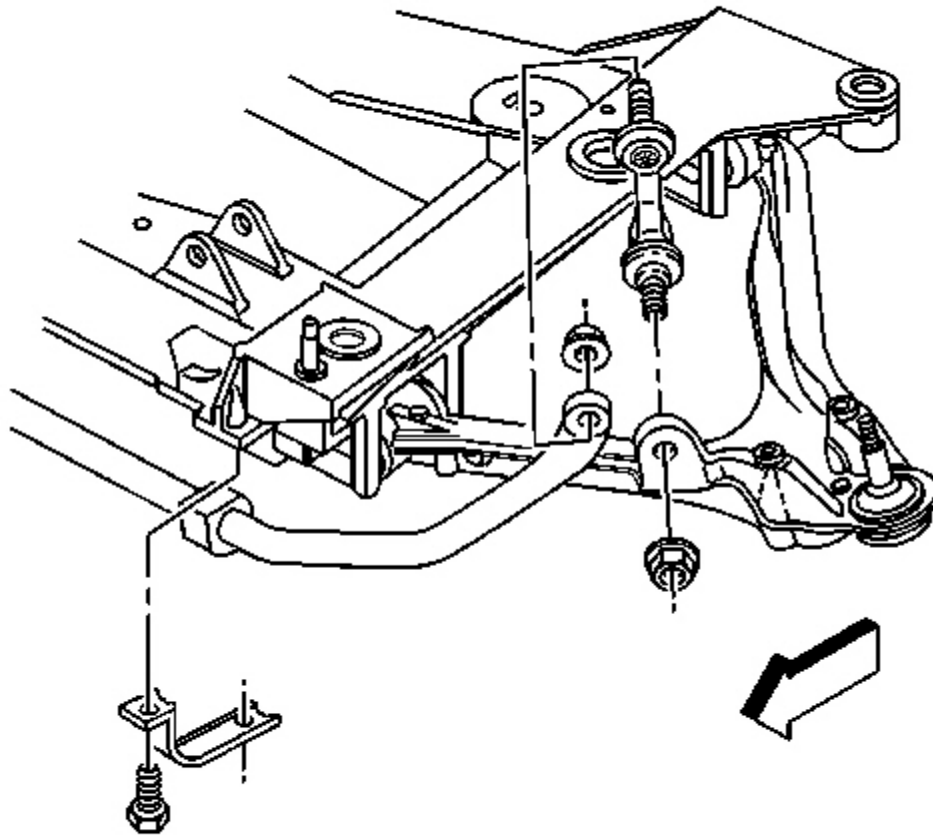


Fig. 23: Stabilizer Shaft Insulator Clamps, Stabilizer Shaft Link & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the stabilizer shaft, insulator clamps and bolts to the crossmember.
2. Install the stabilizer shaft links to the stabilizer shaft.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the stabilizer shaft link nuts.

Tighten: Tighten the stabilizer shaft link nuts to 72 N.m (53 lb ft).

4. Install the stabilizer shaft insulator clamp bolts.

Tighten: Tighten the stabilizer shaft insulator clamp bolts to 58 N.m (43 lb ft).

5. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
6. Lower the vehicle.

STABILIZER SHAFT LINK REPLACEMENT

Removal Procedure

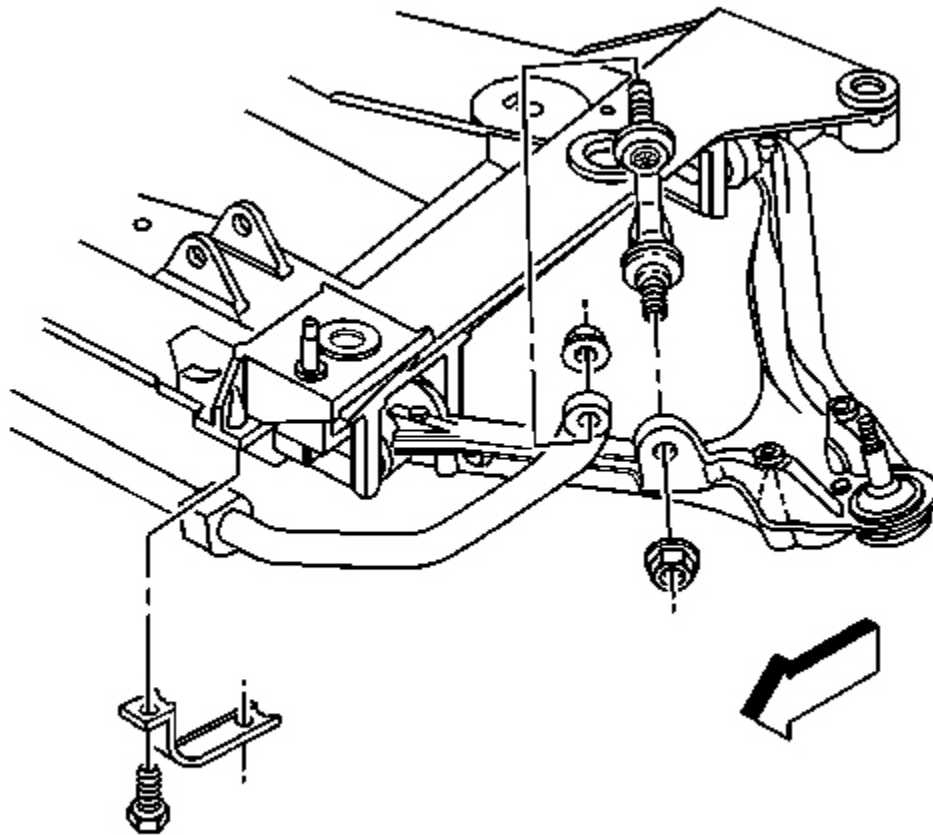


Fig. 24: Stabilizer Shaft Insulator Clamps, Stabilizer Shaft Link & Nuts

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 stabilizer shaft link nuts.
4. Remove the stabilizer shaft link from the stabilizer shaft and lower control arm.

Installation Procedure

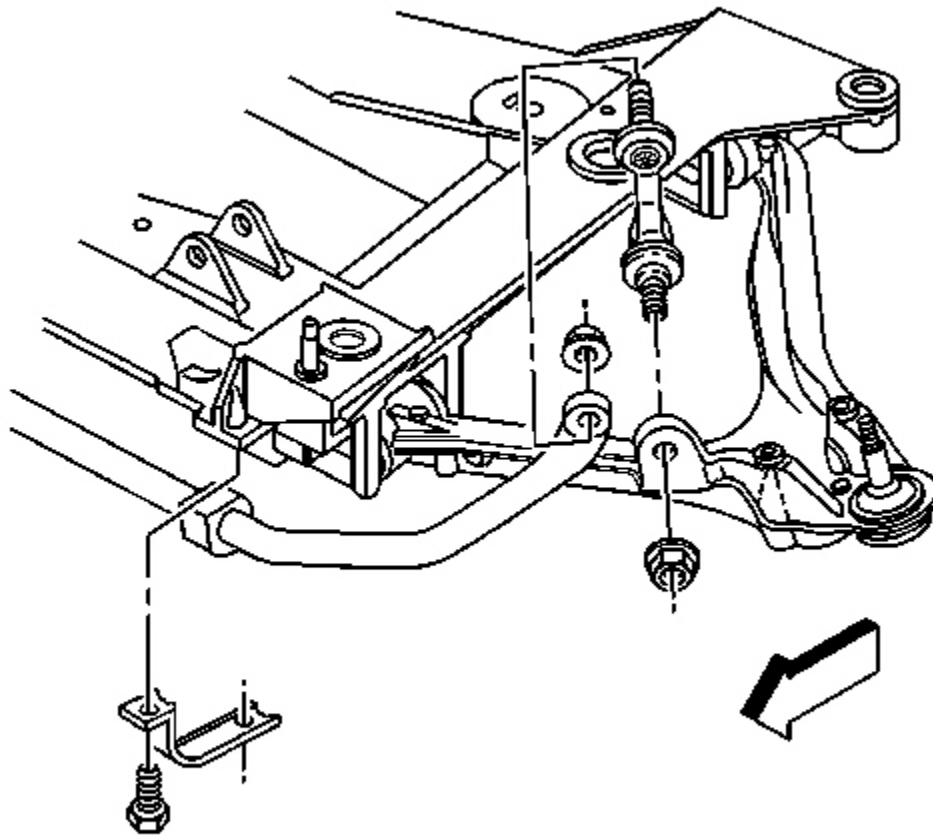


Fig. 25: Stabilizer Shaft Insulator Clamps, Stabilizer Shaft Link & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the stabilizer shaft link into the stabilizer shaft and lower control arm.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the stabilizer shaft link nuts.

Tighten: Tighten the stabilizer shaft link nuts to 72 N.m (53 lb ft).

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

STABILIZER SHAFT INSULATOR REPLACEMENT

Removal Procedure

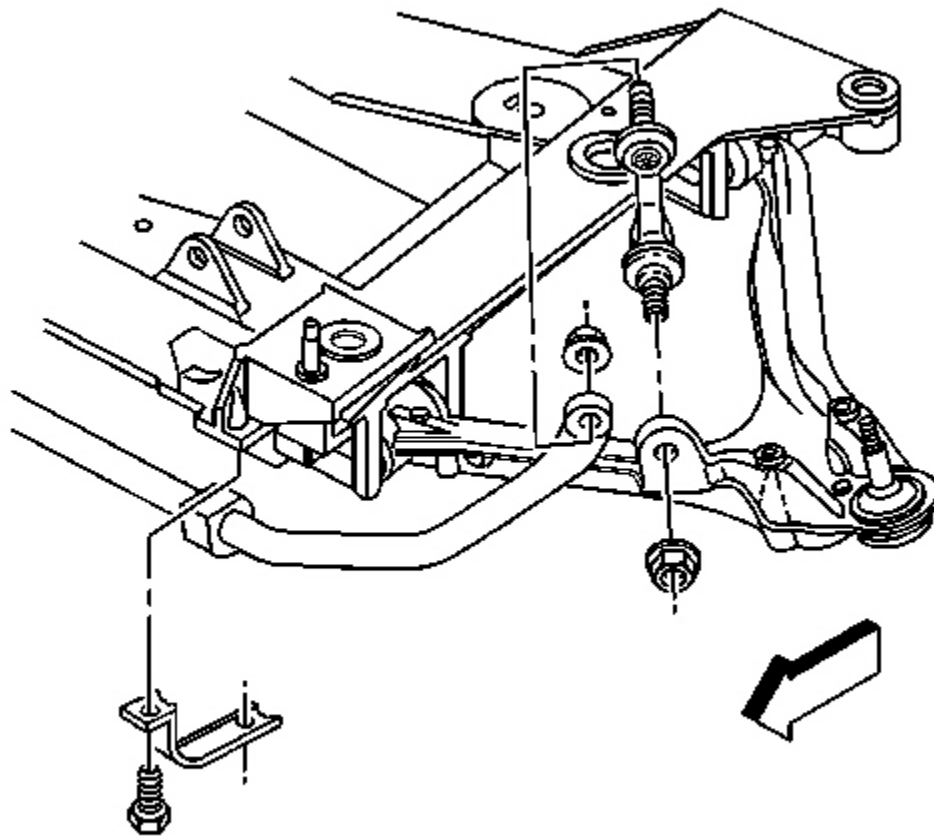


Fig. 26: Stabilizer Shaft Insulator Clamps, Stabilizer Shaft Link & Nuts

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 assemblies. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.
3. Remove the stabilizer shaft from the vehicle. Refer to Stabilizer Shaft Replacement .
4. Remove the stabilizer shaft insulators from the stabilizer shaft.

Installation Procedure

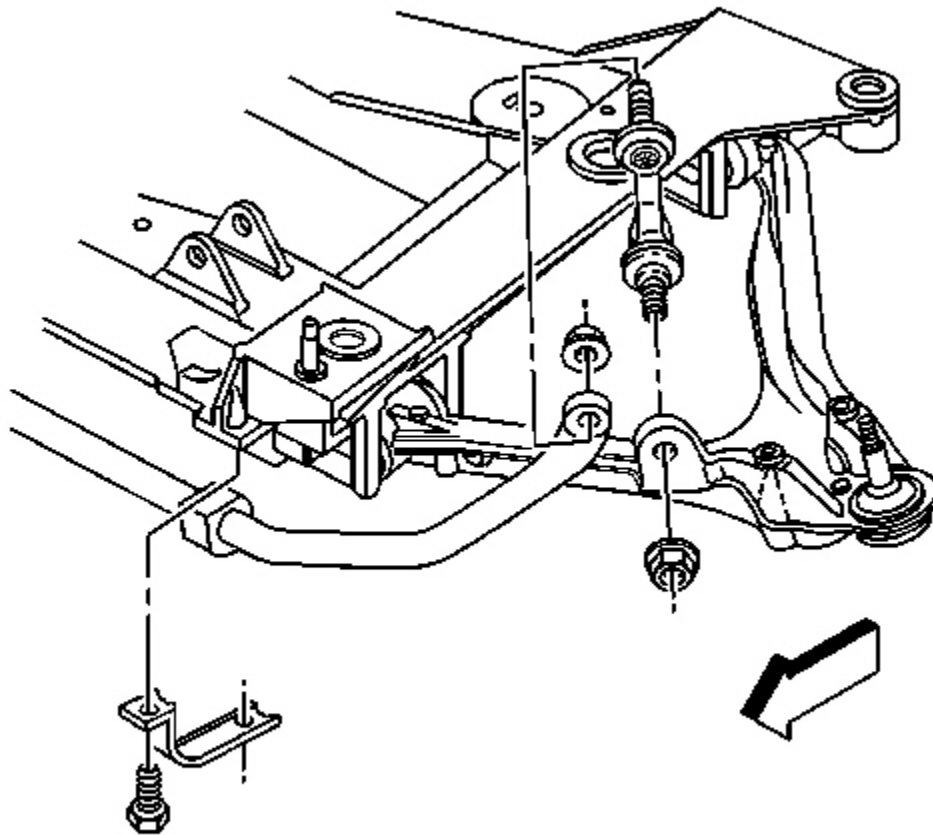


Fig. 27: Stabilizer Shaft Insulator Clamps, Stabilizer Shaft Link & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the stabilizer shaft insulators to the stabilizer shaft.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the stabilizer shaft to the vehicle.

Tighten: Tighten the bolts to 58 N.m (43 lb ft).

3. Install the tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.

4. Lower the vehicle.

FRONT TRANSVERSE SPRING REPLACEMENT

Tools Required

- **J 33432-A** Transverse Spring Compressor. See Special Tools and Equipment .
- **J 42188** Ball Joint Separator

Removal Procedure

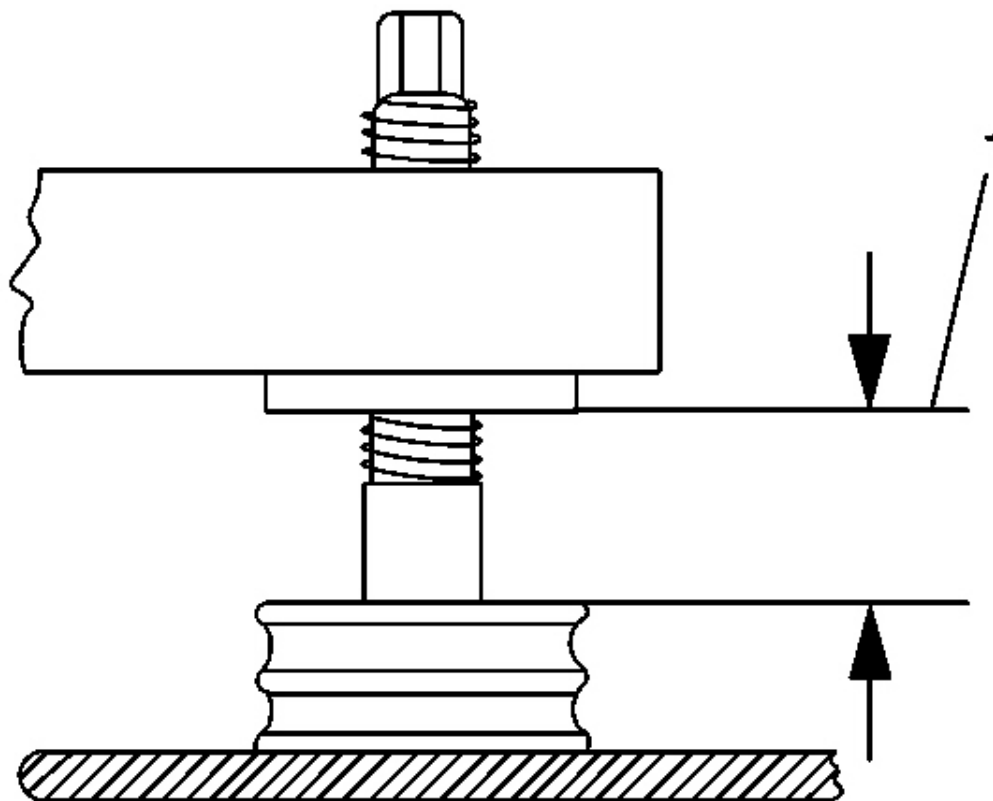


Fig. 28: Measuring The Front Spring Adjuster Bolt Gap
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. If the transverse spring is to be replaced, measure the front spring adjuster bolt gap (1).

This measurement will be used in the installation procedure to setup the vehicle trim height.

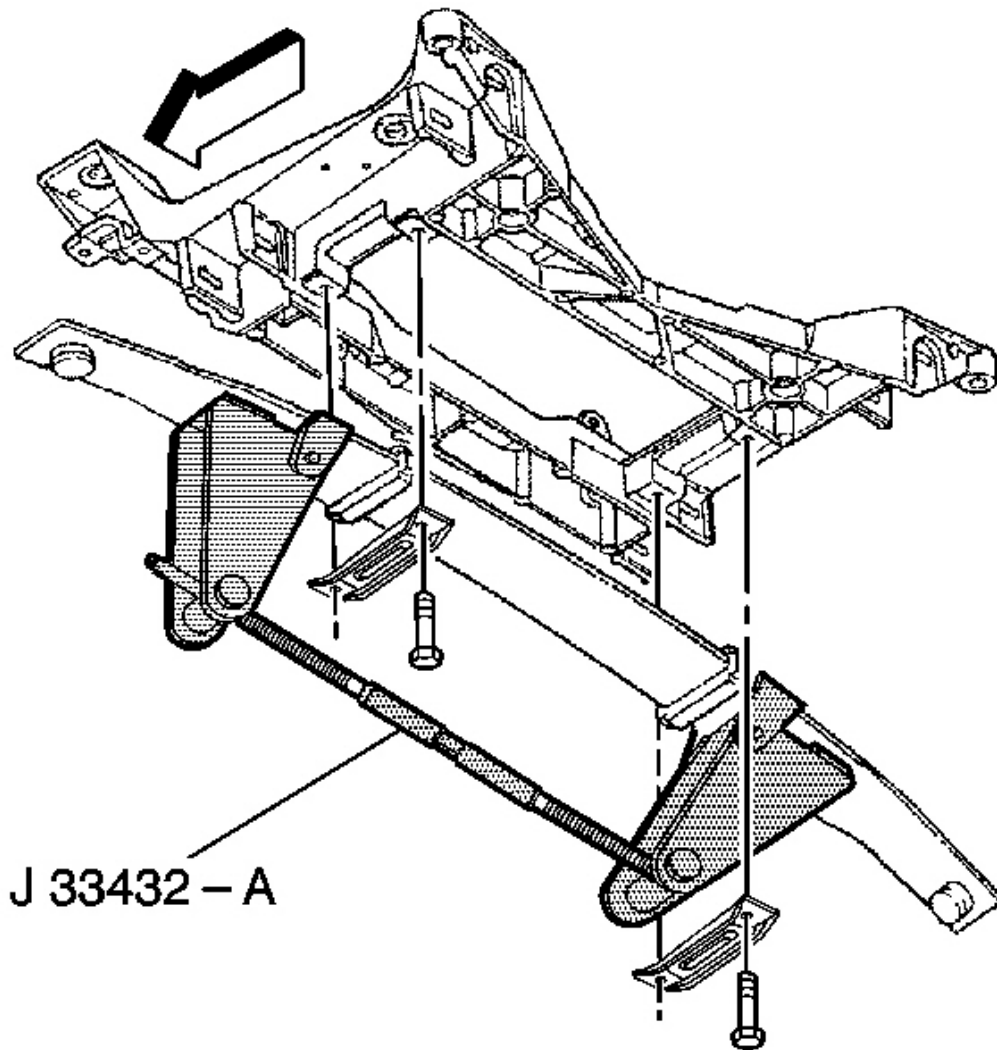


Fig. 29: Using J 33432-A
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: During this procedure, use care not to scratch the transverse spring.

4. Install the transverse spring compressor J 33432-A to the transverse spring. See Special Tools and Equipment .
5. Compress the transverse spring.

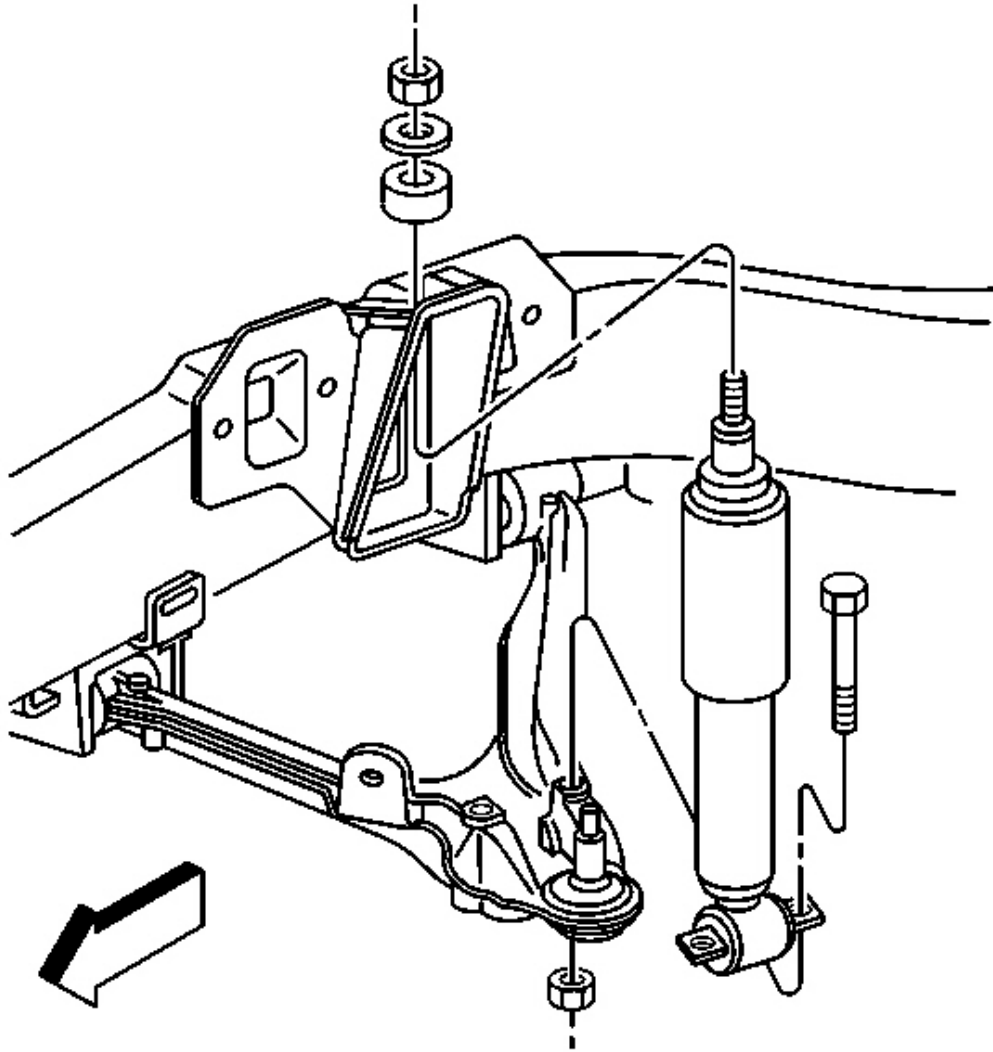


Fig. 30: Lower Shock Absorber & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the lower shock absorber mounting bolts from one of the lower control arms.

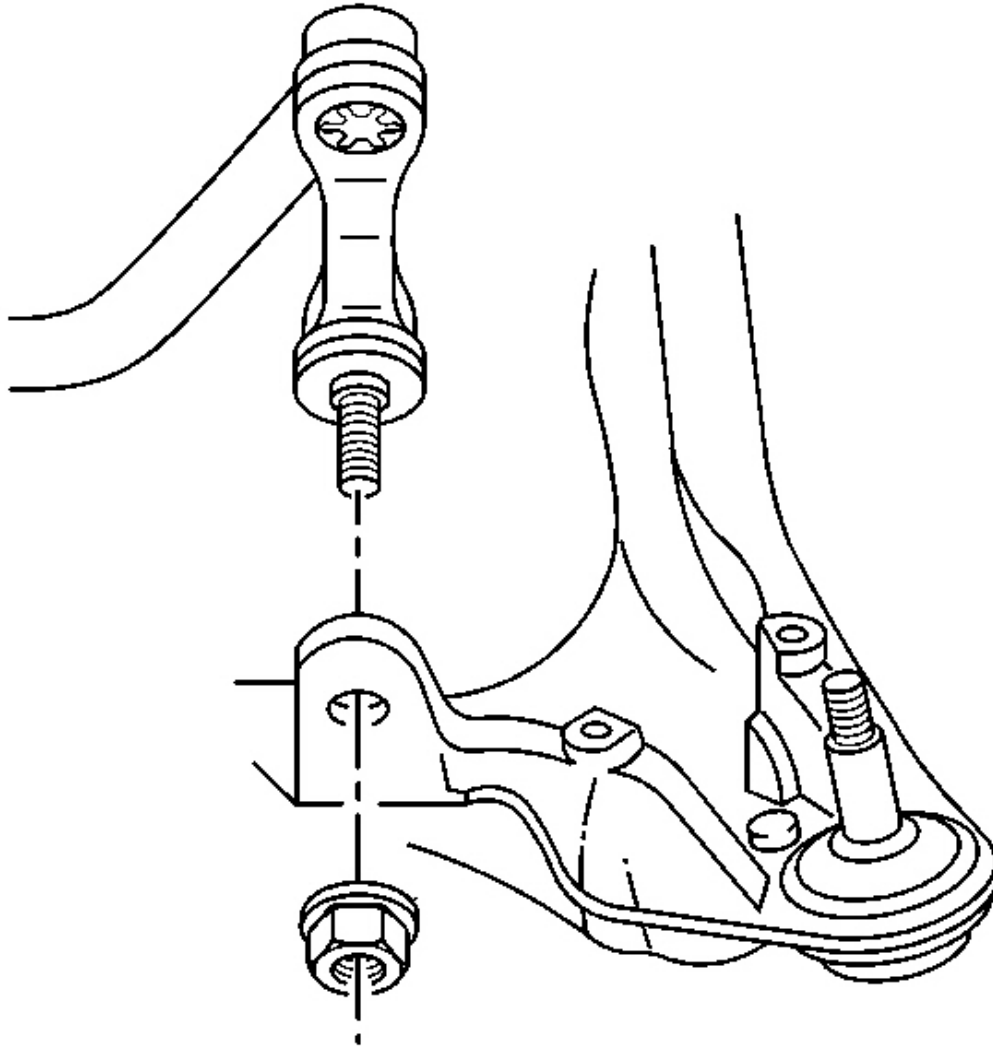


Fig. 31: Stabilizer Shaft Link & Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the stabilizer shaft link from the lower control arm.

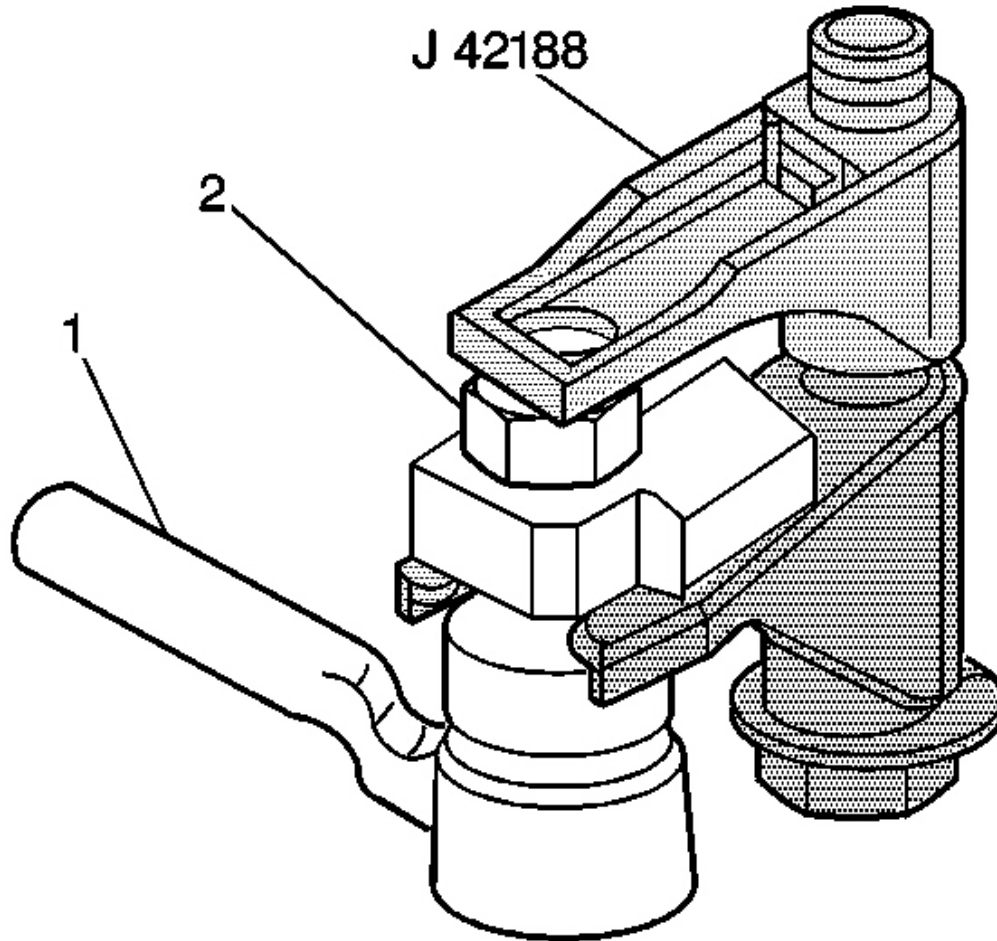


Fig. 32:
Courtesy of GENERAL MOTORS CORP.

8. Loosen the lower ball joint stud nut (2) on the lower control arm. Do not remove the nut.
9. Separate the lower the ball joint from the steering knuckle using ball joint separator tool **J 42188** .

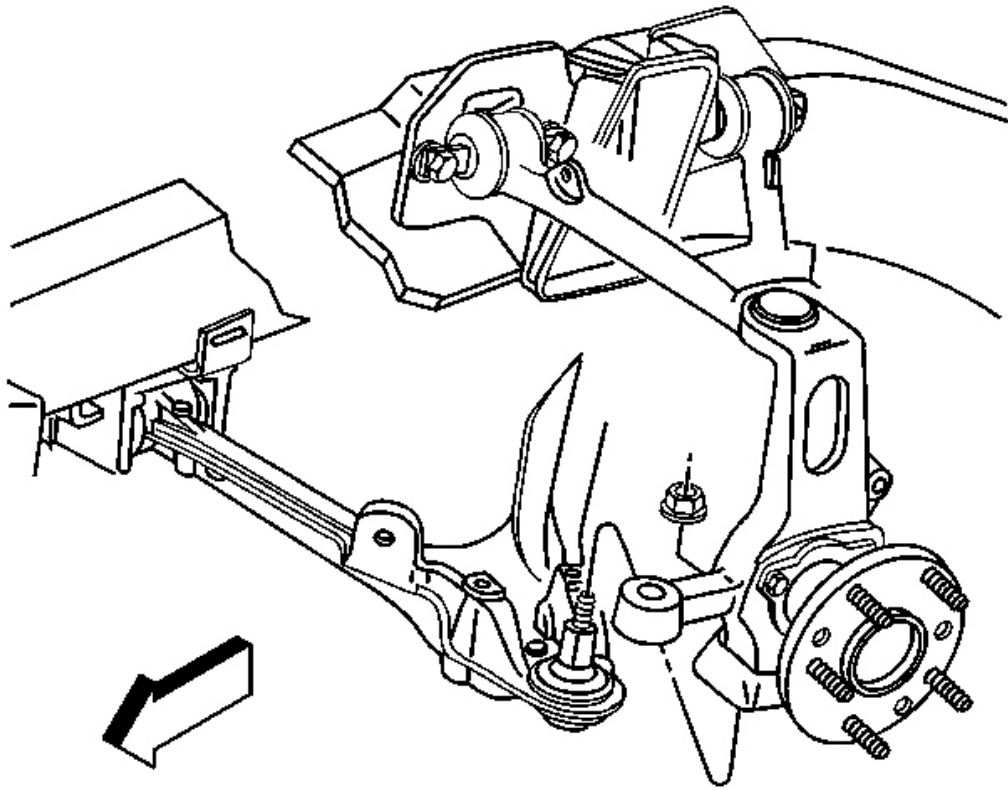


Fig. 33: Lower Control Arm Ball Joint, Stud & Nuts
Courtesy of GENERAL MOTORS CORP.

10. Remove the ball joint separator tool.
11. Remove the lower ball joint stud nut and discard.
12. Support the lower control arms with jackstand.

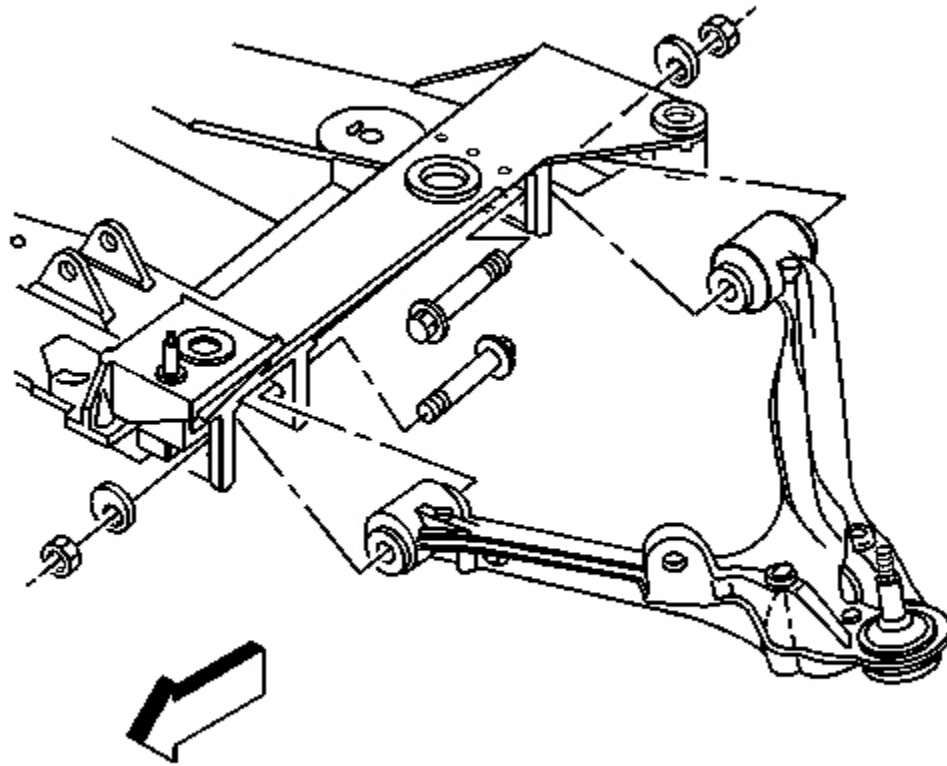


Fig. 34: Lower Control Arm & Bolts
Courtesy of GENERAL MOTORS CORP.

13. Mark the position of the cam bolts for reference at reinstallation.
14. Remove the cam bolts from the lower control arm.
15. Remove the lower control arm.

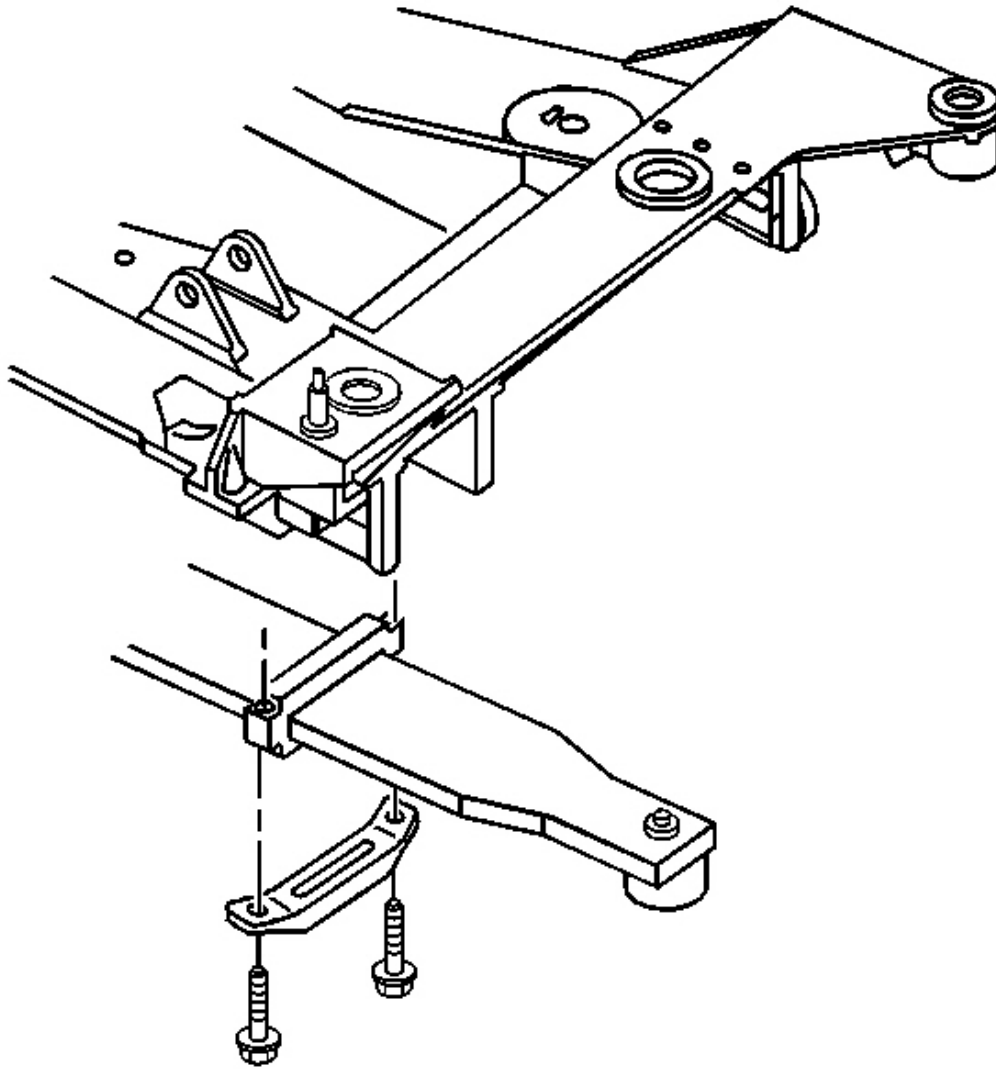


Fig. 35: Transverse Spring, Transverse Spring Compressor & Bolts
Courtesy of GENERAL MOTORS CORP.

16. Remove the transverse spring bolts and retainers.
17. Discard the old transverse spring bolts
18. Remove the transverse spring from the vehicle.
19. Remove the transverse spring compressor from the transverse spring, if the spring is to be replaced.

Installation Procedure

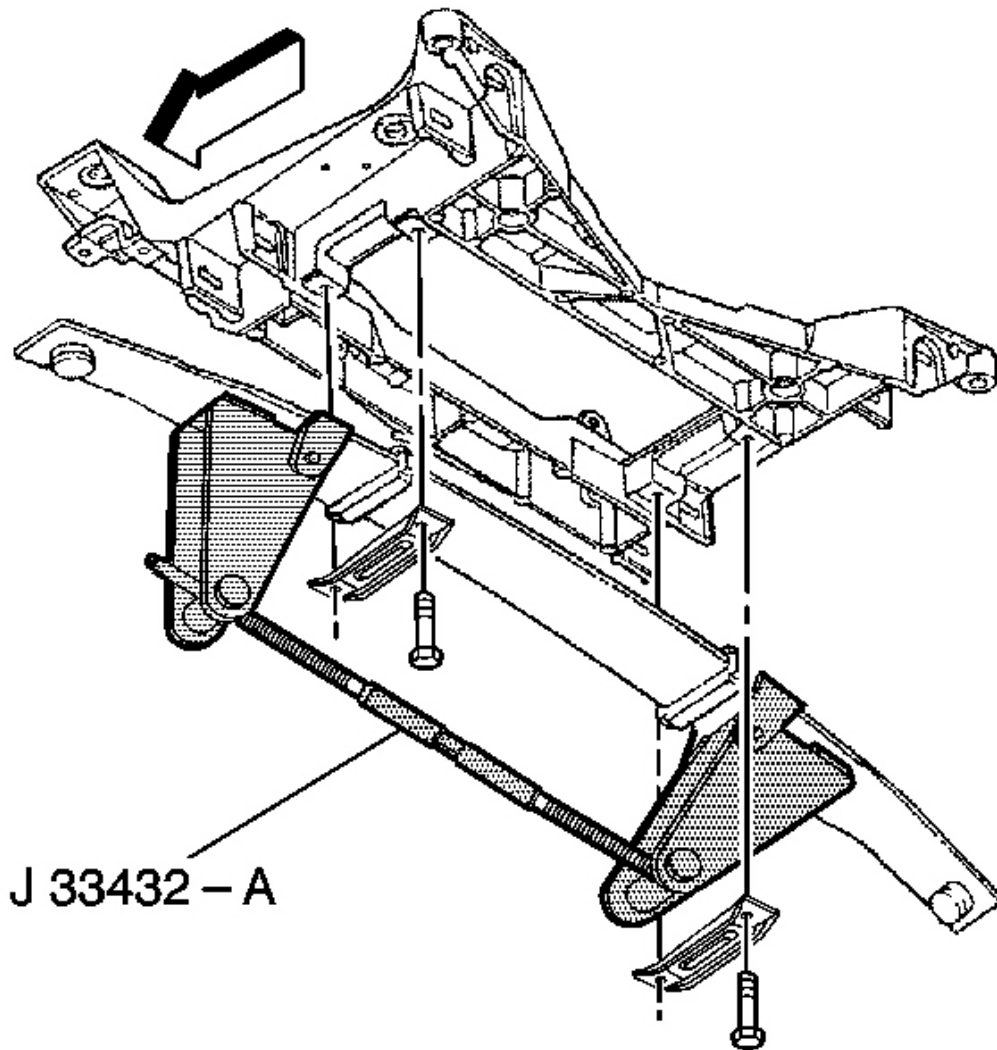


Fig. 36: Using J 33432-A
Courtesy of GENERAL MOTORS CORP.

1. Install the transverse spring compressor **J 33432-A** to the transverse spring. See **Special Tools and Equipment** .
2. Install the transverse spring to the crossmember.

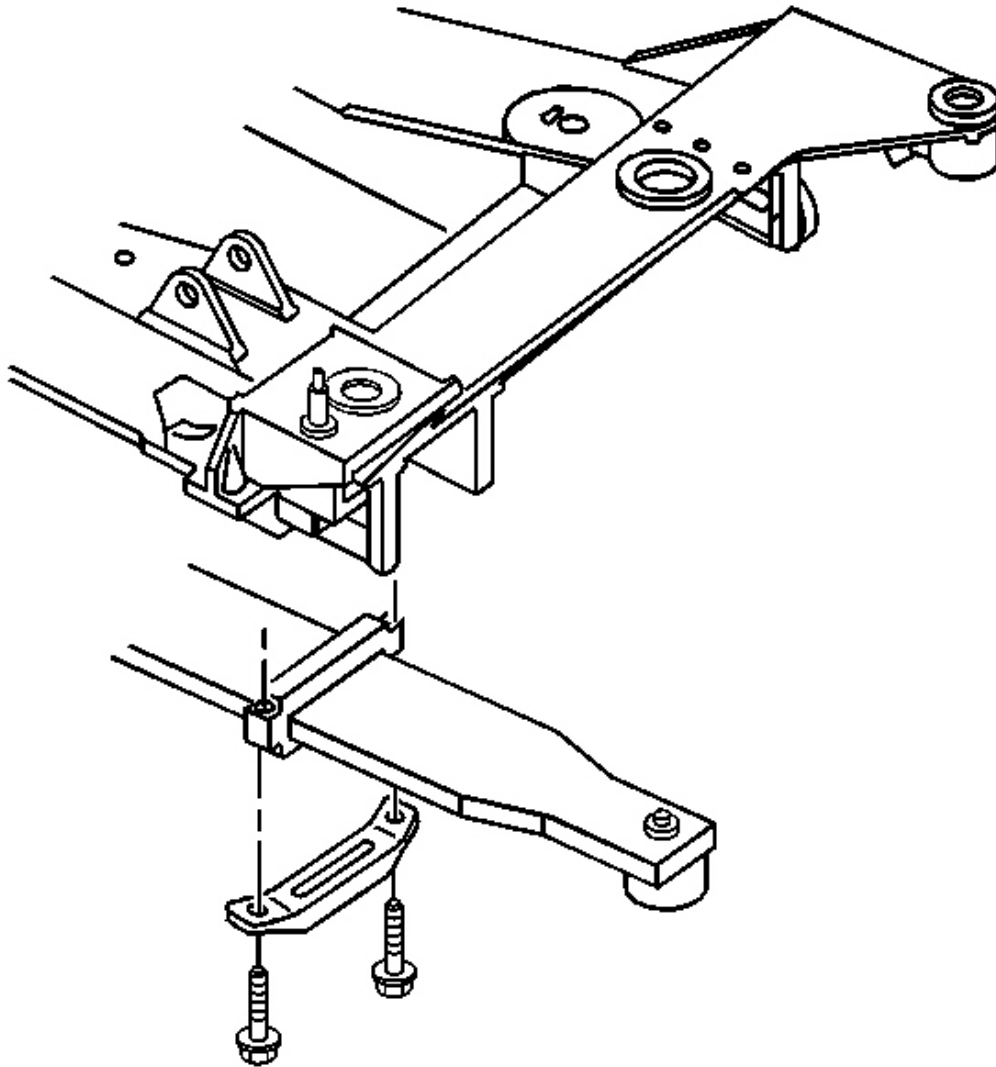


Fig. 37: Transverse Spring, Transverse Spring Compressor & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

NOTE: Do not remove the transverse leaf spring compressor tool until after the shock absorber has been installed. The pad on the transverse leaf spring bolt could move out of position resulting in damage to the pad or a rattle in the suspension.

3. Install the transverse spring retainers and bolts (Use New Bolts) to the crossmember.

Tighten: Tighten the transverse spring retainer bolts (Use New Bolts) to 62 N.m (46 lb ft).

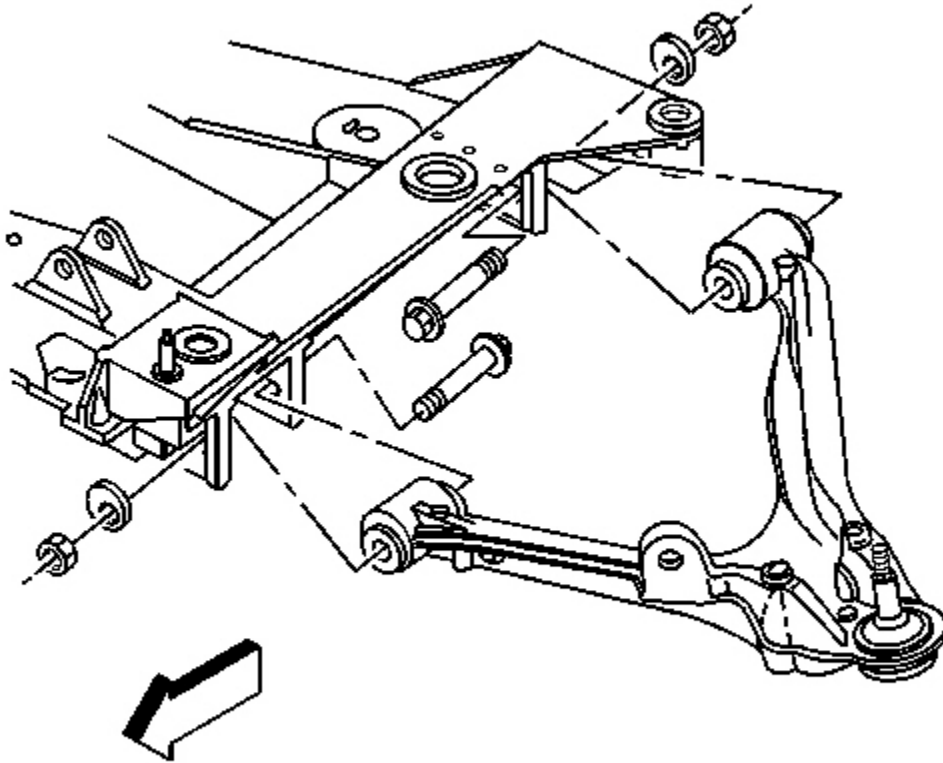


Fig. 38: Lower Control Arm & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the lower control arm to the front crossmember.
5. Install the cam bolts to the position that was marked during disassembly.

Due to a required wheel alignment, tighten the cam bolts but do not set to the final torque specification at this time.

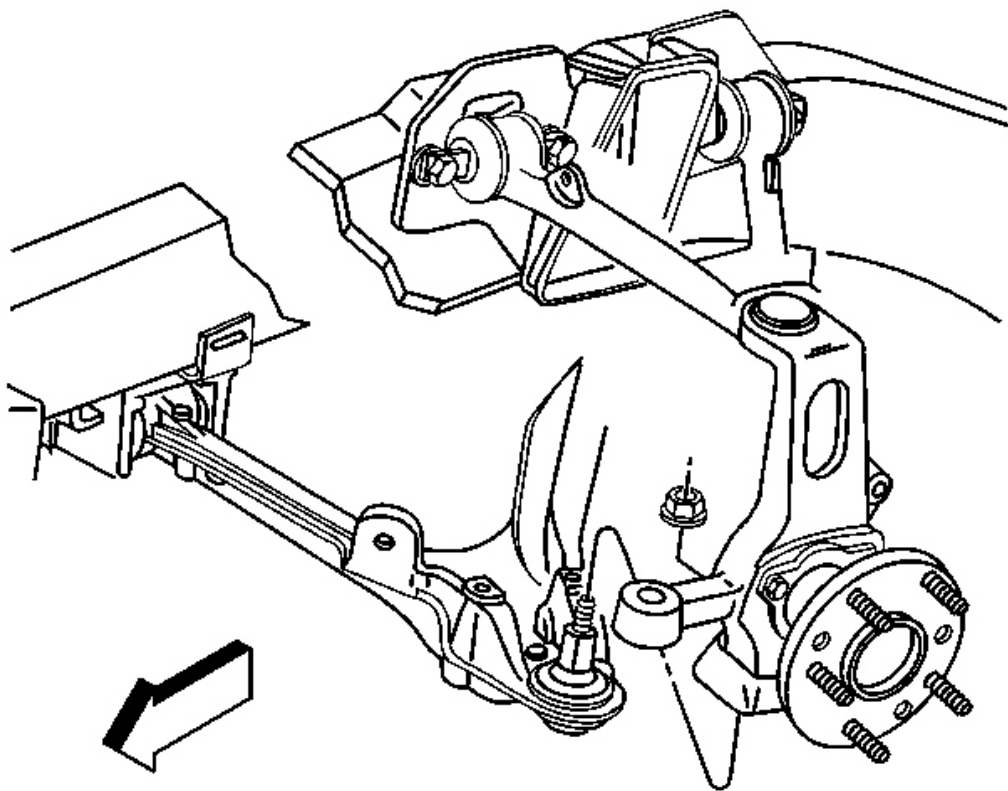


Fig. 39: Lower Control Arm Ball Joint, Stud & Nuts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use a new ball joint stud nut.

6. Install the lower control arm ball joint stud to the steering knuckle.

Tighten: Tighten the lower control arm ball joint stud nut to 30 N.m (20 lb ft) plus 180 degrees.

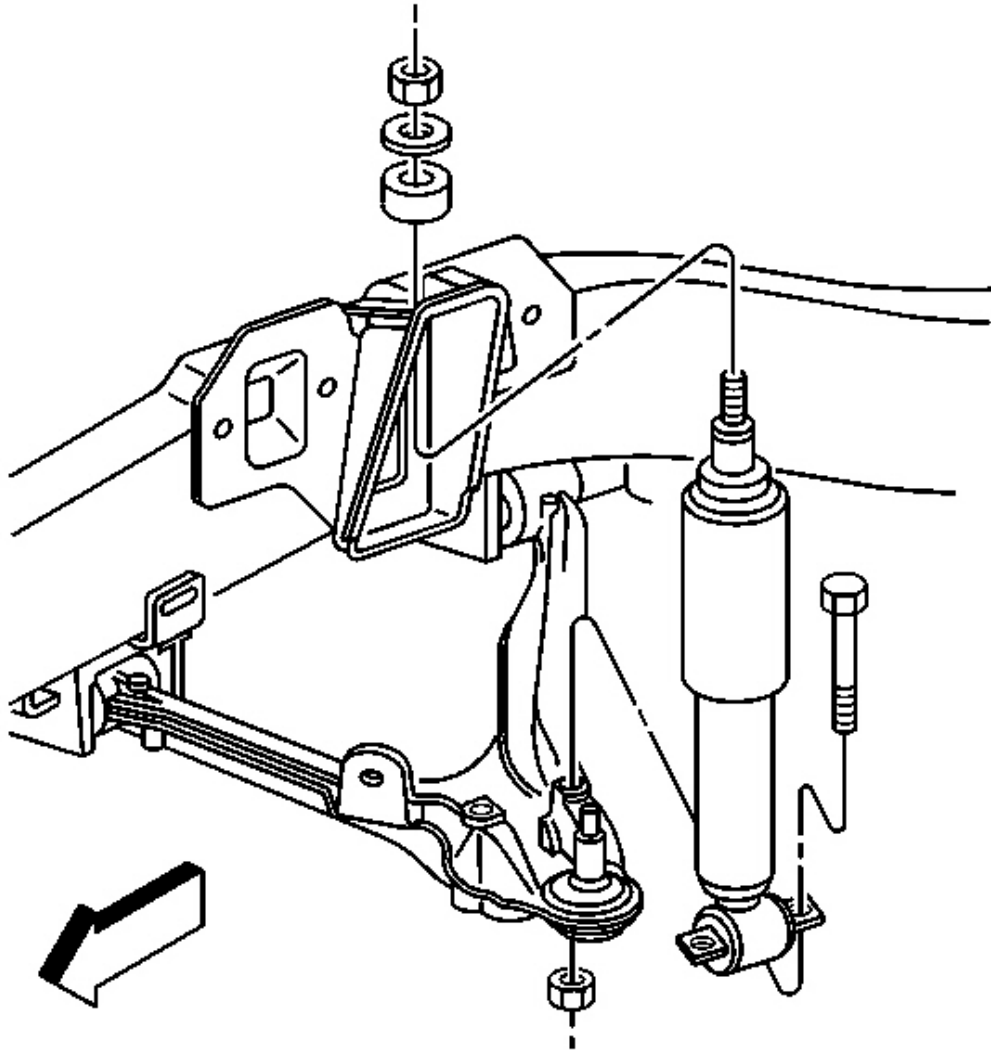


Fig. 40: Lower Shock Absorber & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Support the lower control arm with a jackstand.
8. Install the shock absorber lower mounting bolts.

Tighten: Tighten the shock absorber lower mounting nuts to 28 N.m (21 lb ft).

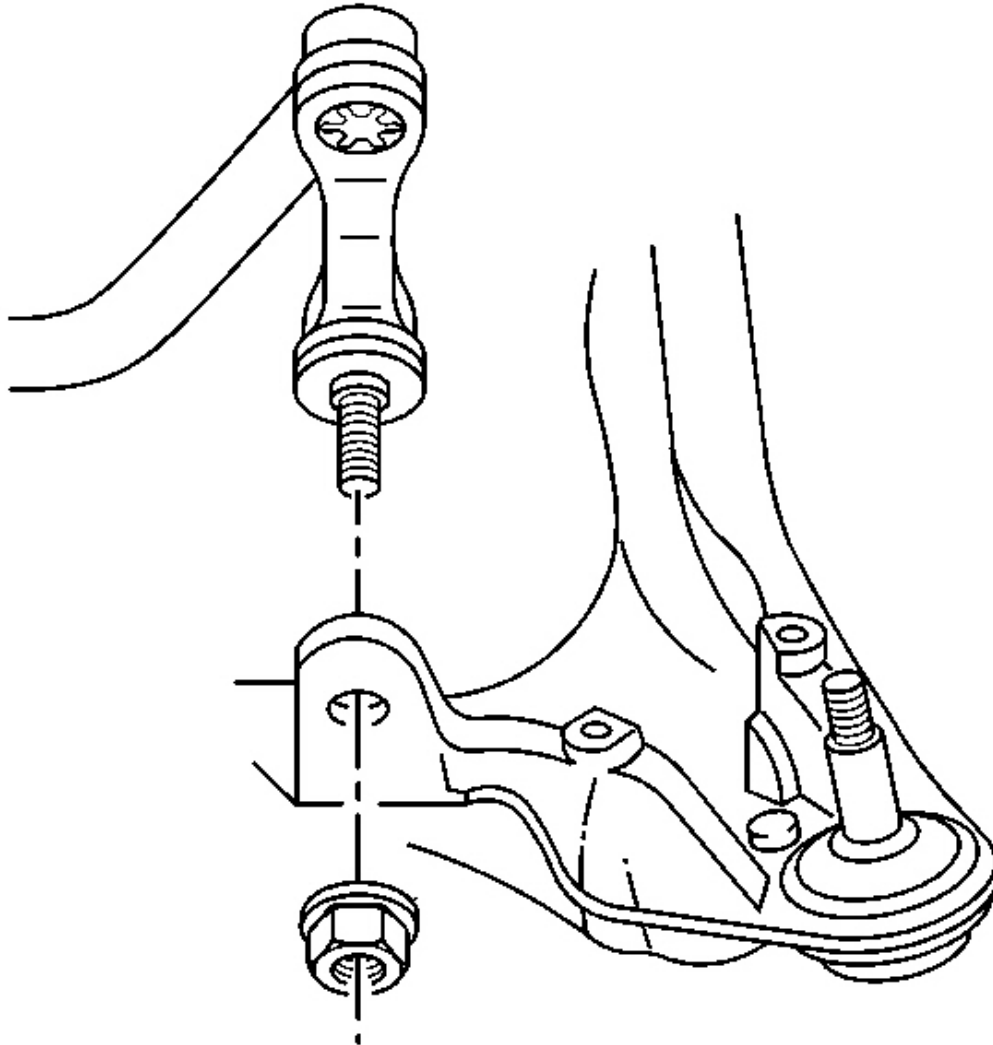


Fig. 41: Stabilizer Shaft Link & Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

9. Connect the stabilizer shaft link to the lower control arm.

Tighten: Tighten the stabilizer link nut to 72 N.m (53 lb ft).

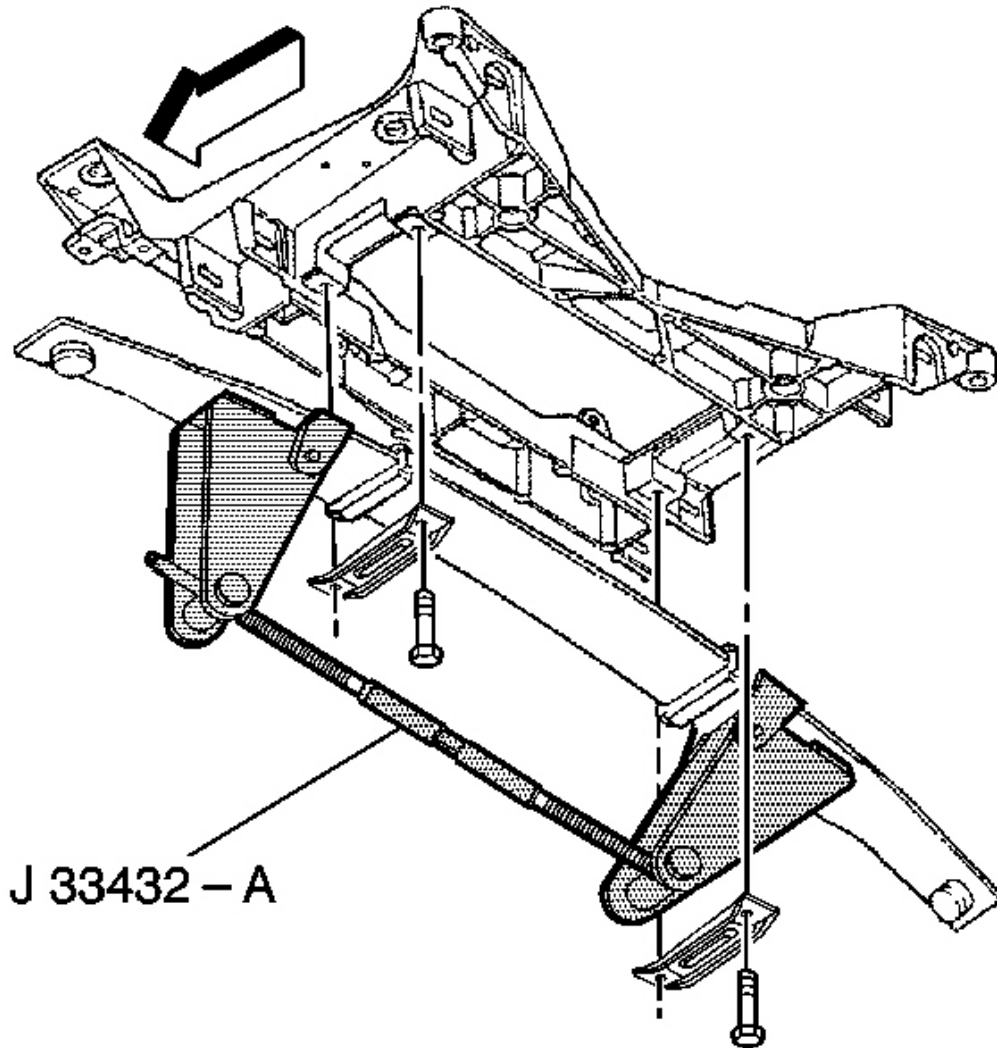


Fig. 42: Using J 33432-A
Courtesy of GENERAL MOTORS CORP.

10. Remove the **J 33432-A** transverse spring compressor from the transverse spring. See **Special Tools and Equipment** .
11. Remove the jackstand from the lower control arms.
12. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
13. Adjust the front trim height. Refer to **Trim Height Inspection Procedure** in Suspension General Diagnosis.

14. Perform a front wheel alignment. Refer to Measuring Wheel Alignment in Wheel Alignment.

UPPER BALL JOINT REPLACEMENT

The upper ball joint is replaced as part of the steering knuckle. Refer to Steering Knuckle Replacement .

WHEEL BEARING/HUB REPLACEMENT - FRONT

Tools Required

J 42188 Ball Joint Separator

Removal Procedure

NOTE: The Front and Rear Wheel Hub/Wheel Speed Sensors are not interchangeable. When you are replacing a Wheel Hub/Wheel Speed Sensor be sure to use the correct Wheel Hub/Wheel Speed Sensor part number. Do not mount the Rear Wheel Hub/Wheel Speed Sensor in the front steering knuckle. The Rear Wheel Hub/Wheel Speed Sensor features a splined hole through the center of the bearing which mates to the drive axle. The Rear Wheel Hub/Wheel Speed Sensor requires the support of the drive axle and the drive axle nut clamped joint to properly carry the vehicle loads. Mounting the Rear Wheel Hub/Wheel Speed Sensor in the front steering knuckle can cause bearing failure and possible damage to the vehicle.

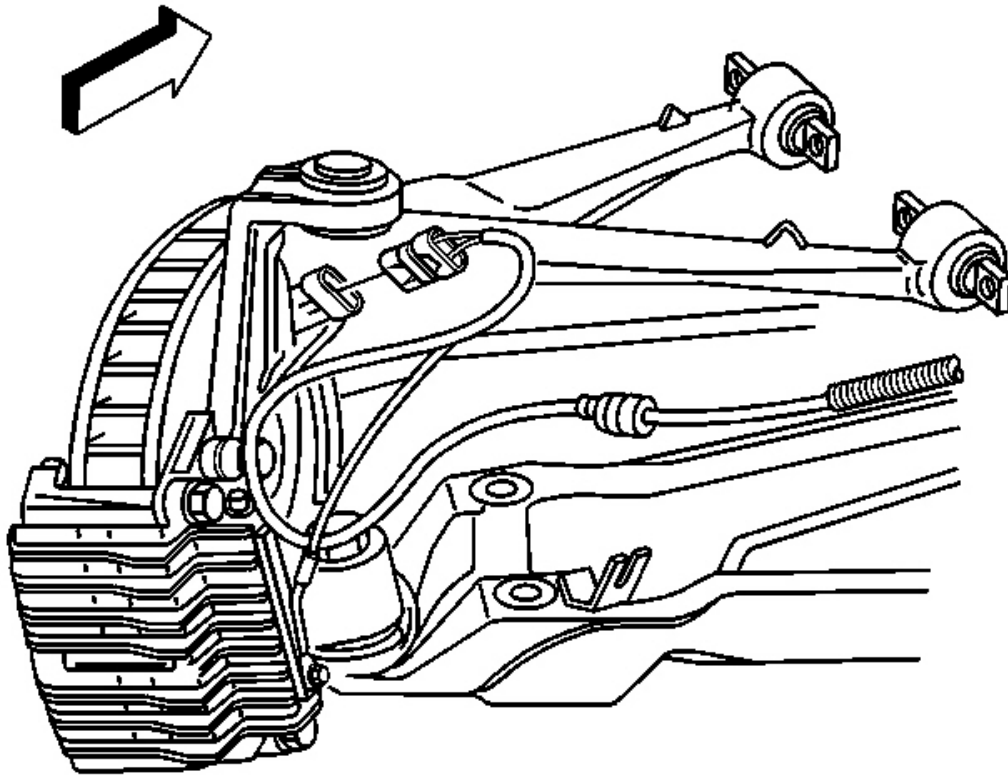


Fig. 43: View Of LF ABS Connector
Courtesy of GENERAL MOTORS CORP.

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. Disconnect the wheel speed sensor electrical connector.
4. Remove the brake caliper and rotor. Refer to **Brake Rotor Replacement - Front** and **Brake Caliper Replacement - Front** in Disc Brakes.

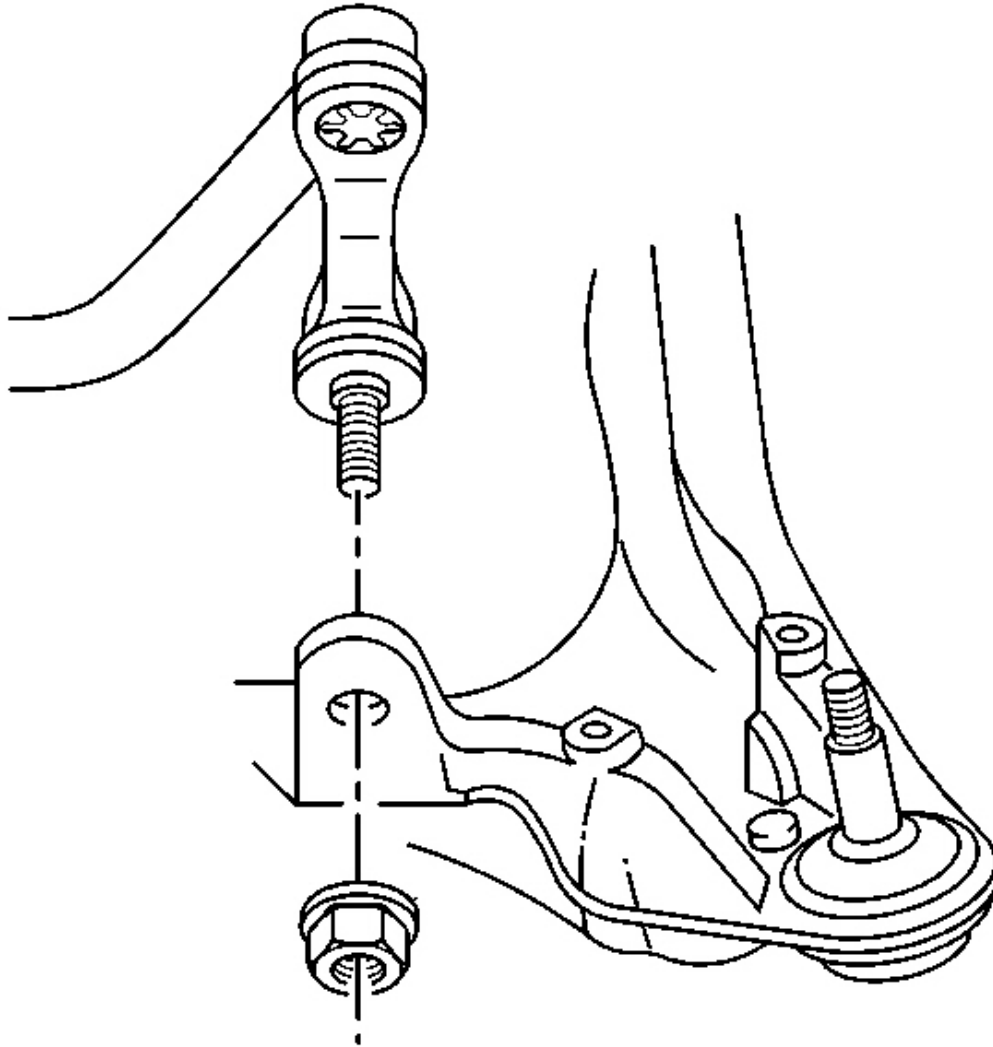


Fig. 44: Stabilizer Shaft Link & Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

5. Remove the stabilizer shaft link from the lower control arm.
6. Support the lower control arm using a jackstand.

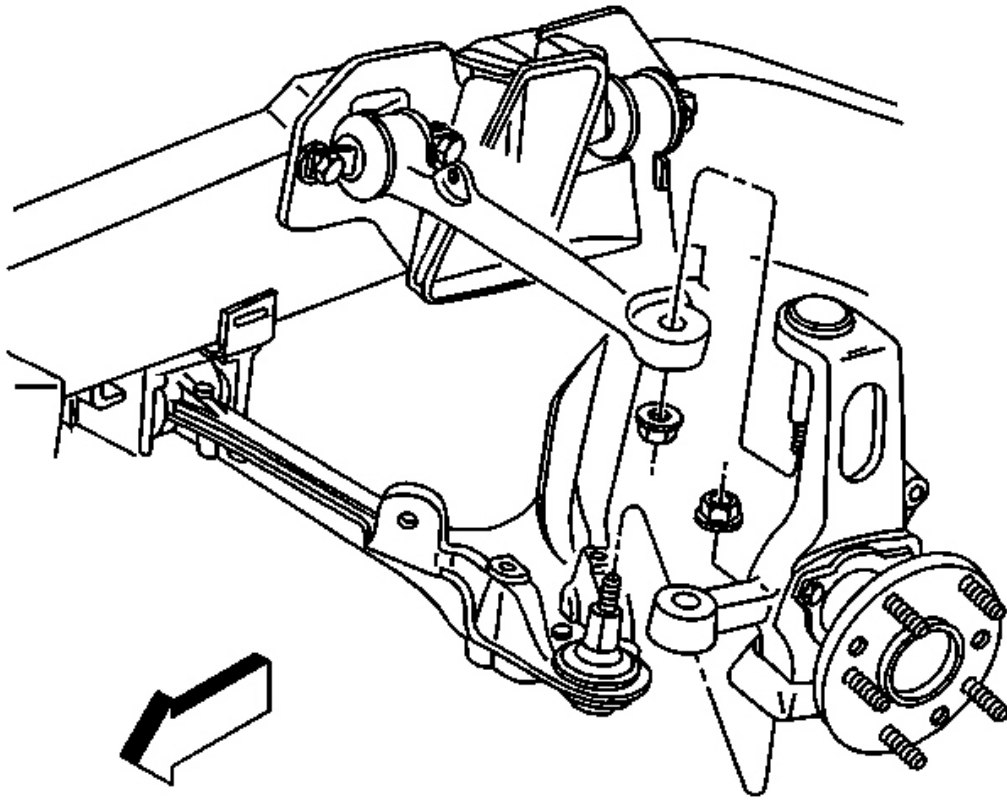


Fig. 45: Lower Control Arm & Outer Tie Rod Ball Stud
Courtesy of GENERAL MOTORS CORP.

7. Separate the outer tie rod ball stud from the steering knuckle using **J 42188** . Refer to **Rack and Pinion Outer Tie Rod End Replacement** in Power Steering Systems.
8. Separate the lower ball joint stud from the steering knuckle using **J 42188** . Refer to **Lower Control Arm Replacement** .

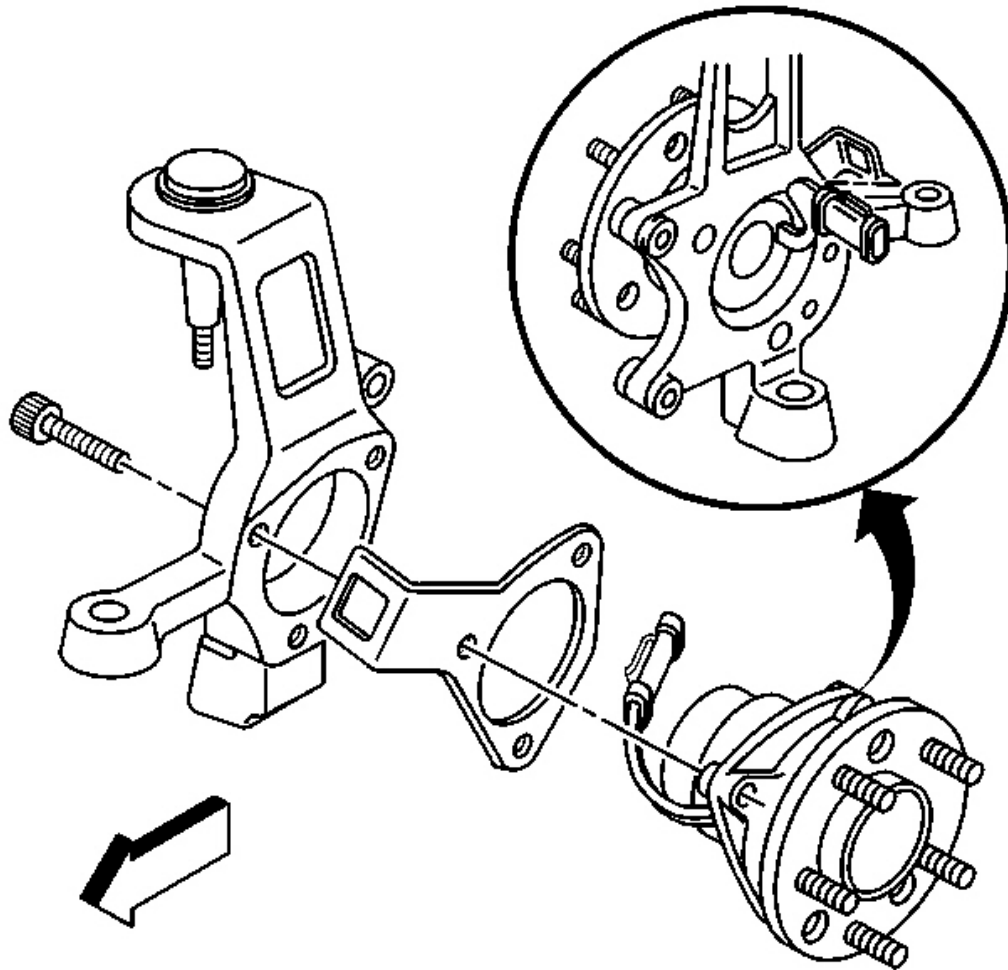


Fig. 46: Wheel Hub & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the wheel hub mounting bolts.
10. Remove the hub and bearing assembly from the steering knuckle.

Installation Procedure

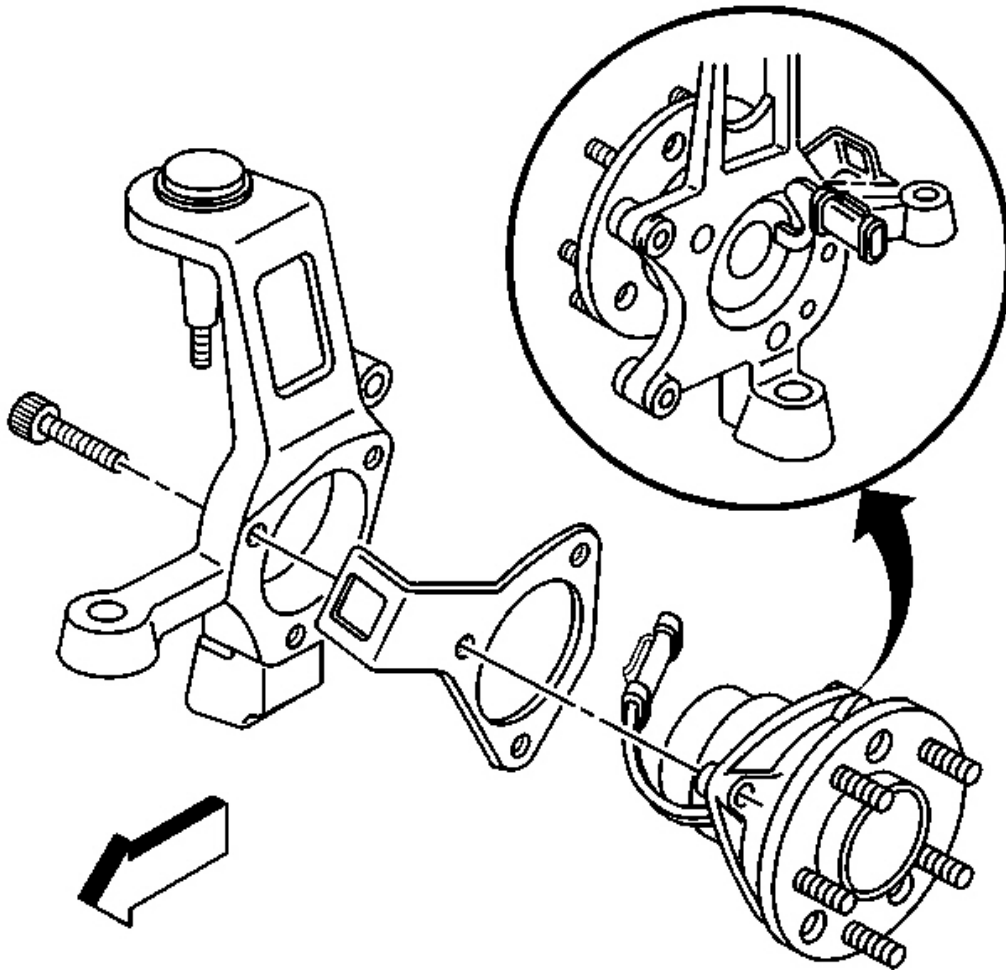


Fig. 47: Wheel Hub & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the hub and bearing assembly into the steering knuckle.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the wheel hub mounting bolts.

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

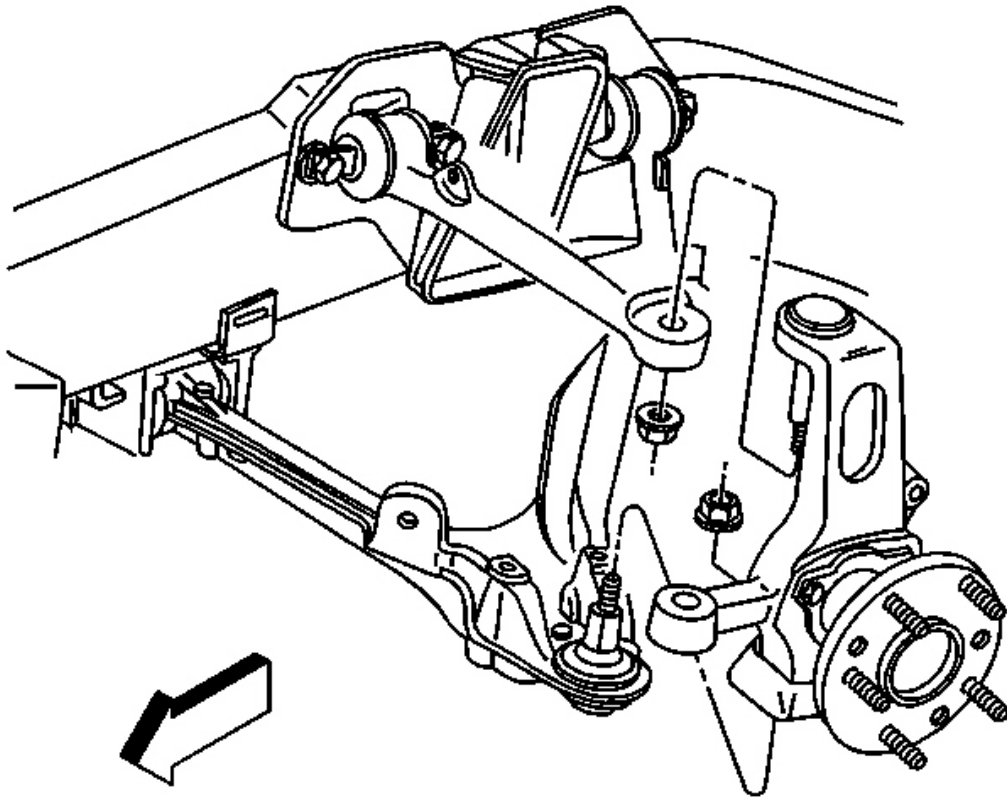


Fig. 48: Lower Control Arm & Outer Tie Rod Ball Stud
Courtesy of GENERAL MOTORS CORP.

3. Install the lower control arm ball stud to the steering knuckle. Refer to **Lower Control Arm Replacement** .
4. Remove the jackstand.
5. Install the steering linkage outer tie rod ball stud to the steering knuckle. Refer to **Rack and Pinion Outer Tie Rod End Replacement** in Power Steering Systems.

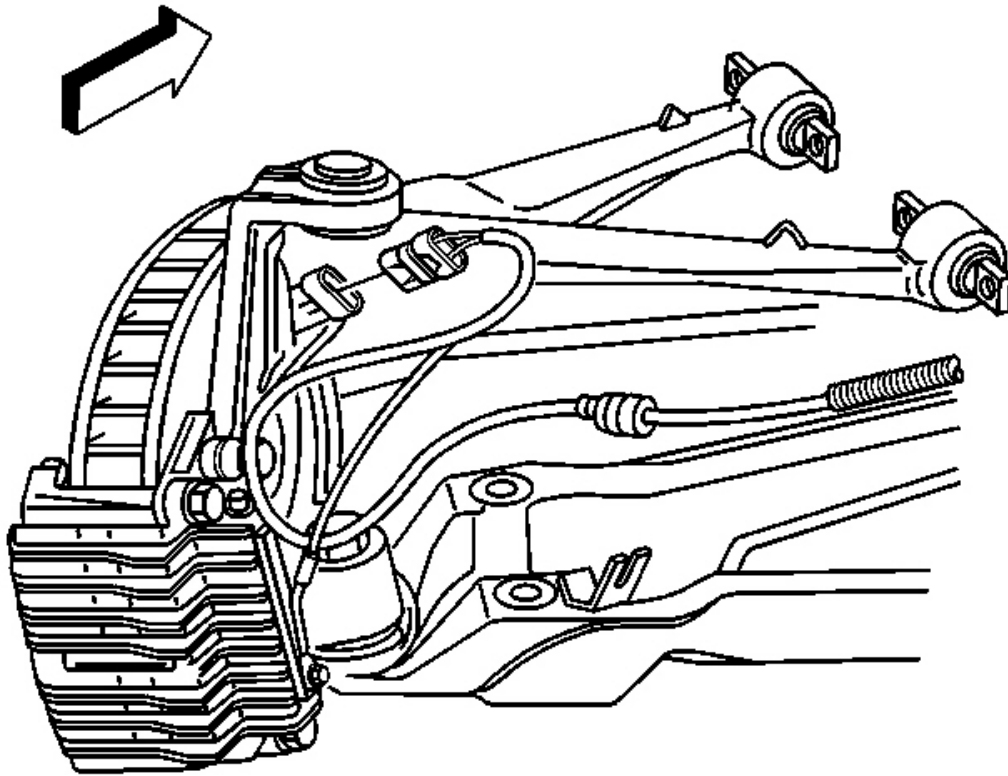


Fig. 49: View Of LF ABS Connector
Courtesy of GENERAL MOTORS CORP.

6. Connect the wheel speed sensor electrical connector.
7. Install the stabilizer shaft link to the lower control arm. Refer to **Stabilizer Shaft Link Replacement**.
8. Install the brake rotor and caliper. Refer to **Brake Rotor Replacement - Front** and **Brake Caliper Replacement - Front** in Disc Brakes.
9. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
10. Lower the vehicle.

STEERING KNUCKLE REPLACEMENT

Tools Required

J 42188 Ball Joint Separator

Removal Procedure

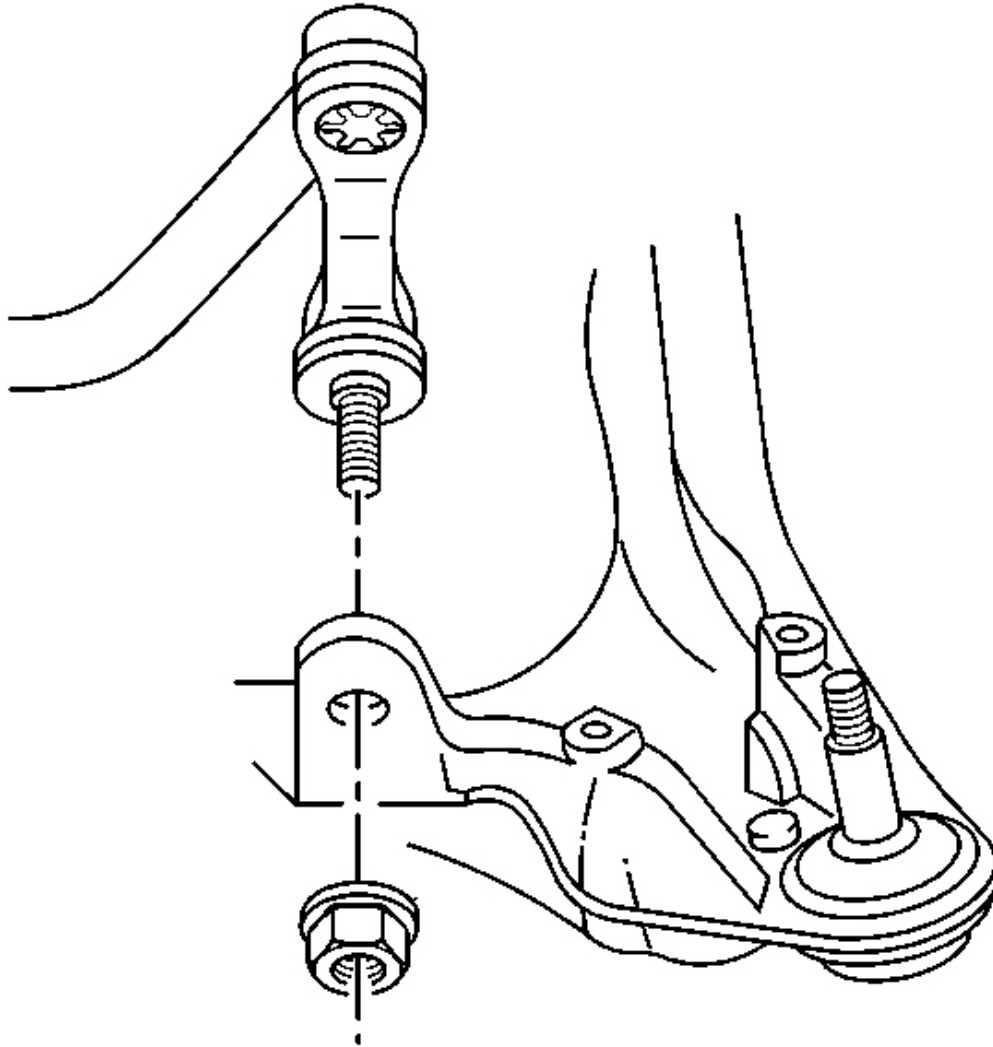


Fig. 50: Stabilizer Shaft Link & Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the brake caliper and rotor. Refer to **Brake Rotor Replacement - Front** and **Brake Caliper Replacement - Front** in Disc Brakes.

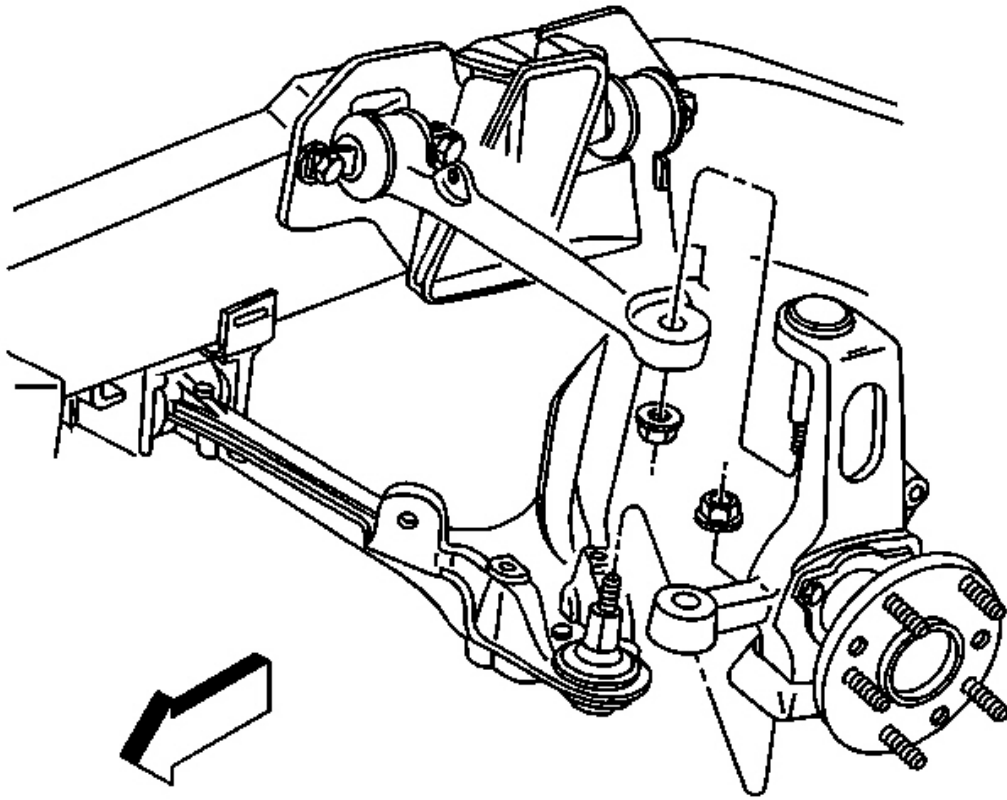


Fig. 51: Lower Control Arm & Outer Tie Rod Ball Stud
Courtesy of GENERAL MOTORS CORP.

3. Remove the stabilizer shaft link from the lower control arm.

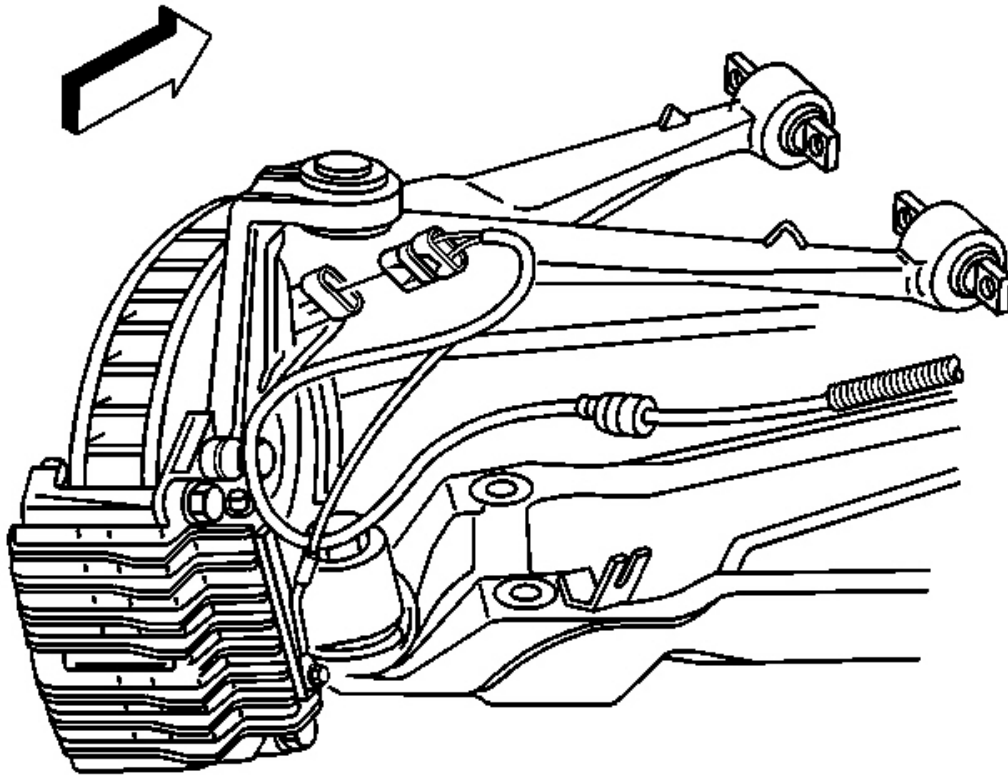


Fig. 52: View Of LF ABS Connector
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the wheel speed sensor electrical connector.
5. Support the lower control arm using a jackstand.
6. Separate the steering linkage outer tie rod ball stud from the steering knuckle using **J 42188** . Refer to **Rack and Pinion Outer Tie Rod End Replacement** in Power Steering Systems.
7. Separate and remove the upper control arm ball joint stud from the steering knuckle using **J 42188** . Refer to **Upper Control Arm Replacement** .
8. Using **J 42188** separate and remove the lower ball joint stud from the steering knuckle. Refer to **Lower Control Arm Replacement** .
9. Remove the steering knuckle from the vehicle.

Installation Procedure

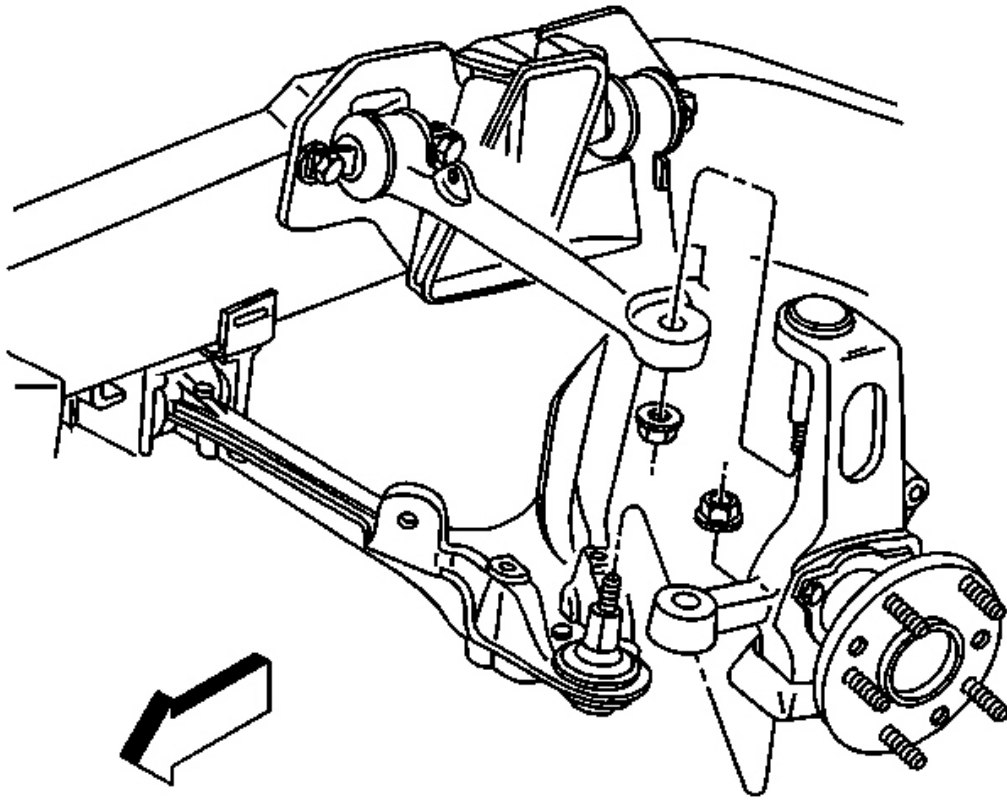


Fig. 53: Lower Control Arm & Outer Tie Rod Ball Stud
Courtesy of GENERAL MOTORS CORP.

1. Install steering knuckle to the upper control arm and the lower control arm. Refer to Upper Control Arm Replacement and Lower Control Arm Replacement .
2. Remove the jackstand.
3. Install the steering linkage outer tie rod ball stud to the steering knuckle. Refer to Rack and Pinion Outer Tie Rod End Replacement in Power Steering Systems.

NOTE: Refer to **Fastener Notice in Cautions and Notices.**

4. Install the stabilizer shaft link to the lower control arm.

Tighten: Tighten the stabilizer shaft link nut to 72 N.m (53 lb ft).

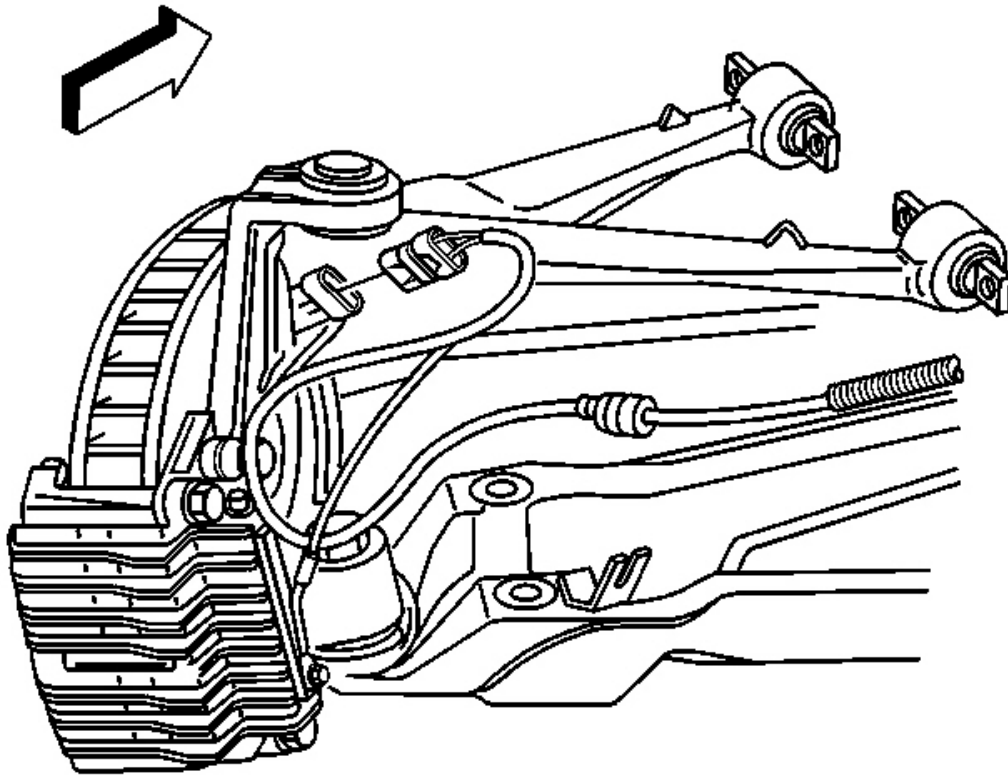


Fig. 54: View Of LF ABS Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the wheel speed sensor electrical connector.
6. Install the brake rotor and caliper. Refer to **Brake Rotor Replacement - Front** and **Brake Caliper Replacement - Front** in Disc Brakes.
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
8. Lower the vehicle.
9. Check the front wheel toe and adjust as necessary. Refer to **Diagnostic Starting Point - Disc Brakes** **Measuring Wheel Alignment** in Wheel Alignment.

UPPER CONTROL ARM REPLACEMENT

Tools Required

J 42188 Ball Joint Separator

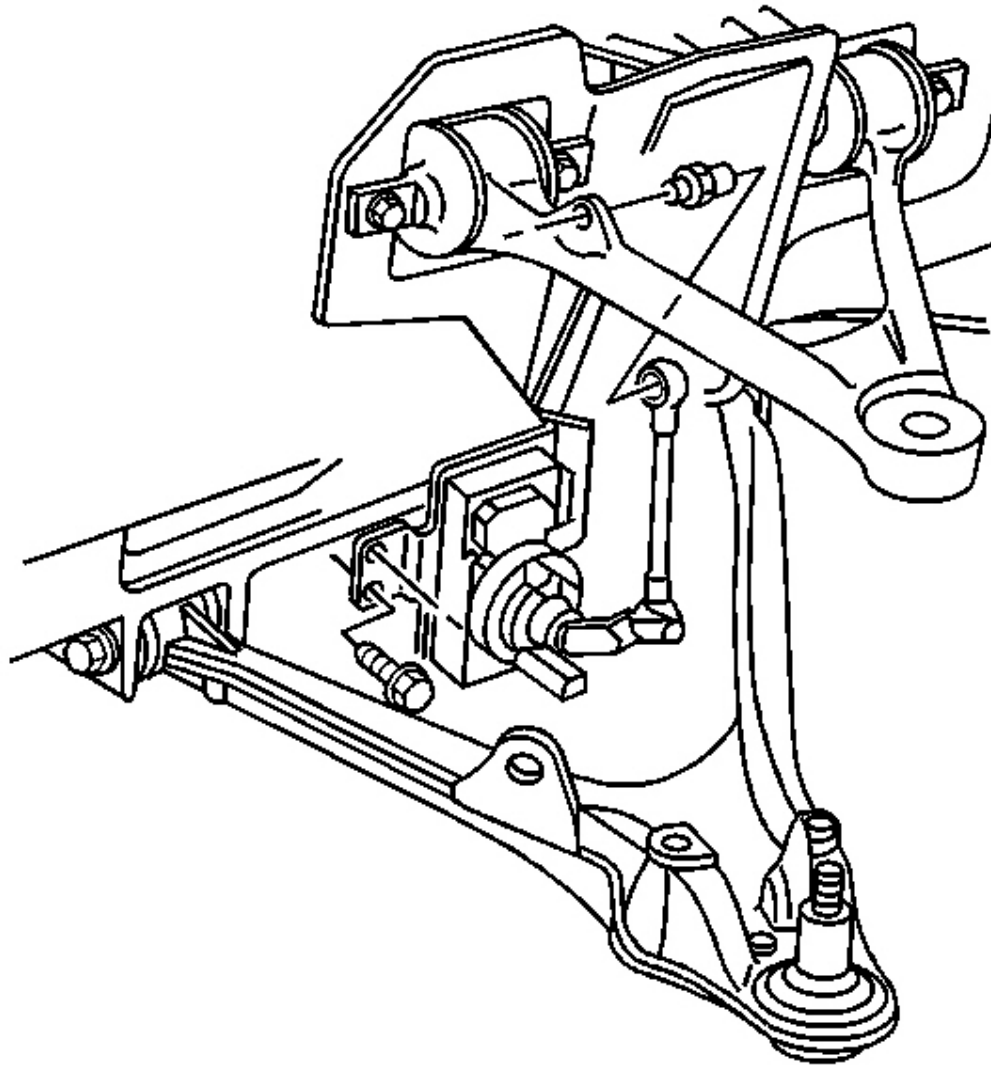


Fig. 55: ESC Sensor Link
Courtesy of GENERAL MOTORS CORP.

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. Disconnect the electronic suspension control (ESC) sensor link.

4. Support the lower control arm with a jackstand.

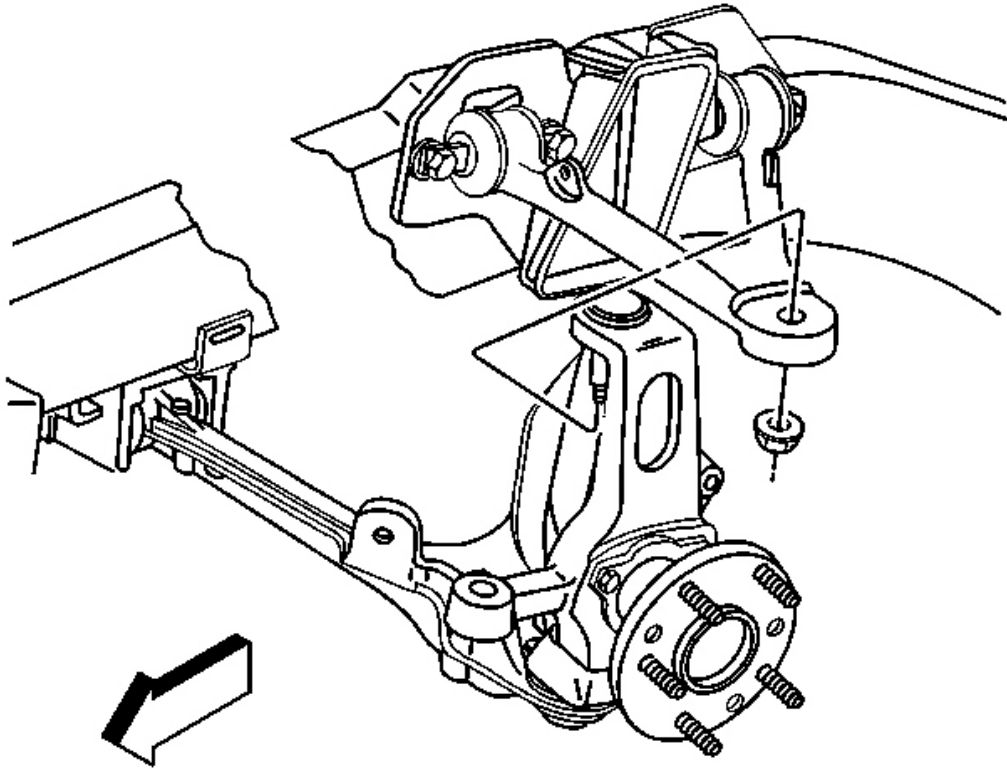


Fig. 56: Upper Ball Joint Stud & Upper Control Arm
Courtesy of GENERAL MOTORS CORP.

5. Loosen the ball joint stud nut but do not remove the nut.
6. Using tool **J 42188** separate the upper ball joint stud from the upper control arm.
7. Remove tool **J 42188** from the ball joint stud.

Remove the ball joint stud nut from the ball joint stud.

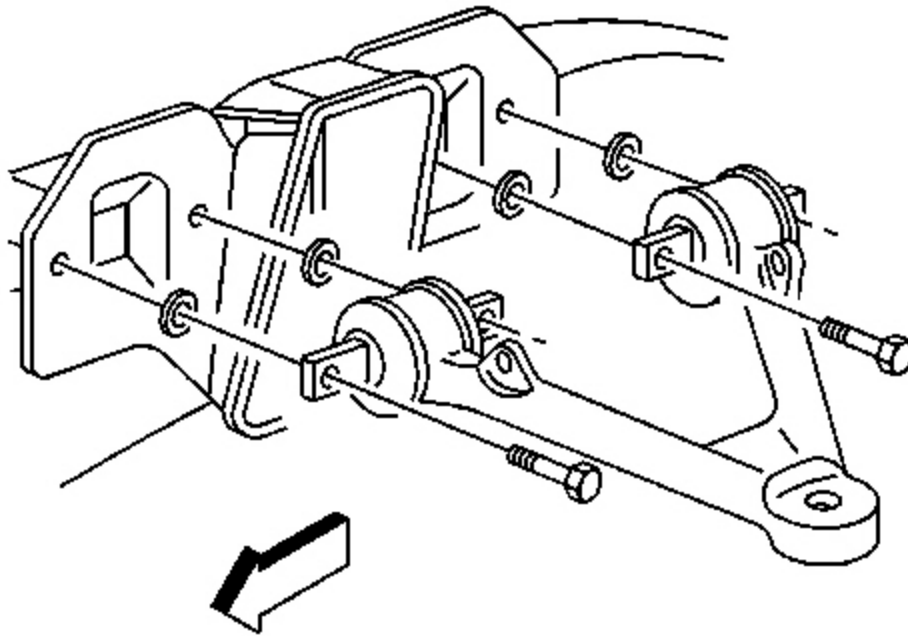


Fig. 57: Upper Control Arm, Bolts & Shims
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The upper control arm shims will have an effect on the camber and the caster. Make sure to use an equal thickness of shims on both sides of each individual upper control arm bushing.

8. Remove the upper control arm bolts and shims. Note the number and position of the shims for installation purposes.
9. Remove the upper control arm from the vehicle.

Installation Procedure

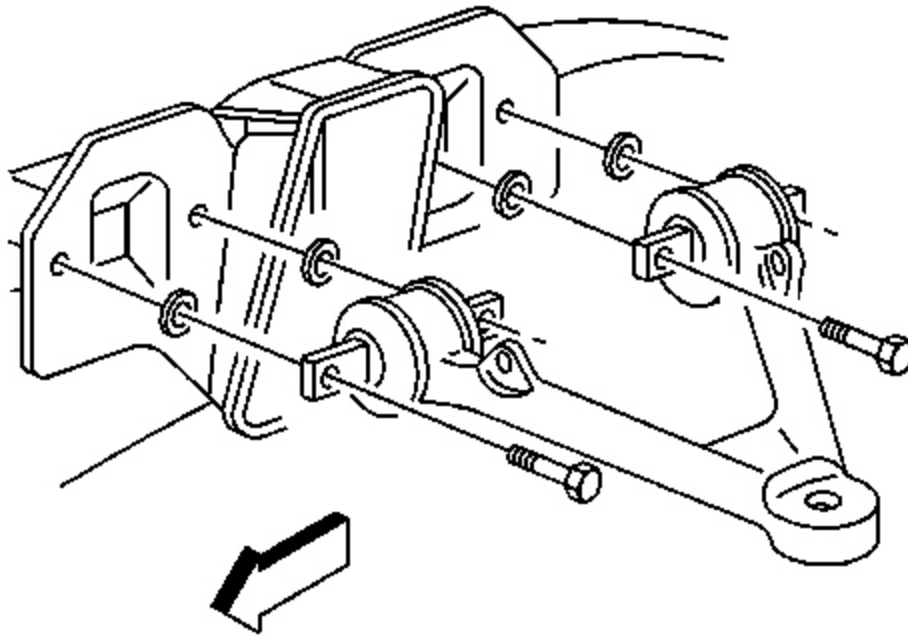


Fig. 58: Upper Control Arm, Bolts & Shims
Courtesy of GENERAL MOTORS CORP.

1. Install the upper control arm to the vehicle.

IMPORTANT: The upper control arm shims will have an effect on the camber and the caster. Make sure to use an equal thickness of shims on both sides of each individual upper control arm bushing.

2. Install the upper control arm shims.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the upper control arm mounting bolts to the upper control arm and frame rail.

Tighten: Tighten the upper control arm mounting bolts to 65 N.m (48 lb ft).

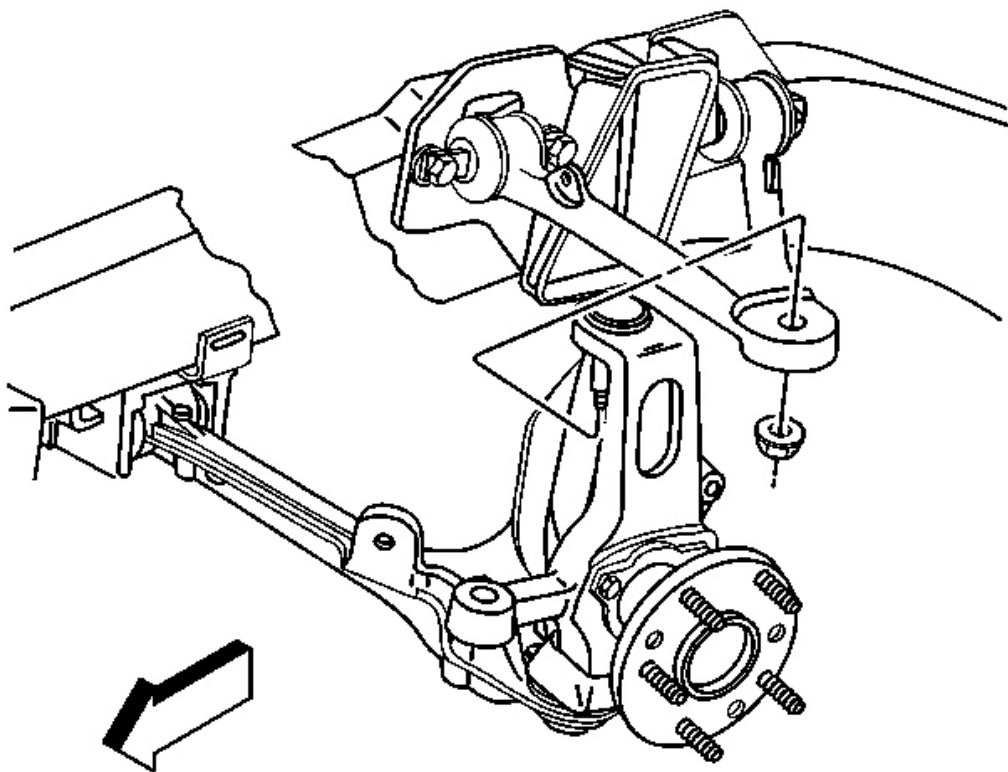


Fig. 59: Upper Ball Joint Stud & Upper Control Arm
Courtesy of GENERAL MOTORS CORP.

4. Install the upper ball joint stud into the upper control arm. It will be necessary to use an Allen wrench to keep the ball joint stud from spinning while tightening the ball joint stud nut.

Tighten: Tighten the upper control arm ball joint stud nut to 20 N.m (15 lb ft) plus 250 degrees.

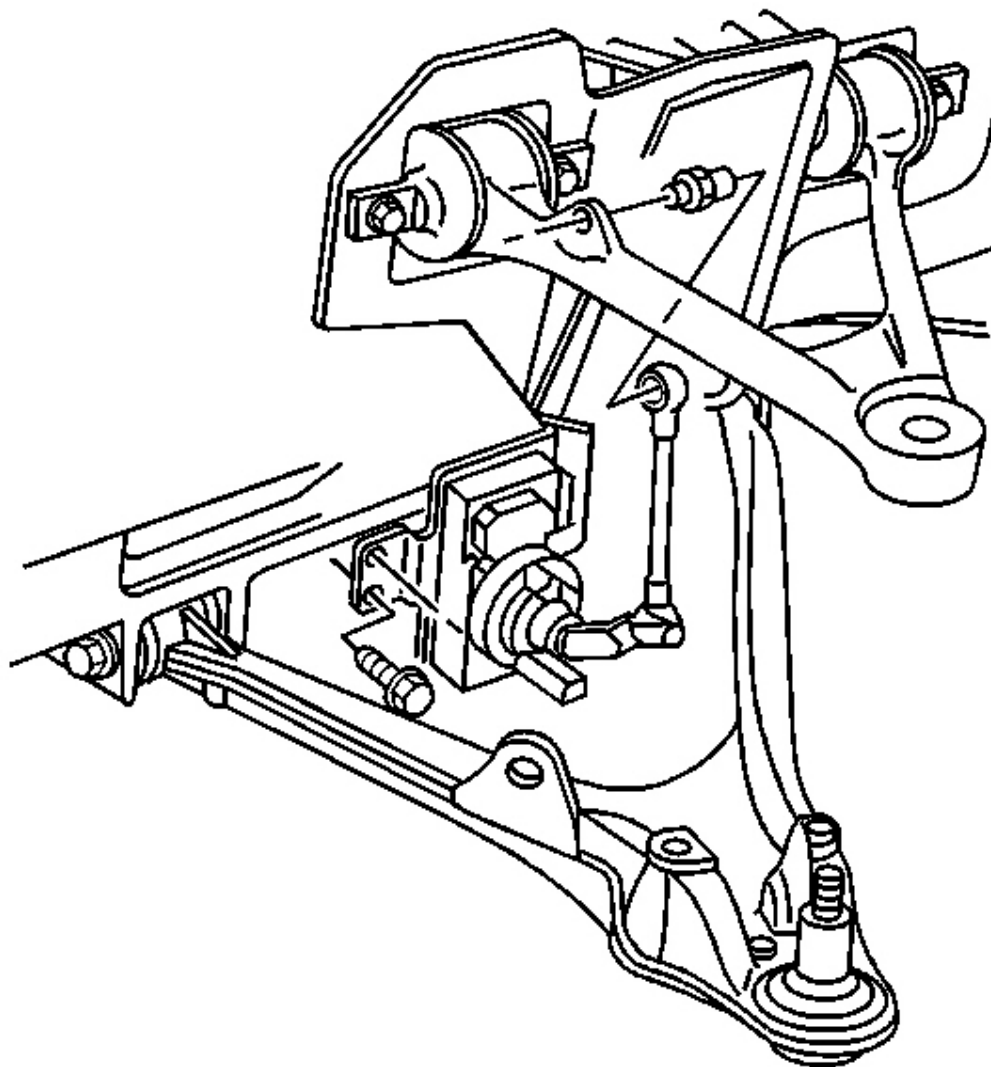


Fig. 60: ESC Sensor Link
Courtesy of GENERAL MOTORS CORP.

5. Connect the ESC sensor link.
6. Remove the jackstand.
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
8. Lower the vehicle.

LOWER CONTROL ARM REPLACEMENT

Tools Required

- **J 42188** Ball Joint Separator
- **J 33432-A** Transverse Spring Remover. See **Special Tools and Equipment** .

Removal Procedure

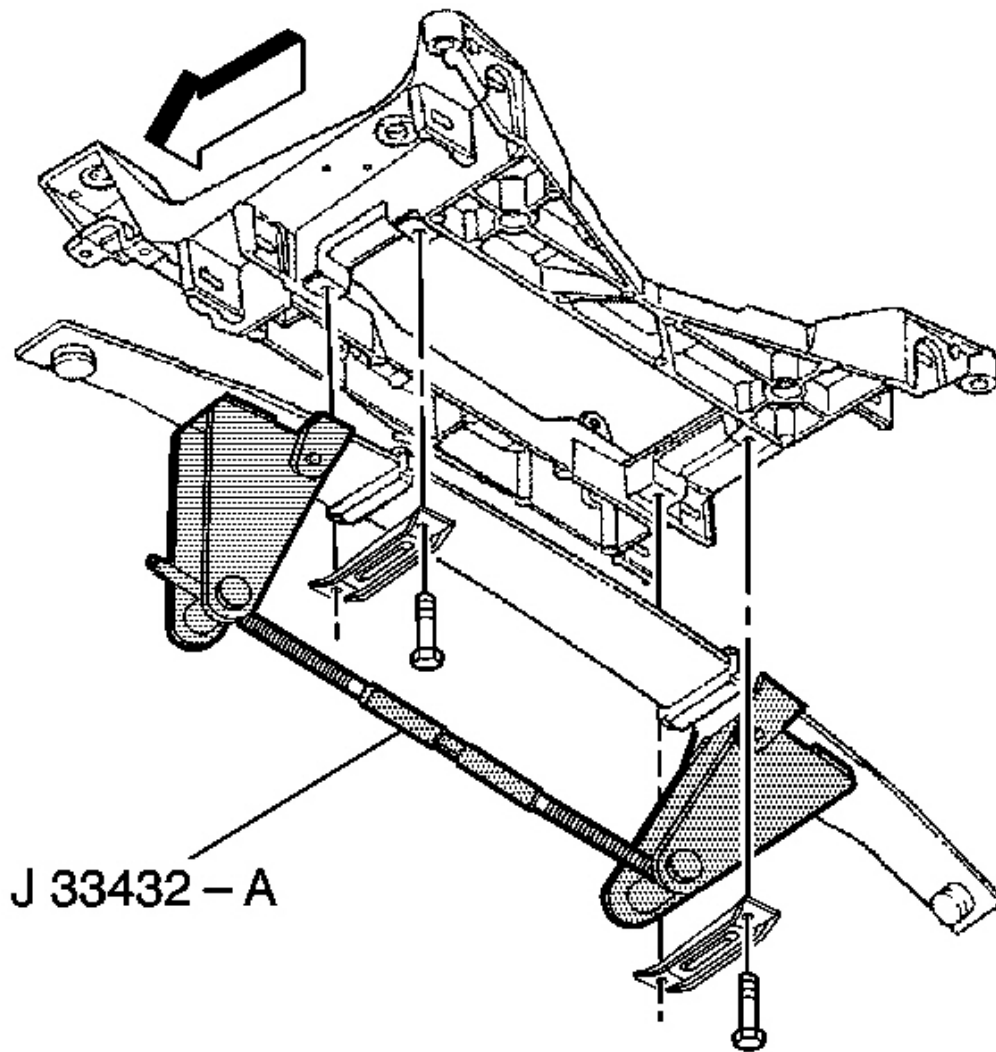


Fig. 61: Using J 33432-A

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. Using the **J 33432-A** , remove the front transverse spring. See **Special Tools and Equipment** . Refer to **Front Transverse Spring Replacement** .

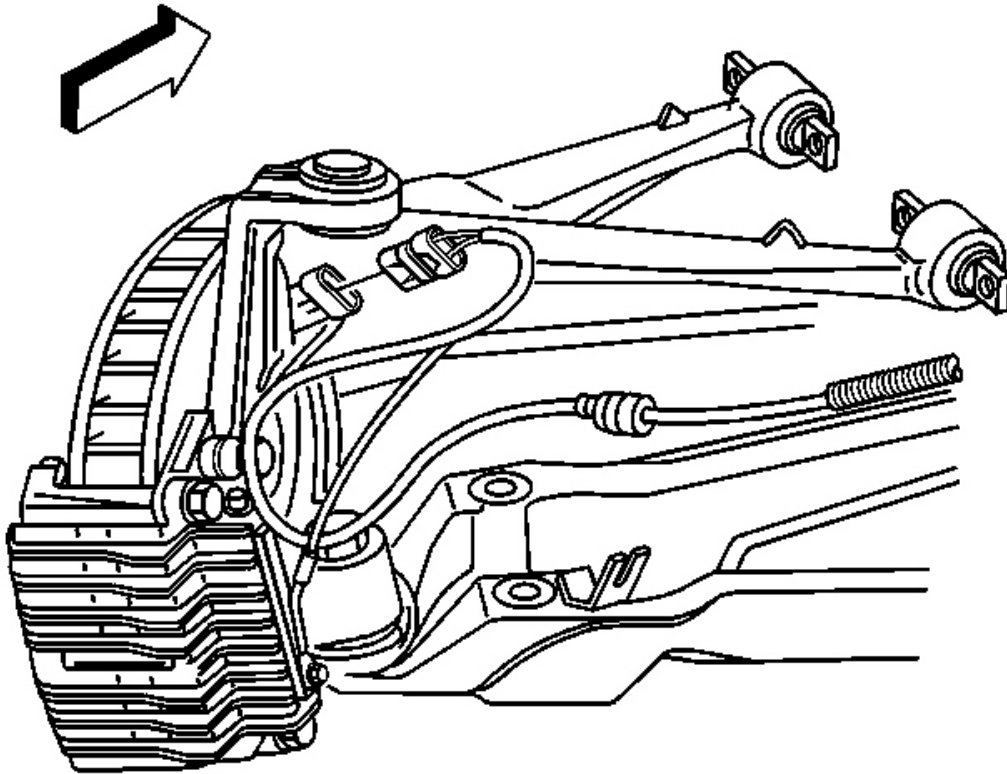


Fig. 62: View Of LF ABS Connector
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the electrical connector from the wheel speed sensor.

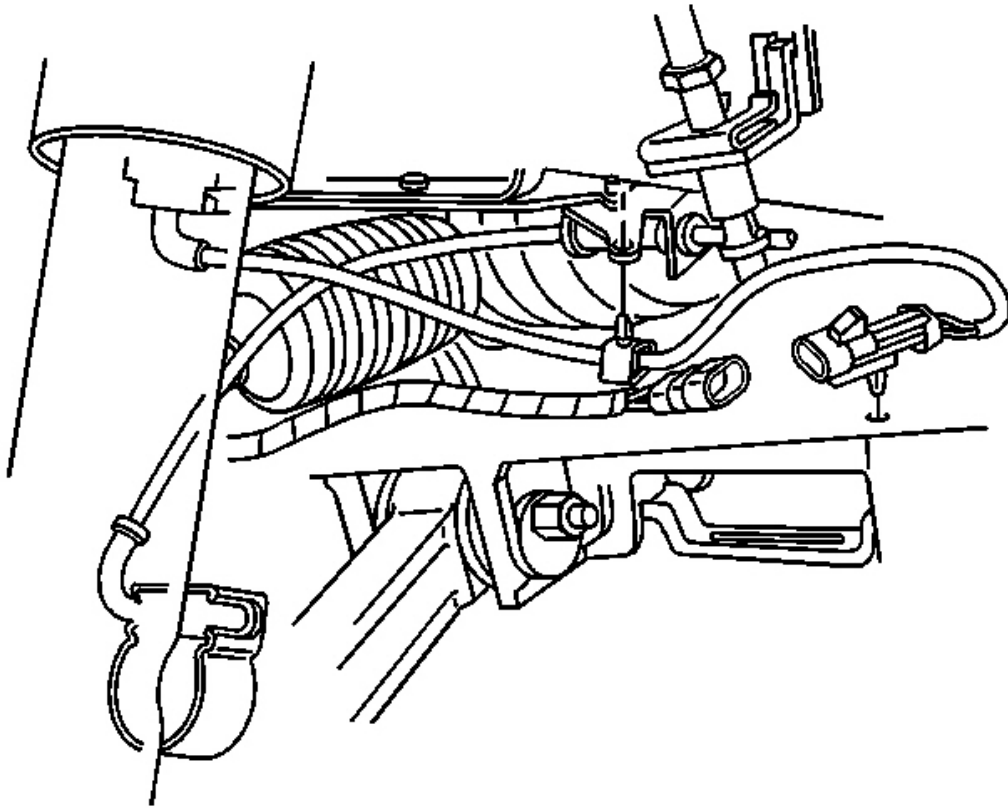


Fig. 63: Shock Absorber ESC Harness Connector
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the electronic suspension control (ESC) electrical connector from the shock, if equipped.

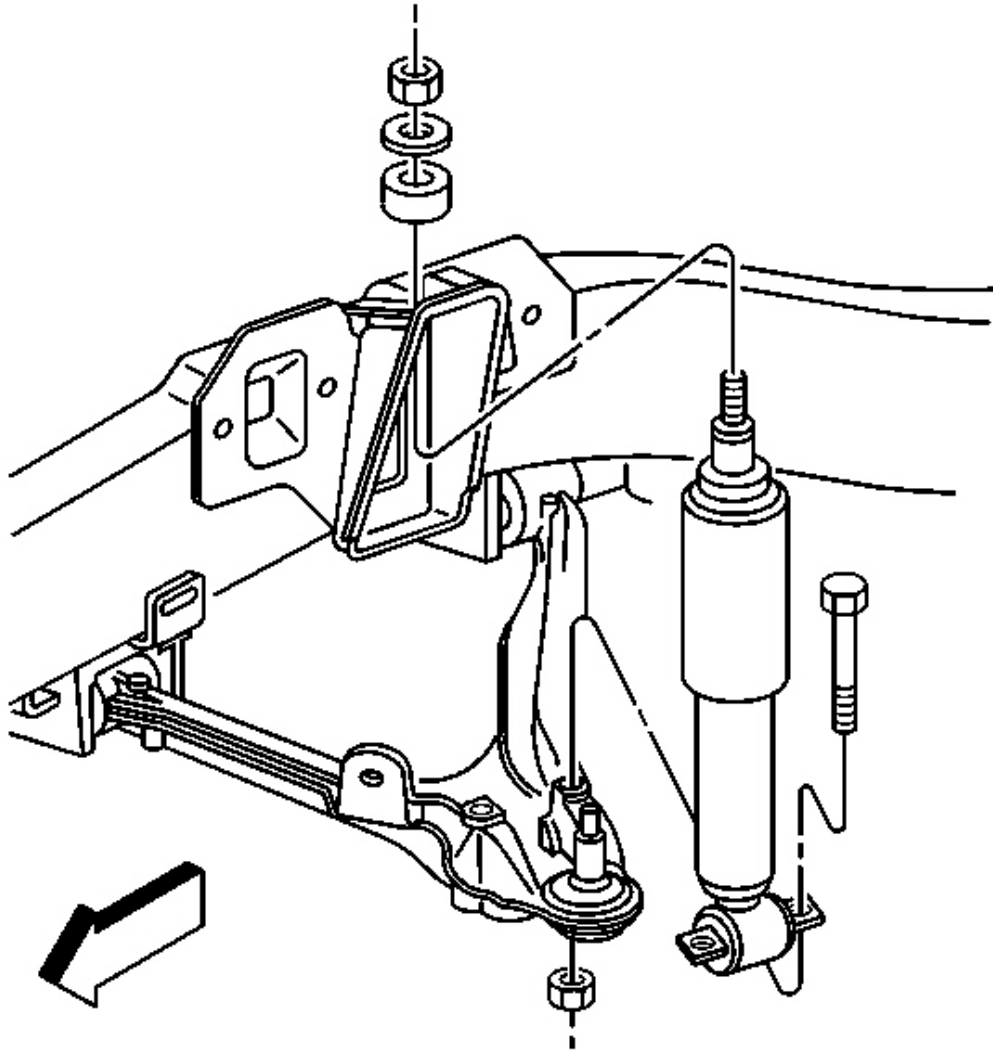


Fig. 64: Lower Shock Absorber & Bolts
 Courtesy of GENERAL MOTORS CORP.

6. Remove the shock absorber from the lower control arm.

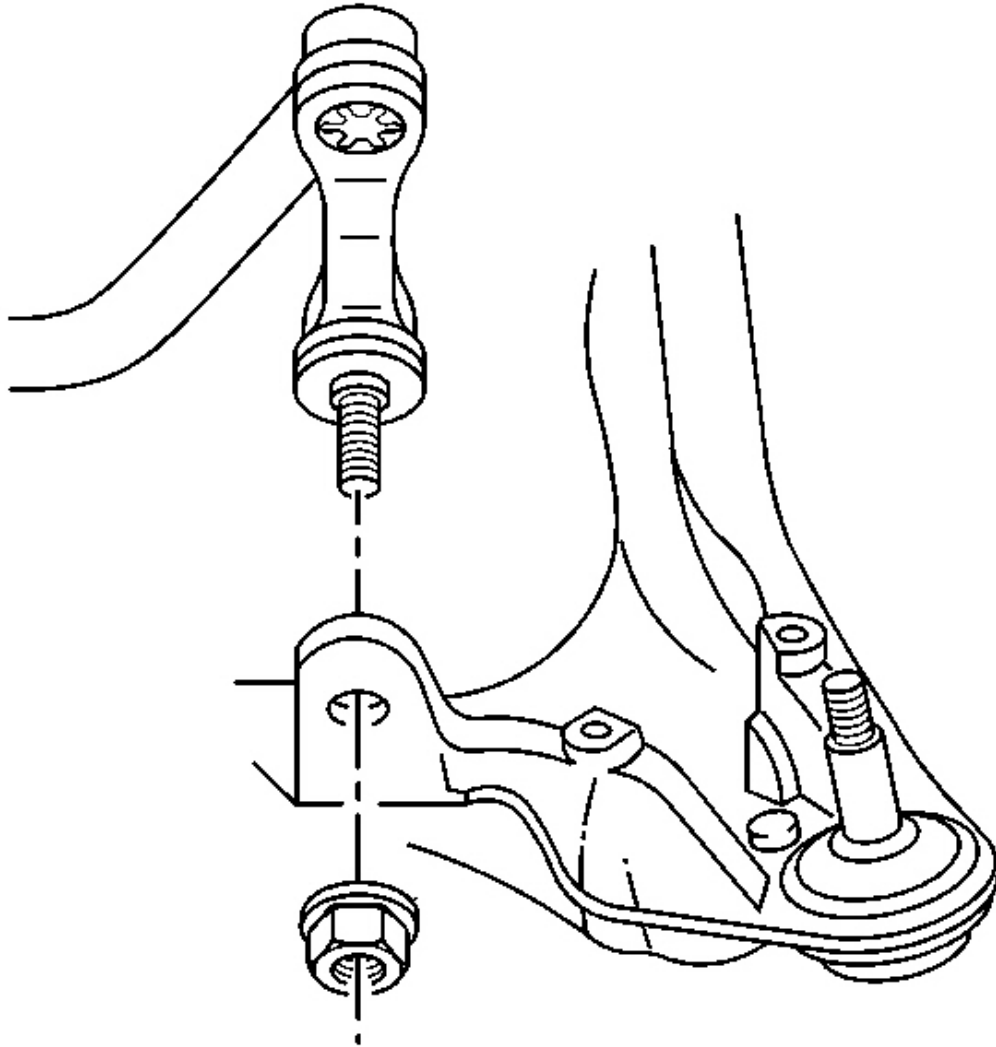


Fig. 65: Stabilizer Shaft Link & Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

7. Remove the stabilizer shaft link from the lower control arm.

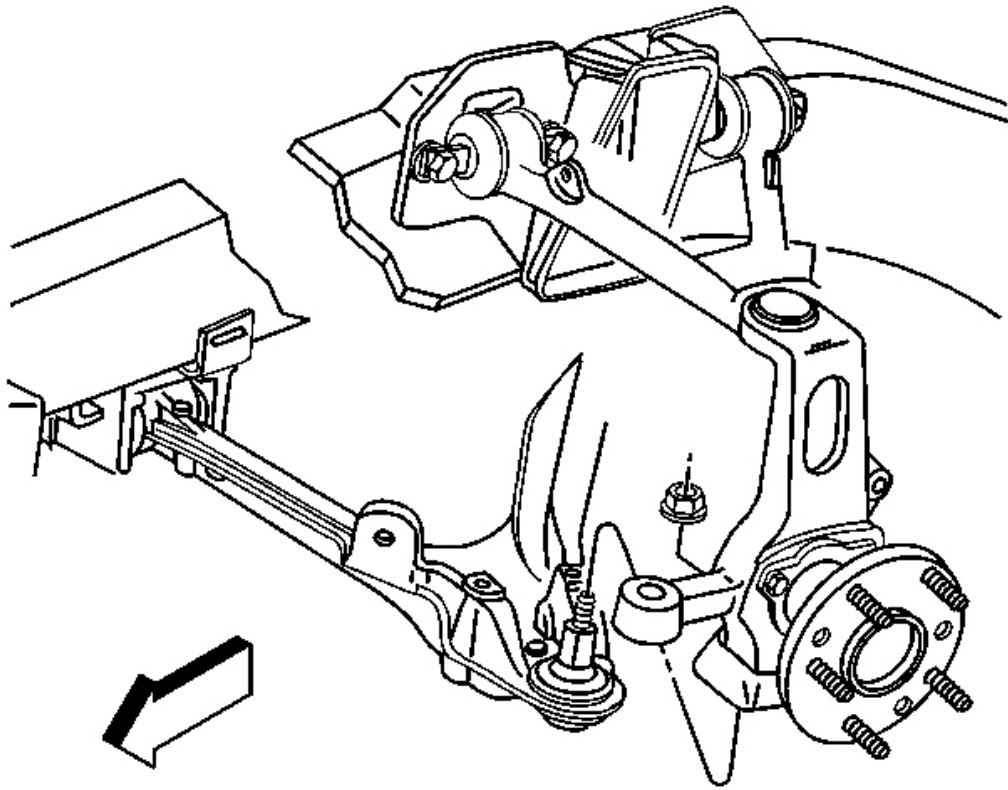


Fig. 66: Lower Control Arm Ball Joint, Stud & Nuts
Courtesy of GENERAL MOTORS CORP.

8. Loosen the ball joint stud nut but do not remove the nut.

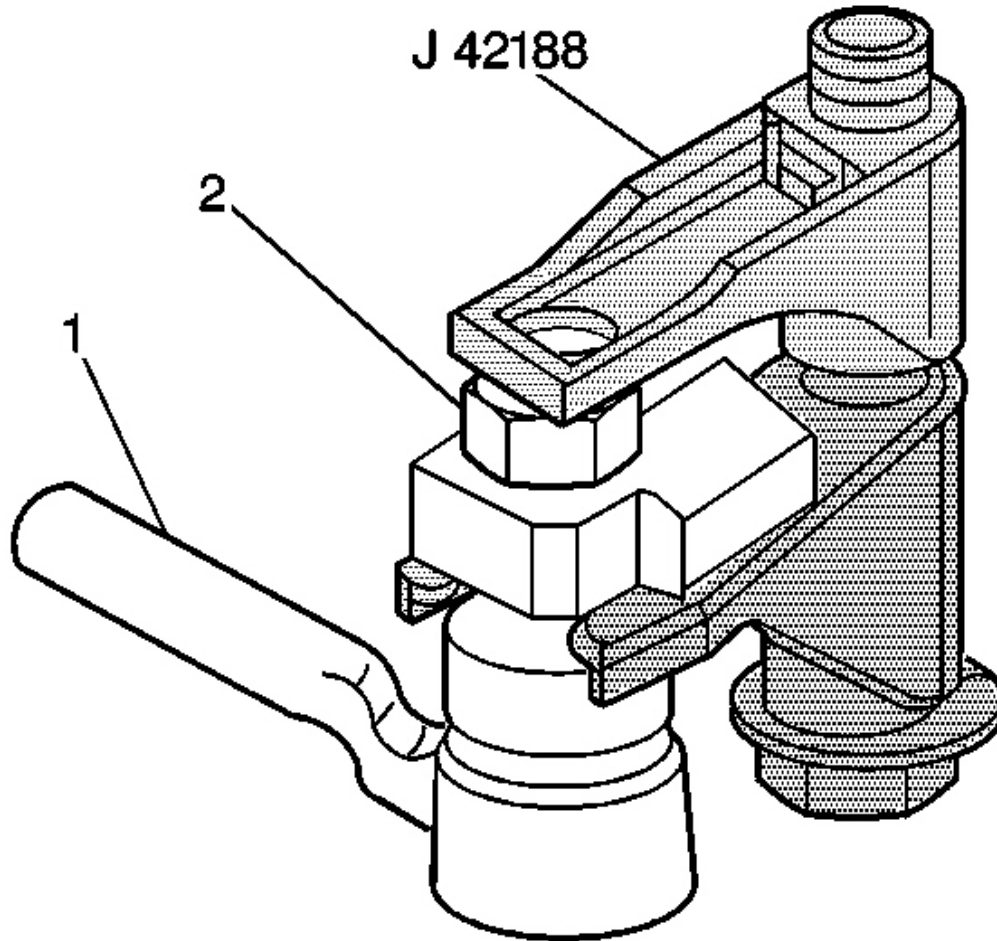


Fig. 67: J 42188, Lower Ball Joint Stud & Nut
Courtesy of GENERAL MOTORS CORP.

9. Using **J 42188** separate the lower ball joint stud from the steering knuckle.
10. Remove **J 42188** and the ball joint stud nut (2).
11. Remove the ball joint stud from the steering knuckle.

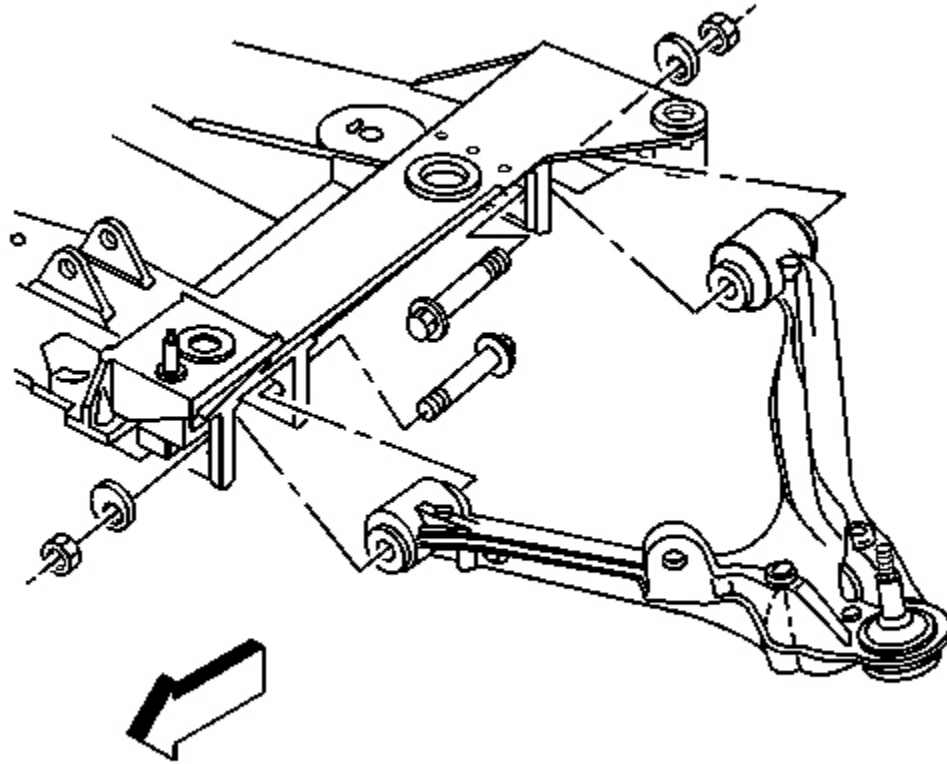


Fig. 68: Lower Control Arm & Bolts
Courtesy of GENERAL MOTORS CORP.

12. Mark the position of the cam bolts for orientation when installing.
13. Remove the cam bolts, washers, and nuts retaining the control arm to the crossmember.
14. Remove the lower control arm from the vehicle.

Installation Procedure

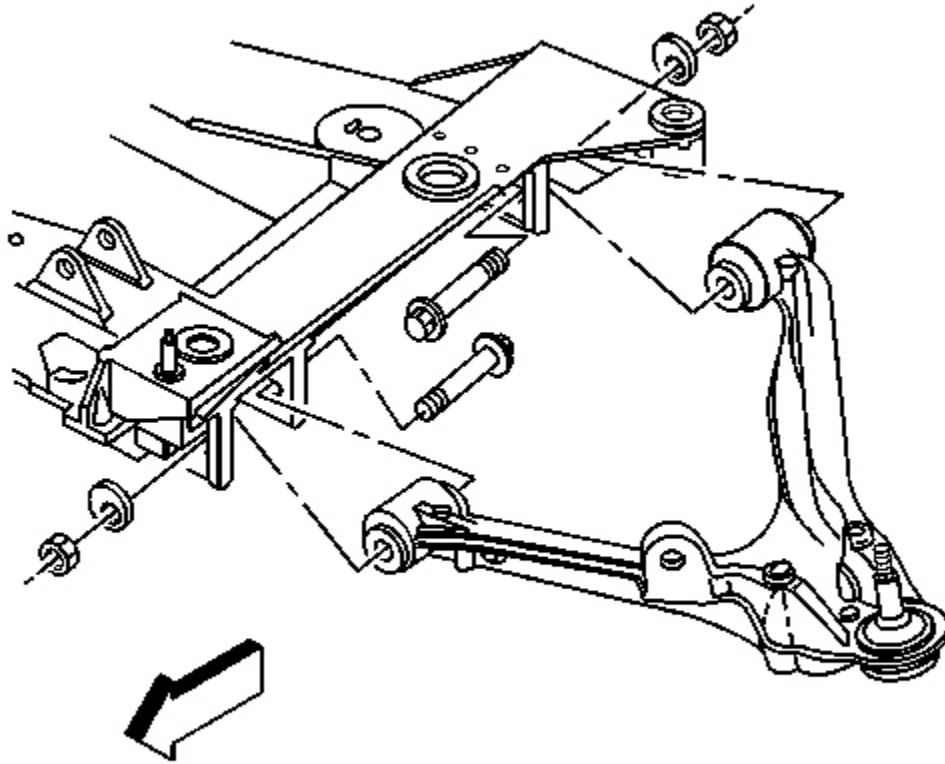


Fig. 69: Lower Control Arm & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the lower control arm to the vehicle.

Install the cam bolts, washers, and nuts retaining control arm to the crossmember.

- Place the cam bolts at the position marked during disassembly.
- Due to a required wheel alignment, tighten the cam bolts but do not set to final torque specifications at this time.

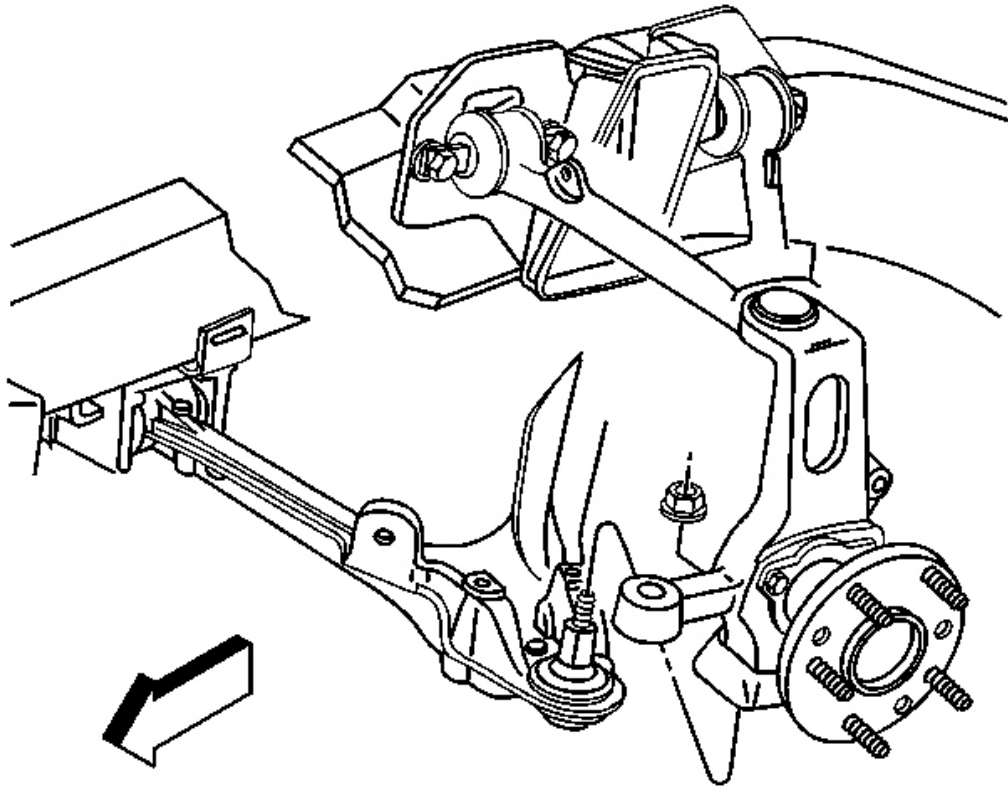


Fig. 70: Lower Control Arm Ball Joint, Stud & Nuts
Courtesy of GENERAL MOTORS CORP.

2. Support the lower control arm with a jackstand.
3. Install the lower ball joint stud to the steering knuckle.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the lower control arm ball joint stud nut.

It may be necessary to use an Allen wrench to keep the ball joint stud from spinning while tightening the ball joint stud nut.

Tighten: Tighten the lower control arm ball joint stud nut to 30 N.m (20 lb ft) plus 180 degrees.

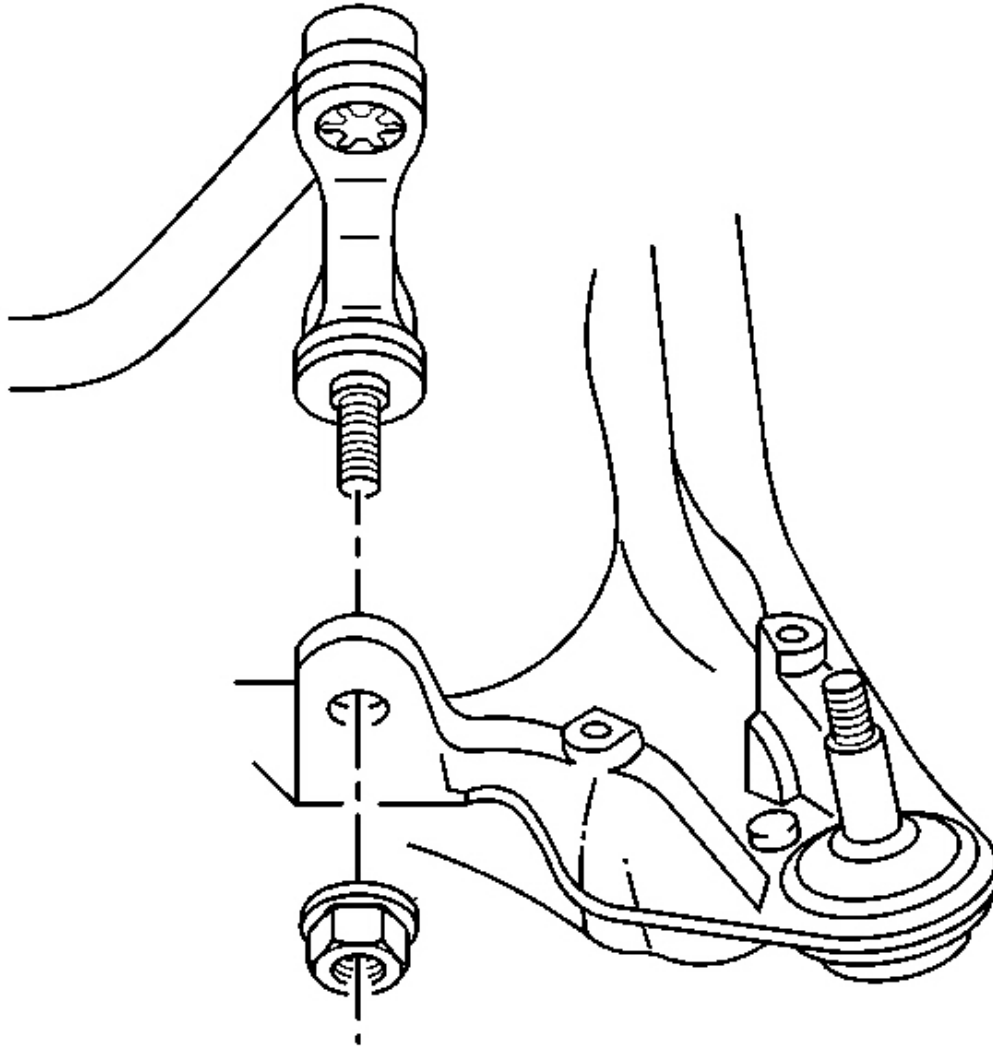


Fig. 71: Stabilizer Shaft Link & Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

5. Install the stabilizer shaft link to the lower control arm.

Tighten: Tighten the stabilizer shaft link nut to 72 N.m (53 lb ft).

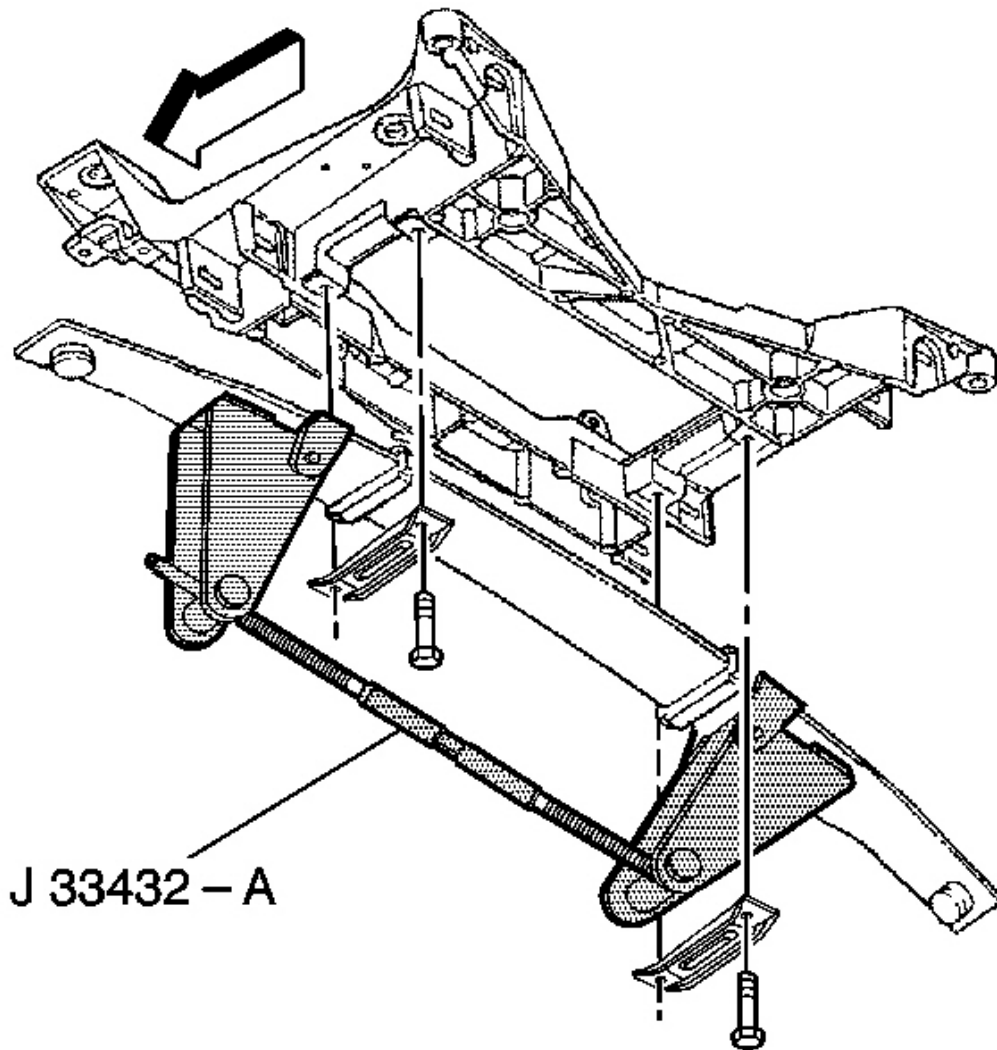


Fig. 72: Using J 33432-A
Courtesy of GENERAL MOTORS CORP.

6. Install the front transverse spring. Refer to **Front Transverse Spring Replacement** .
7. Remove the spring compressor tool **J 33432-A** . See **Special Tools and Equipment** .

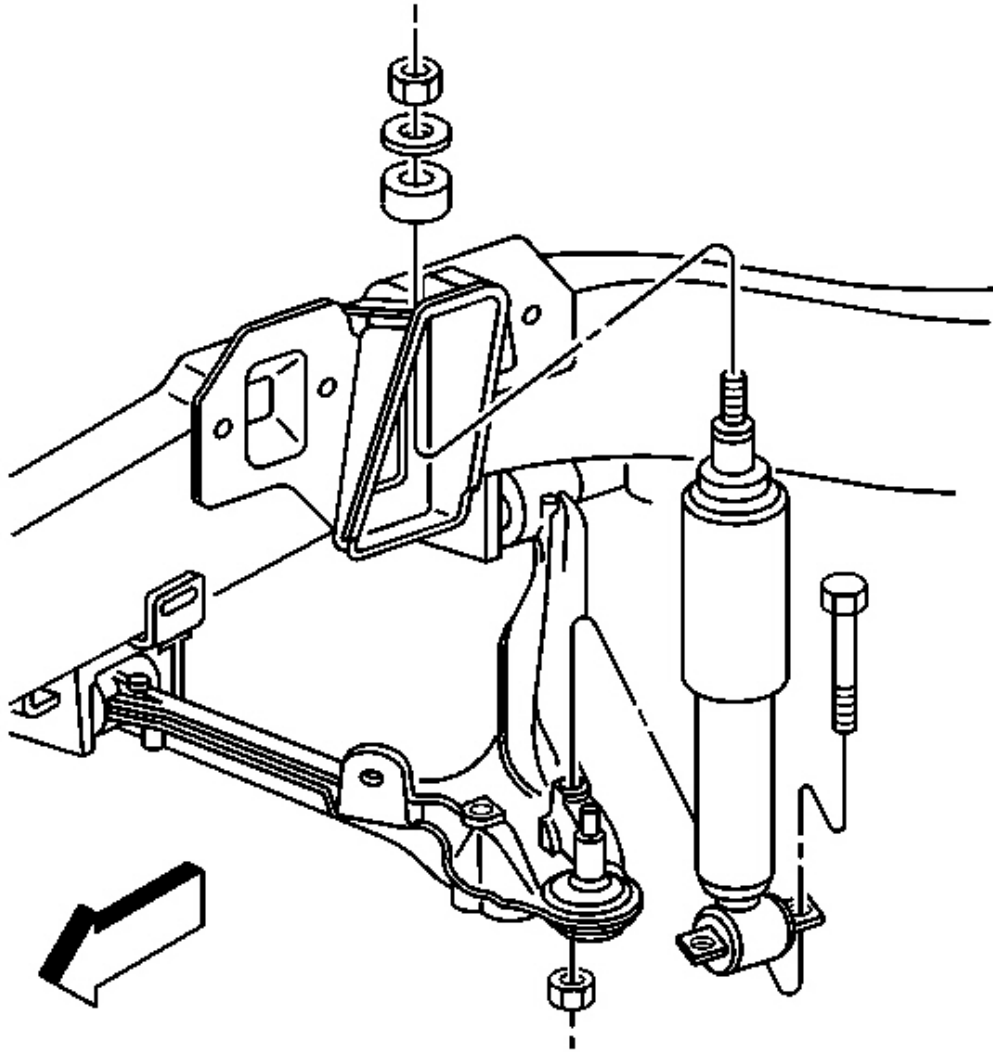


Fig. 73: Lower Shock Absorber & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Connect the shock absorber to the lower control arm.

Tighten: Tighten the shock absorber lower mounting nuts to 28 N.m (21 lb ft).

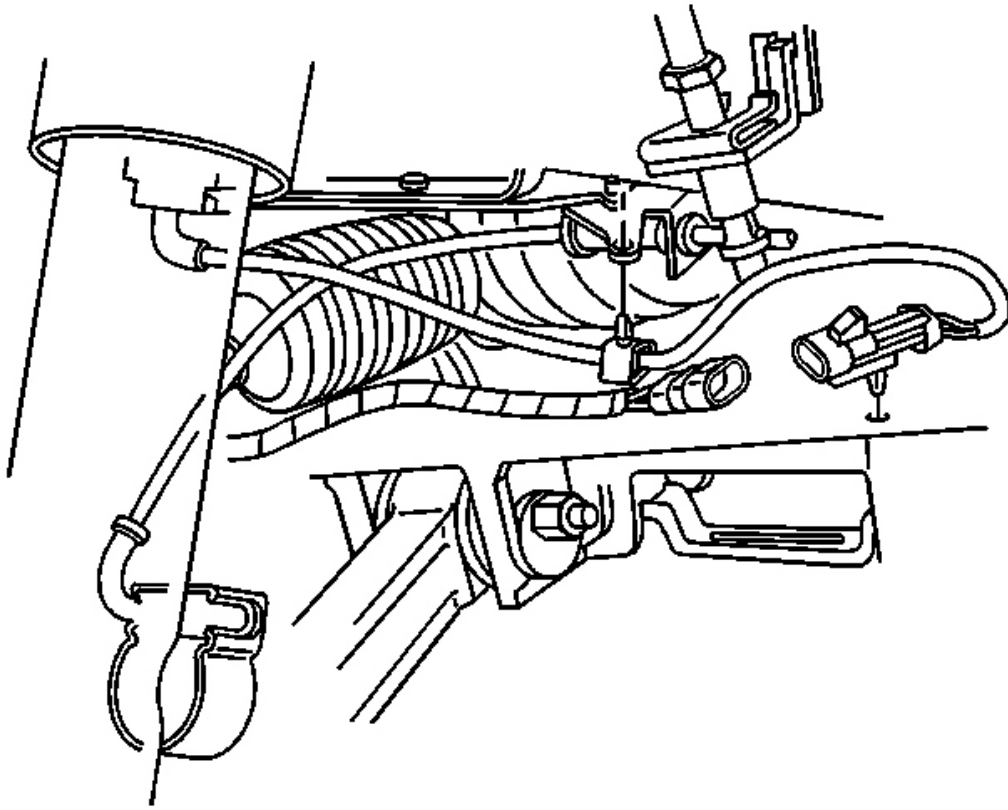


Fig. 74: Shock Absorber ESC Harness Connector
Courtesy of GENERAL MOTORS CORP.

9. Connect the ESC electrical connector to the shock, if equipped.

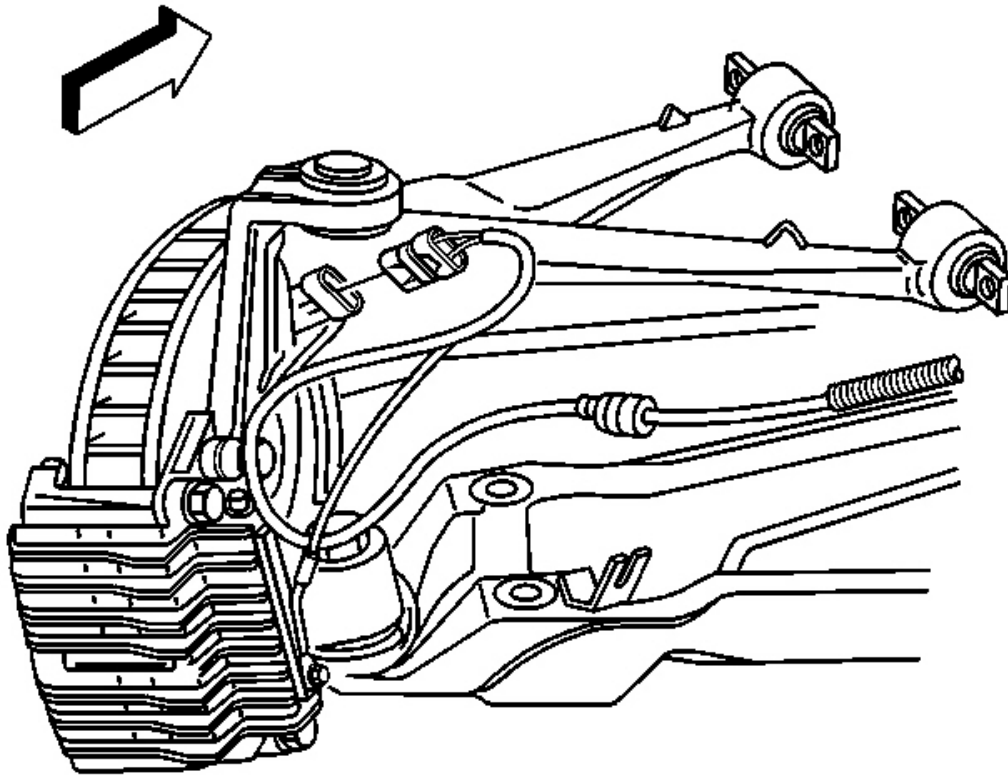


Fig. 75: View Of LF ABS Connector
Courtesy of GENERAL MOTORS CORP.

10. Connect the electrical connector to the wheel speed sensor.
11. Remove the jackstand.
12. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
13. Lower the vehicle.
14. Perform a front wheel alignment. Refer to **Measuring Wheel Alignment** in Wheel Alignment.

Tighten: Tighten the lower control arm cam bolt nuts to 170 N.m (125 lb ft).

WHEEL STUD REPLACEMENT

Tool Required

J 43631 Ball Joint Separator. 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 tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the front wheel hub/speed sensor assembly. Refer to **Wheel Bearing/Hub Replacement - Front** .

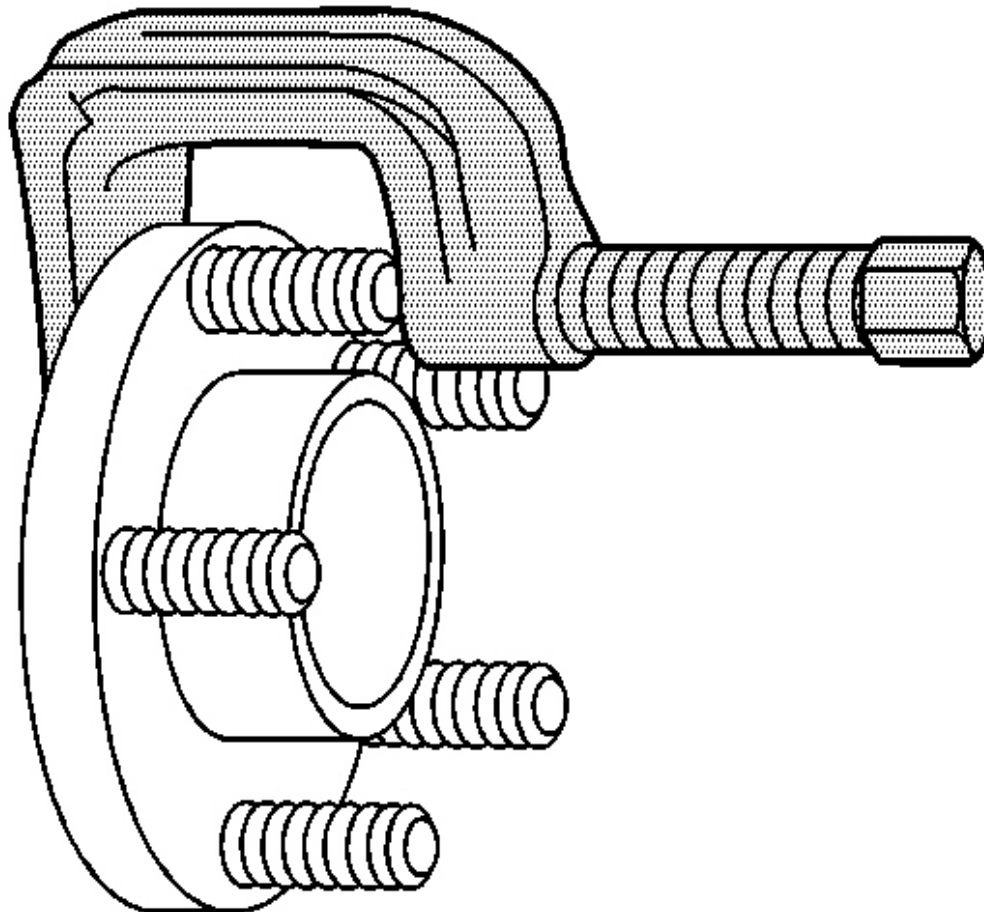


Fig. 76: Removing The Wheel Stud From The Axle Flange
Courtesy of GENERAL MOTORS CORP.

4. Install tool **J 43631** onto the wheel hub and stud. See **Special Tools and Equipment** .
5. Turn the forcing screw in until the stud is pushed out of the wheel hub.

Installation Procedure

1. Place a new stud in the wheel hub.

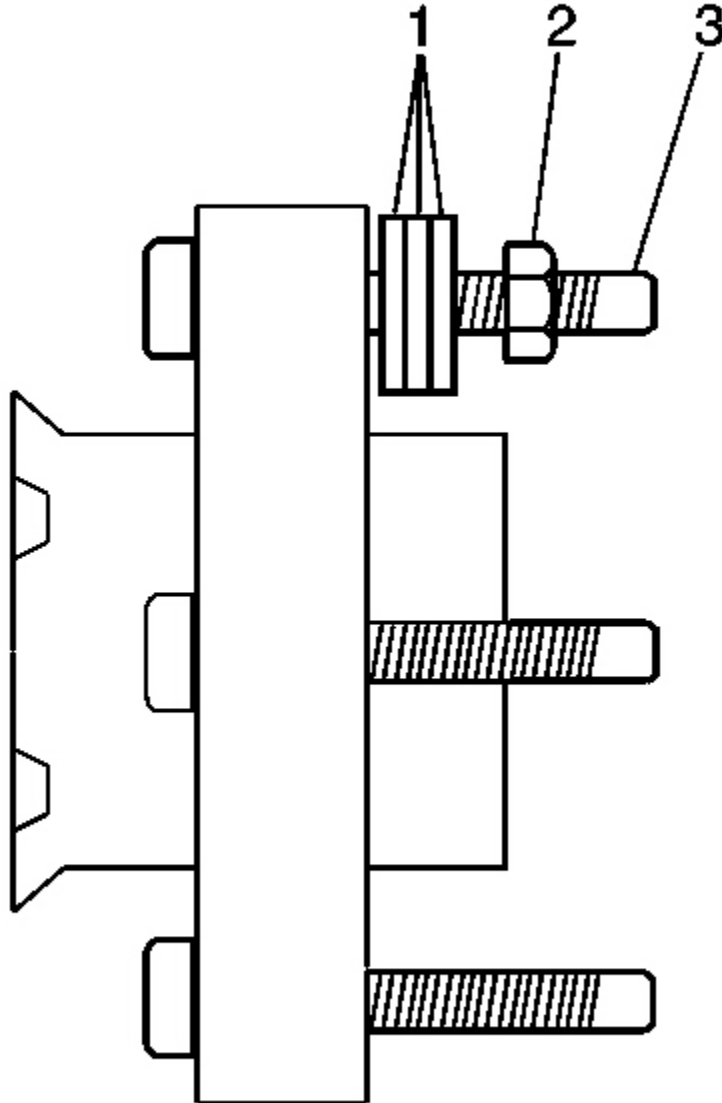


Fig. 77: Wheel Nut, Wheel Stud & Washers
Courtesy of GENERAL MOTORS CORP.

2. Install some washers onto the wheel stud.

3. With the flat side of a wheel nut (2) against the washers, tighten the wheel nut until the wheel stud head seats against the wheel hub flange.

IMPORTANT: Make sure that the wheel stud is fully seated against the wheel hub flange.

4. Remove the wheel nut and washers.
5. Install the wheel hub/speed sensor assembly into the steering knuckle. Refer to **Wheel Bearing/Hub Replacement - Front**.
6. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
7. Lower the vehicle.

SHOCK ABSORBER REPLACEMENT (W/O F55)

Tools Required

- **J 33432-A** Transverse Spring Compressor. See **Special Tools and Equipment**.
- **J 43822** Shock Support Tool. See **Special Tools and Equipment**.

Removal Procedure

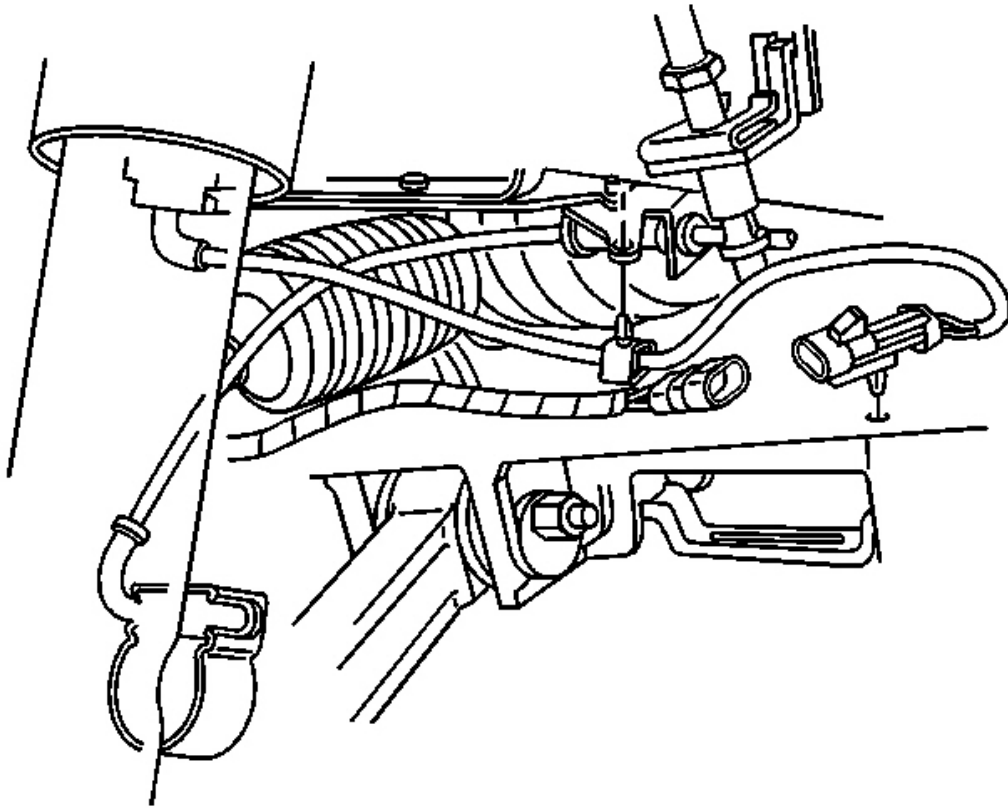


Fig. 78: Shock Absorber ESC Harness Connector
Courtesy of GENERAL MOTORS CORP.

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. Disconnect the electronic suspension control electrical connector from the shock, if equipped.
4. Remove the upper mounting nut, insulator retainer, and insulator.

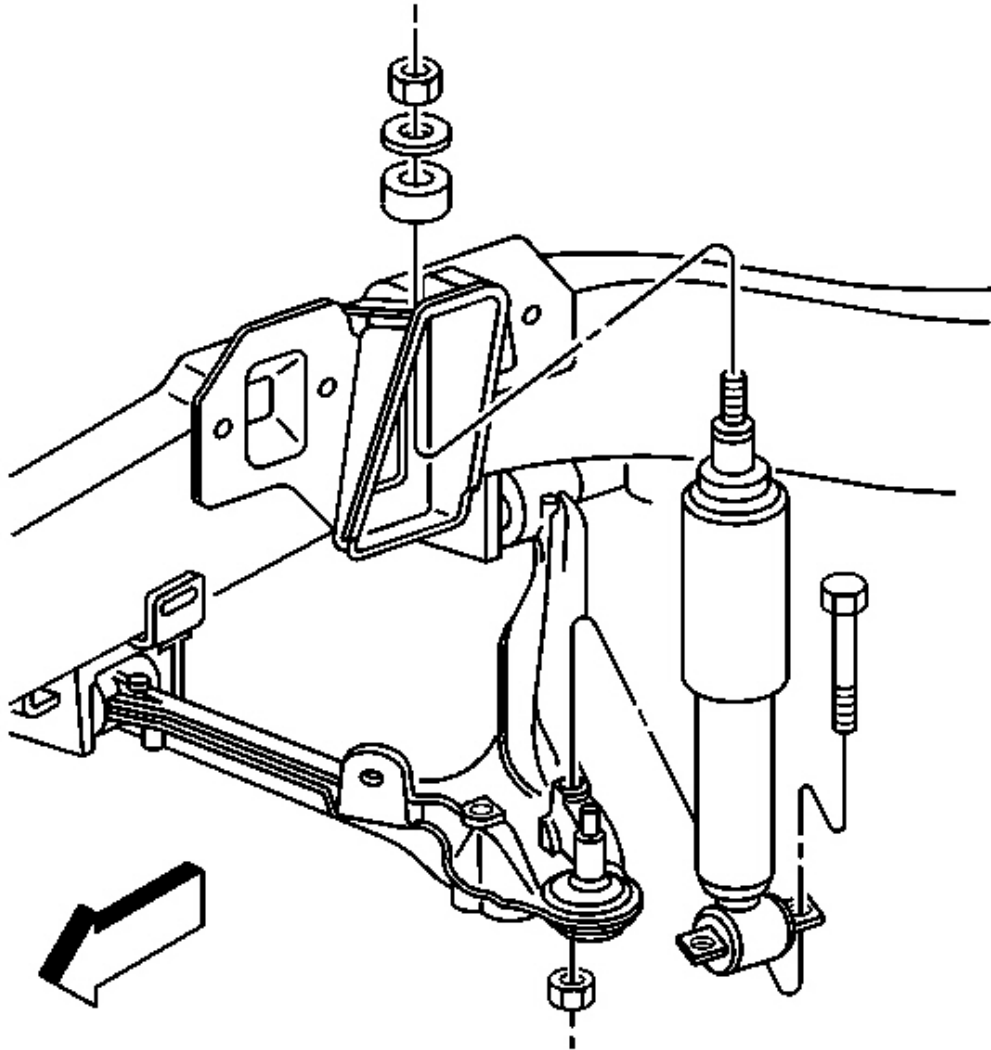


Fig. 79: Lower Shock Absorber & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the shock absorber lower mounting bolts and nuts.
6. Remove the shock absorber from the upper shock tower and the vehicle.
7. Remove the insulator and retainer from shock absorber.
8. For vehicles equipped with heavy duty shocks (FE3) perform the following steps.

IMPORTANT: During this procedure, use care not to scratch the transverse spring.

1. Perform steps 1-4.
2. Using a pry bar compress the shock absorber from the bottom upward.
3. Install the **J 43822** to the shock absorber while the shock is compressed. See **Special Tools and Equipment** .
4. Remove the shock absorber from the shock tower and the vehicle.
5. Remove **J 43822** from the shock absorber. See **Special Tools and Equipment** .

Installation Procedure

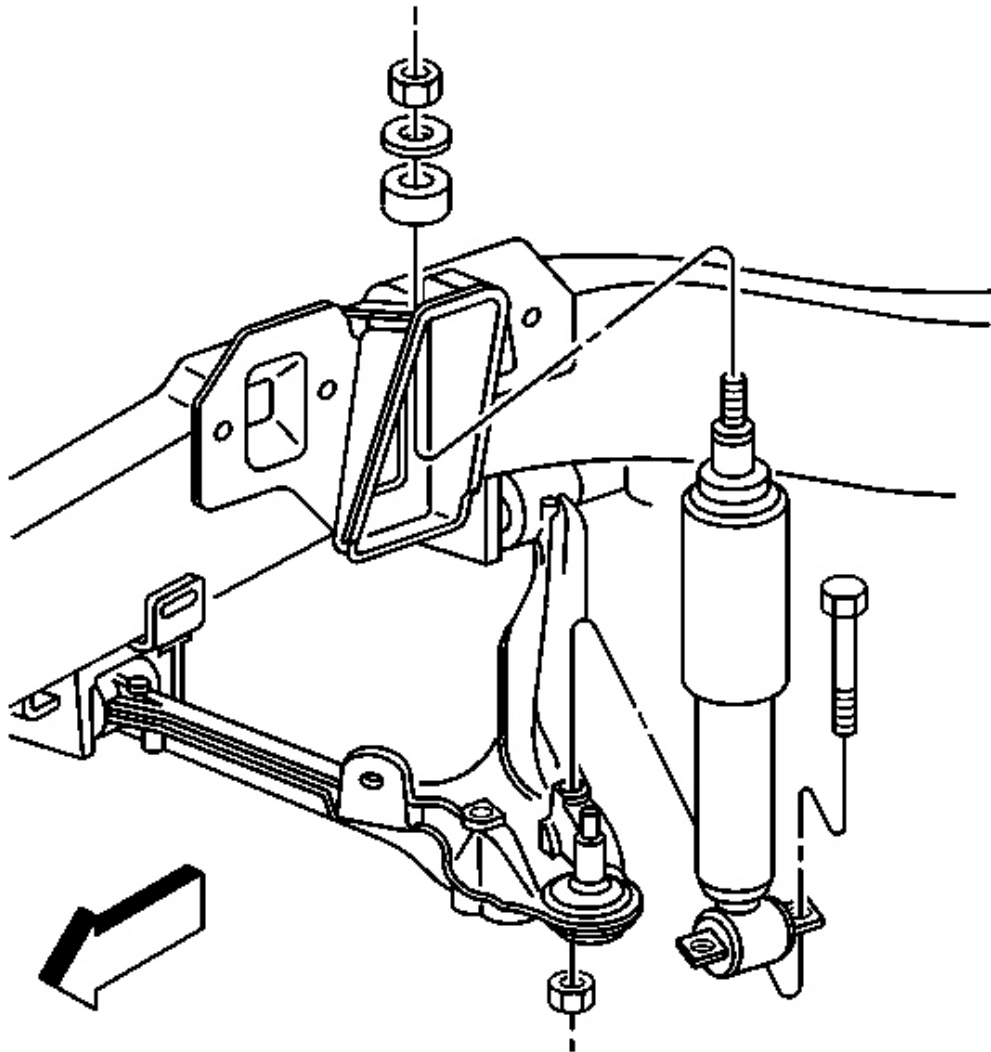


Fig. 80: Lower Shock Absorber & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the retainer and insulator to the shock absorber.
2. Install the shock absorber to the upper shock tower.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the upper insulator, retainer, and nut.

Tighten: Tighten the shock absorber upper mounting nut to 26 N.m (19 lb ft).

4. Install the shock absorber lower mounting bolts and nuts.

Tighten: Tighten the shock absorber lower mounting nuts to 28 N.m (21 lb ft).

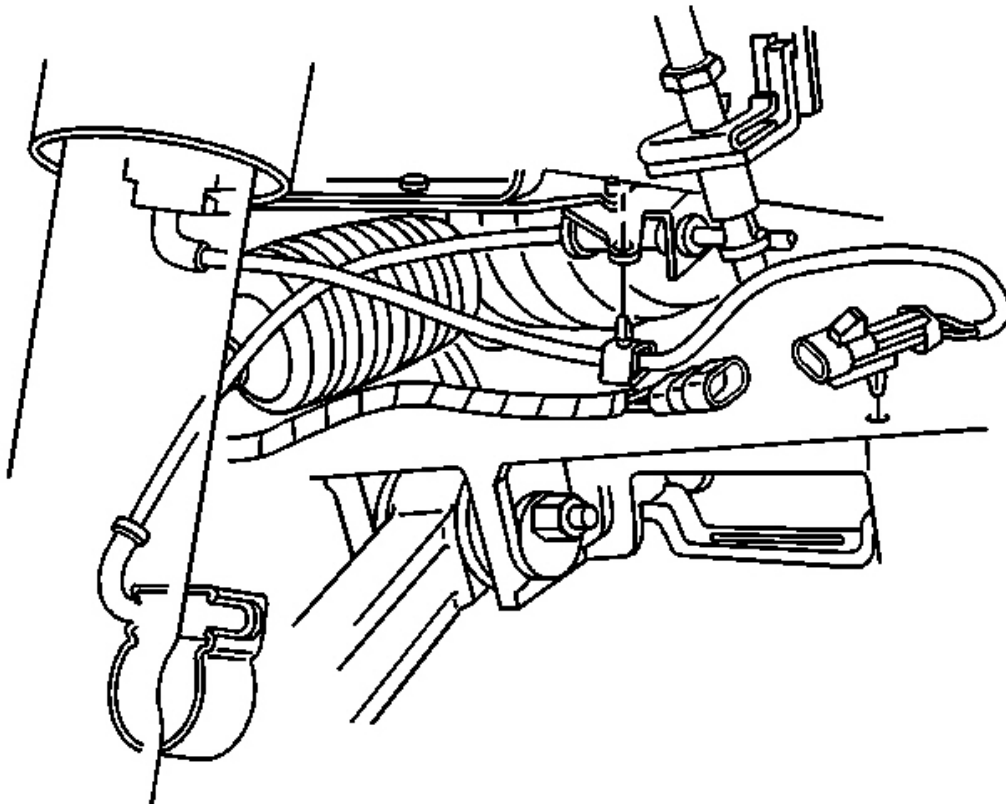


Fig. 81: Shock Absorber ESC Harness Connector

Courtesy of GENERAL MOTORS CORP.

5. Connect the electronic suspension control electrical connector to the shock, if equipped.
6. Remove **J 33432-A** from the spring. See **Special Tools and Equipment** .
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
8. Lower the vehicle.
9. For vehicles equipped with heavy duty shocks (FE3) perform the following steps.
 1. Install the **J 43822** to the shock absorber. See **Special Tools and Equipment** .
 2. Install the shock absorber into the vehicle.
 3. Install the upper insulator, retainer, and nut.

Tighten: Tighten the shock absorber upper mounting nut to 26 N.m (19 lb ft).

4. Remove **J 43822** from the shock absorber. See **Special Tools and Equipment** .
5. Install **J 33432-A** to the spring and compress. See **Special Tools and Equipment** .
6. Raise the lower control arm and install the shock absorber lower mounting bolts and nuts.

Tighten: Tighten the shock absorber lower mounting nuts to 28 N.m (21 lb ft).

7. Remove **J 33432-A** from the spring. See **Special Tools and Equipment** .
8. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
9. Lower the vehicle.

SHOCK ABSORBER REPLACEMENT (W/F55)

Tools Required

- **J 33432-A** Transverse Spring Compressor. See **Special Tools and Equipment** .
- **J 43822** Shock Support Tool. See **Special Tools and Equipment** .

Removal Procedure

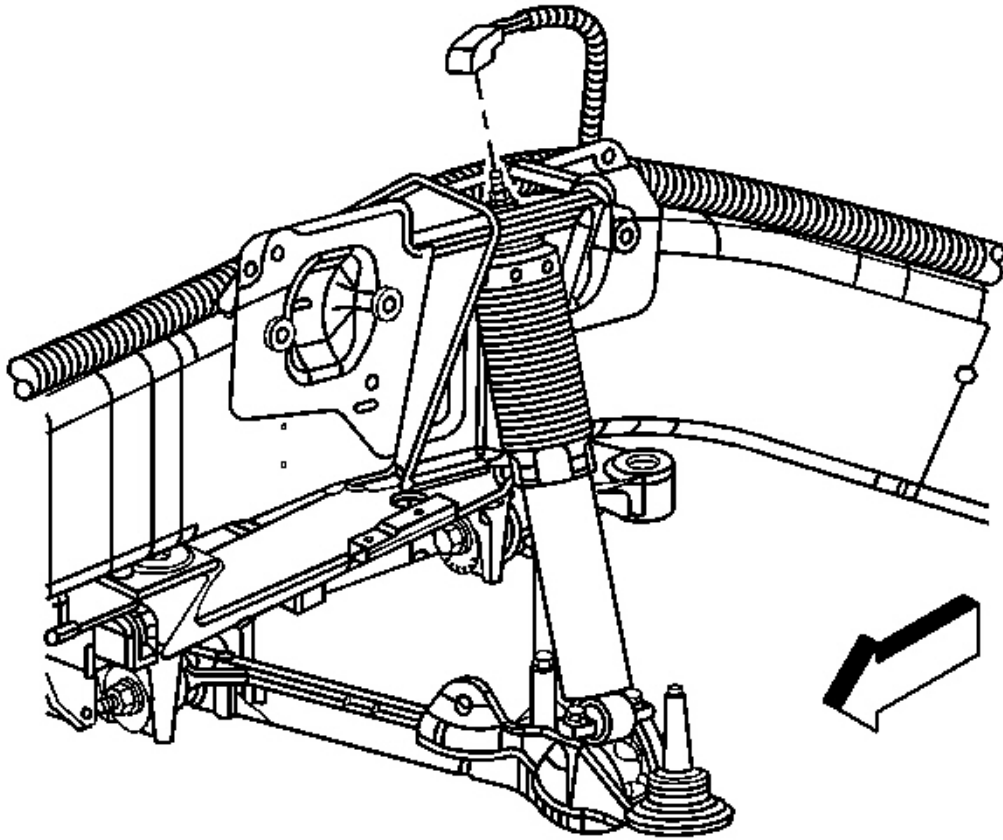


Fig. 82: Front Shock ESC Harness Connector
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the front shock ESC harness connector.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Remove the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

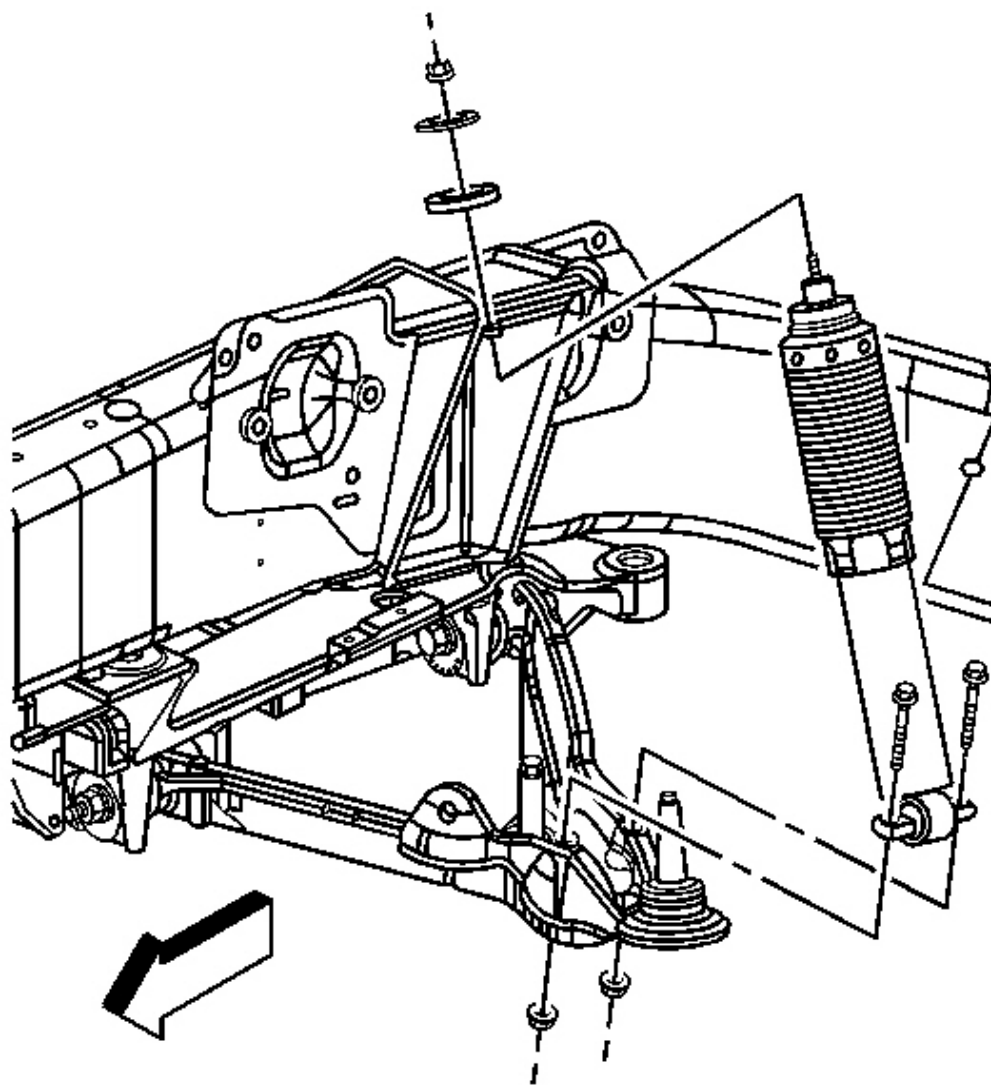


Fig. 83: Shock Absorber Lower Mounting Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The ESC connector seals to the upper shock shaft. If the upper shock shaft is damaged, the shock will need replacement.

4. Using only hand tools, remove the upper mounting nut, insulator retainer and insulator.
5. Remove the shock absorber lower mounting bolts and nuts.

6. Using a pry bar, compress the shock absorber from the bottom upward.
7. While the shock is in the compressed position, install the **J 43822** . See **Special Tools and Equipment** .
8. Remove the shock absorber from the vehicle.
9. Remove the **J 43822** from the shock absorber. See **Special Tools and Equipment** .
10. Remove the insulator and insulator retainer from the shock absorber.

Installation Procedure

1. Install the **J 43822** to the shock absorber. See **Special Tools and Equipment** .
2. Install the insulator and insulator retainer to the shock absorber.

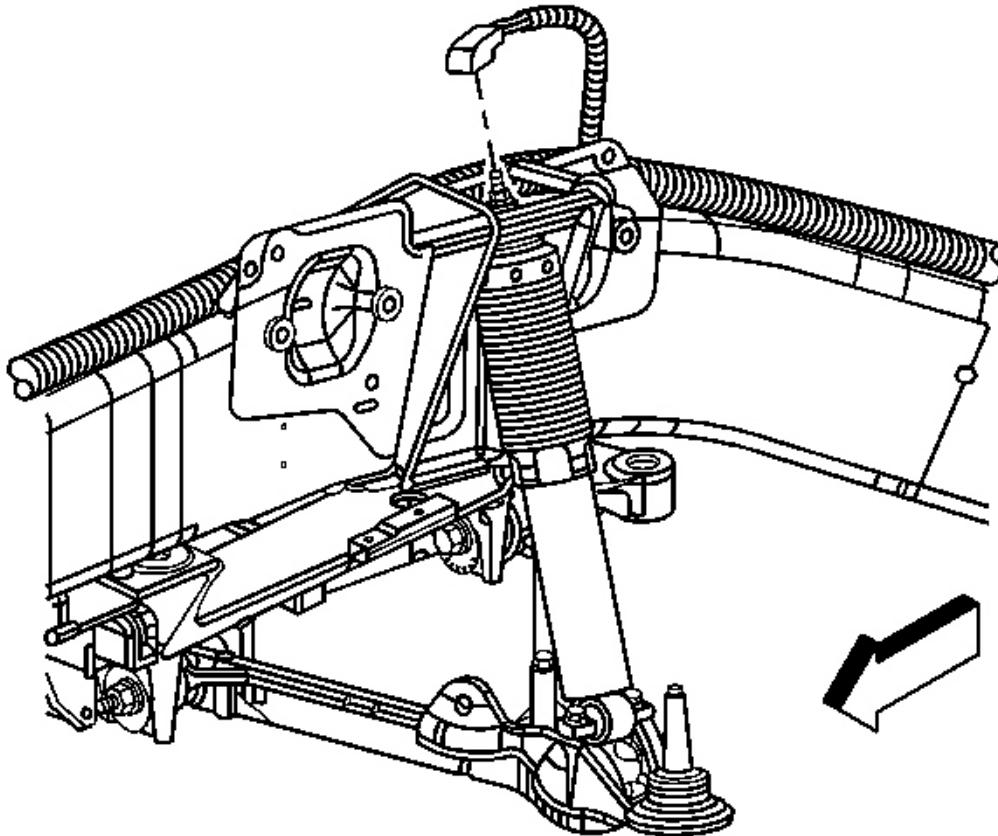


Fig. 84: Front Shock ESC Harness Connector
Courtesy of GENERAL MOTORS CORP.

3. Position the shock absorber between the upper shock support and lower control arm.

NOTE: Refer to Fastener Notice in **Cautions and Notices**.

4. Install the insulator, insulator retainer and nut to the upper shock shaft.

Tighten: Tighten the nut to 26 N.m (19 lb ft).

5. Remove the **J 43822** from the shock absorber. See **Special Tools and Equipment** .
6. Using the **J 33432-A** , compress the coil spring. See **Special Tools and Equipment** .
7. Raise the lower control arm to the shock absorber lower mounting and install the bolts and nuts.

Tighten: Tighten the nut to 28 N.m (21 lb ft).

8. Remove the **J 33432-A** from the coil spring. See **Special Tools and Equipment** .
9. Install the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.
10. Lower the vehicle.

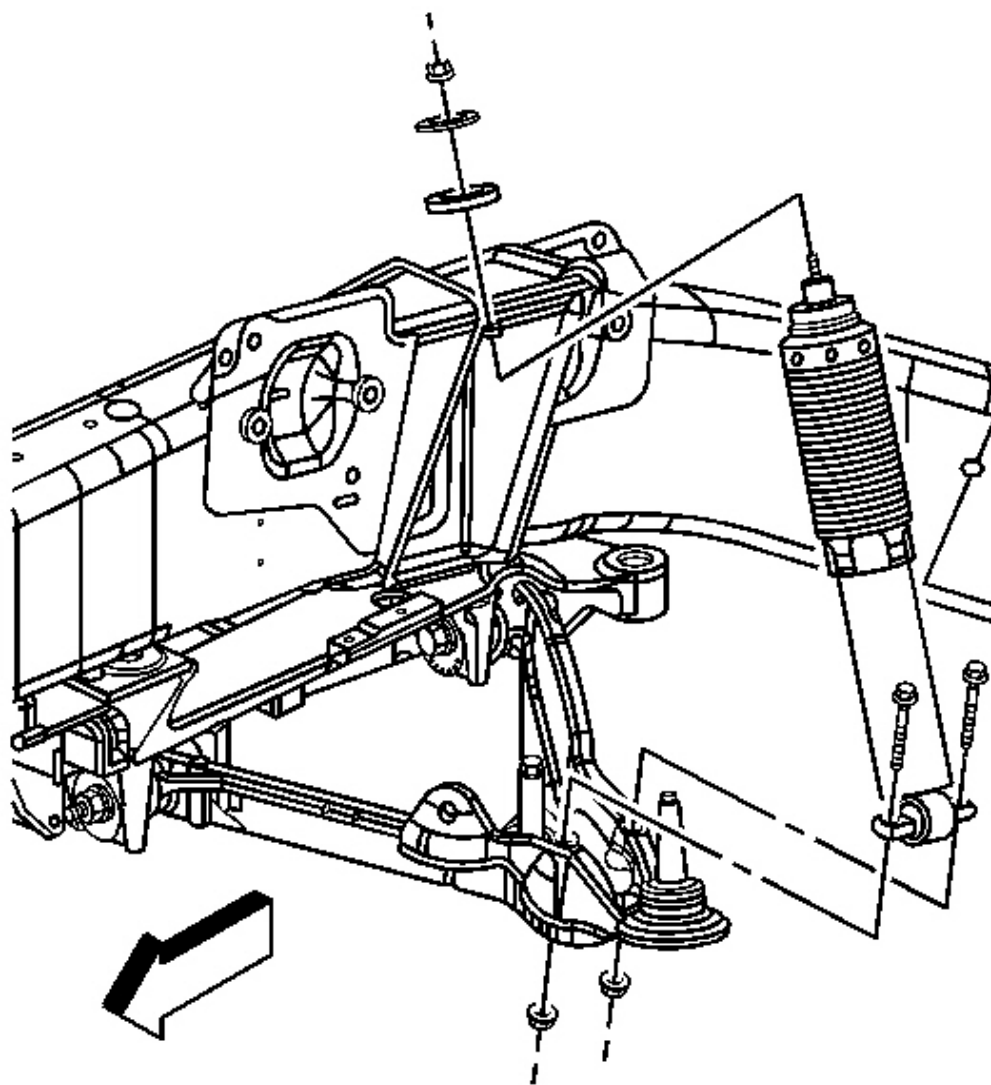


Fig. 85: Shock Absorber Lower Mounting Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

11. Connect the ESC harness connector. Check the connection by lightly pulling upwards on the connector.

SHOCK ABSORBER DISPOSAL

CAUTION: Gas charged shock absorbers contain high pressure gas. Do not remove the snap ring from inside the top of the tube. If the snap ring is removed,

the contents of the shock absorber will come out with extreme force which may result in personal injury.

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

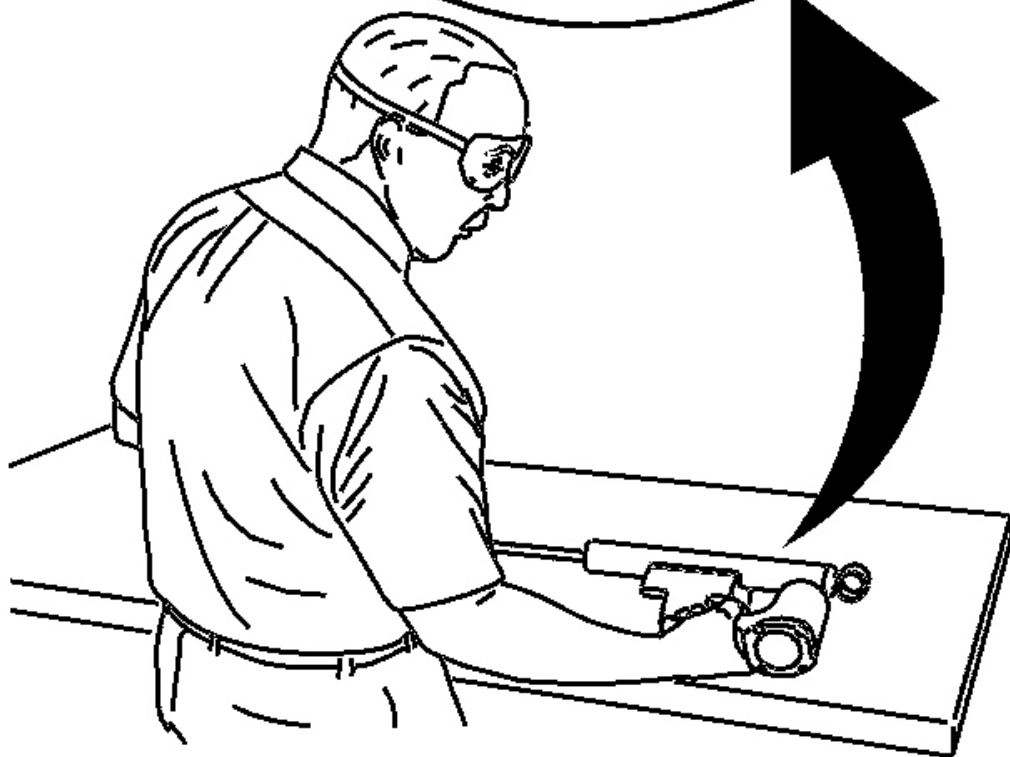
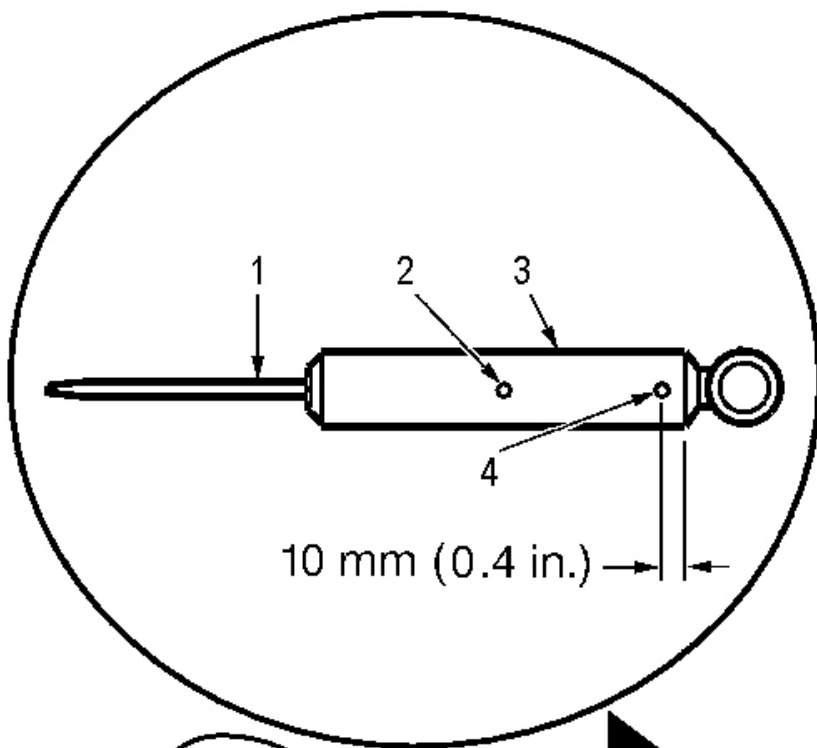


Fig. 86: Making An Indentation 10 mm (0.4 in) From The Bottom Of The Tube
Courtesy of GENERAL MOTORS CORP.

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

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

The front suspension uses a single lightweight fiberglass transverse spring mounted to the lower control arms.

The upper control arms are made of high-strength forged aluminum. The lower control arms, the crossmember and the steering knuckles are made of cast aluminum.

The hub and bearing assembly is a sealed unit. The hub and bearing assembly eliminates the need for wheel bearing adjustment. The hub and bearing assembly requires no maintenance.

The high-strength tubular steel stabilizer shaft provides stability.

The shock absorbers attach at the upper end to the frame and attach at the lower control arm. The shock absorber helps keep the wheel in contact with the road surface under most road conditions. The shock absorber reduces crash-through at full jounce and rebound.

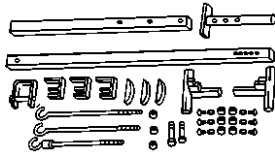
The standard gas shocks and the optional Electronic Suspension Control (ESC) shock absorbers are gas charged to reduce aeration (foaming) of the shock fluid. Aeration of the shock fluid results in unlimited damping control.

SPECIAL TOOLS AND EQUIPMENT

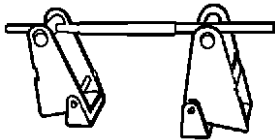
SPECIAL TOOLS

Special Tools

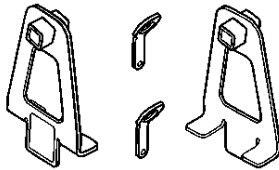
Illustration	Tool Number/ Description



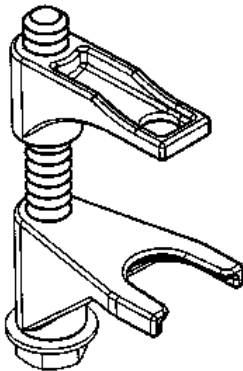
J 28467 - B
Universal Engine Support Fixture



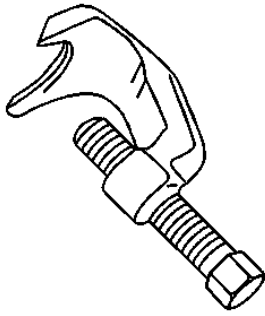
J 33432-A
Transverse Spring Compressor



J 41803
Engine Support Fixture



J 42188
Ball Joint Separator



J 43631
Ball Joint Separator



J 43822
Shock Support Tool