2004 STEERING

Steering Linkage (Non-Rack & Pinion) - C/K SUV

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Idler Arm to Frame Bolt or Nut	99 N.m	73 lb ft
Idler Arm to Relay Rod Nut	62 N.m	46 lb ft
Inner Tie Rod End to Rack and Pinion	100 N.m	74 lb ft
Pitman Arm to Relay Rod Nut	62 N.m	46 lb ft
Pitman Arm to Steering Gear Nut	250 N.m	184 lb ft
Steering Dampener to Frame Bracket Nut	40 N.m	30 lb ft
Steering Dampener to Relay Rod Nut	40 N.m	30 lb ft
Steering Linkage Special Tool	54 N.m	40 lb ft
Tie Rod to Steering Knuckle Nut (15 series)	50 N.m	37 lb ft
Tie Rod to Steering Knuckle Nut (25/35 series)	65 N.m	48 lb ft

REPAIR INSTRUCTIONS

STEERING LINKAGE INSPECTION (STEERING LINKAGE INSPECTION)

Tools Required

- **J 45101** Hub and Wheel Runout Gage
- **J 42640** Steering Column Anti-Rotation Pin

Left Side Steering Linkage

1. Elevate the left front of vehicle and install suitable vehicle support, maintaining contact between the right front wheel and shop floor.

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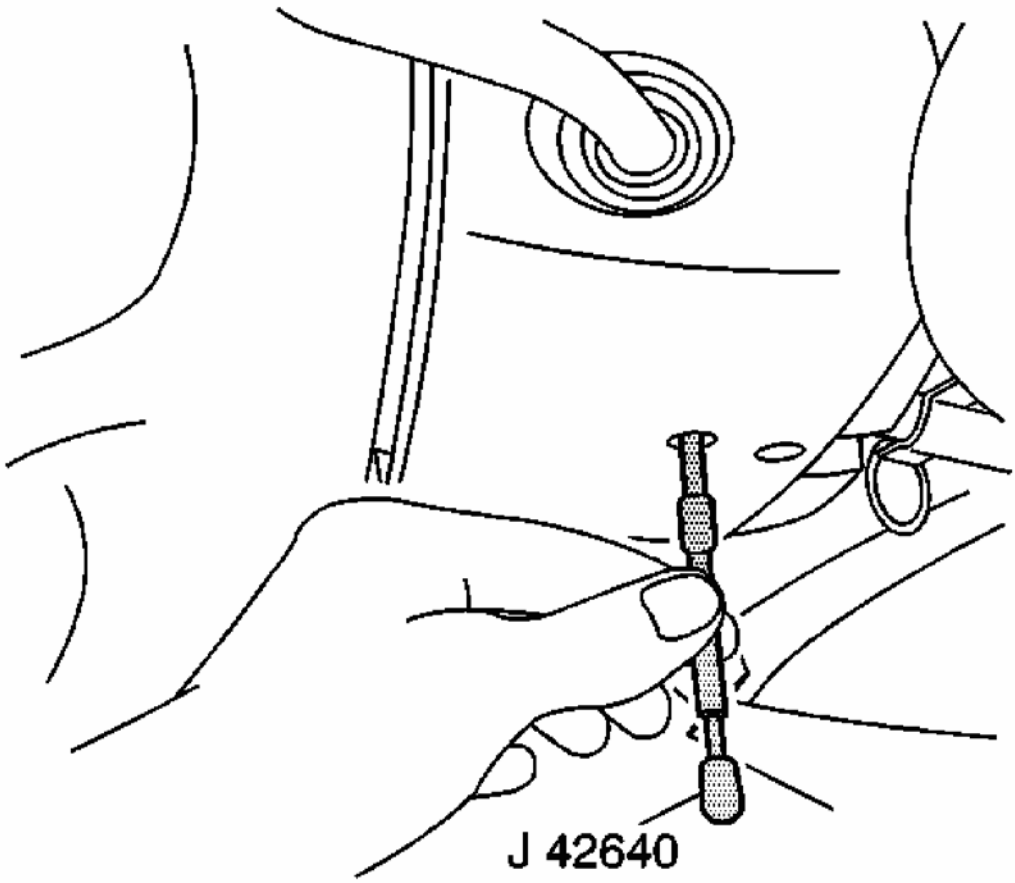

Fig. 1: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

2. Position the wheels in a straight-ahead position and install the **J 42640** .

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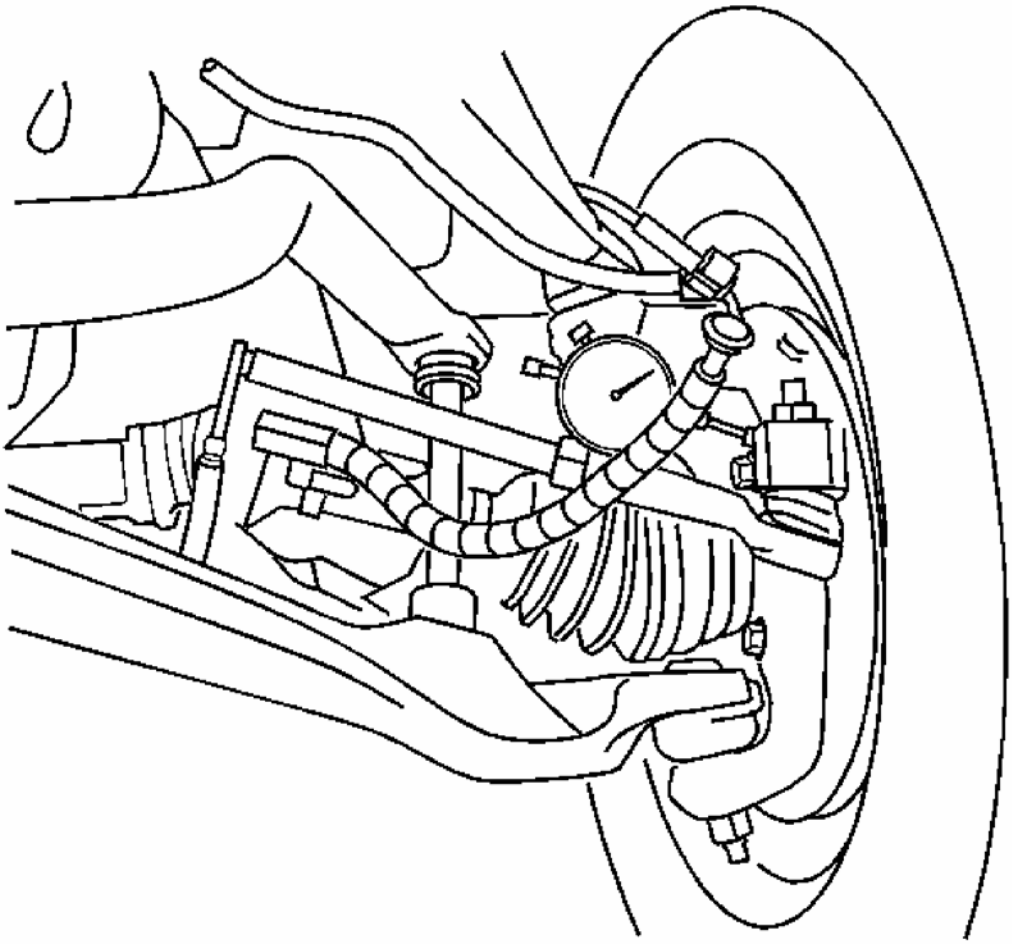

Fig. 2: Installing Dial Indicator Between Outer Tie Rod & Steering Knuckle (Left Side)
Courtesy of GENERAL MOTORS CORP.

3. Install a dial indicator between the outer tie rod and steering knuckle as shown and push inward to remove the lash slowly with one hand.
4. Place the dial indicator at zero, pull outward on the tire and note amount of movement in joint.

   Movement should not exceed 1.0 mm.

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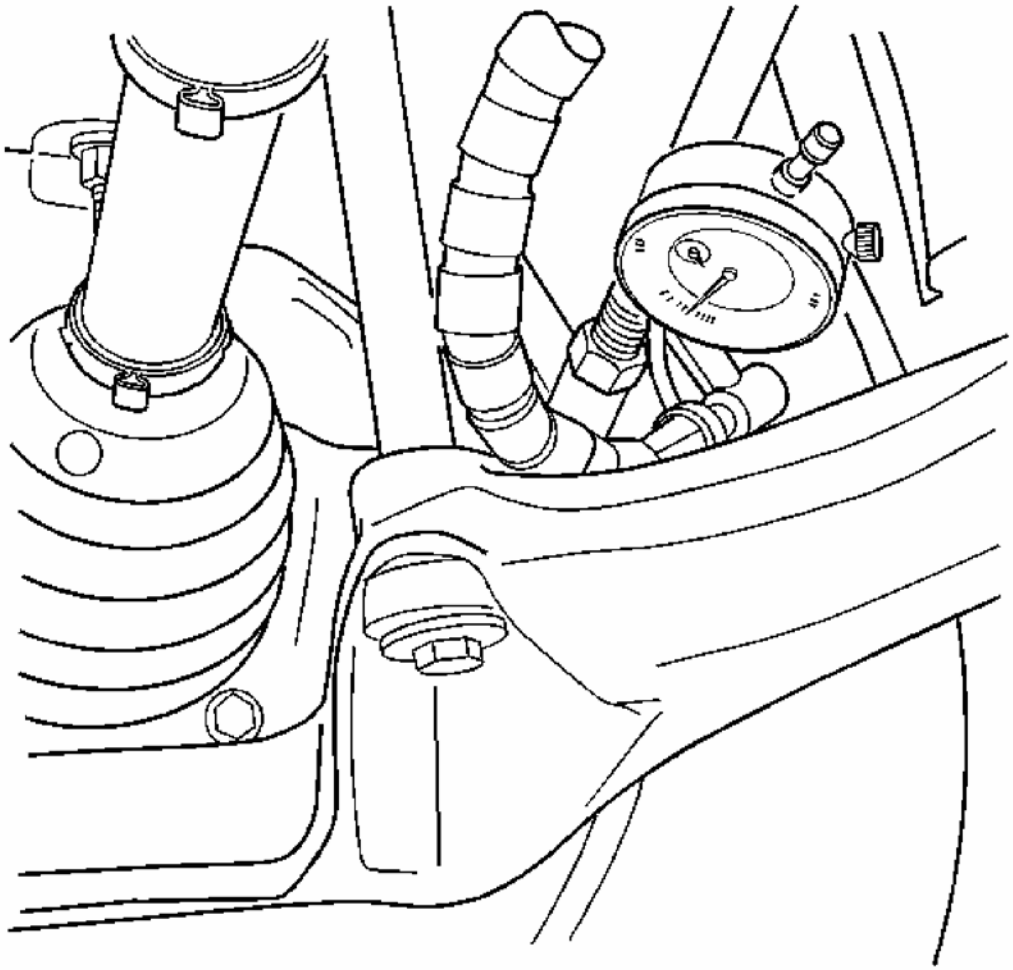

Fig. 3: Installing Dial Indicator Between Outer Tie Rod End & Jam Nut (Left Side)
Courtesy of GENERAL MOTORS CORP.

5. Install the dial indicator between the outer tie rod end and jam nut and attach the other end to the relay rod as shown and push inward on the tire to remove the lash slowly with one hand.
6. Place the dial indicator at zero, pull outward and note amount of movement in the joint.

   Movement should not exceed 1.0 mm.

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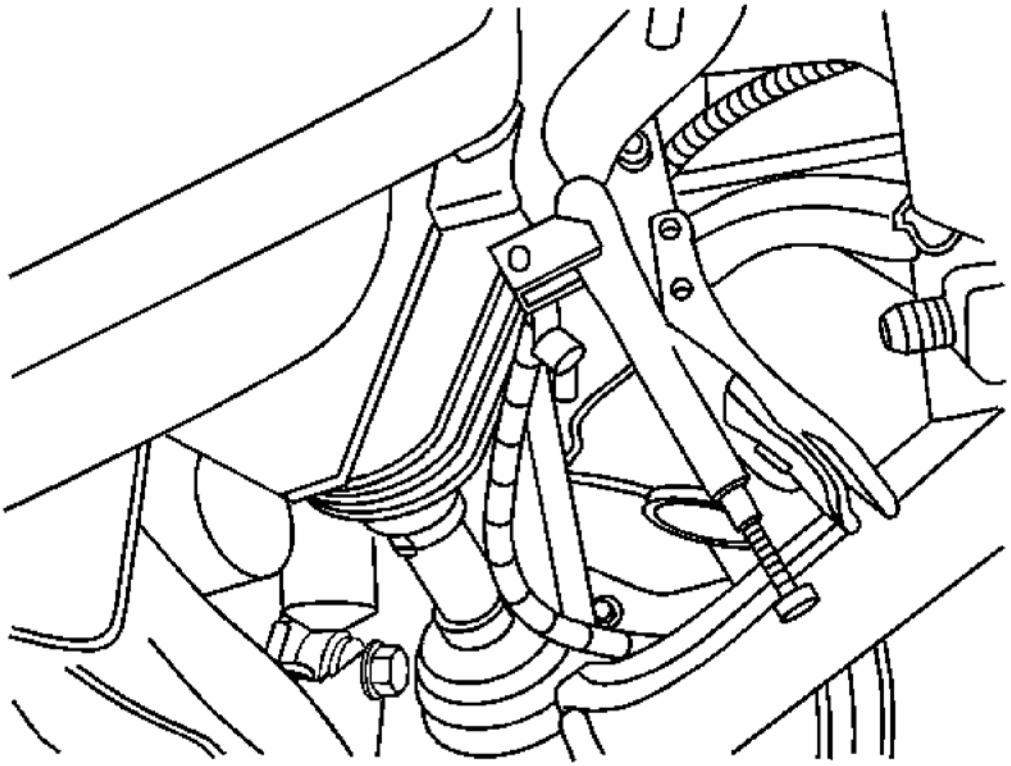

Fig. 4: Installing Dial Indicator Between Pitman Arm & Relay Rod (Left Side)
Courtesy of GENERAL MOTORS CORP.

7. Install the dial indicator between the pitman arm and relay rod as shown in and push inward on the tire to remove the lash slowly with one hand.

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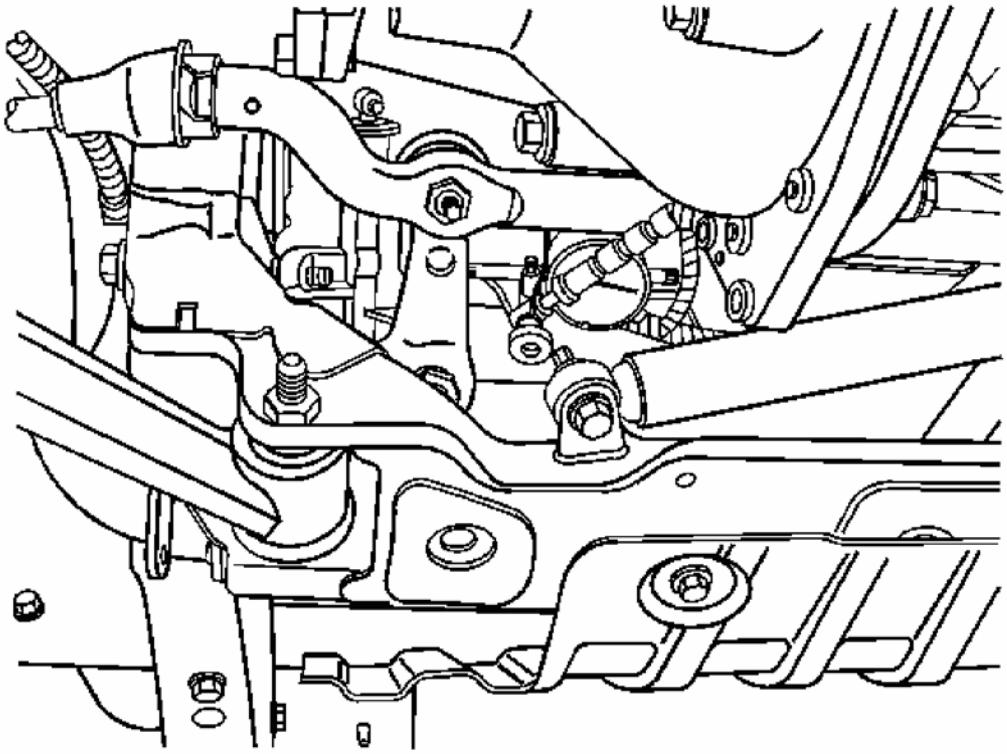

Fig. 5: Placing Dial Indicator At Zero (Left Side)
Courtesy of GENERAL MOTORS CORP.

8. Place the dial indicator at zero, pull outward and note the amount of movement in the joint.

   Movement should not exceed 1.0 mm.

Right Side Steering Linkage

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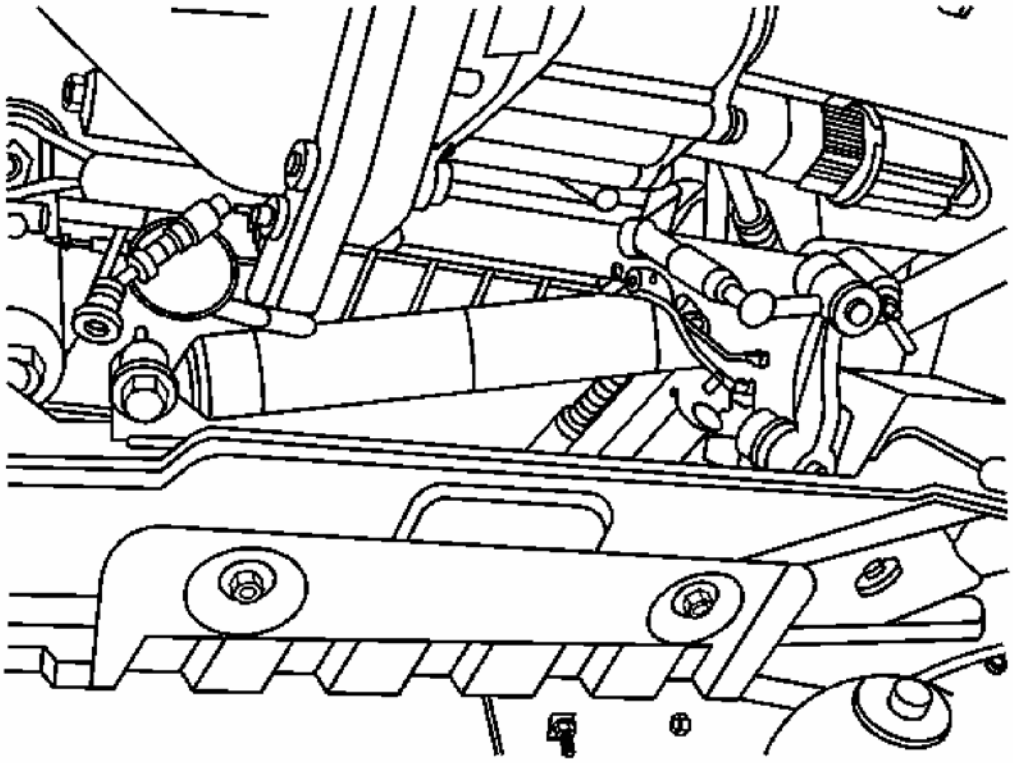

Fig. 6: Elevating Right Front Of Vehicle
Courtesy of GENERAL MOTORS CORP.

1. Elevate the right front of vehicle and install a suitable vehicle support, maintaining contact between the left front wheel shop floor.

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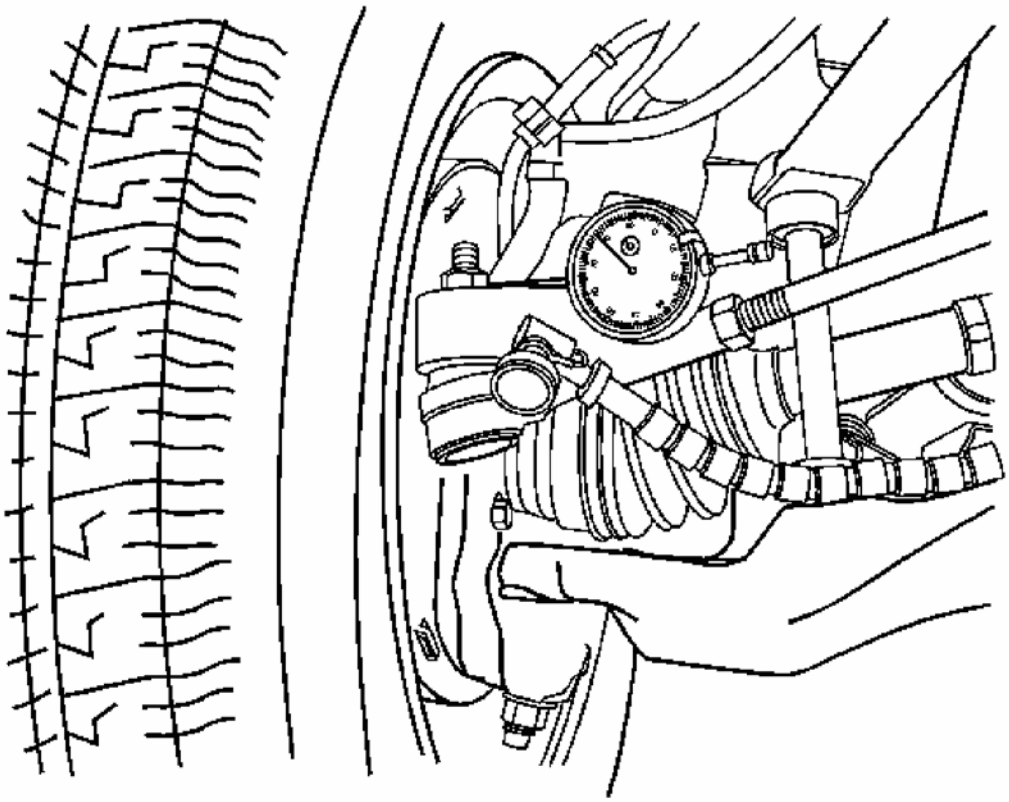

Fig. 7: Installing Dial Indicator Between Outer Tie Rod & Steering Knuckle (Right Side)
Courtesy of GENERAL MOTORS CORP.

2. Install a dial indicator between the outer tie rod and steering knuckle as shown and push inward to remove the lash slowly with one hand.

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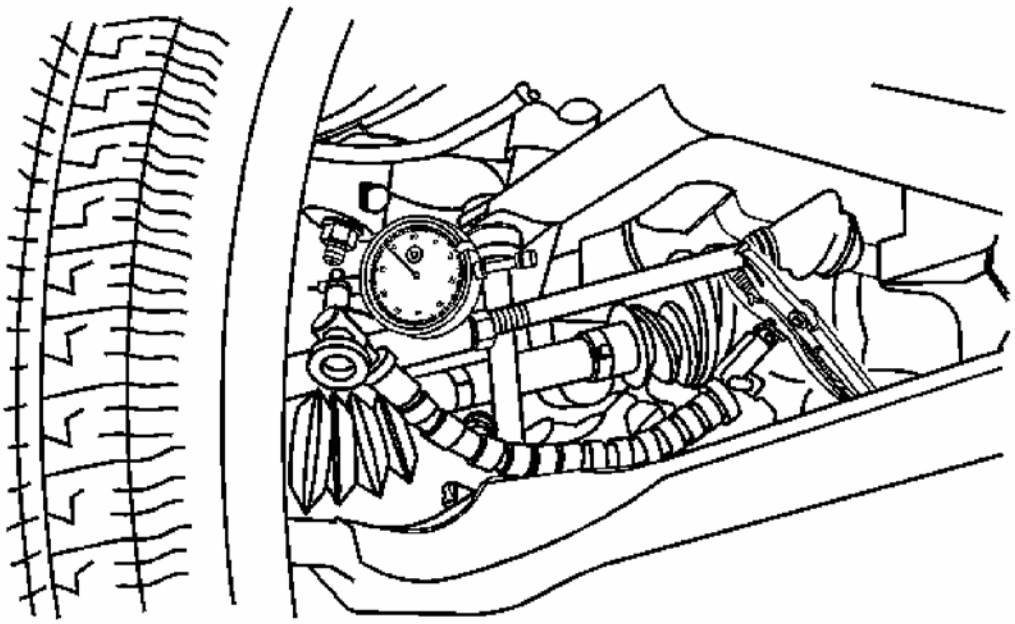

Fig. 8: Placing Dial Indicator At Zero (Right Side)
Courtesy of GENERAL MOTORS CORP.

3. Place the dial indicator at zero, pull outward and note amount of movement in joint.

   Movement should not exceed 1.0 mm.

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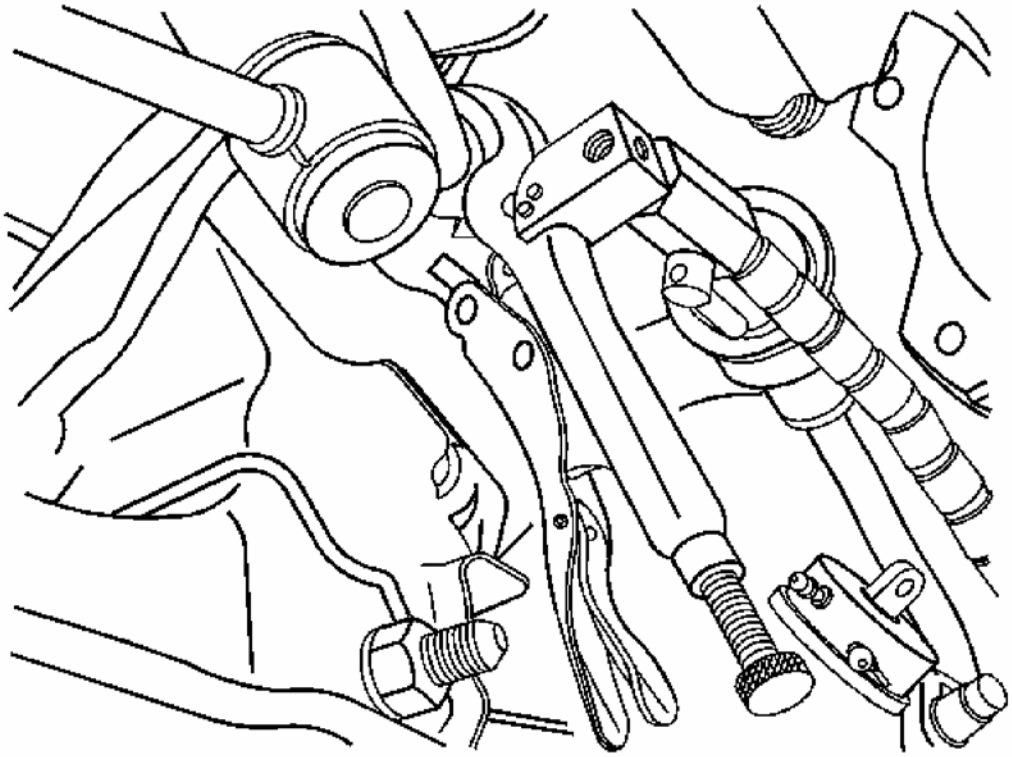

Fig. 9: Installing Dial Indicator Between Outer Tie Rod & Relay Rod (Right Side)
Courtesy of GENERAL MOTORS CORP.

4. Install the dial indicator between the outer tie rod end and relay rod as shown and push inward to remove the lash slowly with one hand.

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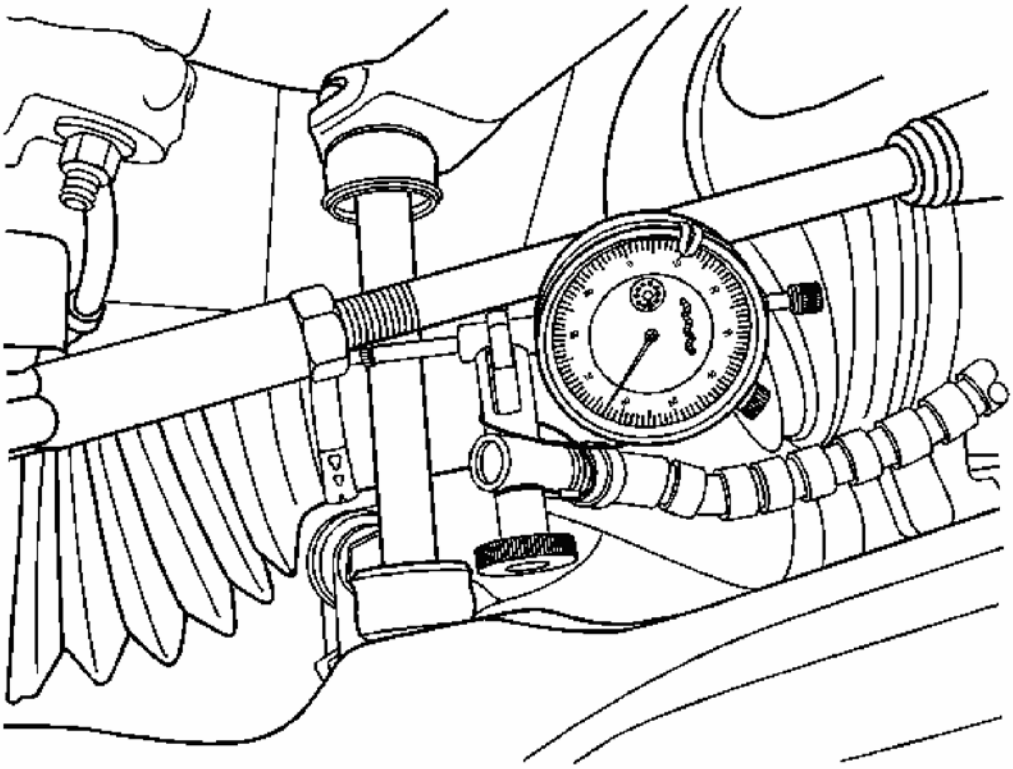

Fig. 10: Placing Dial Indicator At Zero (Right Side)
Courtesy of GENERAL MOTORS CORP.

5. Place the dial indicator at zero, pull outward and note amount of movement in the joint.

   Movement should not exceed 1.0 mm.

STEERING LINKAGE INSPECTION (IDLER ARM INSPECTION)

Tools Required

- **J 35999** Spring Scale. See **Special Tools and Equipment**.
- **J 42640** Steering Column Anti-Rotation Pin
- **J 45101** Hub and Wheel Runout Gage

Idler Arm Inspection Procedure

1. Raise the vehicle on a hoist. Support the vehicle with jackstands. Refer to **Lifting and Jacking the Vehicle** .

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2. Remove the engine protection shield. Refer to **Engine Protection Shield Replacement** .

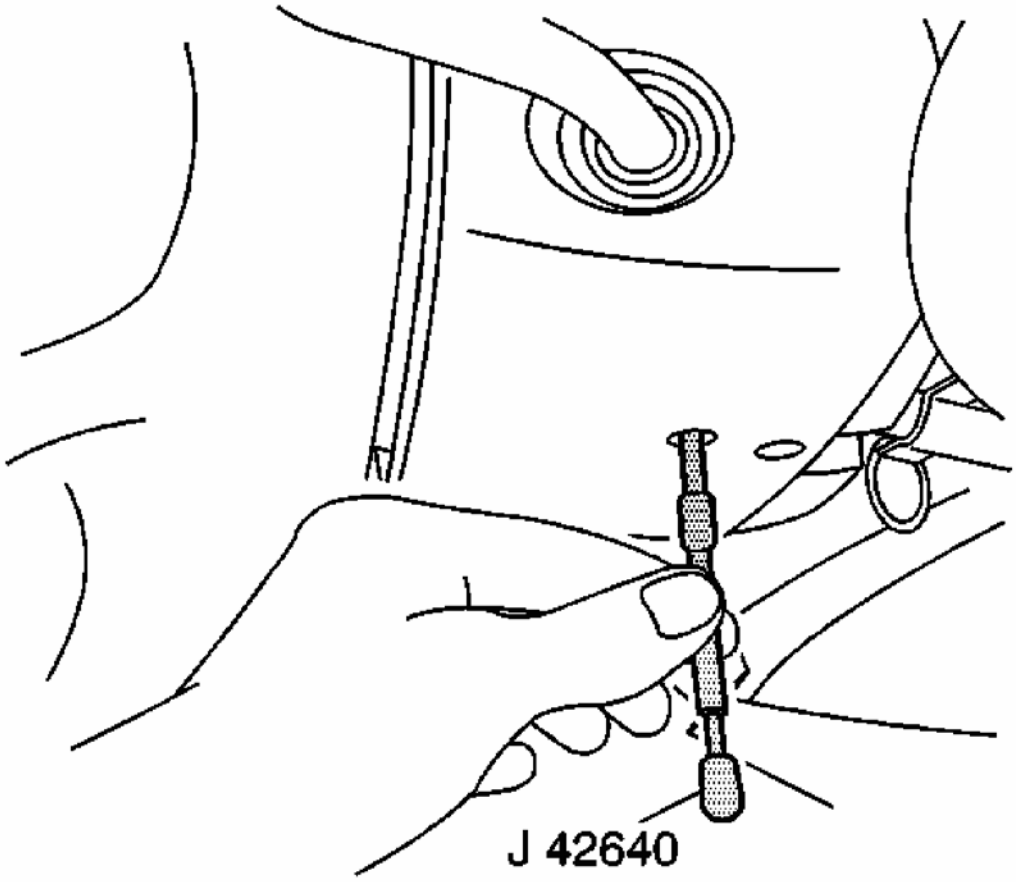

Fig. 11: Identifying J 42640
Courtesy of GENERAL MOTORS CORP.

NOTE: The wheels of the vehicle must be straight ahead and the steering column in the LOCK position before disconnecting the steering column or intermediate shaft from the steering gear. Failure to do so will cause the SIR coil assembly to become uncentered, which may cause damage to the coil assembly.

3. Position the wheels in a straight-ahead position and install the **J 42640** .
4. Install the dial indicator **J 45101** between the idler arm and vehicle frame.

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Ensure the gage is at zero before taking a measurement.

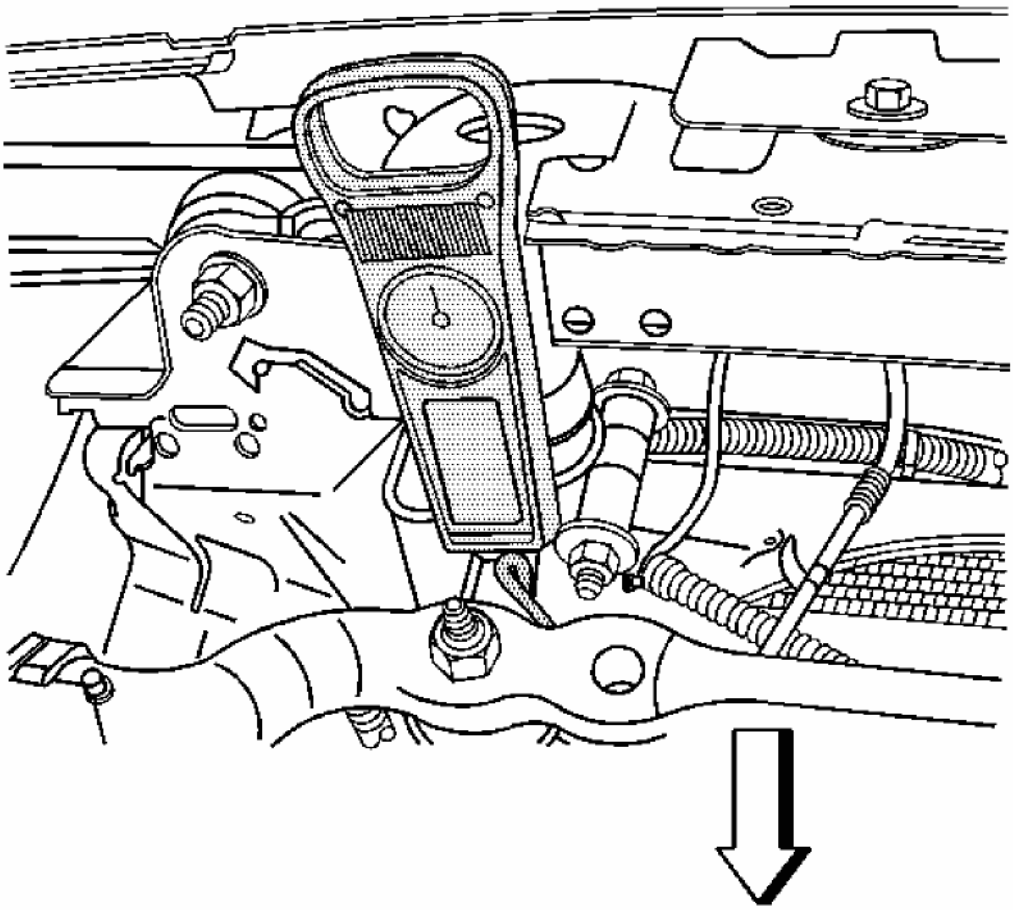

Fig. 12: Placing J 35999 Near Relay Rod End Of Idler Arm
Courtesy of GENERAL MOTORS CORP.

5. Place a **J 35999** near the relay rod end of the idler arm. See **Special Tools and Equipment**.

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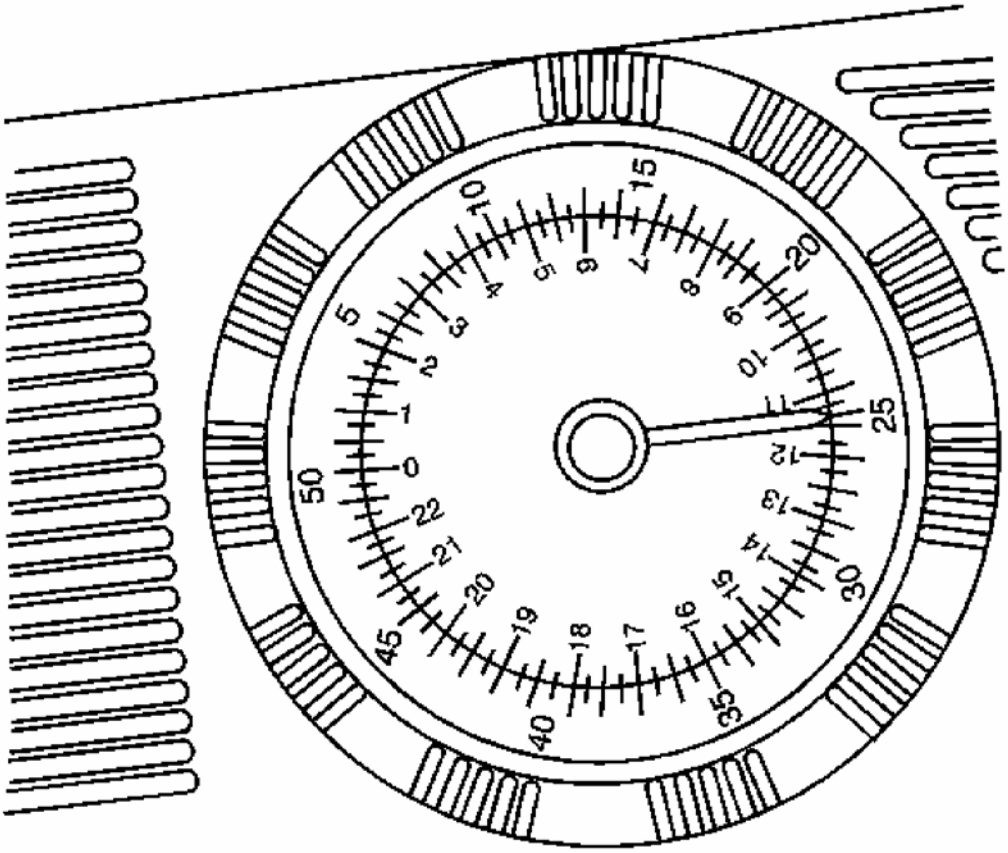

Fig. 13: Measuring Total Distance Arm Moves
Courtesy of GENERAL MOTORS CORP.

6. Exert a 110 N.m (25 lb) force upward, and then downward while measuring the total distance the arm moves.

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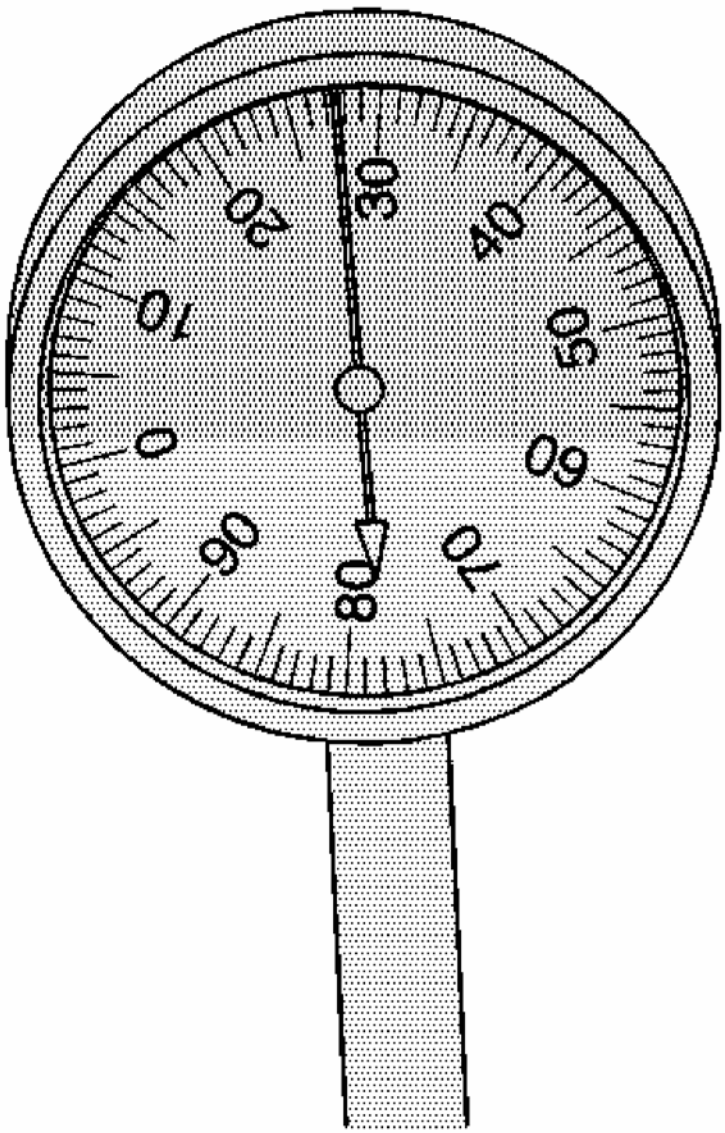

Fig. 14: View Of Gage
Courtesy of GENERAL MOTORS CORP.

7. If movement exceeds 2 mm (0.078 in) replace the idler arm.

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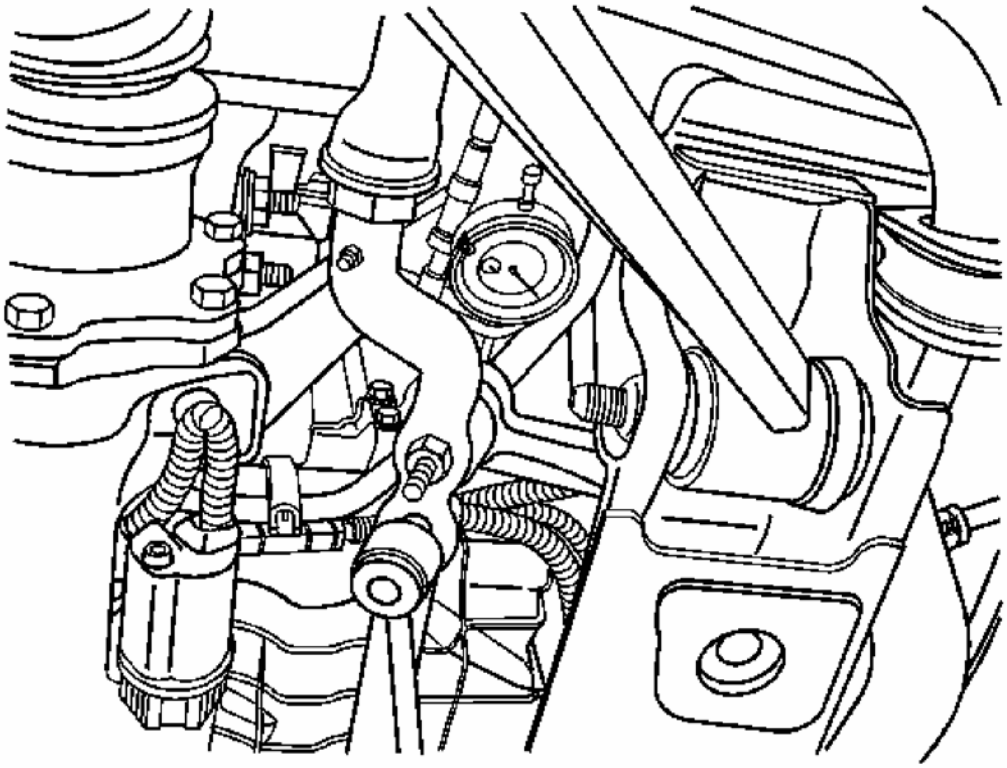

Fig. 15: Installing Dial Indicator At Idler Arm
Courtesy of GENERAL MOTORS CORP.

8. Install the dial indicator at the idler arm.
9. Push the tire inward slowly with one hand to remove any lash.

   Zero out the dial indicator and pull outward in order to take a reading.

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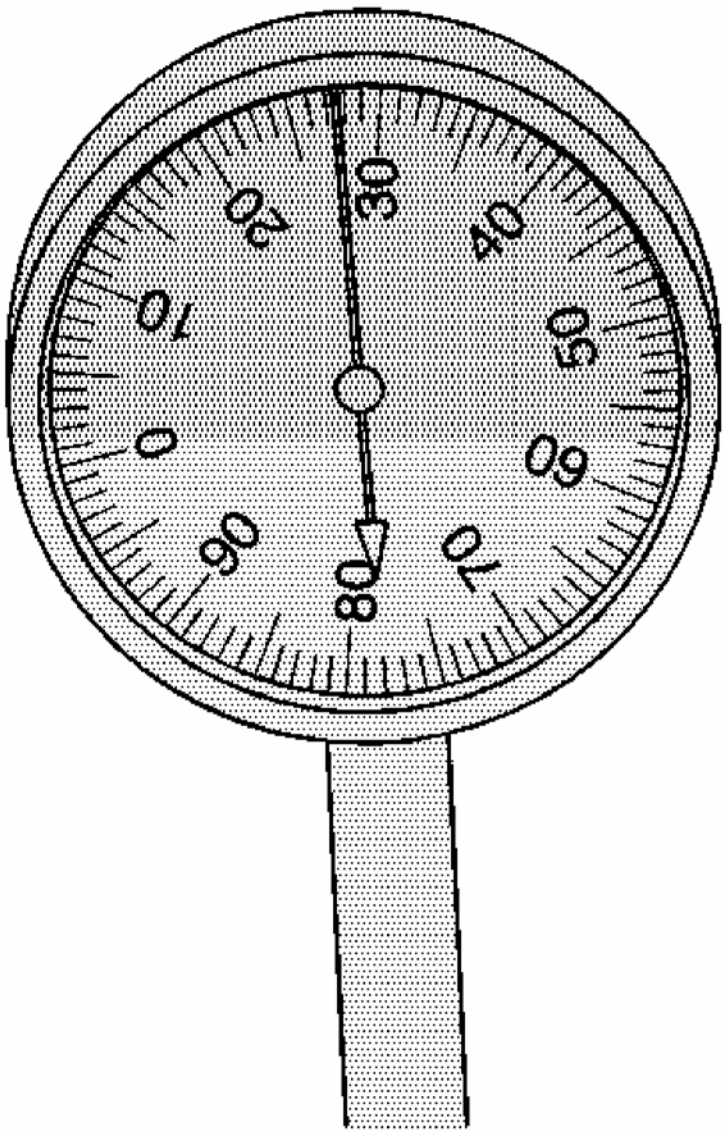

Fig. 16: View Of Gage
Courtesy of GENERAL MOTORS CORP.

10. Allow only 1 mm (0.039 in) of movement at the idler arm ball stud.

    If more than 1 mm exists, replace the idler arm.

11. Install the engine protection shield. Refer to **Engine Protection Shield Replacement** .
12. Lower the vehicle.

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TIE ROD REPLACEMENT

Tools Required

- **J 24319-B** Universal Steering Linkage Puller
- **J 29194** Steering Linkage Installer-14 mm. See **Special Tools and Equipment**.

Removal Procedure

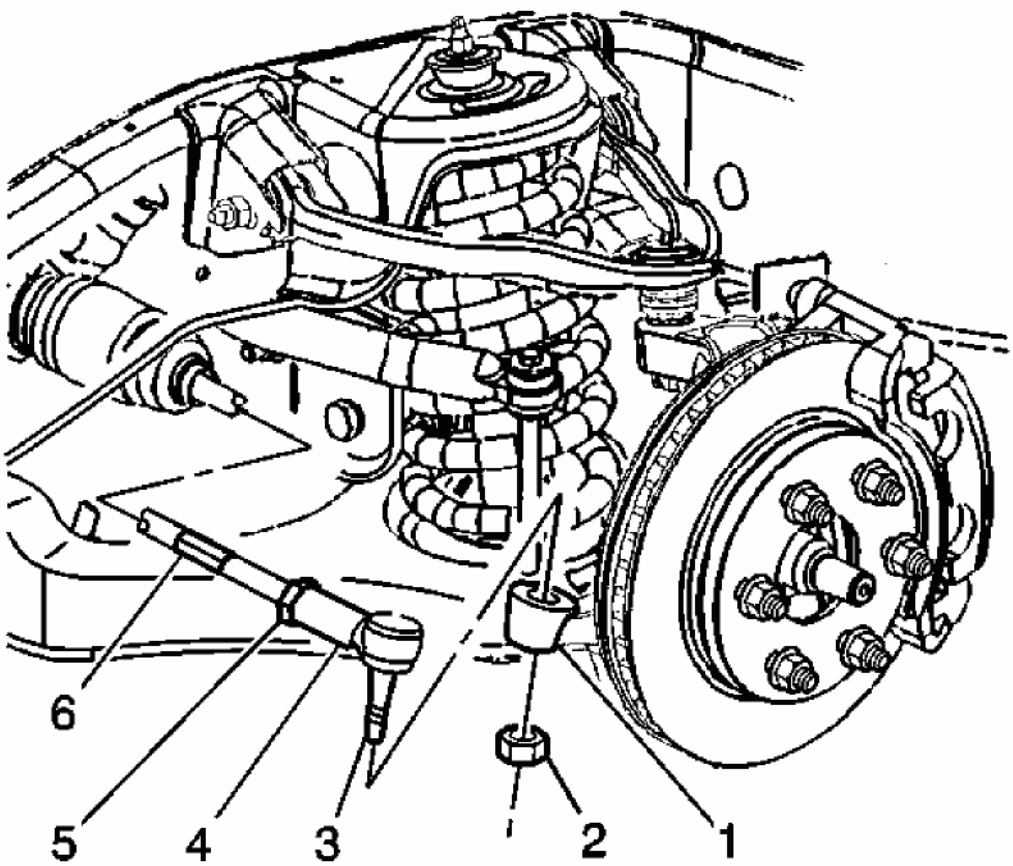

Fig. 17: View Of Outer Tie Rod Ball Stud, Prevailing Torque Nut, Steering Knuckle & Shaft
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT: Use the J 24319-B in order to separate all the tie rods and ball joints.

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2. Remove the nut (2) from the outer tie rod ball stud (3).

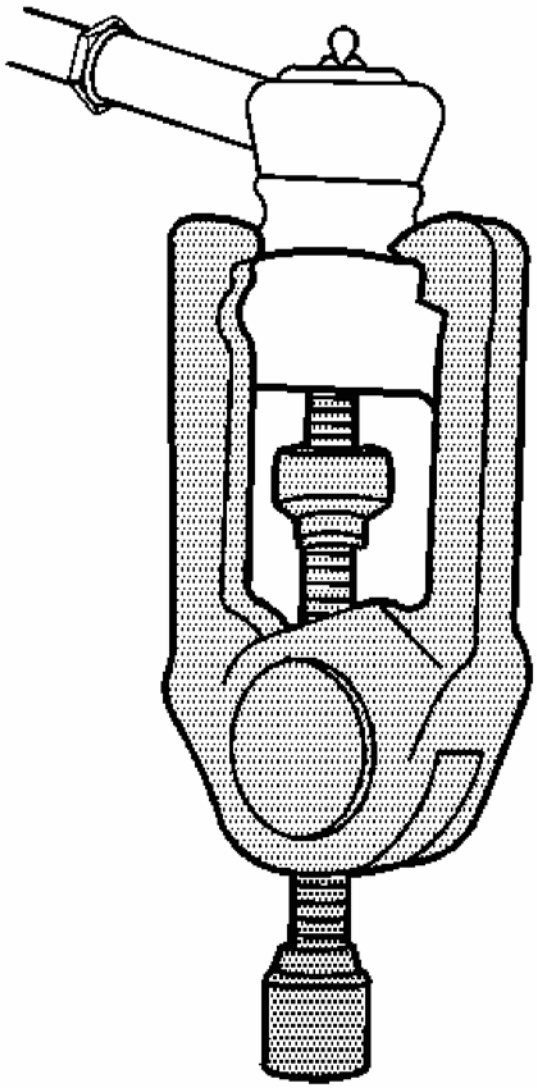

Fig. 18: Removing Outer Tie Rod Assembly From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

3. Use the **J 24319-B** in order to remove the outer tie rod ball stud from the steering knuckle.

IMPORTANT: Do not reuse the nut.

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4. Remove the tie rod end from the shaft by loosening the jam nut.
5. Remove the outer tie rod end from the relay rod.

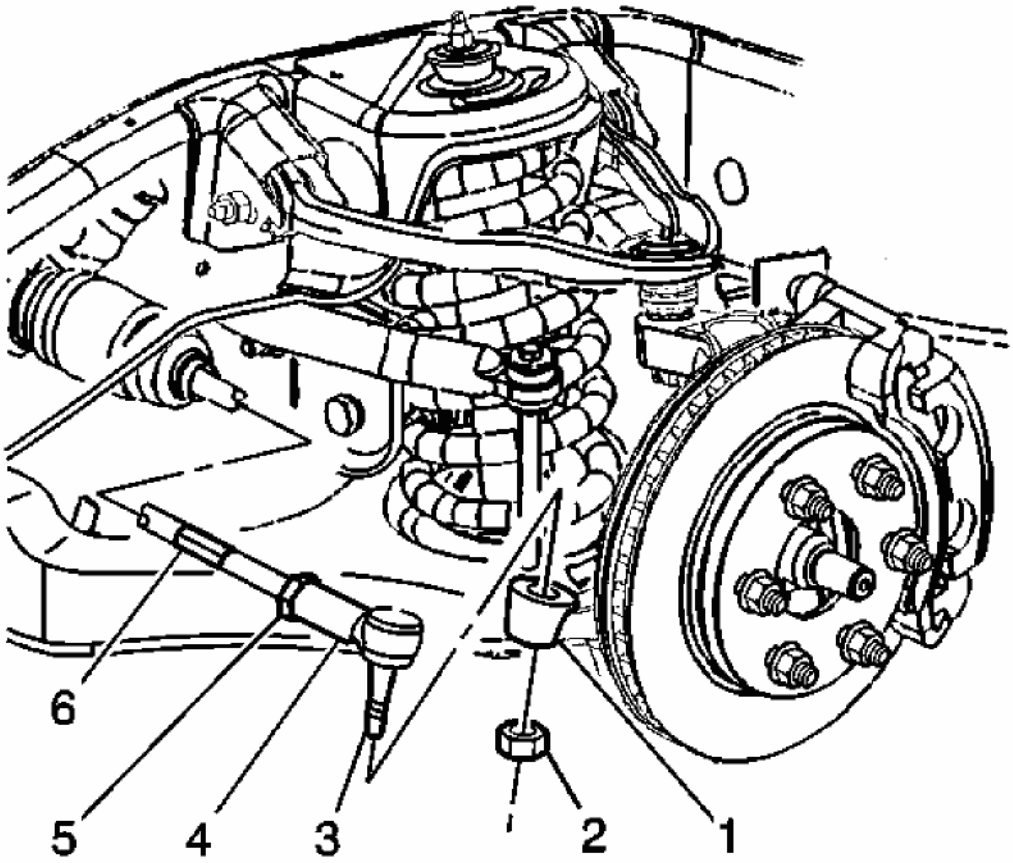

Fig. 19: View Of Outer Tie Rod Ball Stud, Prevailing Torque Nut, Steering Knuckle & Shaft
Courtesy of GENERAL MOTORS CORP.

6. Inspect the shaft (6) for bent or damaged threads.
7. Clean the tapered surface of the steering knuckle (1).

Installation Procedure

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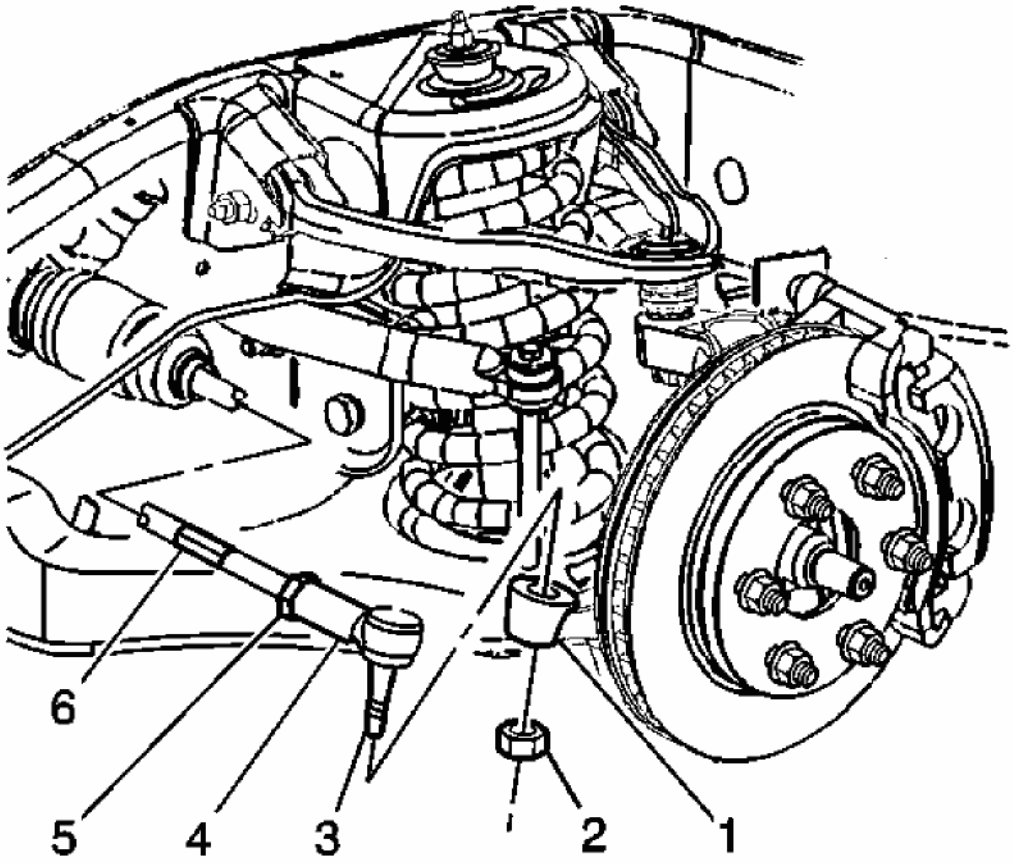

Fig. 20: View Of Outer Tie Rod Ball Stud, Prevailing Torque Nut, Steering Knuckle & Shaft
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the tie rod threads with chassis lubricant. Refer to **Fluid and Lubricant Recommendations** in Maintenance and Lubrication.
2. Install the tie rod end (4) to the shaft (6).
3. Install the outer tie rod ball stud (3) to the steering knuckle (1).

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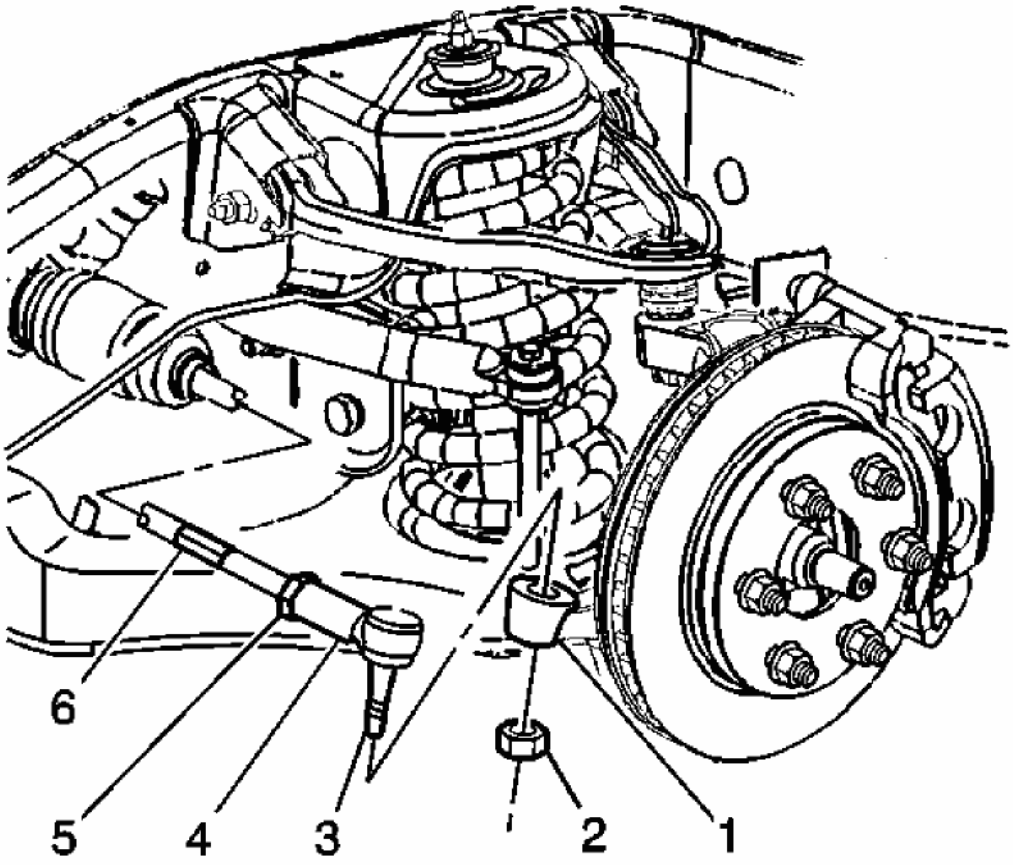

Fig. 21: View Of Outer Tie Rod Ball Stud, Prevailing Torque Nut, Steering Knuckle & Shaft
Courtesy of GENERAL MOTORS CORP.

4. Install the new prevailing torque nut (2) to the outer tie rod ball stud (3).

   Tighten:
   - Tighten the nut to 50 N.m (37 lb ft) for 15 series vehicles.
   - Tighten the nut to 65 N.m (48 lb ft) for 25/35 series vehicles.

5. Adjust the front toe. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

TIE ROD REPLACEMENT - INNER

Tools Required

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J 34028 Inner Tie Rod Wrench. See **Special Tools and Equipment**.

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the engine protection shield, if equipped. Refer to **Engine Protection Shield Replacement** in Frame and Underbody.
3. Remove the outer tie rod end. Refer to **Tie Rod Replacement**.

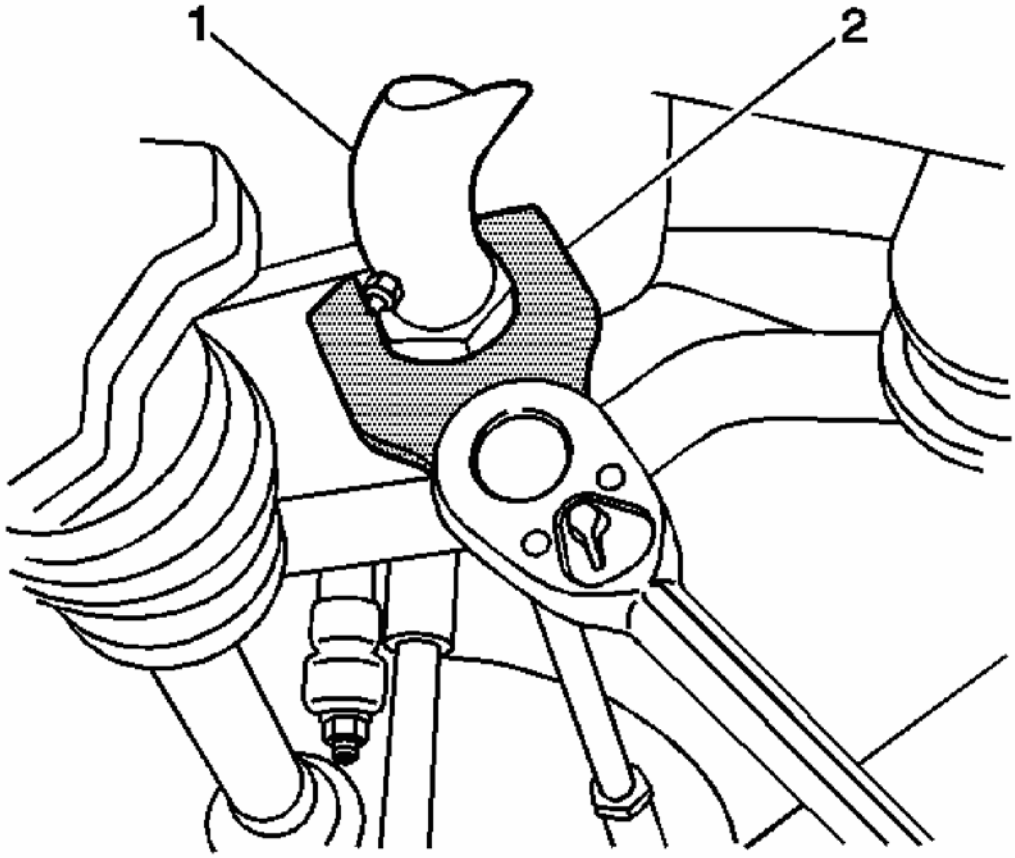

Fig. 22: View Of Inner Tie Rod End Using J 34028
Courtesy of GENERAL MOTORS CORP.

4. Remove the inner tie rod end using the **J 34028** (2). See **Special Tools and Equipment**.

Installation Procedure

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IMPORTANT: Perform the following procedure before installing the new tie rod ends:

1. Remove all traces of the oil, grease, or other contaminants.
2. Clean the threads of the tie rod with denatured alcohol or the equivalent and allow to dry.
3. Apply red LOCTITE Threadlocker, GM P/N 12345493 (Canadian P/N 10953488) to the threads of the inner tie rod.

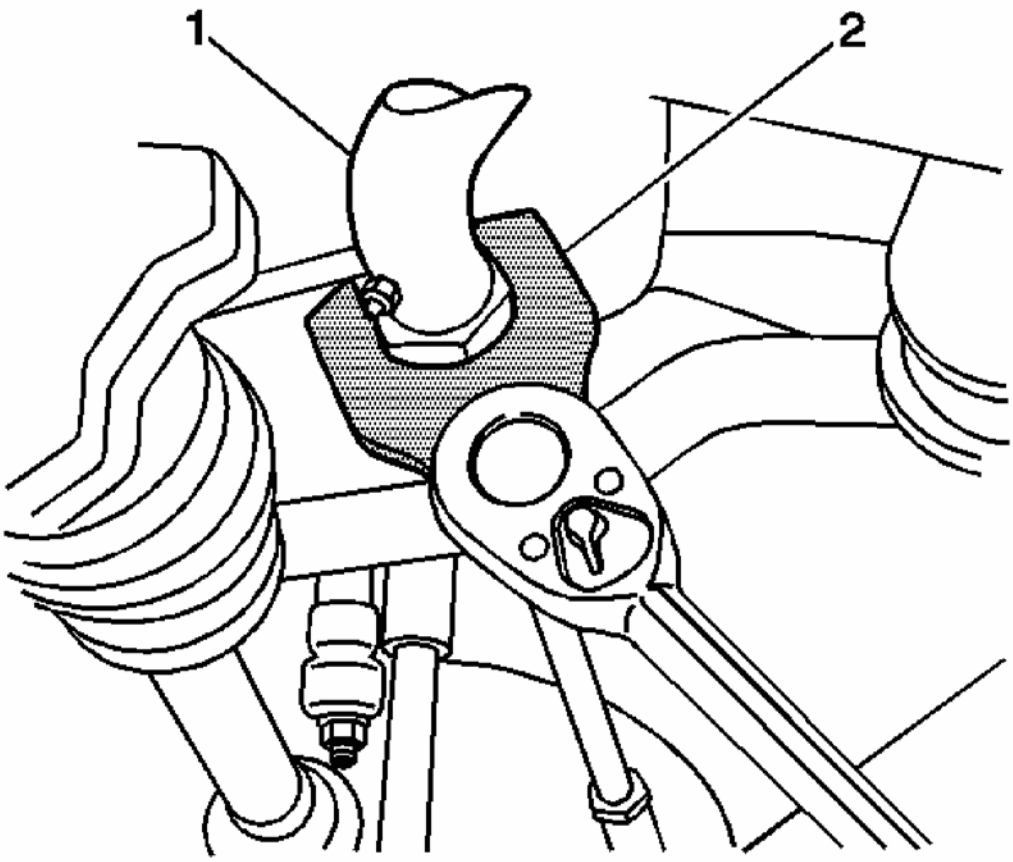

Fig. 23: View Of Inner Tie Rod End Using J 34028
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the inner tie rod to the relay rod.

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Tighten: Using the **J 34028** (2) tighten the tie rod to 100 N.m (74 lb ft). See **Special Tools and Equipment**.

5. Install the outer tie rod end. Refer to **Tie Rod Replacement**.
6. Install the engine protection shield, if equipped. Refer to **Engine Protection Shield Replacement** in Frame and Underbody.
7. Lower the vehicle.
8. Verify the wheel alignment. Refer to **Wheel Alignment Specifications** in Wheel Alignment.

IDLER ARM REPLACEMENT

Tools Required

- **J 24319-B** Universal Steering Linkage Puller
- **J 29193** Steering Linkage Installer (12 mm). See **Special Tools and Equipment**.
- **J 29194** Steering Linkage Installer (14 mm). See **Special Tools and Equipment**.

Removal Procedure

NOTE: Do not attempt to free the ball stud by using a pickle fork or wedge type tool, because seal or bushing damage could result. Use the proper tool to separate all ball joints.

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

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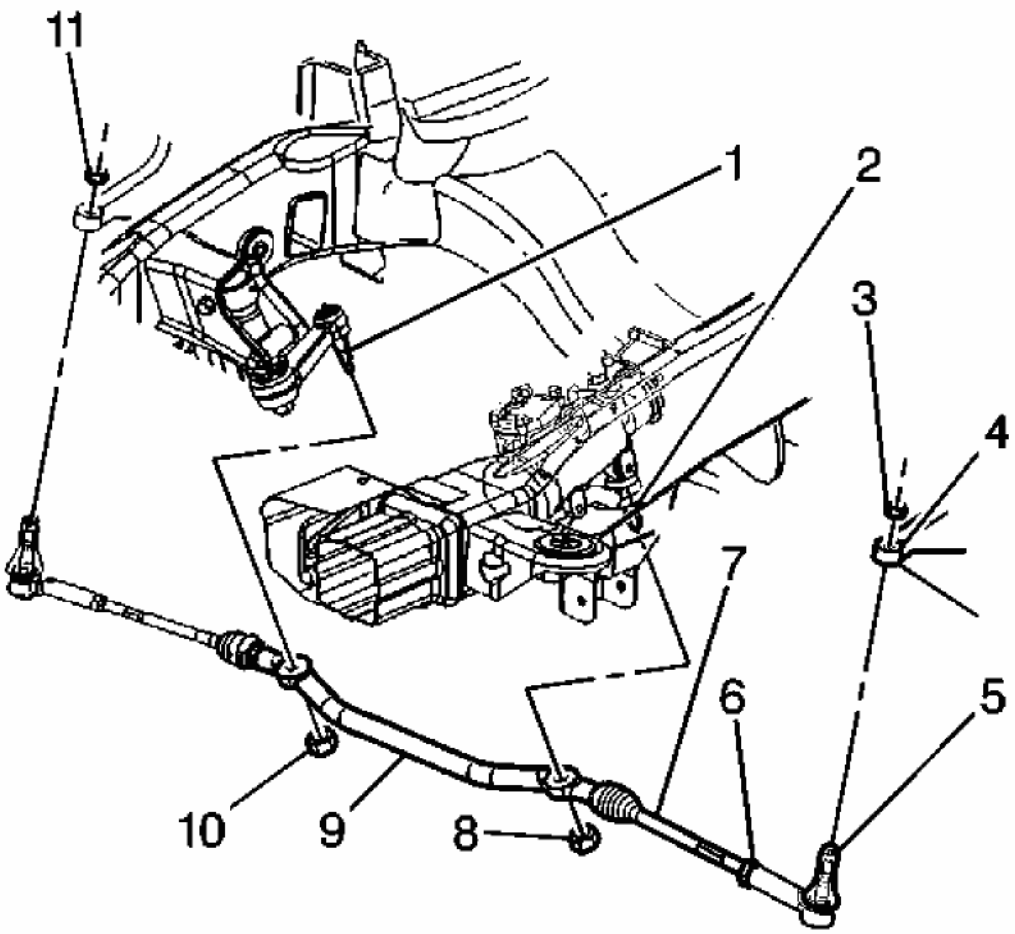

Fig. 24: View Of Relay Rod, Idler Arm Ball Stud, Tie Rod Ends, Pitman Arm Ball Stud & Components
Courtesy of GENERAL MOTORS CORP.

2. Remove the engine protection shield, if equipped. Refer to **Engine Protection Shield Replacement** in Frame and Underbody.
3. Remove the idler arm ball stud nut (10).

   Do not reuse the idler arm ball stud nut.

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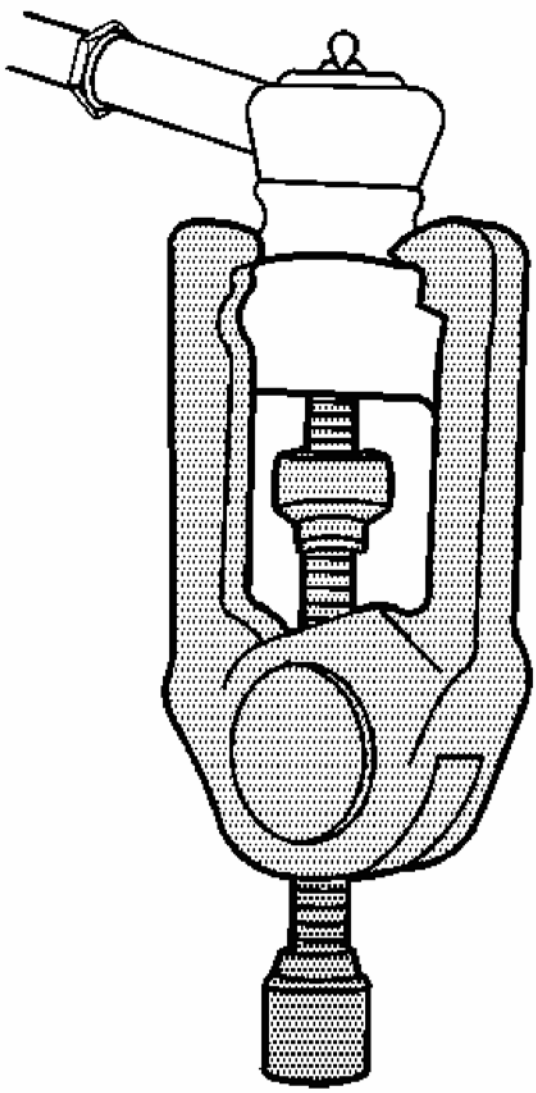

Fig. 25: Removing Outer Tie Rod Assembly From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

4. Remove the idler arm from the relay rod using the **J 24319-B** .

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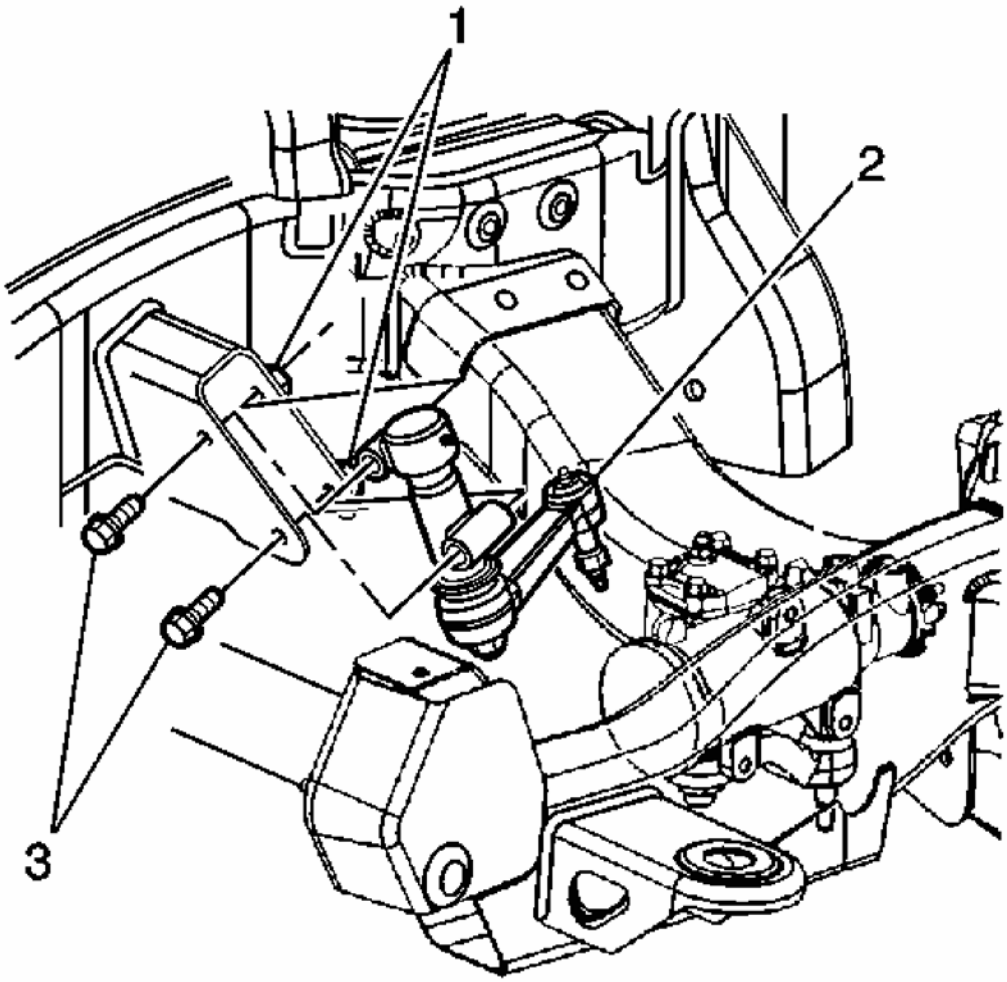

Fig. 26: View Of Idler Arm, Frame Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

5. Remove the idler arm frame bolts (3) and the nuts (1).
6. Remove the idler arm (2) from the vehicle.

Installation Procedure

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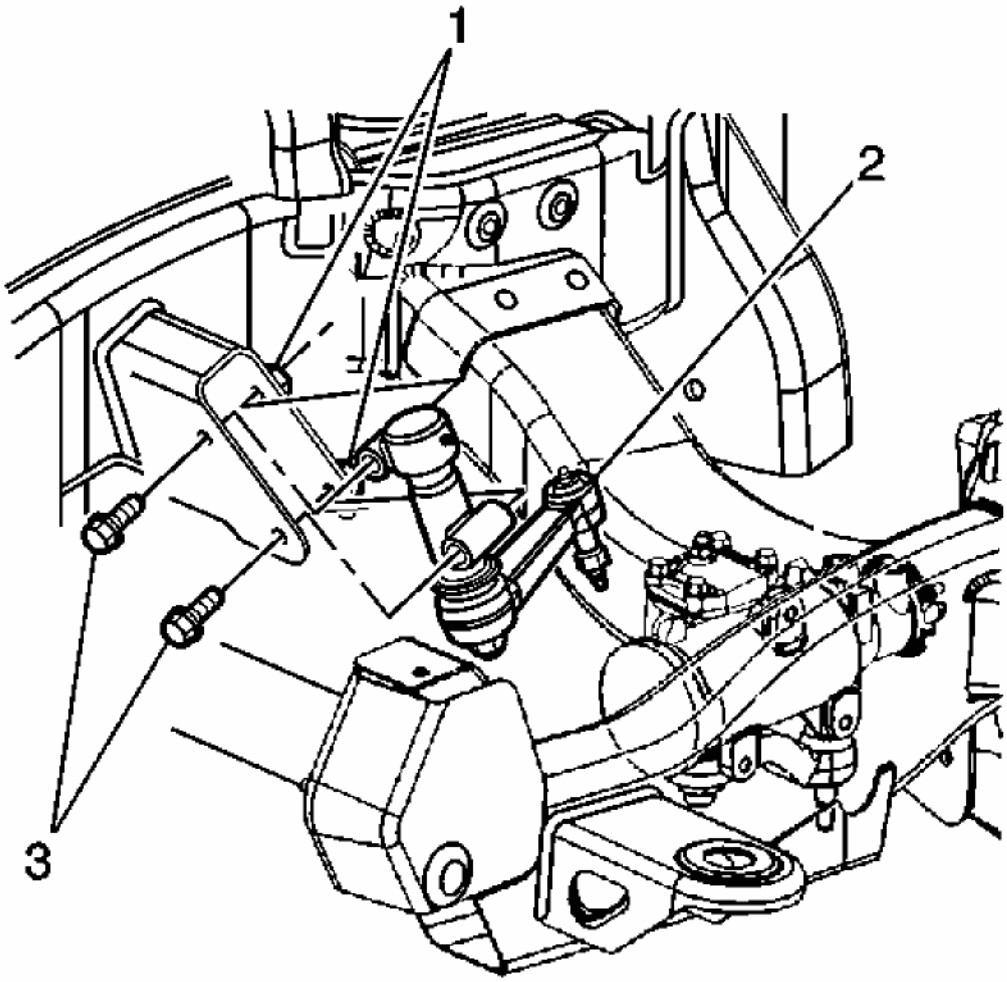

Fig. 27: View Of Idler Arm, Frame Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

1. Position the idler arm (2) on the frame.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the frame bolts (3) and the nuts (1) to the idler arm.

Tighten: Tighten the frame bolts or nuts to 99 N.m (73 lb ft).

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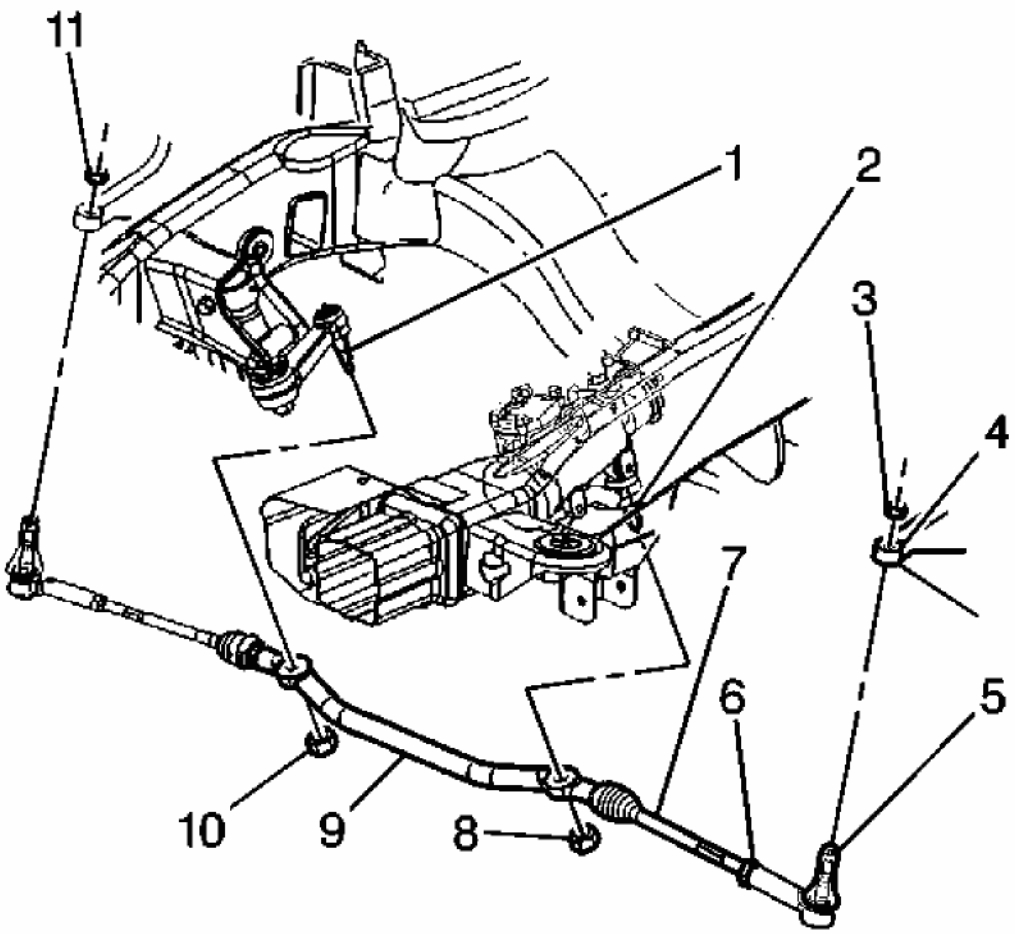

Fig. 28: View Of Relay Rod, Idler Arm Ball Stud, Tie Rod Ends, Pitman Arm Ball Stud & Components
Courtesy of GENERAL MOTORS CORP.

3. Install the relay rod (9) to the idler arm ball stud (1).

   Ensure the seal is on the stud.

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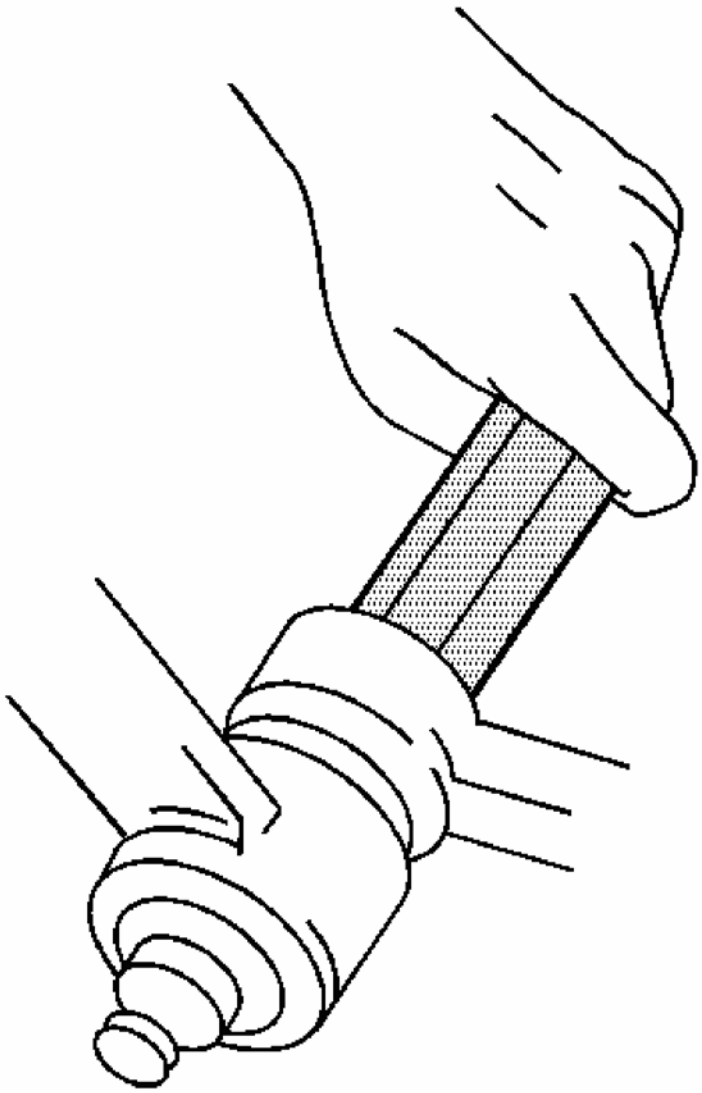

Fig. 29: Seating The Idler Arm Tapers
Courtesy of GENERAL MOTORS CORP.

4. Use the **J 29193** in order to seat the tapers. See **Special Tools and Equipment**.

   Tighten: Tighten the **J 29193** or the **J 29194** to 54 N.m (40 lb ft) in order to seat the tapers. See **Special Tools and Equipment**.

5. Install the new idler arm ball stud prevailing torque nut to the idler arm ball stud.

   Tighten: Tighten the nut to 62 N.m (46 lb ft).

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6. Install the engine protection shield, if equipped. Refer to **Engine Protection Shield Replacement** in Frame and Underbody.
7. Lower the vehicle.
8. Check the wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

RELAY ROD REPLACEMENT

Tools Required

- **J 24319-B** Universal Steering Linkage Puller
- **J 29193** Steering Linkage Installer (12 mm). See **Special Tools and Equipment**.
- **J 29194** Steering Linkage Installer (14 mm). See **Special Tools and Equipment**.

Removal Procedure

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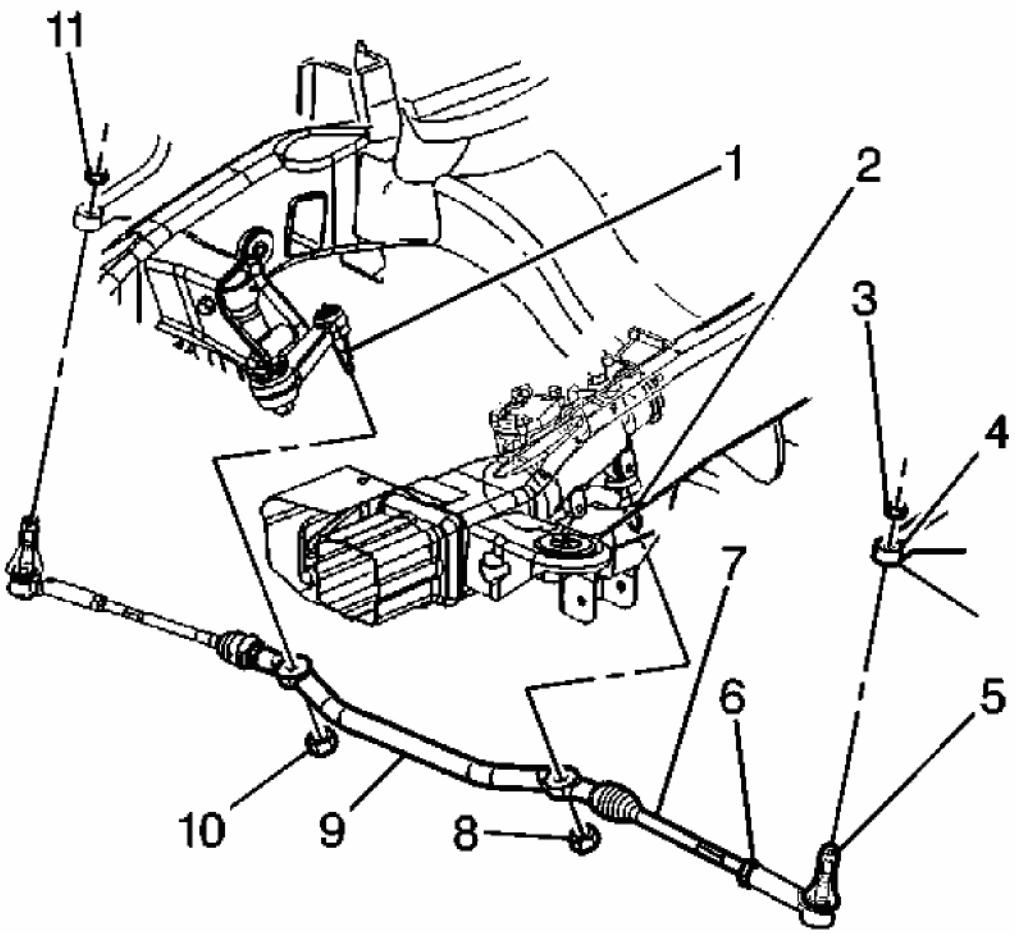

Fig. 30: View Of Relay Rod, Idler Arm Ball Stud, Tie Rod Ends, Pitman Arm Ball Stud & Components
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the engine protection shield, if equipped. Refer to **Engine Protection Shield Replacement** in Frame and Underbody.
3. Remove the steering damper from the relay rod, if equipped. Refer to **Steering Damper Replacement**.

IMPORTANT: Use the proper tool in order to separate all the tie rod and the ball joints.

4. Remove the tie rod ends (6). Refer to **Tie Rod Replacement**.

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5. Remove the idler arm ball stud nut (10).

   Do not reuse the nut.

6. Remove the pitman arm nut (8).

   Do not reuse the nut.

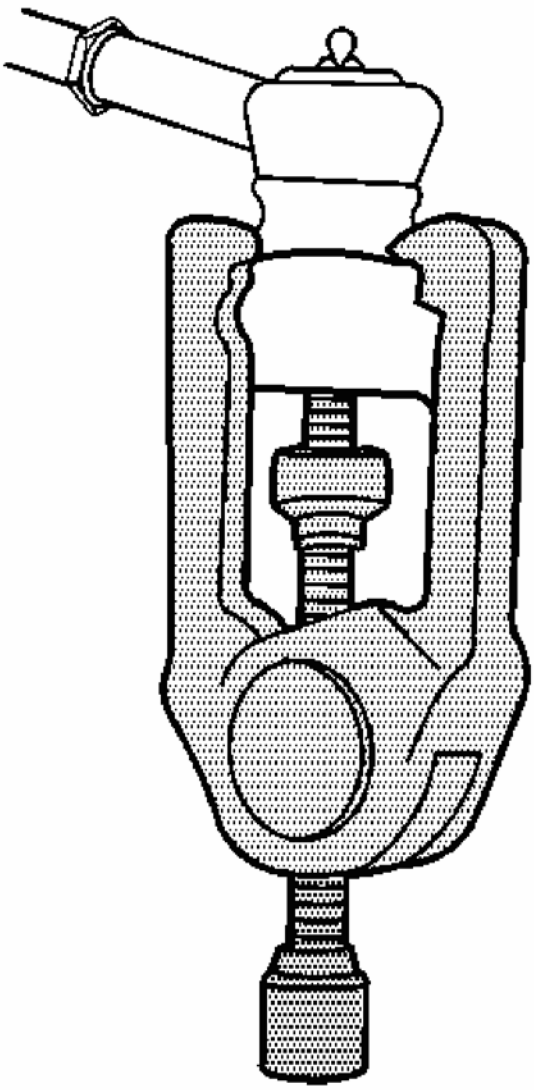

Fig. 31: Removing Outer Tie Rod Assembly From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

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7. Remove the relay rod from the idler arm ball stud using the **J 24319-B** .
8. Remove the relay rod from the pitman arm ball stud using the **J 24319-B** .
9. Remove the relay rod from the vehicle.
10. Inspect the threads on the tie rod ends for damage.
11. Inspect the ball stud threads for damage.
12. Inspect the ball stud seals for excessive damage.
13. Clean the threads on the ball studs.

Installation Procedure

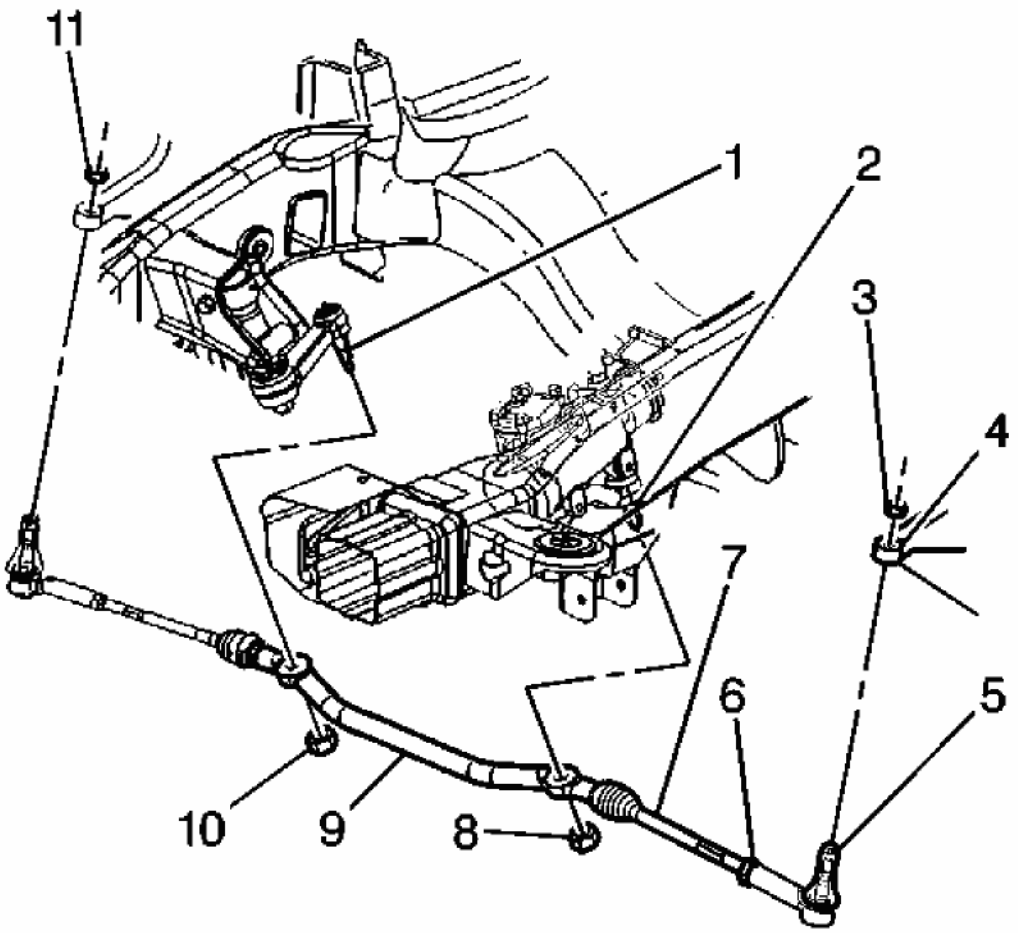

Fig. 32: View Of Relay Rod, Idler Arm Ball Stud, Tie Rod Ends, Pitman Arm Ball Stud & Components
Courtesy of GENERAL MOTORS CORP.

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1. Install the relay rod (9) to the vehicle.
2. Install the relay rod (9) to the pitman arm ball stud (2).
3. Install the relay rod (9) to the idler arm ball stud (1).
4. Ensure the seal is on the stud.

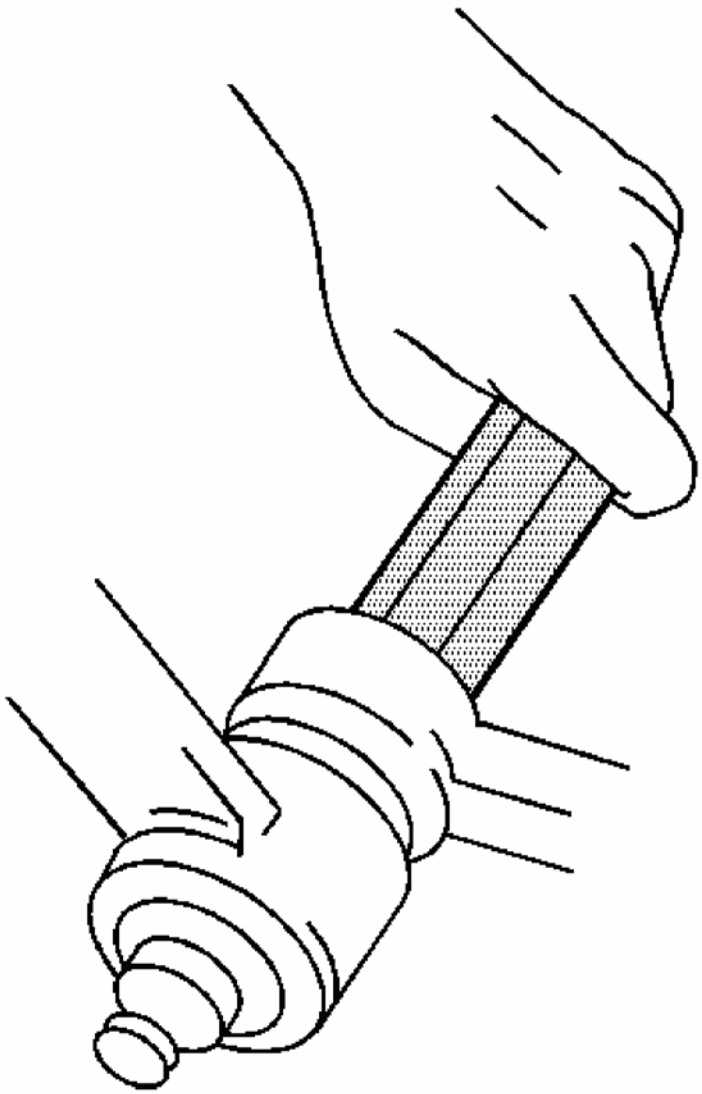

Fig. 33: Seating The Idler Arm Tapers
Courtesy of GENERAL MOTORS CORP.

5. Install the **J 29193** or the **J 29194** . See **Special Tools and Equipment**.

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NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Tighten the steering linkage installer in order to seat the tapers.

   Tighten: Tighten the steering linkage installer to 54 N.m (40 lb ft).

7. Remove the **J 29193** or the **J 29194** . See **Special Tools and Equipment**.
8. Install the new pitman arm prevailing torque nut.
9. Install the new idler arm prevailing torque nut.

   Tighten: Tighten the nuts to 62 N.m (46 lb ft).

10. Install the tie rod ends. Refer to **Tie Rod Replacement**.
11. Install the steering damper to the relay rod, if equipped. Refer to **Steering Damper Replacement**.
12. Install the engine protection shield, if equipped. Refer to **Engine Protection Shield Replacement** in Frame and Underbody.
13. Lower the vehicle.
14. Check the wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

STEERING DAMPER REPLACEMENT

Tools Required

- **J 24319-B** Universal Steering Linkage Puller
- **J 29193** Steering Linkage Installer-12 mm. See **Special Tools and Equipment**.

Removal Procedure

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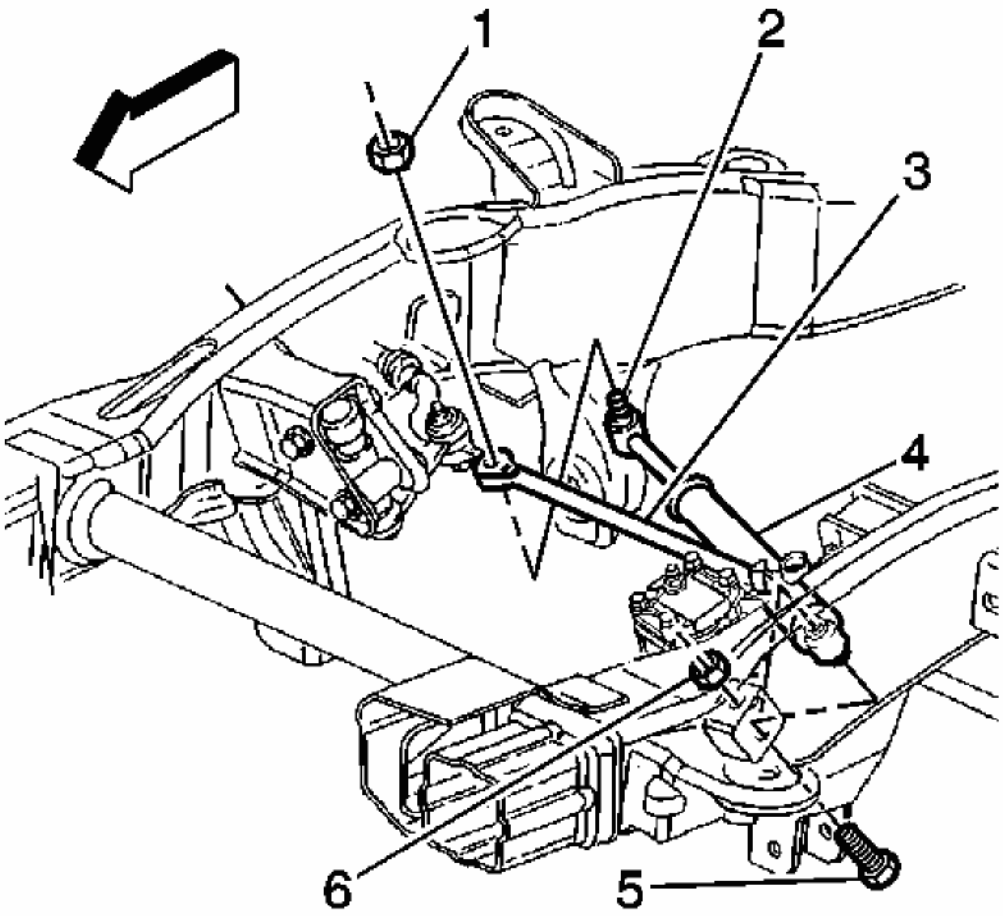

Fig. 34: View Of Steering Damper Components
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Support the vehicle with safety stands. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the engine protection shield, if equipped. Refer to **Engine Protection Shield Replacement** in Frame and Underbody.

IMPORTANT: Do not reuse the nut.

3. Remove the steering damper (2) ball stud nut (1).

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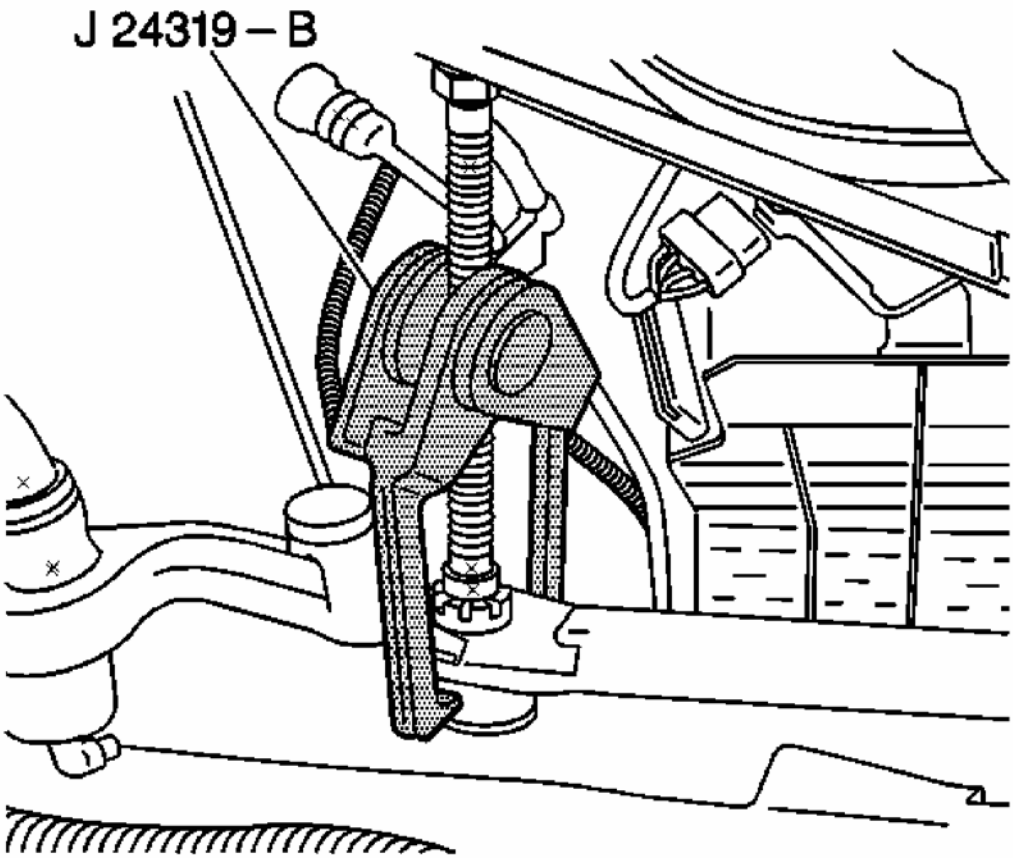

Fig. 35: Removing Steering Damper Ball Stud Using J 24319-B
Courtesy of GENERAL MOTORS CORP.

4. Remove the steering damper ball stud from the relay rod using the **J 24319-B** .

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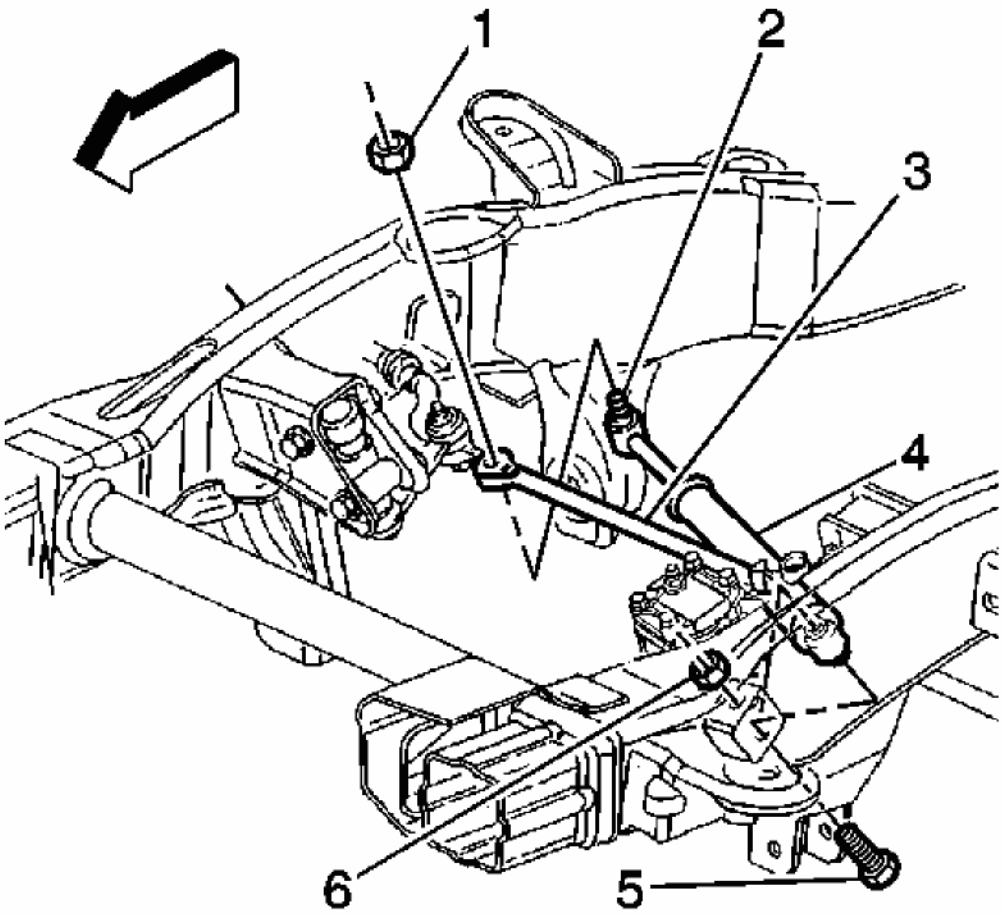

Fig. 36: View Of Steering Damper Components
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not reuse the nut.

5. Remove the steering damper mounting bolt (5) and the nut (6).
6. Remove the steering damper (4) from the vehicle.
7. Inspect the following parts:
   - The steering damper for leaks and damage
   - The mounting bolts and the nuts for damage or corrosion

Installation Procedure

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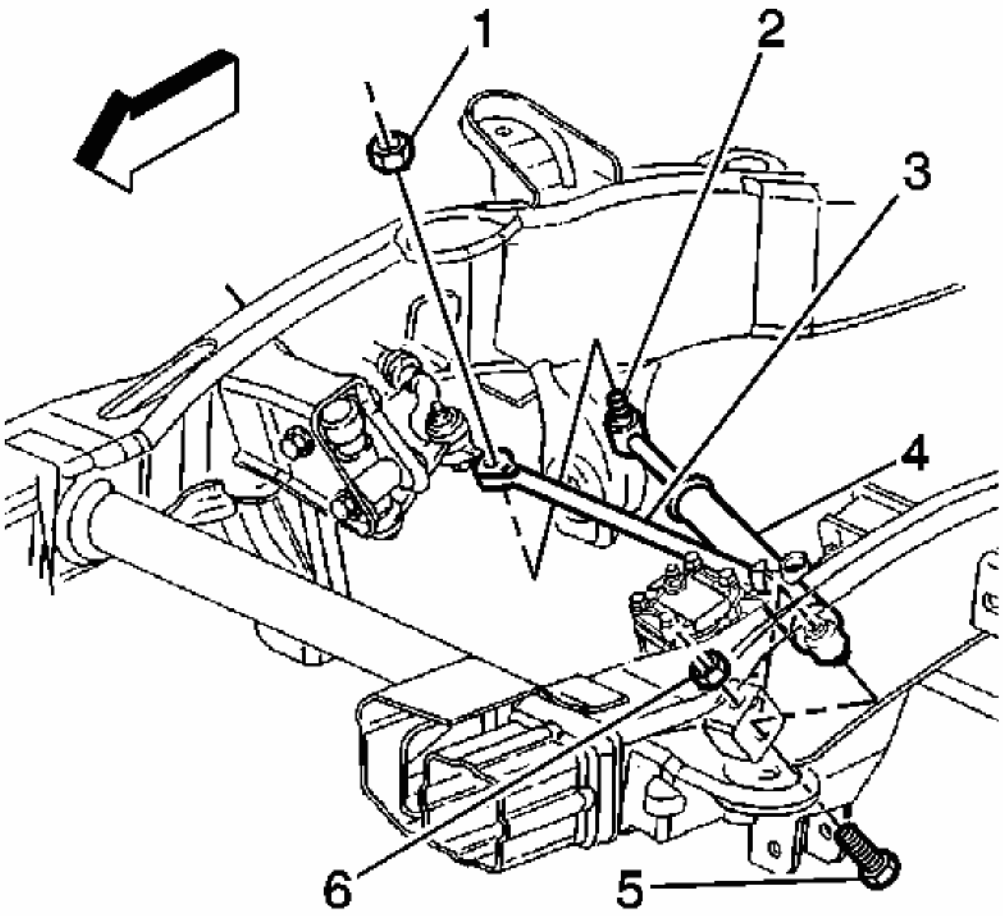

Fig. 37: View Of Steering Damper Components
Courtesy of GENERAL MOTORS CORP.

1. Install the steering damper (4).
2. Install the mounting bolt (5) and a new prevailing torque nut (6).
3. Install the steering damper ball stud (2) to the relay rod (3).

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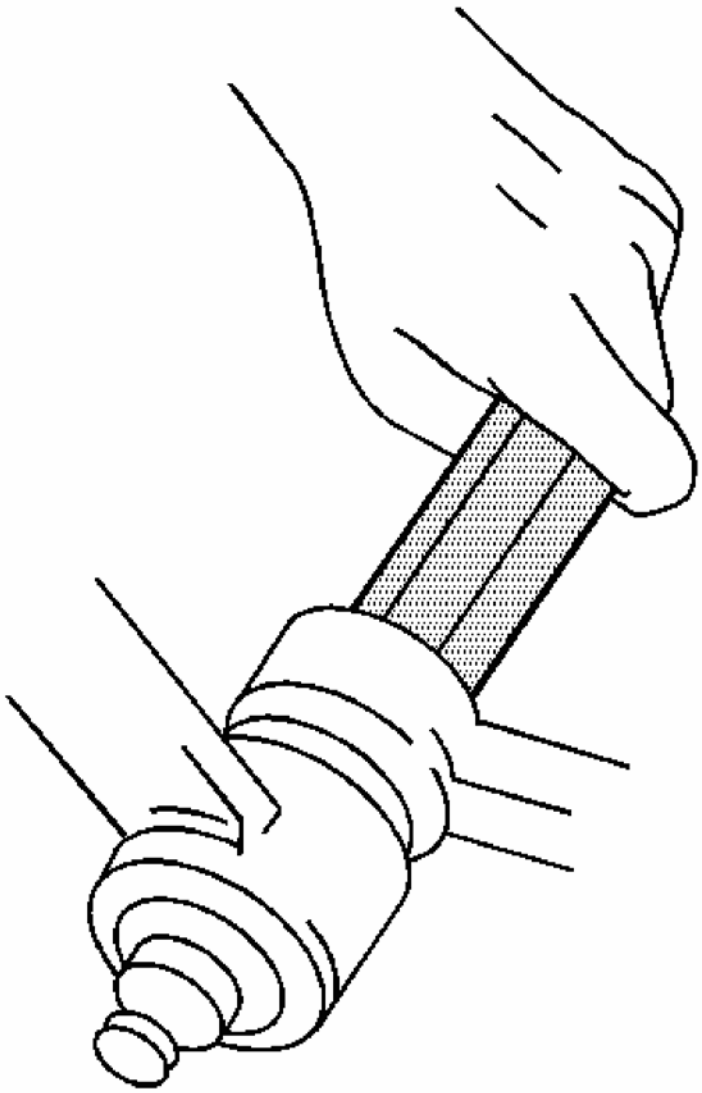

Fig. 38: Seating The Idler Arm Tapers
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the **J 29193** . See **Special Tools and Equipment**.
5. Tighten the steering linkage installer in order to seat the ball stud in the relay rod.

Tighten: Tighten the installer to 54 N.m (40 lb ft).

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6. Remove the **J 29193** . See **Special Tools and Equipment**.
7. Install the prevailing torque nuts.

   Tighten: Tighten the steering damper mounting nut to 40 N.m (30 lb ft).

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

8. Install the engine protection shield, if equipped. Refer to **Engine Protection Shield Replacement** in Frame and Underbody.
9. Lower the vehicle.

PITMAN ARM REPLACEMENT

Tools Required

- **J 6632-01** Pitman Arm Puller
- **J 29107-A** Pitman Arm Puller

Removal Procedure

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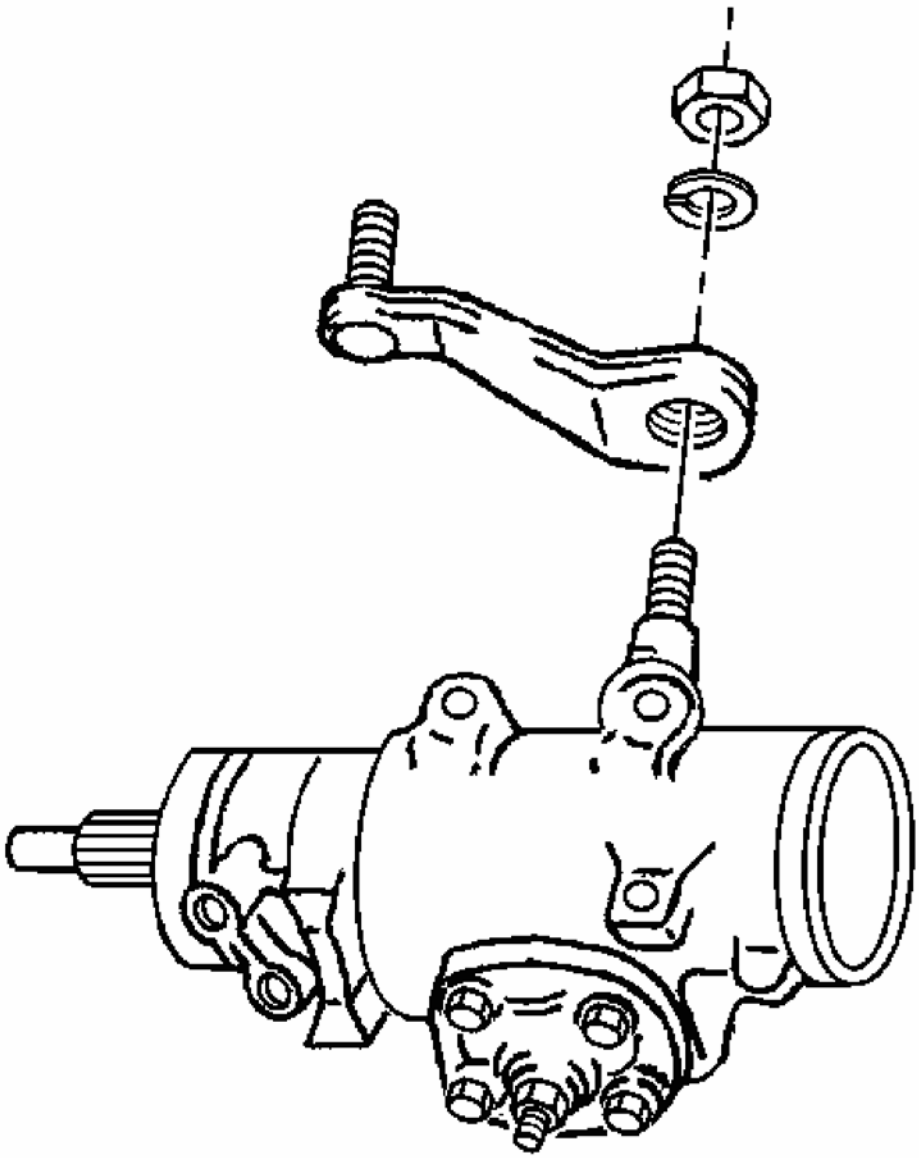

Fig. 39: View Of Pitman Arm, Power Steering Gear, Washer & Nut
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitable support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the power steering gear. Refer to **Power Steering Gear Replacement** in Power Steering System.
3. Install the power steering gear into a vise.

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4. Remove the pitman arm nut and washer.

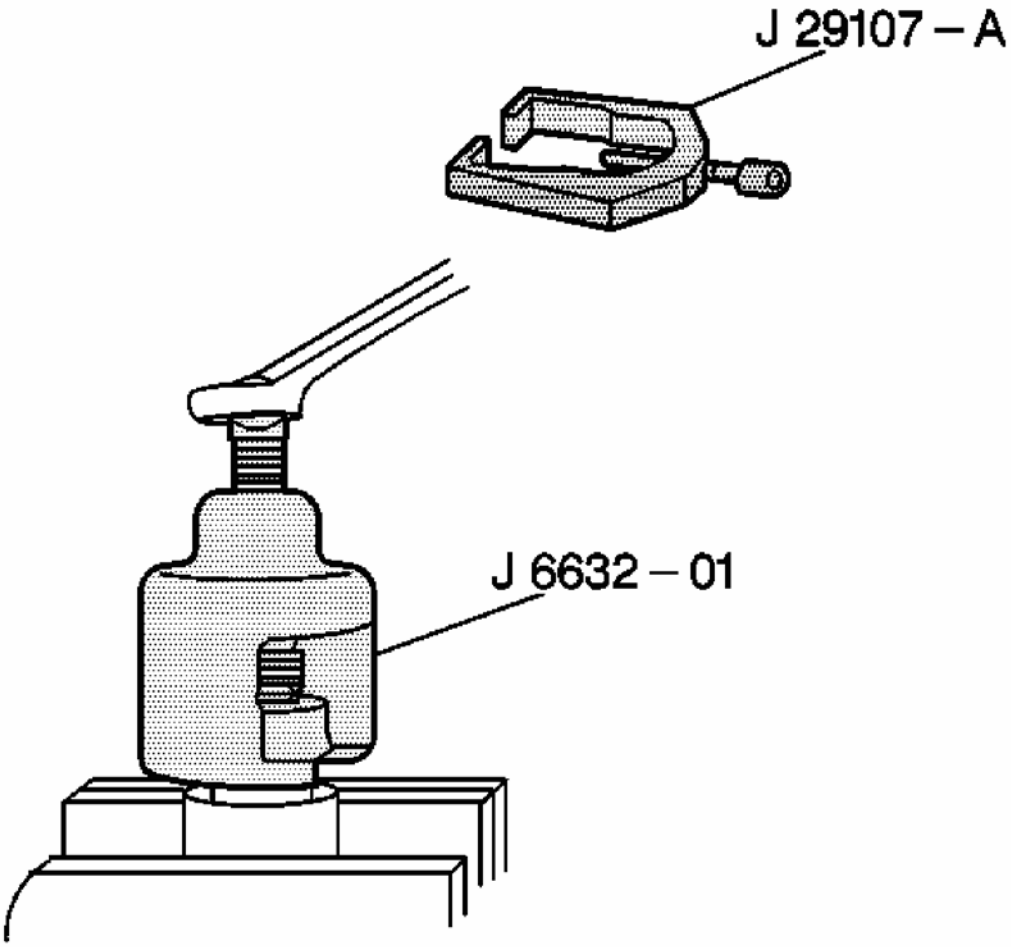

Fig. 40: Removing Pitman Arm Using J 6632-01 Or J 29107-A
Courtesy of GENERAL MOTORS CORP.

5. Remove the pitman arm from the pitman shaft using **J 6632-01** or **J 29107-A** .

Installation Procedure

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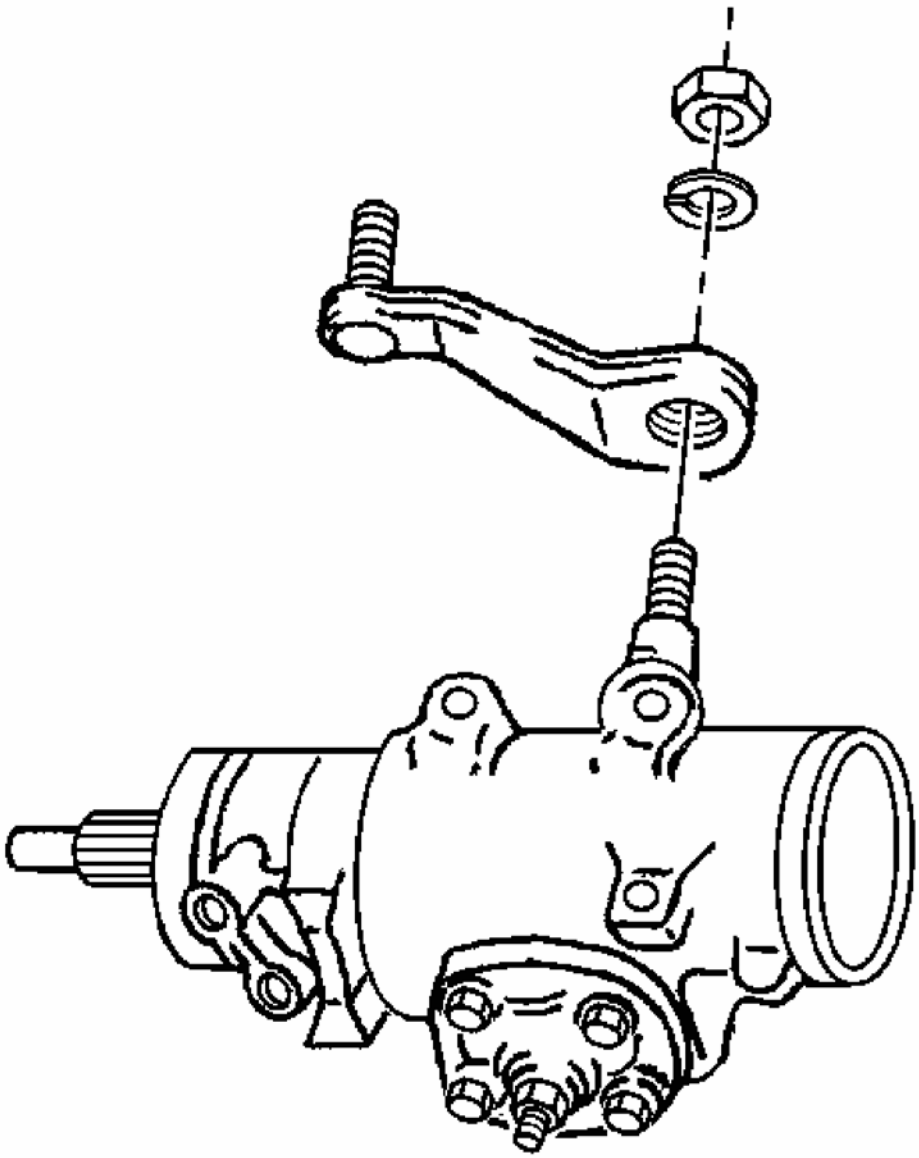

Fig. 41: View Of Pitman Arm, Power Steering Gear, Washer & Nut
Courtesy of GENERAL MOTORS CORP.

1. Install the pitman arm to the power steering gear.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install a new pitman arm washer and nut.

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Tighten: Tighten the nut to 250 N.m (184 lb ft).

3. Remove the power steering gear from the vise.
4. Install the power steering gear. Refer to **Power Steering Gear Replacement** in Power Steering System.
5. Lower the vehicle.
6. Check the wheel alignment. Refer to **Measuring Wheel Alignment (w/Rear Wheel Steering)** or **Measuring Wheel Alignment (w/o Rear Wheel Steering)** in Wheel Alignment.

DESCRIPTION AND OPERATION

STEERING LINKAGE DESCRIPTION AND OPERATION

The steering linkage consists of the following components:

- A pitman arm
- An idler arm
- A relay rod
- 2 adjustable tie rods

When you turn the steering wheel, the steering gear rotates the pitman arm which forces the relay rod to one side. The tie rods connect to the relay rod with the ball studs. The tie rods transfer the steering force to the wheels. Use the tie rods in toe adjustments. The tie rods are adjustable. The pitman arm support the relay rod. The idler arm pivots on a support attached to the frame rail and the ball stud attaches to the relay rod.

The 2 tie rod are threaded into the tube and secured with jam nuts. Right and left hand threads are used in order to permit the adjustment of toe.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Special Tools

Illustration	Tool Number/Description

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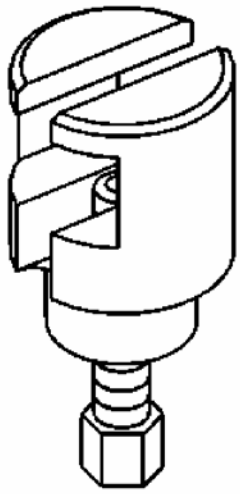
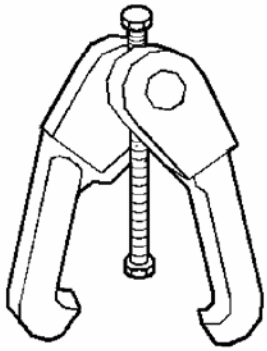
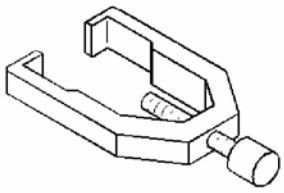
	J 6632-01 Pitman Arm Puller
	J 24319-B Universal Steering Linkage Puller
	J 29107-A Pitman Arm Puller
	J 29193 Steering Linkage Installer (12mm)

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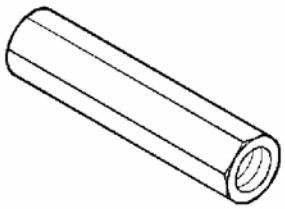
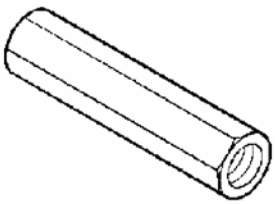
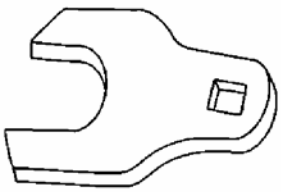
 	J 29194 Steering Linkage Installer (14mm)
	J 34028 Inner Tie Rod Wrench

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2004 Cadillac Escalade

2004 STEERING Steering Linkage (Non-Rack & Pinion) - C/K SUV

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2004 STEERING Steering Linkage (Non-Rack & Pinion) - C/K SUV

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